VERIFICATION / CERTIFICATION REPORT

PROJECT FOR THE CATALYTIC REDUCTION OF N_2O EMISSIONS WITH A SECONDARY CATALYST INSIDE THE AMMONIA REACTOR OF THE NO. 9 NITRIC ACID PLANT AT AFRICAN EXPLOSIVES LTD ("AEL"), SOUTH AFRICA

UNFCCC Registration No. 1171

Monitoring Period
2 July 2010 to 15 April 2011

REPORT NO. 2012-0986
REVISION NO. 01

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VERIFICATION / CERTIFICATION REPORT

Date of first issue: 29 August 2012	Project No.: PRJC-315852-2011-CCS-NOR
Approved by: Trine Kopperud	Organisational unit: DNV KEMA Energy & Sustainability Accredited Climate Change Services
Client: African Explosives Ltd	Client ref.: Hendrik Burger

DNV CLIMATE CHANGE SERVICES AS

Veritasveien 1,
1322 HØVIK, Norway
Tel: +47 67 57 99 00
Fax: +47 67 57 99 11
http://www.dnv.com
Org. No: NO 994 774 352 MVA

Summary:

DNV Climate Change Services AS has been contracted by African Explosives Ltd. to carry out verification and certification of the emission reductions reported for the "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" (UNFCCC Ref. No. 1171) for the period 2 July 2010 to 15 April 2011.

In our opinion, the reported N_2O emission reductions for the period from 2 July 2010 to 15 April 2011, as reported in the revised monitoring report for the project version 05 dated 28 August 2012 are fairly stated. The published monitoring report version 01 of 9 June 2011 was updated in order to reflect the issues raised during this verification.

The emission reductions were calculated correctly on the basis of the approved monitoring methodology AM0034 version 02 and the monitoring plan contained in the registered project design document of 5 April 2007.

Hence, DNV Climate Change Services AS is able to certify that the emission reductions from the project during the period 2 July 2010 to 15 April 2011, amount to 41 439 tonnes of CO_2 equivalents.

Report No.: 2012-0986	Subject Group: Environment	
Report title: Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa		
Work carried out by: Rafi-ud-Din Khawajad, Patrice Massicard, Fahad Saleem		
Work verified by: Trine Kopperud		
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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
DNA	Designated National Authority
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
UNFCCC	United Nations Framework Convention for Climate Change
SRM	Standard Reference Method

1 INTRODUCTION

African Explosives Ltd. (hereafter AEL) has commissioned DNV Climate Change Services AS (DNV) to carry out the verification and certification of the emission reductions reported for the "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" (hereafter the project) for the period 2 July 2010 to 15 April 2011. This report contains the findings from the verification assignment and a certification statement for the certified emission reductions.

1.1 Objective

Verification is the periodic independent review and *ex post* determination by the Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the a registered CDM project activity during a defined verification 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 "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" for the period 2 July 2010 to 15 April 2011 equating to 41 439 tonnes of CO_2 equivalents.

1.2 Scope

The verification scope is:

- To verify that actual monitoring systems and the 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 the reported GHG emission data is sufficiently supported by evidence

The verification shall ensure that the reported emission reductions are complete and that sufficient evidence is provided in order to give reasonable assurance that the amount of calculated GHG emission reductions is fairly stated.

The verification team has based the verification on the recommendations in the Validation and Verification Manual /28/.

1.3 Description of the Project Activity

Project Parties:	*South Africa, United Kingdom of Great Britain and Northern Ireland and Switzerland*
Titles of project activity:	*Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9*

	nitric acid plant at African Explosives Ltd ("AEL"), South Africa
UNFCCC Registration no.:	*1171*
Baseline and monitoring methodology:	*AM0034(version 02)*
Project participants:	*African Explosives Ltd (''AEL'') and N.serve Environmental services GmbH (''N.serve'')*
Location of the project activity:	*Modderfontein, Province of Gauteng, South Africa.*
Registration:	*05 November 2007*
Crediting period:	*05 November 2007 to 04 November 2017*
Period verified in this verification:	*2 July 2010 to 15 April 2011*

The project activity involves the installation of a secondary N_2O catalyst inside the ammonia oxidation reactor (burner) just beneath the precious metal catalyst gauze catalyst. 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 2 July 2010 to 15 April 2011 amount to 41 439 tonnes of CO2 equivalents.

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 N_2O. The nitric acid production (NAP) for the project campaign ($tHNO_3$) shall not exceed the design capacity of the plant.

The baseline emission factor is determined ex-ante, and may necessarily be recalculated when the length of a project campaign is less than the normal campaign length as defined by the historic campaigns. The flow-rate of stack gas, the concentration of N_2O in the stack gas, the operating hours, and the production output of 100% concentrated nitric acid need to be monitored, 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 2, 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 during 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 the product of the nitrous oxide concentration in the stack gas (NCSG) and the volume flow rate in the stack gas (VSG). The N_2O emissions during the baseline campaign are estimated from the product of N_2O emission per hour and the total number of complete hours of operation of the baseline 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 will be 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 emission 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 the product of 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 project 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 for the project campaign (mgN_2O/m^3)
PEn	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:

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

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 emissions 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 emissions 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 an 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 the applied methodology, AM0034 version 2 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. All relevant records of data from the N.serve Database Management System for N_2O destruction system (N.DBMS) /7/ and records from the production logs of the nitric acid production have been examined and verified for the reporting period.

Verification team

				Type of involvement					
Role	***Last Name***	***First Name***	***Country***	Desk review	Site visit	Reporting	Supervision of work	Technical review	TA 5.1 competence
Team leader (Verifier)	Khawaja	Rafi-ud-Din	Norway	✓	✓	✓	✓		
Observer	Massicard	Patrice	Norway	✓	✓	✓			
Technical Expert	Saleem	Fahad	Norway	✓	✓	✓			✓
Technical reviewer	Kopperud	Trine	Norway					✓	✓

Duration of verification

Monitoring report publication:	*13 June 2011*
Preparations:	*14 June 2011 to 29 June 2011*
On-site verification:	*29 June 2011*
Reporting, calculation checks and QA/QC*:*	*3 July 2011 to 29 August 2012*

2.1 Review of Documentation

The basis for the verification has been the monitoring report from the project for the period 2 July 2010 to 15 April 2011 version 01 of 9 June 2011 (published for global stakeholders consultation) and the revised monitoring report version 05 dated 28 August 2012 /1/, the registered project design document (PDD) /2/, and the approved baseline and monitoring methodology applied by the project, AM0034, version 02 /28/. 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, /3/ and /5/ -/26/.

2.2 Site Visit

During the site visit, DNV applied standard auditing techniques to assess the quality of information provided. The following aspects of the CDM project activity were 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 and their implementation in accordance with the monitoring plan.

Further, the following activities were performed:

- For randomly chosen days during the monitoring peirod, a cross-check was made between information provided in the monitoring report and data from other sources such as plant log books, back-up electronic data storage, inventories, purchase records or similar data sources;
- A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD /2/ and AM0034 version 02
- A review of calculations and assumptions made in determining the GHG data and emission reductions; and
- An assessment that quality control and quality assurance procedures are in place to identify and prevent or correct any errors or omissions in the reported monitoring parameters.

The data presented in the monitoring report /1/ was assessed by review of the detailed project documentation and production records, as well as by interviews with personnel at African Explosives Ltd. and N.serve, by observation of established monitoring and reporting practices and collection of measurements, and by assessment of the reliability of the installed monitoring equipment. This has enabled the verification team to assess the accuracy and completeness of the reported monitoring results, and to verify the correct application of the approved monitoring methodology and the determination of the reductions in N_2O emissions.

In addition all parameters required by the monitoring methodology AM0034 version 02 /28/ and the management system were assessed during the site visit.

2.3 Reporting of Findings

Findings established during the verification may be that:

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 verification period.

One CAR, four CLs and one FAR were raised during this verification. Please refer to Appendix A of this report for further details. All the issues raised were sufficiently addressed by the project proponent and closed by DNV.

3 VERIFICATION FINDINGS

This section summarises the findings from the verification of the emission reductions reported for the "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" for the period 2 July 2010 to 15 April 2011.

3.1 Remaining Issues, CARs, FARs from Previous Validation

No FAR is remaining from the previous verification of the project.

3.2 Project Implementation

As per para 198 (a) of VVM version 01.2 /27/, DNV verified that the project is fully implemented in accordance with the PDD version 2 of 5 April 2007 /2/. Furthermore, as per para 198 (b) of VVM version 01.2, DNV confirmed during the on-site visit that the CDM project is completely operational. Neither a notification nor approval of change has been requested to CDM Executive Board.

All physical features (technology, project equipment and monitoring/metering equipment) of the project are in place as per the registered PDD. The verification team inspected all the field installation and instrumentation necessary for the monitoring of the emission reductions.

The baseline campaign was operated from 5 September 2007 to 6 November 2007. The determination of the permitted operating conditions for operating temperature, operating pressure, maximum ammonia flow rate, maximum ammonia to air ratio, normal gauze supplier and normal gauze composition was carried out by the validating DOE while the verification of the normal campaign length as well as the determination of the baseline emission factor was done by DNV during the first verification [1]. The first project campaign with secondary catalyst installed was started on 09 November 2007. This monitoring period is from 2 July 2010 to 15 April 2011 and comprises two project campaigns as stated below.

Campaign PC8	21 September 2010 to 10 February 2011
Campaign PC9	11 February 2011 to 15 April 2011

In addition to the above project campaigns, one intermediate campaign (without secondary catalyst installed) was operated from 2 July 2010 to 21 September 2010. DNV verified that no emission reductions have been claimed for this intermediate campaign (see CAR 1 for details).

DNV verified the plant shut down periods and special events provided in the monitoring report /1/ by checking the raw data, ER calculations /3/ and the daily production records for these periods. It was verified by DNV that the above periods (relevant hours) are not considered in the overall emission reduction calculations. 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. DNV can confirm there was no AMS downtime or malfunction during the verification period which would require correction to the measured data as per AM0034 requirements.

[1] 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.

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 41 439 tonnes of CO_2 equivalents in the period from 2 July 2010 to 15 April 2011 (i.e. 288 days). The yearly expected emission reductions according to the registered PDD are 116 779 tonnes of CO_2 equivalents. This corresponds to emission reductions of 92 143 tonnes of CO_2 equivalents in 288 days and hence the observed emission reductions are considerably lower than the expected. The main reasons for lower than expected CERs are: 1) a full production campaign (from 2 July 2010 to 21 September 2010) was operated without secondary catalyst 2) a considerably lower production of nitric acid during the monitoring period. Moreover, the baseline emission factors for the project campaigns (0.00551 $tN_2O/tHNO_3$ for campaign PC8 and 0.00564 $tN_2O/ tHNO_3$ for campaign PC9) were lower than the estimated value that was given in the registered PDD (0.00601 $tN_2O/tHNO_3$).

3.4 Compliance of monitoring plan with monitoring methodology

DNV is able to confirm that the monitoring plan contained in the registered PDD "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa", version 2.0 of 5 April 2007 /2/ is in accordance with the approved methodology applied by the project activity, i.e. AM0034 (version 02). 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

DNV is able to confirm that the monitoring is complete and has been carried out in accordance with the monitoring plan contained in the registered PDD "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa", version 2.0 of 05 April 2007. The determination of the permitted operating ranges (verified by the validating DOE), the baseline emission factor (verified by DNV during the 1st verification), and the determination of the project emissions are verified and found to be in compliance with AM0034 version 02.

All parameters stated in the validated monitoring plan, the applied methodology AM0034 version 02 and relevant EB decisions have been sufficiently monitored and updated as applicable, including: project emission parameters; baseline emission parameters; leakage parameters; 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. 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 QAL 2 tests have been provided. The QAL 2 test covers all aspects 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

3.6.1 Historical data and permitted operating conditions

In order to avoid that the operation of the nitric acid production plant is manipulated in a way to increase the N_2O generation, and thereby increasing the CERs, the ammonia flow, ammonia to air ratio, operating temperature and pressure in the ammonia oxidation reactor and the use of ammonia oxidation catalyst is monitored during one campaign length (baseline campaign) and compared to the historical values as determined in the PDD. The baseline N_2O emission factor ($tN_2O/tHNO_3$) is determined from the measurements of N_2O concentration and stack gas flow during the baseline campaign prior to the installation of the secondary catalyst. If the plant operates outside of the permitted range for more than 50% of the duration of this baseline, the emission factor is not valid and the baseline campaign needs to be repeated.

In order to take into account the variations in campaign length and its influence on N_2O emission levels, the historic campaign lengths and the baseline campaign length are to be determined and compared to the project campaign length. Campaign length is defined as the total number of metric tonnes of nitric acid at 100% concentration produced with one set of gauzes.

The average historic campaign length (CL_{normal}) defined as the average campaign length for the historic campaigns used to define operating condition, will be used as a cap on the length of the baseline campaign.

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. The nitric acid production for the project campaign ($tHNO_3$), NAP, shall not exceed the design capacity during a calendar year.

The table below is summarising the permitted operating conditions and the normal campaign length.

The CDM Executive Board clarified in EB31 meeting that either validating or verifying DOE could undertake the task of determination of the permitted operating conditions for project activities using approved methodology AM0034. For this project the determination of the permitted ranges, normal gauze supplier and composition were included in the scope of the validating DOE /4/. However it was stated in the validation report that the verification of normal campaign length should be confirmed by the verifying DOE.

Data variable	Reported value	Observation
Design capacity	106 621 100% metric tonnes per year (292.112 metric tonnes per day operating 365 days per year).	Verified by validating DOE /4/
OT_{normal}	810°C to 915°C	Verified by validating DOE /4/
OP_{normal}	860 to 910 kPa (gauge)	Verified by validating DOE /4/
AFR_{max}	3.877 t NH_3/h	Verified by validating DOE /4/

$AIFR_{max}$	11.5 %	Verified by validating DOE /4/
CL_{normal} t HNO_3	24 026.2 tonnes	Excel sheet with historical data was provided /25/. DNV was able to confirm the reported value is correct. Random picked data points were checked against production logs.
GS_{normal} Gauze supplier for the operation condition campaigns	W.C. Heraeus	Verified by validating DOE /4/
GC_{normal} Gauze composition for the operation condition campaigns	Platium (Pt) 59% Rhodium (Rh) 4% Palladium (Pd) 37%	Verified by validating DOE /4/

3.6.2 Information flow

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 /2/ as per the applied and approved methodology, AM0034 version 02 /28/.

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 standardisation calculation
- Stack gas N_2O concentration and calculation of amount of N_2O
- Nitric acid produced
- Operating parameters of the ammonia oxidation reactor (temperature, pressure, ammonia 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. Each of the two nitric acid plants at AEL has its 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 at 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. The hourly averages are the basis of the analysis of the data for the purpose of the calculation of the emissions 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) /7/.
The nitric acid production is measured by mass flow meter and the data are automatically transferred to the plant's control system. Daily cumulative data are stored and printed for archiving.

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.

Each parameter and the values verified are listed in sections 3.6.3 to 3.6.6 below. Further detailed information on recording frequency and calibration are given in Appendix B.

3.6.3 Monitored data for project emissions within the project boundary

The only emission source from the project is the remaining quantity of N_2O in the stack gas.

According to AM0034 the emissions reductions can only be requested for the nitric acid production up to the design capacity. For the AEL9 plant, the design capacity is 106 621 tons of 100% HNO_3 per year (292.112 t per day x 365 days) /2/. The production of nitric acid for the campaigns operated during the current monitoring period is as follows:

Campaign PC8 (21 September 2010 to 10 February 2011): 13 855 t 100% HNO_3

Campaign PC9 (11 February 2011 to 15 April 2011): 18 596 t 100% HNO_3

The total production during this monitoring period (288 days) is 32 451 tons of 100% HNO_3 (approx. 113 $tHNO_3$ per day). The corresponding production at design capacity is 84 128 t HNO_3 (292.112 t per day x 288 days). The production for this monitoring period is therefore below the design capacity for the plant.

The following equipment and related documentation has been assessed, refer to Annex B for further details and information about calibration of the monitoring equipment:

Data variable	**Tag. No.**	**Reported value Campaign PC8**	**Reported value Campaign PC9**	**Assessment /Observation**
VSG Normal gas volume flow rate of the	**FT-200**	41 780 Nm^3/h Range:	42 261 Nm^3/h Range:	The stack gas flow rate is continuously measured with a flow meter: Emerson Rosemount Annubar Model 485 combined with pressure transmitter Rosemount 3051S

stack gas during project campaign (Nm^3/h)		18-45 000 Nm^3/h	18-45 000 Nm^3/h	Static pressure and process temperature are measured with a single pipe penetration, and compensated flow is calculated dynamically (Nm^3/h). All transmitters were properly installed. Specification of the flow meter is provided /5/. The flow meter was calibrated prior to shipment by the supplier Emerson Rosemount and thereafter regularly in accordance with AEL calibration routine /19/. The overall conclusion in the QAL 2 report is that the stack gas flow meter is suitable to measure the stack gas flow and that the uncertainty is ± 2.65%, and the combined uncertainty after normalisation by PSG and TSG is 3.22% /6/. The standard reference method (SRM) showed a deviation to the installed flow meter. Correction factor from the TÜV SÜD Industrie Service GmbH QAL 2 report is 0.962 /6/. It has been verified that the same value is used in the calculation spread sheet for adjusting the total stack gas flow during the monitoring period. The measurement range of the flow meter is appropriate and the measured average flow rate is within the range expected for a nitric acid plant with a capacity of 292.112 metric tonnes per day. The AST was due on 10 June 2010 (one year after the previous AST of 10-11 June 2009) but was performed on 6 July 2010 instead /10/. But this delay in calibration did not necessitate any correction of the data as per EB 52 Annex 60 guidelines because during the missing calibration period (from 2

				July 2010 to 6 July 2010), the plant was operated without secondary catalyst installed in the AOR and no emission reductions were claimed for this period (the intermediate campaign from 2 July 2010 to 21 September 2010 as discusses in section 3.2 above). Therefore DNV confirms that the instrument calibration is valid for the whole monitoring period. The internal calibration records /19/ were also verified by DNV.
TSG (^oC)	**TE–120**	Range: 0-500 ^oC The temperature is used for standardisation of volume flow rate in the stack.	Range: 0-500 ^oC The temperature is used for standardisation of volume flow rate in the stack.	The temperature in the stack gas is measured by a thermocouple type PT100_385 3-wire RTD Transmitter: Rosemount Model 644 RAI. The overall conclusion in the QAL 2 report /6/ is that the TSG equipment is suitable to measure the stack gas temperature and that the combined standard uncertainty is ± 2.55 % /6/. The AST was due on 10 June 2010 (one year after the previous AST of 10-11 June 2009) but was performed on 6 July 2010 instead /10/. But this delay in calibration did not necessitate any correction of the data as per EB 52 Annex 60 guidelines because during the missing calibration period (from 2 July 2010 to 6 July 2010), the plant was operated without secondary catalyst installed in the AOR and no emission reductions were claimed for this period (the intermediate campaign from 2 July 2010 to 21 September 2010 as discusses in section 3.2 above). Therefore DNV confirms that the instrument calibration is valid for the whole monitoring period. The internal calibration records /19/ were also verified by DNV.
PSG (hPa abs)	**PT-200**	Range 0 – 1000 hPa (abs).	Range 0 – 1000 hPa (abs).	The pressure in the stack gas is measured by a Rosemount pressure probe. Transmitter: Rosemount; type

		The pressure is used for standardisation of volume flow rate in the stack	The pressure is used for standardisation of volume flow rate in the stack	3051Ta12B21BB4I1M5Q4. The overall conclusion in the QAL 2 report is that the PSG equipment is suitable to measure the stack gas pressure and that the combined standard uncertainty is ± 0.70 % /6/. The AST was due on 10 June 2010 (one year after the previous AST of 10-11 June 2009) but was performed on 6 July 2010 instead /10/. But this delay in calibration did not necessitate any correction of the data as per EB 52 Annex 60 guidelines because during the missing calibration period (from 2 July 2010 to 6 July 2010), the plant was operated without secondary catalyst installed in the AOR and no emission reductions were claimed for this period (the intermediate campaign from 2 July 2010 to 21 September 2010 as discusses in section 3.2 above). Therefore DNV confirms that the instrument calibration is valid for the whole monitoring period. The internal calibration records /19/ were also verified by DNV.
NCSG N_2O concentration in the stack gas (mgN_2O/Nm^3 converted from ppmv)	**AT-110**	84.08 mg /Nm^3 Range: 0-2000 ppmv	113.25 mg /Nm^3 Range: 0-2000 ppmv	The concentration of N_2O in the stack gas is continuously measured by the non-dispersive infrared photometry (NDIR) analyser ABB AO2040-Uras14. The N_2O concentration is recorded every two seconds and hourly means are derived by the data acquisition system. Sufficient documentation has been provided for the fulfilment of QAL 1 /8/ /9/. According to the QAL 2 report, the combined uncertainty of the analyser is 2.69 % /6/. The standard reference method (SRM) showed a deviation to the AMS. Correction factor based on TÜV QAL 2 reference measurements were 0.970

				/6/. It was verified that the same value is used in the calculation spread sheet /3/ for adjusting the N_2O concentration during the monitoring period. The AST was due on 10 June 2010 (one year after the previous AST of 10-11 June 2009) but was performed on 6 July 2010 instead /10/. But this delay in calibration did not necessitate any correction of the data as per EB 52 Annex 60 guidelines because during the missing calibration period (from 2 July 2010 to 6 July 2010), the plant was operated without secondary catalyst installed in the AOR and no emission reductions were claimed for this period (the intermediate campaign from 2 July 2010 to 21 September 2010 as discusses in section 3.2 above). Therefore DNV confirms that the instrument calibration is valid for the whole monitoring period. The internal calibration records /19/ were also verified by DNV. It was also verified that zero and span checks during the project campaign was done twice a week by trained AEL personnel /19/. Further calibration with standard gases was performed in cases where a deviation exceeding 1% of the full range of the analyzer was detected. It was verified that the calibration of N_2O analyser were properly performed /19/. The calibration gas used for span check was 955 ppmv during the project campaigns. With a precision of ± 2%. The analyser room and equipment is inspected weekly. Weekly check lists and N_2O Maintenance Activities Log Book were made available during the site visit.
NAP t HNO_3	**FT-111**	**13 855** t HNO_3	**18 596** t HNO_3	The nitric acid is measured with a mass flow meter Coriolis Micro Motion CMF 200 from Emerson.

Nitric acid 100% concentrated produced over a project campaign				100% nitric acid is calculated from the measurements of flow from the mass flow meter, and the concentration. The concentration is measured as an integral part of the flow meter. The concentration is checked against manual measurement of concentration in laboratory. Calibration certificates are provided /19/. Equipment specification was provided at the site visit. The flow accuracy is <= 0.1 % of measured flow rate. Sampling of concentration measurements and values from mass flow meter were performed during the site visit including checks of transfer of data. An analysis was provided to DNV showing comparison of the NAP values determined from tank level/mass balance method and NAP values obtained from Coriolis mass flow meters. The analysis was checked by DNV and found appropriate. A clarification (CL1) was also raised by DNV in this regard which was closed after receiving an appropriate response from the PP.
OH Operating hours during project campaign (hours)	N/A	**1 129**	**1 525**	Operating hours are determined from the production data /3/. A trip value for the oxidation temperature of 810°C is applied as the exclusion criterion for determining those hours where the plant was offline during the project campaign. OH was verified by DNV to be correctly reported /3/.
CL_n Campaign length of project campaign (t HNO_3)	**FT-111**	**13 855**	**18 596**	The CL_n has the same value as reported for NAP above. The monitoring equipment is as described for NAP.
EF_n Emission	N/A	**0.00027**	**0.00037**	The value has been calculated from monitoring data using the algorithm

factor for project campaign n $tN_2O/t\ HNO_3$				described in N.DBMS /7/ which is as per the methodology. The calculations are exported to an excel file /3/. The spread sheet calculations have been checked and found to be correct. Hourly raw data was made available for verification.
$GS_{project}$ Gauze supplier for the project campaign	N/A	**W.C. Heraeus**	**W.C. Heraeus**	At the site visit invoices were made available for verification of the catalyst supplier /14/.
$GC_{project}$ Gauze composition for the project campaign	N/A	**Platium (Pt) 60.1% Rhodium (Rh) 3.9% Palladium (Pd) 36.0%**	**Platium (Pt) 59.9% Rhodium (Rh) 3.9% Palladium (Pd) 36.2%**	The composition used in the project campaigns PC8 and PC9 was verified from the invoices of the catalyst composition made available for verification /14/ (also refer to CL3). DNV confirms that the composition is same as that used in the baseline and historical campaigns.
OT_h (°C) Oxidation Temperature for each hour	**TC102-A TC102-B TC102-C TC102-D**	**N/A**	**N/A**	The monitoring of OT_h is required by AM0034 in order to determine when the plant was operating outside of OT_{normal} during the baseline campaign (see section 3.6.4). The parameter is also used to check if the plant is in operation (if the temperature is below 810^{o}C, the plant is considered to be shut down). This criterion is then used to calculate the operating hours (OH) of the plant. Calibration is performed in accordance to the procedure “C9NA 002 Nitrates calibration procedure”. Calibration certificates were checked and DNV is able to confirm the calibration result is OK. The calibration is valid the entire monitoring period /19/.
OP_h (Pa-gauge) Oxidation Pressure for each hour	**PT-100**	**N/A**	**N/A**	The monitoring of OP_h is required by AM0034 in order to determine when the plant was operating outside of OP_{normal} and is only applicable for the baseline campaign, see section 3.6.4.

AFR (t NH_3/h) Ammonia gas flow rate to the ammonia oxidation reactor.	**FT101**	**N/A**	**N/A**	The monitoring of AFR is required by AM0034 in order to determine when the plant was operating outside of AFR_{max} and is only applicable for the baseline campaign, see section 3.6.4.
AIFR (% v/v) Ammonia to air ratio	**N/A**	**N/A**	**N/A**	The monitoring of AIFR is required by AM0034 in order to determine when the plant was operating outside of $AIFR_{max}$ and is only applicable for the baseline campaign, see 3.6.4.

3.6.4 Monitored data for baseline emissions within the project boundary

The verification of the baseline campaign data (campaign H15, from 5 September 2007 to 6 November 2007) and the determination of the baseline campaign emission factor were included in the scope of the verifying DOE /4/. As per the methodology, if the length of each individual project campaign CL_n is longer than or equal to the average historic campaign length CL_{normal} or to the baseline campaign length whichever is shorter, then all N_2O values measured during the baseline campaign can be used for the calculation of EF (subject to the elimination of data from the operating limits analysis). However, if $CL_n < CL_{normal}$, EF_{BL} is recalculated by eliminating those N_2O values that were obtained during the production of tonnes of nitric acid beyond the CL_{BL} (i.e. the last tonnes produced) from the calculation of EF_{BL}.

Two project campaigns (PC8 and PC9) are included in this monitoring period. The length of project campaign PC8 (13 855t 100% HNO_3) is shorter than the baseline campaign (17 718 t 100% HNO_3) as well as the historic campaign (24 026.2 t 100% HNO_3), therefore, the baseline emission factor EF_{BL} has been recalculated as described above. DNV checked the recalculation and confirms that it has been executed correctly as per the methodology. The recalculated EF_{BL} for PC8 is 0.00551 $tN_2O/tHNO_3$. Meanwhile, for project campaign PC9, since the length of campaign (18 596 t 100% HNO_3) is longer than the baseline campaign length (17 718 t 100% HNO_3), no recalculation of EF_{BL} is required as per the methodology. EF_{BL} used for PC9 is 0.00564 $tN_2O/tHNO_3$. Information and details about calibration of the monitoring equipment used during baseline determination are given in Appendix B.

Data variable	Tag. No.	Value Applicable for PC 8	Value applicable for PC9	Assessment / Observation
VSG_{BC} Normal gas volume flow rate of the stack gas during baseline	**FT-200**	42 983 Nm^3/h	42 983 Nm^3/h	See comments in 3.6.3 VSG_{BC} was verified by DNV to be correctly reported /3/ /22/. The measurement range of the flow meter is appropriate and the measured average flow rate is within the range expected for a

				nitric acid plant with a capacity of 292.112 metric tonnes per day. The calibration is performed as per the monitoring plan in the registered PDD and is documented /18/. DNV can confirm the correction factor determined in QAL 2 /6/ for VSG was retroactively and correctly applied to the data for VSG monitored during the baseline campaign /24/.
$NCSG_{BC}$ N_2O concentration in the stack gas (mgN_2O/Nm^3 converted from ppm)	**AT-110**	1 725.20 mg/Nm^3 (recalculated)	1 764.44 mg/Nm^3	See comments in 3.6.3 $NCSG_{BC}$ for PC9 is calculated correctly /3/. Re-calculated $NCSG_{BC}$ for campaign PC8 was verified by DNV and found to be correctly calculated /3/. The calibration is performed as per the monitoring plan in the registered PDD and is documented /6/. DNV can confirm the correction factor determined in QAL 2 for NCSG /6/ was retroactively and correctly applied to the data for NCSG value monitored during the baseline campaign /24/.
OH_{BC} Operating hours of the plant	N/A	1 474 h	1 474 h	See comments in 3.6.3. OH_{BC} was verified by DNV to be correctly reported /3/.
NAP_{BC} t HNO3 Nitric acid 100% concentrated produced over a project campaign	**FT-111**	17 718 t/HNO_3	17 718 t/HNO_3	See comments in 3.6.3. NAP_{BC} was verified by DNV to be correctly reported /3/ /18/.

EF_{BL} Emission factor for baseline period $tN_2O/t\ HNO_3$	N/A	0.00551 t N_2O/ t HNO_3 (recalculated)	0.00564 t N_2O/ t HNO_3	EF_{BL} was verified by DNV to be correctly calculated and reported according to EB 51 Annex 12 /3/. The re-calculated EF_{BL} for campaign PC8 was verified by DNV /3/.
AFR Ammonia gas flow rate to the AOR	**FT101**	Available in excel sheets /3/	Available in excel sheets /3/	AFR is continuously monitored. $NCSG_{BL}$ and VSG_{BL} values monitored when AFR is exceeding AFR_{max} are excluded prior to the calculation of the average values for $NCSG_{BL}$ and VSG_{BL} /3/. Calibration is performed in accordance to the procedure “C9NA 002 Nitrates calibration procedure”. Calibration certificates were checked and DNV is able to confirm the calibration result is OK. The calibration is valid for the entire period for the baseline campaign /18/.
AIFR Ammonia to Air Ration	**FT-100** (air flow) **FT-101** (NH_3 flow)	Available in excel sheets /3/	Available in excel sheets /3/	AIFR is calculated from results of AFR (Tag No.: FT101) and Primary Air flow rate (Tag No.: FT100). $NCSG_{BL}$ and VSG_{BL} values monitored when AIFR is exceeding $AIFR_{max}$ are excluded prior to the calculation of the average values for $NCSG_{BL}$ and VSG_{BL} /3/ Calibration is performed in accordance to the procedure “C9NA 002 Nitrates calibration procedure”. Calibration certificates were checked and DNV is able to confirm the calibration result is OK. The calibration is valid for the entire period for the baseline campaign /18/.

OT_h Oxidation temperature for each hour	**TC102-A** **TC102-B** **TC102-C** **TC102-D**	Available in excel sheets /3/	Available in excel sheets /3/	OT_h is monitored hourly. $NCSG_{BL}$ and VSG_{BL} values monitored when OT_h is outside the permitted operating range are excluded prior to the calculation of the average values for $NCSG_{BL}$ and VSG_{BL} /3/. Calibration is performed in accordance to the procedure “C9NA 002 Nitrates calibration procedure”. Calibration certificates were checked and DNV is able to confirm the calibration result is OK. The calibration is valid the entire period for the baseline campaign /18/.
OP_h Oxidation Pressure for each hour	**PT-100**	Available in excel sheets /3/	Available in excel sheets /3/	OP_h is monitored hourly. $NCSG_{BL}$ and VSG_{BL} values monitored when OP_h is outside the permitted operating range are excluded prior to the calculation of the average values for $NCSG_{BL}$ and VSG_{BL} /3/. Calibration is performed in accordance to the procedure “C9NA 002 Nitrates calibration procedure”. Calibration certificates were checked and DNV is able to confirm the calibration result is OK. The calibration is valid the entire period for the baseline campaign /18/.
GS_{BL} Gauze supplier for baseline campaign	N/A	W.C. Heraues	W.C. Heraues	Verified by validating DOE /4/.
GC_{BL} Gauze composition for baseline campaign	N/A	59% Pt 4% Rh 37% Pd	59% Pt 4% Rh 37% Pd	Verified by validating DOE /4/.

3.6.5 Other factors and calculated parameters

The following parameters are used in the calculation of emissions reductions or are parameters needed to be reported in relation to regulation of N_2O emissions. The verification team has manually checked the calculated values by use of raw data. Other data for the required parameter according to AM0034 and the source of data was checked.

Data variable	Reported value	Assessment/ Observation
UNC	**4.2 %**	The overall uncertainties for the AMS have been reported in the QAL 2 report /6/.
$EF_{ma,n}$ Moving average emission factor derived over the time from campaign specific emission factors. $tN_2O/t\ HNO_3$	**Campaign PC8: 0.00154** **Campaign PC9: 0.00141**	The moving average is calculated as the average of EF_n from all the previous campaigns as: $EF_{ma,n} = (EF_1 + EF_2 + \ldots + EF_n) / n$ ($tN_2O/tHNO_3$) DNV has verified the emission factors' data for previous campaigns and confirms that $EF_{ma,n}$ has been correctly calculated both for PC8 and PC9.
EF_{min} The lowest of EFn observed during the first ten campaigns of the project crediting period. $tN_2O/t\ HNO_3$	**NA**	This parameter is not applicable to this monitoring period. This parameter is only relevant when the more than ten production campaigns have been operated.
EF_p Emmision factor used for the specific campaign n $tN_2O/t\ HNO_3$	**Campaign PC8: 0.00154** **Campaign PC9: 0.00141**	As required by the methodology AM0034 version 02, the higher of the two values of $EF_{ma,n}$ and EF_n has correctly been applied in the emission reduction calculations.
EF_{reg} National regulation on N_2O emissions	**No regulation**	It was confirmed at the site visit that there is no N_2O regulation in South Africa. This parameter is reported in the monitoring report in E.1:"Data and parameters for calculation of Baseline campaign emissions". The N_2O regulation is followed up during the project campaigns and included in the monitoring report. Further African Explosives Ltd. has included procedure for following up any new regulations in its ISO 14001 systems /21/.

NO_x regulation	-	At the site visit, the NO_x concentration was observed to be below the regulation limit of 400 ppm set by the Ministry of Environmental Protection /21/.

3.6.6 Emissions outside the project boundary and leakages

There are no additional emissions to be recorded outside the project boundary or any leakages related to the project activity.

3.7 Quality of Evidence to Determine Emission Reductions

The main monitoring parameters are automatically collected by the monitoring system. The raw data are stored as 2 second values at two different locations. All necessary documentation is collected, referenced and aggregated and is easily accessible in spread sheets generated by N.DBMS (N.serve Database Management System). Access to hourly raw data was made available to DNV /3/ in order to check the data presented through the N.DBMS. The statistical analysis and determination of correct mean values by the N.DBMS are further cross-checked in Excel calculation spreadsheets /3/. No deviation was found.

Measurements are performed by calibrated equipment /6/ /19/ and calibrations are valid both for the baseline campaign and the current monitoring period. The delayed AST period (2 July 2010 to 6 July 2010) does not have any impact on the emission reductions since no secondary catalyst was installed during that period and no emission reductions have been claimed for these days. The key data has also been cross-checked via other sources, such as control room stations and on-site meters. There was no incident resulting in AMS downtime during the monitoring period. No assumptions are used, that have any influence on reported emission reductions.

The project participants have provided excel sheets containing the raw data and calculations for the campaigns no. PC8 and PC9 /3/. These datasheets were verified by DNV and DNV confirms the calculations of baseline emissions and project emissions have been carried out in accordance with the formulae and methods described in the monitoring plan and applied methodology. As per the methodology, AM0034 version 2, no leakage calculation is required.

The calculations of the emission reduction in the spreadsheet and the monitoring report for the monitoring period were checked by DNV and found to be correct, with details as below:

1) The hourly means of N_2O concentration and gas flow in the stack gas were calculated correctly, with correct application of 95% confidence interval; and total N_2O emissions of the project campaign were calculated correctly. Correction factors of 0.962 for gas flow rate and 0.970 for N_2O concentration were applied correctly /6/.

2) The nitric acid productions (100% HNO_3) for the baseline and project campaigns covered in the verification period were calculated correctly. The number of hours of operation in each project campaign covered in the verification period was also correctly calculated.

3) The project emission factor was correctly calculated by correct calculations and comparison of a campaign specific emission factor.

4) The baseline emission factor was correctly determined by comparing the campaign length with the average historic campaign length, and subsequently determining the corresponding baseline emission factor.
5) The emission reductions were then correctly calculated with consideration if the design capacity was exceeded in the specific project campaign.

There is limited uncertainty related to manual transfer of data used in the calculation of emission reduction since the monitored parameters are collected by the automated measurement system.

The calculation of the emission reduction for the monitoring period was checked by DNV and found to be correct.

3.8 Management System and Quality Assurance

The quality assurance and quality control procedures in terms of equipment operation and maintenance as well as data reporting are covered by documented procedures.

The nitric acid plant AEL9 of African Explosives Ltd. is ISO9001 and ISO14001 certified /15/ /16/. A CDM procedure is developed for the project activity and incorporated into the quality assurance system. Audits are performed twice a year.

Local operators, instrumentation engineers and calibration personnel have been trained by equipment suppliers and qualified internally. Data handling solutions involve redundancy, data manipulation protection, integrity check as well as proper archiving.

For this monitoring system, the quality assurance and control procedure is also according to EN14181 which stipulates three levels:

- 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 EN14181 as stipulated in the applied methodologies, 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 ISO14956”. DNV was able to verify that the evaluation has been carried out by TÛV SUD before installation of AMS according to ISO14956 version 1.0, and the evaluation is deemed to be acceptable.[2] /8/ /9/.
- QAL2 (including AST): The installed AMS is tested and compared to a SRM. The QAL2 test was carried out by TÜV SUD Industrie Services in February 2008 (date of report 19 March 2008) /6/; TÜV SUD is ISO 17025:2005 accredited /22/. DNV can confirm the correction factors determined in QAL 2 was correctly applied to the data for NCSG and VSG monitored during the project campaign. Further the maximum uncertainty of the AMS (UNC) was correctly applied to the calculation of the baseline emissions factor as per the methodology.

[2] The N_2O analyzers used in this project is the model ABB AO2000 Uras 14 NDIR. ABB has conducted and completed the QAL1 tests for the follow-up model ABB AO2000 Uras 26 of the analyzer module within the same analyzer series (QAL1 Tested by TÜV SÜD) . Since there are no major technical differences between the two analyzer models it is assumed that the analyzers meet the requirements of the QAL1 test in the same way as the follow-up model. A statement was received from ABB where it is stated that the modules Uras 14 and Uras 26 have identical construction for the optical devices and optical filter methods, which is relevant for the technical data in the QAL1 test according to ISO 14956

- AST: The latest annuals surveillance test (AST) was performed on 6 July 2010 and confirmed that operation of the AMS was acceptable and that the calibration functions for NCSG and VSG were still valid and that the requirements for variability are fulfilled /10/.
- QAL3: Span and zero checks are carried out twice a week /19/.

4 CERTIFICATION STATEMENT

DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions that have been reported for the project "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" (UNFCCC Registration Reference No.1171) for the period 2 July 2010 to 15 April 2011.

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 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 2 of 5 April 2007 and the monitoring report version 05 dated 28 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.

In our opinion the GHG emissions reductions of the "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" (UNFCCC Registration Ref. No.1171) for the period 2 July 2010 to 15 April 2011 are fairly stated in the monitoring report version 05 dated 28 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 2 of 5 April 2007.

DNV Climate Change Services AS is able to certify that the emission reductions from the "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" during the period 2 July 2010 to 15 April 2011 amount to 41 439 tonnes of CO_2 equivalents.

Oslo, 29 August 2012

Rafi-ud-Din Khawaja
CDM Verifier & Sector Expert
DNV Climate Change Services AS

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/ CDM Monitoring Report: "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" (No 2), version 01 of 9 June 2011 and version 05 dated 28 August 2012.

/2/ CDM Project Design Document: "Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa", Version 2.0, date of completion: 05 April 2007.

/3/ CDM Project Spreadsheets for the verification period 2 July 2010 to 15 April 2011
Excel file for reporting raw data:
- CDM Data No.9 4th MP.xlsx

Excel file for reporting calculation of emission reductions:
- AEL_No9_MP4_PC_Calc_V5_MS_120828.xlsx

Excel file for cross-checking:
- Project 1171 Monitoring period 04_02_07_2010 - 15_04_2011 Emission reduction calculation.xlsx

/4/ Validation report by TÜV SUD: "Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa", report no. 912444, 10 May 2007.

/5/ Product specification for stack gas flow meter:
The Annubar Flowmeter Series. Product Data Sheet 00813-0100-4809, Rev GA
Of November 2008.

/6/ TÜV SUD Industrie Services QAL 2 report. Author Erhard Krämer. Report no. IS-US3-MUC dated 19 March 2008 (Test conducted from 07.02.2008 to 13.02.2008).

/7/ Martin Stilkenbäumer, N.serve: "Documentation of N.serve Database Management System for N_2O Destruction CDM Projects"

/8/ TÜV SÜD Suitability test report for German Standards , March 2003

/9/ TÜV SUD QAL 1 report Uras 26 (follow-up version of Uras 14), June 2006

/10/ MÜLLER-BBM report M80 456/1: "Report on performance test of continuously operating measuring system on a nitric acid plant". (AST) dated 27 July 2009 (Test conducted from 10.06.2009 to 11.06.2009).
MÜLLER-BBM report M92 321/1: "Report on performance tests of continuously operating measuring systems on a nitric acid producing plant, Nitrates No.9". AST conducted on 6 July 2010, valid until 5 July 2011, date of report 26 October 2010.

/11/ Afrox Ltd.: Certificates of analysis of calibration test gases during the monitoring period.
Analysis report dated 5 June 2007 (Afrox Cetification Cylinder No. 875450):
1005 ppmv N_2O valid until June 2008.

Analysis report dated 19 March 2008 (Afrox Certification Cylinder No. 948098): 955 ppmv N_2O valid until 19 February 2009.

Cylinder No. 986435. Analysis report dated 27 March 2008. Expiring date 26 March 2011.

/12/ Calibration reports N_2O analyser ABB AO2040 Uras 14:

- AT-110 N_2O Analyzer Calibration Cell Report from September 2007 (baseline campaign)

/13/ African Explosives Ltd. "Procedure for CDM data preparation" revision 00 of 13.02.2008.

/14/ Heraeus South Africa Ltd. Ammonia Oxidation Catalyst, AEL No.9 Campaigns Confirmation for PC8 and PC9

/15/ ISO 9001:2008 Certificate number LS 0243 issued by SABS Commercial Ltd. valid until 8 September 2012.

/16/ ISO 14001:2004 Certificate number EM 140394 issued by SABS Commercial Ltd. valid until 3 February 2012.

/17/ Instrument data sheets:

-Nitric acid flow meter Tag. No. FT-111.

-Stack gas flow meter Tag.No. FT-200

-N_2O analyser Tag. No. AT-110

/18/ African Explosives Ltd.: Calibration certificates for the baseline campaign

Calibration certificates for stack gas parameters by AEL Ltd:

VSG - tail gas flow (FT-200):

Calibration dates: August 2007, November 2007, February 2008 (exact dates not available). Validity of calibration: 4 months

NCSG - N_2O concentration in the stack gas (AT-110): see reference /12/

TSG – Tail gas temperature (TE-120):

Calibration dates: August 2007, November 2007, February 2008 (exact dates not available). Validity of calibration: 1 year

PSG- Tail gas pressure (PT-200):

Calibration dates: August 2007, November 2007, February 2008 (exact dates not available). Validity of calibration: 1 year

Nitric acid flow meter (FT-111):

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-111. Date 04.01.2007. Valid until 03.01.2010

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-111. Date 11.04.2008. Valid until 10.04.2011

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-111. 25.11.2008. Validity: 24.11.2011

Calibration certificates for AOR parameters equipment by AEL Ltd:

AFR - Ammonia gas flow rate (FT-101):

Calibration dates: 04 Sept.2007 and 10 Feb. 2008. Valid until 9 Sept. 2008.

AIFR - Ammonia to Air (calculated from ammonia gas flow rate and air flow to AOR),

FT-100 (air flow):
Calibration dates: 04 Sept.2007 and 10 Feb. 2008. Valid until 9 Sept. 2008.
OTh – Oxidation temperature (TC102-A, TC102-B, TC102-C, TC102):
Calibration dates: 04 Sept.2007 and 10 Feb. 2008. Valid until 9 June 2008.
OPh – Oxidation pressure (PT-100):
Calibration dates: 04 Sept.2007 and 10 Feb. 2008. Valid until 9 Sept. 2008

/19/ Calibration Certificates:

Calibration certificates for stack gas parameters by AEL Ltd:

Dates of calibration relevant to the current monitoring period:

VSG - tail gas flow (FT-200):

- Calibration dates: 19 July 2010, 24 November 2010, 10 February 2011, and 15 June 2011. Validity of calibration: 4 months (calibration is done at the end of each campaign)

NCSG - N_2O concentration in the stack gas (AT-110):

- QAL3 tests done twice a week from the period 2 July 2010 to 15 April 2011

TSG – Tail gas temperature (TE-120):

- Calibration dates: 19 July 2010, 24 November 2011, 10 February 2011 and 15 June 2011. Validity of calibration: 4 months (calibration is done at the end of each campaign)

PSG- Tail gas pressure (PT-200):

- Calibration dates: 19 July 2010, 24 November 2011, 10 February 2011 and 15 June 2011. Validity of calibration: 4 months (calibration is done at the end of each campaign)

Calibration certificates for Nitric acid flow meter (FT-111):

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-111. Date 24 February 2009 Valid for 3 years until 23 February 2012.
- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-111. Date 24 November 2010 Valid for 3 years until 23 November 2013.

Calibration certificates for AOR parameters equipment by AEL Ltd:

AFR - Ammonia gas flow rate (FT-101):

Calibration dates: 4 May 2010, 28 August 2010, 4 November 2010 and 25 July 2011. Valid until 21 January 2012 (Calibration is done once every 6 months, only during the plant shut down between two campaign)

AIFR - Ammonia to Air (calculated from ammonia gas flow rate and air flow to AOR), FT-100 (air flow):

Calibration dates: 4 May 2010, 28 August 2010, 4 November 2010 and 22 July 2011. Valid until 21 January 2012 (Calibration is done once every 6 months, only during the plant shut down between two campaign)

OTh – Oxidation temperature (TC102-A, TC102-B, TC102-C, TC102):

Calibration dates: 4 May 2010, 28 August 2010, 4 November 2010 and 22 July 2011. Valid until 21 January 2012 (Calibration is done once every 6 months, only during the plant shut down between two campaign)

OPh – Oxidation pressure (PT-100):

Calibration dates: 4 May 2010, 28 August 2010, 4 November 2010 and 22 July 2011. Valid until 21 January 2012 (Calibration is done once every 6 months, only during the plant shut down between two campaign)

/20/ CDM Operation Training – Certificate by AEL Ltd.:

- Certificate of Competence of Mr. Y. Jacobs number 7504185108085 dated 10 December 2009
- Certificate of Competence of Mr. P. Scutte number 5004165045086 dated 10 December 2009
- Certificate of Competence of Mr. P. De Villiers number 4703085070089 dated 10 December 2009
- Certificate of Competence of Mr. J. Gavin number 7307195028081 dated 10 December 2009
- Certificate of Competence of Mr. D. Maseko number 7009305527081 dated 10 December 2009

/21/ Republic of South Africa – Department of Environmental Affairs and Tourism - Atmosphere pollution prevention Act 1965 of December 2003.

/22/ DNV Climate Change Services AS: Verification report for 1st monitoring period for the project activity. Report no. 2010-0900

/23/ Route Calibration Services: Calibration certificate No. S 110. Dated 31.07.2009 (uncertainty of nitric acid flow meter).

/24/ CDM Project Spreadsheets for the verification period 05 November 2007 to 10 February 2010, including baseline campaign data:

AEL 9_PC_No1_Calc_V8b_MS_100708.xls

/25/ Historical NAP data:

No9 NAP per campaign_CLnormal_MS_20110321.xls

/26/ AEL Ltd: Procedure for Nitric acid production determination, revision 00 dated 13 February 2009

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

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

/28/ CDM Executive Board, Approved Monitoring methodology AM0034, version 02

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

/29/ Hendrik Burger, Production Manager Nitrates, African Explosives Ltd.

/30/ Thembeka Lucy Dhlodhlo, Production Technical Services Nitrates, African Explosives Ltd.

/31/ Martin Stilkenbaumer, Monitoring expert, N.serve

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APPENDIX A

CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUEST

Corrective action requests

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 1	It has been observed that there was a short campaign between 1 August 2010 to 21 September 2010 that was operated without the secondary catalyst and has not been reported in the monitoring report. This campaign should be mentioned in the monitoring report as an intermediate campaign without secondary catalyst installed.	The campaign between 2 July 2010 to 21 September 2010 was operated without secondary catalyst installed. Therefore because operation of the plant without secondary catalyst does not represent the project activity that demands the use of secondary catalyst, a project campaign operated entirely without abatement catalyst should be excluded from both emission reduction calculations and moving average emission factor calculations. However the monitoring report was updated accordingly and the campaign was mentioned as intermediate campaign without secondary catalyst installed.	Because the operation of plant without secondary catalyst does not represent the project activity, it is DNV's opinion that a project campaign operated entirely without abatement catalyst should be excluded from both emission reduction calculations and moving average emission factor calculations. DNV check the emission reduction calculations and confirmed that this has been correctly executed by the project participants. However, the intermediate campaign was reported in the updated MR as a corrective action. CAR 1 is closed.

Clarification requests

CL ID	Clarification request	Response by Project Participants	DNV's assessment of response by Project Participants
CL 1	The monitoring report states the NAP will be determined by mass flow meter directly. However, as per the monitoring plan in the PDD, the NAP would be determined using mass balance calculation in terms of sales and storages, and the Coriolis flow meter readings would be used for apportionment to No. 9 and No. 11 lines since the mass balance calculations are done for No. 9 and No. 11 plants together. Furthermore as per the monitoring plan, if both the flow meters are taken out for maintenance, then the ammonia consumption and conversion efficiency of each of the two nitric acid plants would be used to determine the ratio of the production between the two lines. In addition, it has been observed that some of the NAP values used in the spreadsheets and thus towards emission reduction calculations are based on the Coriolis flow meter values reported in the data storage system and some values are based on	The NAP values are determined as described in the PDD as a result of a combination of mass balance and flow meter readings. The exact procedure is described in the AEL internal procedure "CDM OI002 NAP procedure". The preference is given to the flow meter reading, while the flow meter reading and the mass balance result are compared on a daily basis. Deviations of more than 5 % are investigated and after other plausibility checks it is decided which value is reported. During the first verification for this project, for the monitoring period 5. November 2007 to 10 February 2008 a similar CAR was raised and sufficiently closed during that verification. An analysis was done in order to compare the NAP values determined from tank level/mass balance method and NAP values obtained from Coriolis mass flow meters. The analysis showed that the accuracy of the mass balance calculation and the Coriolis flow meter was equally acceptable; hence the use of Coriolis mass flow meters will be used for determination of NAP. The determination of NAP related data as CLnormal was re-calculated and raw data provided for determination. DNV has	DNV has reviewed the "CDM OI002 NAP procedure" /26/, which is used by AEL to report the daily nitric acid production. The procedure outlines in detail the steps and formulae to calculate the nitric acid production and compare it against 1) the mass balance between various consumers and 2) change in the storage tank level. It was observed by DNV that the NAP values for AEL 9 are corrected more often than those of AEL 11. On query, DNV was informed that the Coriolis flow meter of AEL 11 is more reliable and does not show much variations but the Coriolis flow meter of AEL 9 shows deviations more often. Moreover, since AEL 9 is operated as a 'swing plant' (to control the acid production), therefore the production figures of AEL 9 has to be corrected against mass balance for most of the time while the production from AEL 11 is mostly reported based on the Coriolis flow meter reading. DNV agrees with the use of Coriolis flow meter as the primary source of production reporting and the practice of comparing it against mass balance/storage tank level as a cross check. The same issue was raised during the first verification period of this project (8 February 2008 to 23 May 2009)

	the corrected values from the mass balance calculations. This approach does not seem to be as per the monitoring plan in the PDD. Therefore, it needs to be clarified if the NAP has been determined as per the monitoring plan in the registered PDD, and if the monitoring plan is in accordance with the methodology as per para 203 of VVM version 01.2. A consistent approach need to be adopted ensuring that the values used towards emission reduction are conservative. Furthermore, for some of the corrected values there is a deviation found between the mass balance and the Coriolis flow meter values which needs to be justified.	checked the provided analysis and verified the re-calculation of HNO_3 production (NAP) related data as CL_{normal}, NAP_{BL}, CL_{BL} and CL_n. DNV confirmed the values are correctly calculated. Mass balance calculations were used to cross check NAP values from Coriolis mass flow meter. During this monitoring period for the following periods the calculated NAP values were used instead of the measured NAP values from the NAP flow meter: 23/09/2010 – 27/09/2010 and 29/10/2010 – 30/10/2010 Deviations of 7-9% between the measured NAP values and the calculated NAP values were noted and the calculated values according to the AEL internal procedure were used for these periods. The respective production documentation sheets were made available to DNV for cross checking purposes. 28/01/2011 – 09/02/2011 High deviations between NAP flow meter values and calculated values were noted. After the plant restarted (27/01/2011) it was noted that the plant production flow readings were not corresponding to the ammonia flow measurements. Initially the manual production calculation was used, but this was also left as it was obvious that this was not	and was closed appropriately. DNV checked the production records and confirmed that correct values were used for ER calculations. CL1 is closed.

		tying up with the mass balance. This last change happened on 2 February. The production values used were based on the corrected average that was then adjusted as the plant ran. Initially the stoichiometric conversion of ammonia was used to calculate the nitric acid production; this was then adjusted to better reflect the mass balance values. 14/02/2011 – 06/03/2011 It was noted that the plant production flow readings were not corresponding to the ammonia consumption during production and calculated values according to the AEL internal procedure were used for these periods. The respective production documentation sheets were made available to DNV for cross checking purposes.	
CL 2	Calibration certificates for the stack gas flow meter FT-200 (and the temperature and pressure probe PT-200 and TE-120) were provided for the following dates: 17/11/2009, 23/03/2010, 19/07/2010, and 24/11/2010. The calibration certificates showed no deviations and were found OK for all of these equipments mentioned above. Since the monitoring period is from 02/07/2010 to 15/04/2011 and the validity of the calibration certificates	The calibration certificates for 10/02/2011 and 15/06/2011were provided	The calibration certificates of the instruments dated 10/02/2011 and 15/06/2011 were reviewed by DNV. The certificates show that no deviations exist for any of the instruments. CL 2 is closed.

	is 4 months, next calibration certificates after 24/11/2010 needs to be provided.		

CL 3	Invoices for the new gauzes from Heraeus S.A. Ltd for September 2010 gauze change dated 1 October 2010 and for February 2011 gauze change dated 4 February 2011 have been provided and verified by DNV. The composition of the gauzes has been verified from the internal spreadsheets maintained by AEL to be 60% Pt, 3.81% Rh, 36.01% Pd for September 2010 gauze change. The composition of the February 2011 gauze change needs to be provided.	The gauze composition for project campaign 8 starting 21.09.2010 was 60.1% Pt, 3.9% Rh, 36.0% Pd. The gauze composition for project campaign 9 starting 11.02.2011 was 59.9% Pt, 3.9% Rh, 36.2% Pd. A confirmation from the gauze supplier regarding the gauze composition was provided. The values used in The AEL internal spreadsheet were preliminary values only.	The invoice from the gauze supplier, Heraeus Refinery SA (Pty) was provided to DNV. The invoice confirms the gauze composition to be 59.9% Pt, 3.9% Rh, 36.2% Pd. CL 3 is closed.
CL 4	The stack gas concentrations of N_2O of around 100 mgN_2O/m^3 have been observed during the monitoring period except during the period between 2/02/2011 to 10/02/2011 where higher values of around 1000 mgN_2O/m^3 were noted. However, these higher values were excluded from the data series applying statistical analysis as per the methodology, where values falling out of 95% confidence interval were excluded, which needs to be clarified.	The NCSG and VSG data for the project campaign were treated in the following way: The same statistical evaluation that was applied to the baseline data series was applied to the project data series: a) Calculate the sample mean (x) b) Calculate the sample standard deviation (s) c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation) d) Eliminate all data that lie outside the 95% confidence interval	It was confirmed by DNV that correct statistical procedure has been applied to the N_2O concentration data as per the methodology and that the exclusion of these extreme values is a consequence of applying the statistical analysis. CL 4 is closed.

		e) Calculate the new sample mean from the remaining values eared The statistical analysis was applied exactly according to the methodology AM0034 version 02. It is the nature of the data handling process that outliers and extreme values that are higher or lower than the 95% confidence interval are excluded from the final calculation of the average value for each specific campaign.	

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	-	-	-

No FARs had been issued for the previous verification

Forward action requests from this verification

FAR ID	Forward action request
FAR 1	Evidence supporting the composition of gauzes reported in AEL spreadsheet should be maintained and provided for future verifications.

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APPENDIX C

VERIFICATION MONITORING PARAMETERS

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**NAP/NAP_{BC}** Nitric acid 100% concentrated produced over a baseline campaign/project campaign
Measuring frequency:	Continuously
Reporting frequency:	Every Hour
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Mass Flow Meter – Micro Motion CMF200 TAG: FT-111
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. The monitoring equipment (Coriolis mass flow meter) is common practice for measuring nitric acid and measurement uncertainty is 0.1% (as per the supplier).
Calibration frequency /interval:	Every three years
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure no C09NA revision 1 “Calibration Procedures” of African Explosives Ltd.
Company performing the calibration:	Alpret Control Specialists Ltd.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes /18/ /19/
If applicable, has the reported data been cross-checked with other available data?	The data has been cross checked with NAP data from mass balance method /26/.
How were the values in the monitoring report verified?	DNV performed samples checks of production log books
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK, all activities are regulated by QA/QC Procedures. The data are automatically transferred and stored in the plant’s process control system. All data necessary for the emission reduction calculation are manually transferred to the dedicated relational database management system (N.DBMS) and excel

	calculations spreadsheets. DNV checked the raw data from the PCS and no error was found.
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**NCSG/ $NCSG_{BC}$** N_2O concentration in the stack gas
Measuring frequency:	Continuously
Reporting frequency:	Every 2 seconds
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	ABB AO2040 Uras 14 TAG no AT-110
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the N_2O analyser was not stated in the PDD as the installed analyser at the time of validation was a S.A. MIR 9000 analyser. However it was stated in the PDD that a new analyser ABB AO2040 Uras 14 will be installed in May 2007. The installed analyzer ABB AO2040 Uras 14 is widely used to measure N_2O concentration and have also passed QAL 1. The ABB AO2040 Uras 14 was used during the baseline and project campaign. The measurement accuracy is determined to be 2.69% (as per QAL 2 report) /6/
Calibration frequency /interval:	Internal calibration by AEL Ltd.: Bi-weekly: Zero and span check and calibration in case of deviation > 1% of range of analyzer. External calibration: QAL 2 by an authorized ISO 17025 institute every 5 years, AST test every year in between QAL 2 test /6/

	/10/.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Analyzer is calibrated as per ISO 9001 Procedure no C09NA revision 1 “Calibration Procedures” of African Explosives Ltd.
Company performing the calibration:	External calibration : QAL2 Report number IS-US3-MUC issued by TÜV SUD Industrie Services report dated 19 March 2008 (test conducted on 7-13/02/2008) /6/; valid until 6 February 2013. QAL 2 test are performed by external company accredited for ISO 17025 /6/. AST test: Müller-BBM Gmbh on 10-11/06/2009, report dated 27/07/2009 and on 6/07/2010, report dated 26/10/2010 /10/. Internal calibration by AEL Nitrates Instrumentation Department: Biweekly Zero and span is done by AEL.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes /6/ /18/ /19/
Is(are) calibration(s) valid for the whole reporting period?	The QAL 2 test is valid until 6 February 2013 /6/. However the AST tests were carried out in June 2009 and July 2010. The AST was due on 10 June 2010 (one year after the previous AST of 10-11 June 2009) but was performed on 6 July 2010 instead /10/. But this delay in calibration did not necessitate any correction of the data as per EB 52 Annex 60 guidelines because during the missing calibration period (from 2 July 2010 to 6 July 2010), the plant was operated without secondary catalyst installed in the AOR and no emission reductions were claimed for this period (the intermediate campaign from 2 July 2010 to 21 September 2010 as discusses in section 3.2 above) The zero and span checks were performed bi-weekly during the monitoring period.
If applicable, has the reported data been cross-checked with other available data?	The data are cross-checked with the concentration measurement by a SRM during the QAL 2 test /6/.
How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV /3/. Random picked data points were checked against

	data stored on the monitoring PC.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK, all activities are regulated by QA/QC Procedures. 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).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**TSG** (stack gas temperature)
Measuring frequency:	Every 2 seconds
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Thermocouple type PT100_385-wire RTD Transmitter: Rosemount Model 644 RAI Tag. No.: TE-120

Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The monitoring equipment represents good monitoring practice. Measurement uncertainty: 2.55% (as per QAL 2 test report) /6/
Calibration frequency /interval:	Internal calibration at least once per year, usually every 4 months after each campaign /18/ /19/. QAL 2 test every 5 years, and AST test every year in between QAL 2 test.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure no C09NA revision 1 "Calibration Procedures" of African Explosives Ltd
Company performing the calibration:	QAL 2: TÜV SUD Industrie Services on 7-13/02/2008) report dated 19 March 2008 /6/; valid until 6 February 2013. . AST test: Müller-BBM Gmbh on 10-11/06/2009, report dated 27/07/2009 and on 6/07/2010, report dated 26/10/2010 /10/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	The QAL 2 test is valid until 6 February 2013 /6/. However the AST test was carried out in June 2009 and July 2010 /10/. The AST was due on 10 June 2010 (one year after the previous AST of 10-11 June 2009) but was performed on 6 July 2010 instead /10/. But this delay in calibration did not necessitate any correction of the data as per EB 52 Annex 60 guidelines because during the missing calibration period (from 2 July 2010 to 6 July 2010), the plant was operated without secondary catalyst installed in the AOR and no emission reductions were claimed for this period (the intermediate campaign from 2 July 2010 to 21 September 2010 as discusses in section 3.2 above).
If applicable, has the reported data been cross-checked with other available data?	NA

How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. One 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).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**PSG** (stack gas pressure)
Measuring frequency:	Every 2 seconds
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag No.	Rosemount pressure probe. Transmitter: Rosemount; type 3051Ta12B21BB4I1M5Q4 Tag no.: PT-200

Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The monitoring equipment represents good monitoring practice. Measurement uncertainty: 0.7% (as per QAL 2 report) /6/.
Calibration frequency /interval:	Internal calibration at least once per year, usually every 4 months after each campaign /18/ /19/. QAL 2 test every 5 year, and AST test every year in between QAL2 test /6/ /10/.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure no C09NA revision 1 “Calibration Procedures” of African Explosives Ltd QAL 2 test is performed in accordance with EN14181 /6/
Company performing the calibration:	AEL Nitrates Instrumentation Department /18/ /19/ and QAL 2 test is performed by external company accredited for ISO 17025 (TÜV SUD Industrie Services test on 7-13/02/2008, report dated 19 March 2008, valid until 6 February 2013) /6/ /8/. AST test: Müller-BBM Gmbh on 10-11/06/2009, report dated 27/07/2009 and on 6/07/2010, report dated 26/10/2010 /10/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	The QAL 2 test is valid until 6 February 2013 /6/. However the AST test was carried out in June 2009 and July 2010 /10/. The AST was due on 10 June 2010 (one year after the previous AST of 10-11 June 2009) but was performed on 6 July 2010 instead /10/. But this delay in calibration did not necessitate any correction of the data as per EB 52 Annex 60 guidelines because during the missing calibration period (from 2 July 2010 to 6 July 2010), the plant was operated without secondary catalyst installed in the AOR and no emission reductions were claimed for this period (the intermediate campaign from 2 July 2010 to 21 September 2010 as discusses in section 3.2 above).

If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. One 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).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**VSG_{BC}/VSG** Stack gas flow
Measuring frequency:	Every 2 seconds
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag No.	Emerson Rosemount Annubar Model 485 with 3051 DP transmitter TAG no FT-200

Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the flow meter was not stated in the PDD. This analyzer is widely used to measure volume flow. Uncertainty is determined in QAL 2 to be ± 2.65 %
Calibration frequency /interval:	Internal calibration at least once per year usually every 4 months after each campaign /18/ /19/. QAL 2 test every 5 years /6/, and AST test every year in between QAL 2 test /10/.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Internal calibration: Meter is calibrated as per ISO 9001 Procedure no C09NA revision 1 "Calibration Procedures" of African Explosives Ltd QAL 2 test is performed by external company accredited for ISO 17025 (TÜV SUD Industrie Services test on 7-13/02/2008, report dated 19 March 2008, valid until 6 February 2013) /6/ /8/. AST test: Müller-BBM Gmbh on 10-11/06/2009, report dated 27/07/2009 and on 6/07/2010, report dated 26/10/2010 /10/.
Company performing the calibration:	AST/QAL2 Report number IS-US3-MUC issued by TÜV SUD Industrie Services /6/. QAL 2 report. Author Erhard Krämer.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	The QAL 2 test is valid until 6 February 2013. However the AST tests were carried out in June 2009 and July 2010. The AST was due on 10 June 2010 (one year after the previous AST of 10-11 June 2009) but was performed on 6 July 2010 instead /10/. But this delay in calibration did not necessitate any correction of the data as per EB 52 Annex 60 guidelines because during the missing calibration period (from 2 July 2010 to 6 July 2010), the plant was operated without secondary catalyst installed in the AOR and no emission reductions were claimed for this period (the intermediate campaign from 2 July 2010 to 21 September 2010 as discusses in section 3.2 above).
If applicable, has the reported data been cross-checked with other available data?	NA

How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV /3/. Random picked data points were checked against data stored on the monitoring PC.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. One 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).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameters: (as in monitoring plan of PDD):	**OT_h, OP_h, AFR and AIFR** (AIFR is calculated from results of AFR (Tag No.: FT101) and Primary Air flow rate (Tag No.: FT100))
Measuring frequency:	Continously
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag No.	Thermocouples AOR: Type K-6 Multipoint thermocouple Tag. No.: TC-102-A, TC-102-B, TC-102-C, TC-102-D

	Pressure AOR: PT-100, Yokogawa type Press Tx Ammonia flowmeter: FT101, Yokogawa type orifice plate with D.P. transmitter Primary Air flow rate: FT100, Yokogawa D.P. transmitter.
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. The measurement accuracy is 1% for thermocouples, 1.7% for oxidation pressure, 1.25% for AFR and 1.66% for AIFR (air flow) as per calibration requirements at AEL. The monitoring equipment represent good monitoring practice.
Calibration frequency /interval:	Every 6 months for AFR, AIFR and oxidation pressure (Primary Air flow). Validity 7 month. Every 3 months for thermocouples. Validity 4 months
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure no C09NA revision 1 "Calibration Procedures" of African Explosives Ltd.
Company performing the calibration:	African Explosives Ltd.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes. /18/ /19/
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV /3/. Random picked data points were checked against data stored on the monitoring PC (during 1st verification period).
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. 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).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

APPENDIX D

CURRICULA VITAE OF THE VERIFICATION TEAM MEMBERS

Rafi-ud-Din Khawaja *holds a Master's Degree in Environmental Engineering with over 8 years of experience in air pollution control technology, air pollution monitoring, risk management reviews (RMR), ambient air quality analysis (AAQA), transport phenomena, urban and industrial air quality management .*

He has acquired over four years of experience in validation and verification of numerous CDM and JI projects while working in DNV. He has been qualified as a CDM validator for technical area Renewables (hydro) and as a CDM validator/verifier as well as a Technical Reviewer (TR) for technical area N2O under the Qualification Scheme of Climate Change Services of DNV.

His qualification, industrial experience and experience in CDM facilitate him to assess all technical areas to sufficient degree.

Patrice Massicard *holds a Master degree in Mechanical Engineering and has an overall experience of around 10 years. Prior to joining DNV, having around 3 years' experience in Oil & Gas industry and 5 years' experience in mechanical industry covering equipment design. He has experience of around 2 years in DNV for the certification of oil & gas processing equipments, and 1 year experience in the validation of CDM projects. His qualification, industrial experience and experience in CDM demonstrate him sufficient sectoral competence in the filed oil & gas and mechanical industries.*

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.

Trine Kopperud *holds a Bachelor First Honours Degree in Chemical and Process Engineering with an overall experience of around 25 years in chemical process industries. Prior to joining DNV she has gained experience from fertiliser production (including ammonia, nitric acid and catalysts production and sales), magnesium production and energy efficiency. Positions in research and operations including 5 years' experience in N_2O abatement technologies (research & development, operation, application and sales).*

She has experience of 5 years in validation and verification of CDM projects/JI and other 3rd party validation/verification services in several countries including China, Africa, India, Middle East and Eastern Europe.

Her qualification, industrial experience and experience in CDM/JI demonstrate her sufficient sectoral competence in Chemical Processes Industries and Metal production.