VERIFICATION / CERTIFICATION REPORT

N_2O ABATEMENT PROJECT AT NITRIC ACID PLANT NO. 11 AT AFRICAN EXPLOSIVES LTD ("AEL"), SOUTH AFRICA

UNFCCC Registration No. 1364

Monitoring Period
17 November 2010 to 28 February 2011

REPORT NO. 2012-0293
REVISION NO. 01

DET NORSKE VERITAS

DET NORSKE VERITAS

VERIFICATION / CERTIFICATION REPORT

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

Date of first issue: 27 August 2012	Project No.: PRJC-315885-2011-CCS-NOR
Approved by: Ole A. Flagstad	Organisational unit: DNV KEMA Energy & Sustainability Accredited Climate Change Services
Client: African Explosives Ltd	Client ref.: Hendrik Burger

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 "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (UNFCCC Ref. No. 1364) for the period 17 November 2010 to 28 February 2011.

In our opinion, the reported N_2O emission reductions for the period from 17 November 2010 to 28 February 2011, as reported in the monitoring report for the project version 06 dated 22 August 2012 are fairly stated.

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, version 1.c. of 25 September 2007.

DNV Climate Change Services AS is able to certify that the emission reductions from the project during the period 17 November 2010 to 28 February 2011, amount to 74 590 tonnes of CO_2 equivalents.

Report No.: 2012-0293	Subject Group: Environment	
Report title: N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa		
Work carried out by: Rafi-ud-Din Khawaja, Patrice Massicard, Fahad Saleem		
Work verified by: Weidong Yang		
Date of this revision: 27 August 2012	Rev. No.: 01	Number of pages: 31

Indexing terms

Key words	Service Area
Climate Change Kyoto Protocol Verification Clean Development Mechanism	Verification Market Sector Process Industry

- ☒ No distribution without permission from the client or responsible organisational unit
- ☐ free distribution within DNV after 3 years
- ☐ Strictly confidential
- ☐ Unrestricted distribution

Table of Content ***Page***

Abbreviations

AEL	African Explosives Ltd.
AMS	Automated Measuring System
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
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
NG	Natural Gas
N_2O	Nitrous oxide
PDD	Project Design Document
QAL1	One of the Quality Assurance Levels defined by EN 14181:2004 "Stationary source emissions – quality assurance of automated measuring systems".
QAL2	One of the Quality Assurance Levels defined by EN 14181:2004 "Stationary source emissions – quality assurance of automated measuring systems".
QAL3	One of the Quality Assurance Levels defined by EN 14181:2004 "Stationary source emissions – quality assurance of automated measuring systems".
QMS	Quality Management System
SRM	Standard Reference Method
UNFCCC	United Nations Framework Convention for Climate Change

1 INTRODUCTION

African 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 "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (hereafter the project) for the period 17 November 2010 to 28 February 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 the emission reductions reported for the "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", for the period from 17 November 2010 to 28 February 2011, equating to 74 590 tonnes of CO_2 equivalents.

1.2 Scope

The verification scope is:

- To verify that the 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 reported emission reductions are complete and accurate in order to be certified.

The verification team has based the verification on the recommendations in the Validation and Verification Manual version 0.1.2 /6/.

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:	*N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa*
UNFCCC registration No:	*1364*
Baseline and	

Monitoring methodology:	*AM0034(version 02)*
Project participants:	*African Explosives Ltd ("AEL") authorised by South Africa, N.serve Environmental Services GmbH, Germany ("N.serve") and Electrabel NV/SA authorised by United Kingdom of Great Britain and Northern Ireland and N.serve Environmental Services GmbH, authorised by Switzerland*
Location of the project activity:	*Modderfontein 1645, Province of Gauteng, South Africa.*
Registration date:	*08 February 2008*
Project's crediting period:	*08 Feb 08 to 07 Feb 18 (Fixed)*
Period verified in this verification:	*17 November 2010 to 28 February 2011*

The project was registered as CDM project activity on 08 February 2008.

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 17 November 2010 to 28 February 2011 amount to 74 590 tonnes of CO_2 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 for the project campaign ($tHNO_3$), NAP, shall not exceed the design capacity.

The baseline emission factor is determined ex-ante, and may necessarily be re-calculated when the length of a project campaign is shorter than the normal campaign length as defined by the historic campaigns. The flow-rate of stack gas, the concentration of N_2O in the stack gas, the operating hours, and the production output of 100% concentrated nitric acid need to be monitored in order to calculate the campaign-specific emission factor and the emission reductions for a specific campaign. The emission reductions for a monitoring period are the sum of emission reductions for each campaign within the monitoring period.

In accordance to the applied methodology AM0034 version 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 amount 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 of the stack gas in the baseline campaign (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 estimated as a 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)
PE_n	Total N_2O emissions of the nth project campaign (tN_2O)
OH	The total number of operation hours of the project campaign (h)

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

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

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

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

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 for emission reductions calculation. 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) and records from the production logs of the nitric acid production have been examined and verified for the reporting period.

The verification process was guided by a verification checklist (Appendix B), which aims to ensure a transparent verification process. These documents show in detail how emission reductions have been verified and how the verification findings have been reached.

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	✓	✓	✓			
Expert	Saleem	Fahad	Norway	✓	✓	✓			✓
Technical reviewer	Yang	Weidong	USA					✓	✓

Duration of verification

Monitoring report publication: *13 June 2011*

Preparations: *14 June 2011 to 29 June 2011*

On-site verification: *30 June 2011*

Reporting, calculation checks and QA/QC: *3 July 2011 to 27 August 2012*

2.1 Review of Documentation

The basis for the verification has been the monitoring report from the project for the period 17 November 2010 to 28 February 2011, dated 9 June 2011 and the revised monitoring report version 06 dated 22 August 2012 /1/, the registered project design document (PDD) /2/, the validation report /7/, verification reports from previous monitoring periods, and the approved baseline and monitoring methodology applied by the project, AM0034, version 02 "*Catalytic reduction of N2O inside the ammonia burner of nitric acid plants*" /5/. 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 /9/-/29/.

2.2 Site Visit

During the site visit of 30 June 2011 at African Explosives Ltd., the following personnel were interviewed or assisted the verification team:

Name	*Organization*	*Position*
Hendrik Burger	African Explosives Ltd.	Production Manager Nitrates
Thembeka Lucy Dhlodhlo	African Explosives Ltd.	Production Technical Services Nitrates
Martin Stilkenbaumer	N.serve Environmental Services GmbH	Project manager Monitoring Expert

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 are their implementation in accordance with the monitoring plan.

Further, the following activities were performed:

- A cross-check 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 /5/ 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.

No CAR was identified for this verification period but 2 CLs and 1 FAR were issued. The CLs are related to the nitric acid production reporting methods and the N_2O concentration trend for the current monitoring period while the FAR deals with the evidence for the gauze composition. 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 "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" for the period 17 November 2010 to 28 February 2011.

The findings of the verification are documented in more detail in the verification checklists given in Appendix A of this report.

3.1 Remaining Issues (FARs) from Previous Verification

This is the third verification period. There are no remaining issues (FARs) from the previous verification.

3.2 Project Implementation

As per para 198 (a) of VVM version 01.2 /6/, DNV verified that the project is fully implemented in accordance with the PDD version 1.c. of 25 September 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 20 July 2006 to 18 February 2007. The determination of the permitted operating conditions for operating temperature, operating pressure, maximum ammonia flow rate, maximum ammonia to air ratio, normal campaign length, normal gauze supplier and normal gauze composition was carried out by the validating DOE while the verification of the baseline campaign as well as the determination of the baseline emission factor was done by DNV during the first verification [1]. Due to the additional costs associated with the installation and operation of secondary catalyst, the project proponents did not want to install the abatement catalyst before the project got registered. This resulted in an intermediate campaign (without N_2O abatement catalyst installed) from 25 February 2007 to 18 August 2007 between the baseline campaign and the first project campaign. DNV finds the justification for the intermediate campaign to be reasonable, and in accordance with the clarification AM_CLA_0234 issued on 2 August 2012. Also, since the operating parameters OTh, OPh, AFR and AIFR measured during the baseline campaign were within the permitted operating range for more than 50% of the time, the selected baseline campaign is found to be valid and in compliance with AM0034. The same issue was also addressed by a request for review for the first verification of this project.

The first project campaign started on 12 September 2007. The project got registered with UNFCCC on 8 February 2008, which is the starting date of the crediting period.
During this monitoring period one production campaign was completed:

Campaign PC7 19 November 2010 to 28 February 2011 (102 days)

[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.

The details of previous production campaigns are as follows:

Campaign PC1	12 September 2007 to 19 March 2008
Campaign PC2	20 March 2008 to 28 September 2008
Campaign PC3	04 October 2008 to 23 May 2009
Campaign PC4	8 June 2009 to 27 December 2009
Campaign PC5	30 December 2009 to 3 August 2010
Campaign PC6	4 August 2010 to 16 November 2010

By reviewing the production records, DNV verified that during the current monitoring period from 17 November 2010 to 28 February 2011 there were four shutdowns in the nitric acid plant operation.

- 4 December 2010 (12:00 to 14:00)
- 16 December 2010 (07:00 to 22:00)
- 17 December 2010 (14:00 to 23:00)
- 23 January 2011 (06:00 to 18:00)
- 28 February 2011 Plant was shut down for gauze change

It was verified by DNV by reviewing the raw data and the ER calculations /3/ as well as the daily production records /17/ 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.

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

The emission reductions achieved in this monitoring period are 74 590 tonnes of CO_2 equivalents in the period from 17 November 2010 to 28 February 2011 (i.e. 104 days). The yearly expected emissions reductions according to the registered PDD is 265 460 tonnes of CO_2 equivalents (based on 365 days of plant operation). This corresponds to emission reductions of 75 638 tonnes of CO_2 equivalents in 104 days, which is quite close to the actually achieved emission reductions. This is considered to be reasonable by DNV. The total production of nitric acid for the current monitoring period from 17 November 2010 to 28 February 2011 (104 days) is 66 874 (approx. 643 metric tonnes of 100% HNO_3 per day) while the corresponding production at design capacity is 80 600 metric tonnes of 100% HNO_3 (775 t per day x 104 days). The production during the current monitoring period is therefore below the design capacity for the plant and is hence fully eligible for emission reduction calculations.

3.4 Compliance of monitoring plan with monitoring methodology

DNV is able to confirm that the monitoring plan contained in the registered PDD "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", version 1.c. of 25 September 2007 is in accordance with the approved methodology applied by

the project activity, i.e. AM0034 (version 02) /5/. 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 of the project is complete and in accordance with the monitoring plan contained in the registered PDD version 1.c. of 25 September 2007 as per the approved monitoring methodology, AM0034, version 02 /5/. The monitoring plan and the applied methodology have been properly implemented and followed by the project participants. The determination of the permitted operating ranges, the baseline emission factor and the project emissions are verified and found to be in compliance to AM0034 version 02 /5/.

All parameters stated in the validated monitoring plan and the applied methodology AM0034 version 02 /5/ have been sufficiently monitored and updated as applicable, including: project emission parameters; baseline emission parameters; leakage emissions; management and operational system: the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan.

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

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

3.6 Assessment of Monitoring Parameters

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 (AOR) 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 (t N_2O/t HNO_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 campaign, 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 determined and compared to the project campaign length. Campaign length is defined as the total tonnes of nitric acid at 100% concentration produced with one set of gauzes.

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 design capacity of the nitric acid production should be used for the emission reduction calculations if the nitric acid production of a project campaign

($tHNO_3$), NAP, exceeds the design capacity. The ex-ante determined baseline emission factor may need to be re-calculated when a project campaign length is less than the historic campaign length. The emission reductions for a monitoring period are the sum of emission reductions for each campaign within the monitoring period.

The table below summarizes the permitted operating conditions.

Data variable	Reported value
Design capacity	282 875 metric tonnes of 100% HNO_3 per year (775 metric tonnes per day with 365 operating days per year).
OT_{normal}	820°C to 905°C
OP_{normal}	365 kPa to 450 kPa (gauge)
AFR_{max}	9.094 t NH_3/h
$AIFR_{max}$	11.5 %
CL_{normal}	127 302.4 t HNO_3
GS_{normal} Gauze supplier for the operation condition campaigns	W.C. Heraeus
GC_{normal} Gauze composition for the operation condition campaigns	Platinum (Pt) 56.5% Rhodium (Rh) 3.8% Palladium (Pd) 39.7%

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 /5/.

The verification team confirms that the monitoring report includes all parameters and the monitored data at the interval required by the methodology and the registered 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
- Operating parameters of the ammonia oxidation reactor (temperature, pressure, ammonia and air input)

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

signals are converted by the Programmable Logic Controller (PLC) into a digital signal which is then fed into SCADA data acquisition and database system. Thus collected and processed data, i.e. calculation, raw data, calculated values, are stored in the server continuously and are available in the network system as digital values. Each of the two AEL nitric acid plants (AEL 9 and AEL 11) 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) /4/.

The nitric acid production hourly data from the mass flow mater are transferred to the plant's process control system, and the daily cumulated production value is recorded and archived.

All data necessary for the monitoring and verification procedures related to the project activity are transferred from the nitric acid plant's data acquisition system into a dedicated relational database management system ("N.DBMS") based on Microsoft Access 2002. Database management systems are designed for a structured storage of large amounts of data providing for minimum redundancy and maximum flexibility to allow best practice data analysis.

At N.serve the received data is stored in the N.serve fileserver in a special section for the storage of monitoring data separately for each project. The files are protected against manipulation by a password. Martin Stilkenbäumer, at N.serve is responsible for the correct data handling and processing.

In order to verify that correct data is used for ER calculation, DNV checked the data from productions logs and raw data taken from the SCADA system and compared them against the data available in the excel sheets provided by N.serve.

The verification team assessed the information flow and data collection system and confirms that it meets the requirements of the monitoring plan contained in the registered PDD as per the applied and approved methodology, AM0034 Version 02. Each parameter and the values verified are listed in sections 3.6.3 to 3.6.6 below. Further detailed information on recording frequencies and calibrations are given in Appendix C.

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 AEL11 plant the design capacity is 282 875 metric tonnes of 100% HNO_3 per year (775 t per day x 365 days) /2/ /7/. The total production for the current monitoring period from 17 November 2010 to 28 February 2011 (104 days) is 66 874 (approx. 643 metric tonnes of 100% HNO_3 per day). The corresponding production at design capacity is 80 600 metric tonnes of 100% HNO_3 (775 t per day x 104 days). The production

during the current monitoring period is therefore below the design capacity for the plant and is hence fully eligible.

The following equipments and related documentations were assessed by DNV as part of this verification (further details on each monitoring parameter are given in Appendix C):

Data variable	**Tag. No.** **Range**	**Reported value PC7**	**Assessment /Observation**
VSG Normal gas volume flow rate of the stack gas during project campaign (Nm^3/h)	**FT-76550** Range: 0-150 000 Nm^3/h	75 167 Nm^3/h	The stack gas flow rate is continuously measured with a flow meter: Emerson Rosemount AnnubarR Model 485 with 3051S transmitter. Static pressure and process temperature are measured with a single pipe penetration, and compensated flow is calculated dynamically (Nm^3/h). All transmitters are properly installed. Specifications of the flow meter are provided /9/. The calibration frequency is once per year (however it is usually done every 7 month at the end of each campaign) /21/. Latest QAL2 test (including AST) was conducted from 6 July 2010 to 8 July 2010 by MÜLLER-BBM GmbH and is valid until 2015 /13/. The overall conclusion in the QAL2 report is that the stack gas flow meter is suitable to measure the stack gas flow. The combined uncertainty of flow measurement at standard conditions is ± 2.96 % /10/ and the correction factor based on QAL2 report is 0.96 /13/. It was verified that the same value of correction factor is used in the calculation spreadsheet /3/ for adjusting the total stack gas flow during the monitoring period. The measurement range of the flow meter is appropriate. The internal calibration records /21/ were also verified by DNV.
PSG	**PT-76506** Range 0 - 1000 Pa (abs).	The pressure is used for standardisation of volume flow rate in the stack	The pressure in the stack gas is measured by a Rosemount pressure probe. Transmitter: Rosemount; type 3051TA1A2B21BB4I1M5Q4 The overall conclusion in the QAL2 report /13/ is that the PSG equipment is suitable to measure the stack gas pressure and that the combined standard uncertainty is ± 0.70 % /10/.

TSG	**TE-76170** 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: Rosemont Model 644 RAI The overall conclusion in the QAL2 report is that the TSG equipment is suitable to measure the stack gas temperature and that the measurement uncertainty is ± 2.55 % /10/.
NCSG N_2O concentration in the stack gas (mgN_2O/Nm^3)	**AT-76020-2** Range: 0-2000 ppmv	163.75 mg N_2O/m^3	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 QAL1 /11/. According to the QAL2 report, the overall uncertainty of the measured N_2O concentration by the analyser is 2.69% /10/. After the baseline campaign the N_2O analyzer was replaced from MIR 9000 to ABB AO2000 Uras 14 and the QAL2 was repeated. A correction factor for ABB AO2000 Uras 14 (based on TÜV QAL2 reference measurements) was determined to be 0.99 /10/. It has been verified that the same value is used for adjusting the N_2O concentration during the monitoring period. The analyser passed the yearly functionality AST test (part of EN14181) conducted on 6 to 8 July 2010 /13/. It was verified that zero and span check during the project campaign was done twice a week. 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 /15/. The calibration gas used for span check was 1000

			ppmv with a precision of ± 1%. The expiry date is 01 September 2012 /14/. 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 Nitric acid 100% concentrated produced over a project campaign	**FT-76010**	**66 874** t HNO_3	The nitric acid is measured with a mass flow meter Coriolis MicroMotion CMF300 from Emerson. The flow meter measures the density and temperature of the acid which are used to calculate the concentration of the acid. The total mass flow is then multiplied by the calculated concentration to give 100% nitric acid. The concentration is also checked against manual measurements performed in the laboratory. Calibration certificates are provided /21/. Equipment specification was provided at the site visit. The measurement accuracy is <= 0.1 % of flow rate /25/. 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 the 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	N/A	**2 382**	The operating hours are determined from the production logs. A trip value for the oxidation temperature of 820°C is applied as the exclusion criterion for determining those hours where the plant was offline during the project campaign.
CL_n Campaign length of project campaign	**FT-76010**	**66 874**	The monitoring equipment is as described for NAP.
EF_n Emission	N/A	**0.000417**	The value has been calculated from monitoring data using the algorithm described in N.DBMS /4/.

factor for project campaign $tN_2O/t\ HNO_3$			The calculations are exported to an excel file /3/. The spreadsheet calculations have been checked and found to be correct. Hourly raw data was also made available for verification.
$GS_{project}$ Gauze supplier for the project campaign	N/A	**W.C. Heraeus**	At the site visit invoices were made available for verification of the catalyst supplier /20/. Supplier of primary catalyst is W.C. Heraeus.
$GC_{project}$ Gauze composition for the project campaign	N/A	**Platinum (Pt) 55.7% Rhodium (Rh) 3.7% Palladium (Pd) 40.6%**	The composition of the gauzes for the current monitoring period was verified from the internal spread-sheets maintained by AEL /18/. FAR1 was raised, where PP were asked to provide DNV with the vendor receipts/ lab analysis for the catalysts received by AEL. Type of primary catalyst is Heraeus FTC Plus. The composition used in the baseline campaigns was verified to be 56.5 % Pt, 3.8% Rh and 39.7 % Pd. The compositions used in the project campaigns are hence the same type as used in the baseline campaign.
OT_h (°C) Oxidation Temperature for each hour	**TE-76159/1 76159/2 76159/3 76159/4 76159/5**	N/A	The monitoring of OT_h is required by AM0034 in order to determine when the plant was operating outside of OT_{normal} and is only applicable for the baseline campaign, see section 3.6.4.
OP_h (Pa-gauge) Oxidation Pressure for each hour	**PT-76002-1**	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.	**FT-76003/1**	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	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 and the determination of the baseline campaign emission factor were included in the scope of the first verification /8/. Since the length of the current project campaign (PC7= 66 874 t 100% HNO_3) is shorter than the normal campaign length (CL_{normal} = 127 302.4 t 100% HNO_3), the EF_{BL} was recalculated after eliminating those N_2O values which were obtained for the nitric acid produced beyond CL_n. It is confirmed that the calculation of the baseline emission factor was correctly executed following the requirement of the applied methodology AM0034 version 02 and the clarifications provided by CDM EB /5/. Further details on each monitoring parameter are given in Appendix C.

Data variable	Tag. No.	Reported value for the baseline calculation	Assessment / Observation
VSG_{BC} Normal gas volume flow rate of the stack gas during baseline	**FT-76550**	72 468 Nm^3/h	See comments in 3.6.3 VSG_{BC} was verified by DNV to be correctly reported /3/ /8/.
$NCSG_{BC}$ N_2O concentration in the stack gas (mgN_2O/Nm^3)	**AR-76020-2**	1 557.84 mg/m^3 (recalculated for the current project campaign PC7 as per the methodology)	During the baseline campaign, the concentration of N_2O in the stack gas was continuously measured by the non-dispersive infrared photometry (NDIR) analyser MIR 9000 /8/. The N_2O concentration was recorded every two seconds and hourly means were derived by the data acquisition system. Sufficient documentation were provided for the fulfilment of QAL1 /11/. According to the QAL2 report, the combined relative uncertainty of the analyser is 2.68% /10/. The standard reference method (SRM) showed a deviation to the AMS. Correction factor based on TÜV QAL2 reference measurements was 1.104 /10/. It has been verified that the same value is used in the calculation spread sheet for adjusting the N_2O concentration during the baseline campaign. $NCSG_{BC}$ was verified by DNV to be

			correctly reported /3/ /8/.
OH_{BC} Operating hours of the plant	N/A	4 950 h	See comments in 3.6.3 OH_{BC} was verified by DNV to be correctly reported /3/ /8/.
CL_{BL}/NAP_{BC} t HNO3 Nitric acid 100% concentrated produced over a project campaign	**FT-76010**	134 700 $tHNO_3$	See comments in 3.6.3 NAP_{BC} was verified by DNV to be correctly reported /3/ /8/.
BE_{BC} **(tN_2O)**	**N/A**	623.110 (recalculated for the current project campaign PC7 as per the methodology)	BE_{BC} was verified by DNV to be correctly calculated and reported /3/ /8/.
EF_{BL} Emission factor for baseline period $tN_2O/t\ HNO_3$	N/A	0.004441 $t\ N_2O/\ t\ HNO_3$ (recalculated for the current project campaign PC7 as per the methodology)	EF_{BL} was verified by DNV to be correctly calculated and reported /3/ /8/.
GS_{BL} Gauze supplier for baseline campaign	N/A	W.C. Heraues	Verified during the first verification /8/.
GC_{BL} Gauze composition for baseline campaign	N/A	56.5 % Pt 3.8% Rh 39.7% Pd	Verified during the first verification /8/. Type of primary catalyst was Heraeus FTC Plus.
OP_h (kPa-gauge) Hourly oxidation pressure during the baseline campaign	**PT-76002-1**	N/A	OP_h is measured to check if the parameter is within the permitted operating range during the baseline campaign or if the plant is out of operation. This was verified during validation of the project /7/. More details are given in Appendix C.

OT_h (°C) Hourly oxidation temperature during the baseline campaign	**TE-** **76159/1** **76159/2** **76159/3** **76159/4** **76159/5**	N/A	OT_h is measured to check if the parameter is within the permitted operating range during the baseline campaign or if the plant is out of operation. This was verified during validation of the project. /7/. More details are given in Appendix C.
AFR (t NH_3/h) Ammonia gas flow rate to ammonia oxidation reactor	**FT-** **76003/1**	N/A	AFR is measured to check if the parameter is within the permitted operating range during the baseline campaign or if the plant is out of operation. This was verified during validation of the project. /7/. More details are given in Appendix C.
AIFR (% v/v) Ammonia to Air ratio into ammonia oxidation reactor during baseline campaign	N/A	N/A	AIFR is measured to check if the parameter is within the permitted operating range during the baseline campaign or if the plant is out of operation. This was verified during validation of the project. /7/. More details are given in Appendix C.

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 are required parameter according to AM0034 and the source of data was checked.

Data variable	Reported value	Assessment/ Observation
UNC	**3.99 %**	The overall uncertainties for the AMS have been reported in the QAL2 report /11/.
$EF_{ma,n}$ Moving average emission factor derived over the time from campaign specific emission factors. $tN_2O/t\ HNO_3$	**Campaign PC7:** **0.000843**	The moving average is calculated as the average of EF_n from all the campaigns until PC7. $EF_{ma,n} = (EF_1 + EF_2 + \ldots + EF_n) / n$ Refer to the calculation procedure in section 1.4. Calculation of the emission factors for the previous project campaigns is also present in the excel sheet /3/ from where it was verified that the $EF_{ma,n}$ has been correctly calculated and reported.

EF_{min} The lowest of EFn observed during the first ten campaigns of the project crediting period. $tN_2O/t\ HNO_3$	**N/A**	This value is not applicable until 10 campaigns have been finalised.
EF_p Emission factor used for the specific campaign n $tN_2O/t\ HNO_3$	**Campaign PC7: 0.000843**	The higher of the two values $EF_{ma,n}$ and EF_n has correctly been applied in the emission reduction calculations /3/.
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 Section E1. The N_2O regulation is followed up during the project campaigns and included in the monitoring report. Further African Explosives Ltd. has included the ISO 14001 procedure for following up any new environmental regulations /24/.
NOx regulation		At the site visit the NOx concentration was observed to be below the value set by the Ministry of Environmental Protection (400 ppm) /24/.

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) /4/. 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 equipments and the calibrations are valid for the entire monitoring period. The key data can also be cross-checked via other sources, such as control room stations and on-site meters. No assumptions are used that have any material influence on reported emission reductions.

The project proponent has provided Excel sheets containing the raw data and ER calculations /3/. These data were verified 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 the applied methodology. In accordance with AM0034 version 2 no leakage calculation is required.

The calculations of the emission reduction in the spreadsheet /3/ and the monitoring report /1/ 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 the correct application of 95% confidence interval; and total N_2O emissions of the project campaign were also calculated correctly. Correction factors of 1.01 (for baseline campaign) and 0.96 (for project campaign) were applied for the gas flow rate and 1.104 (for baseline campaign) and 0.99 (for project campaign) were applied for N_2O concentration.
2) The nitric acid productions (100% HNO_3) for the baseline and project campaigns covered in the monitoring period were calculated correctly. The number of hours of operation in the project campaign covered in the monitoring period was also correctly calculated.
3) The project emission factors were correctly calculated.
4) The baseline emission factor was correctly determined according to AM0034. Since $CL_n < CL_{normal}$, all the N_2O values measured beyond CL_n were excluded while recalculating the average NCSG used for the calculation of the baseline emission factor.
5) Any N_2O values measured during hours where the plant operated outside the permitted ranges was excluded from the calculation of the baseline emission factor.
6) The emissions reductions were correctly calculated with consideration if the HNO_3 design capacity was exceeded in the project campaign.

The overall uncertainty for the AMS has been determined to be 3.99 % /11/. 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 AEL 11 of Africans Explosives Ltd. is ISO9001 and ISO14001 certified /19/ /20/. 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 are 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 of quality control:

- QAL 1: According to CDM-EB48 report, para77, "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 EN ISO14956". DNV was able to verify that the evaluation has been carried out by a third party laboratory/testing institute with ISO 17025 accreditation /10/ /13/ /23/ before installation of the AMS and the evaluation is deemed to be acceptable.

- QAL2: The installed AMS is tested and compared to a SRM. For the N_2O analyzer, the QAL2 tests were carried out by TÜV SUD Industrie Services in February 2008 which is valid until 2013 /10/. For stack gas flow measurement, QAL2 tests were carried out by TÜV SUD Industrie Services in February 2008 /10/ and by MÜLLER-BBM in July 2010 /13/. A new QAL2 correction factor (changed from 1.010 to 0.96) was defined for stack gas flow in July 2010.

- AST: The AST for N_2O analyzer was performed in June 2009 and July 2010. In both these tests, it was confirmed that operation of the AMS was acceptable and that the calibration functions for NCSG (determined during QAL2) was still valid and that the requirements for variability are fulfilled /13/. The AST for VSG was also performed in June 2009 and July 2010 (with QAL2). In both these tests, it was confirmed that operation of the AMS was acceptable and that the calibration functions for VSG (determined during QAL2) was still valid and that the requirements for variability are fulfilled /13/.

- QAL3: Span and zero checks are carried out twice a week. DNV checked the records on-site and confirmed the frequency.

4 CERTIFICATION STATEMENT

DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions that have been reported for the project "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (UNFCCC Registration Reference No.1364) for the period 17 November 2010 to 28 February 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 1.c. of 25 September 2007 and the monitoring report version 06 dated 22 August 2012. The verification included i) checking whether the provisions of the monitoring methodology and the monitoring plan were consistently and appropriately applied and ii) the collection of evidence supporting the reported data.

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

In our opinion the GHG emissions reductions of the "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (UNFCCC Registration Ref. No.1364) for the period 17 November 2010 to 28 February 2011 are fairly stated in the monitoring report version 06 dated 22 August 2012.

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

DNV Climate Change Services AS is able to certify that the emission reductions from the "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" during the period 17 November 2010 to 28 February 2011 amount to 74 590 tonnes of CO_2 equivalents.

Oslo, 27 August 2012

Rafi-ud-Din Khawaja	Ole A. Flagstad
CDM Verifier	*Approver*
DNV Climate Change Services AS	DNV Climate Change Services AS

REFERENCES

/1/ CDM Monitoring Report: "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", dated 9 June 2011 (published).
Revised final version 06 dated 22 August 2012.

/2/ CDM Project Design Document: "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", Version 1.c., date of completion: 25 September 2007.

/3/ CDM Project Spreadsheet for the verification period 17 November 2010 to 28 February 2011. Filename:

- *AEL_No11_MP3_PC_Calc_V2_MS_20120822.xlsx*
- *CDM Data No. 11 3MP_V3_20120216_MS.xlsx*
- *Project 1364 Monitoring period 03_ 17_11_2010 - 28_02_2011 Emission reduction calculation.xls*

/4/ Martin Stilkenbäumer, N.serve: "Documentation of N.serve Database Management System for N_2O Destruction CDM Projects"

/5/ CDM Executive Board, Approved Monitoring methodology AM0034, version 02. "Catalytic reduction of N2O inside the ammonia burner of nitric acid plants".

/6/ CDM Executive Board, Validation and Verification Manual. Version 01.2.

/7/ Validation report by TÜV SUD: "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", report no. 1017249, 27 September 2007.

/8/ DNV Climate Change Services AS: Verification/Certification report for N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa for the monitoring period 08 February 2008 to 23 May 2009. Report no 2010-1012 revision 02 dated 16 December 2011

/9/ Product specification for stack gas flow meter:
The Annubar Flowmeter Series. Product Data Sheet 00813-0100-4809, Rev GA of November 2008

/10/ TÜV SUD Industrie Services QAL2 report. Author Erhard Krämer. Report no. IS-US3-MUC/th dated 06 September 2007. (QAL2 for MIR 9000 analyser used in the baseline campaign, period of test 01.08.2007 to 04.08.2007). Valid until 2012.
TÜV SUD Industrie Services QAL2 report. Author Erhard Krämer. Report no. IS-US3-MUC/th dated 09 July 2008. QAL2 for Uras 14 analyzer. Period of test 09.02.2008 to 11.02.2008. Valid until 8 February 2013.

/11/ TÜV SUD QAL 1 report Uras 14. Report number 2410 6657 and 170 608 dated June 2006
TÛV Rheinland: Report on the laboratory test of the Multigas analyzer MIR 9000 CLD Option of the company Environment S.A. for the measurement of NO/NOx, NO_2; CO_2; O_2; N_2O and CH_4. (QAL1)

/12/ TÜV SUD Indsutrie Service: Letter confirming required frequency for zero/span check (QAL3) for Uras 26 (follow-up version of Uras 14).

/13/ MÜLLER-BBM report M80 456/2: "Report on performance test of continuously operating measuring system on a nitric acid plant". AST conducted in 11 June 2009 to 12 June 2009, valid until 10 June 2010, date of report 28 July 2009.

MÜLLER-BBM report M86 201/2: “Report on performance tests for the component N2O and calibration of the components volume flow, temperature and pressure of continuously operating measuring system on a nitric acid producing plant”. QAL2 test (including AST) conducted on 6 to 8 July 2010, QAL2 valid until 5 July 2015, AST valid until 5 July 2011, date of report 4 November 2010.

/14/ Afrox Ltd.: Certificates of analysis of calibration test gases (1000 ppmv) during the monitoring period. Certification date 02 September 2009. Cylinder No. 1351510. Expiring date 01 September 2012.

/15/ Calibration reports N_2O analyser MIR 9000:

- AT-76020-2 N_2O Analyzer Calibration Cell Report form July 2006 to February 2007.

Calibration reports N_2O analyser ABB Uras 14:

- AT-76020-2 N_2O Analyzer Calibration Cell Report form November 2010 to February 2011.

/16/ African Explosives Ltd. “Procedure for CDM data preparation” revision 00 of 13.02.2008.

/17/ African Explosives Ltd.: Daily production reports for the period from 17 November 2010 to 28 February 2011

/18/ African Explosives Limited (AEL): Excel spread-sheet for the compositions of Primary and secondary catalyst

/19/ ISO 9001:2000 Registration number LS 0243 issued by SABS Commercial Ltd. valid until 4 July 2009 (issued 5 July 2006).

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

/20/ ISO 14001:2004 Registration number EM 140394 issued by SABS Commercial Ltd. valid until 11 January 2009 (issued 7 June 2006)

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

/21/ Calibration Certificates:

Nitric acid flow meter (NAP) Tag. No. FT-76010:

Dates of calibration relevant to the current monitoring period:

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-76010. 15 October 2010; valid until 14 October 2013.

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-76010. 9 March 2011, valid until 8 March 2014.

-Internal calibration by AEL Ltd.

Oxidation temperature (OTh) Tag. No.76159/1-5:

Dates of calibration relevant to the current monitoring period:

03/08/2010, 09/03/2011

Oxidation pressure (OPh) Tag.no. PT-76002-1:

Dates of calibration relevant to during the current monitoring period:

03/08/2010,08/03/2011

Ammonia flow rate (AFR) Tag.no. 76003/1:

Dates of calibration relevant to the current monitoring period:
03/08/2010, 08/03/2011

Primary air to ammonia oxidation reactor (used to calculate AIFR):
Dates of calibration relevant to the current monitoring period:
03/08/2010, 08/03/2011

Stack gas flow meter Tag. No. FT-76550 (VSG/VSG_{BC}), stack gas temperature Tag. No. TE-76170 (TSG), stack gas pressure Tag. No. PT-76506 (PSG):
Dates of internal calibration : 28.05.2010, 03.08.2010, 09.03.2011

/22/ 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
- Certificate of Competence of Mr. R. Huggins number 7611285179088 dated 21 July 2008
- Confirmation letter for training of Nomsa Phiri number 663465

/23/ DAP (Deutsches Akkreditierungssystem Prüfwesen GmbH: TÜV SÜD Accreditation for ISO 17025:2005 dated 13 July 2007. DAP registration number DAP-PL-2885.80. Valid until 22 May 2011.

/24/ Republic of South Africa – Department of Environmental Affairs and Tourism - Atmosphere pollution prevention Act 1965 of December 2003.

/25/ Route Calibration Services: Calibration certificate No. S 110. Dated 31.07.2009 (uncertainty of nitric acid flow meter).

/26/ AEL Ltd.: Span gas tracking log, version1.

/27/ AEL Ltd: Procedure for Nitric acid production determination, revision 00 dated 13 February 2009

/28/ Emerson Process Management (Alpert Control Specialists): Calibration certificate for the Coriolis meter dated 9 March 2011

/29/ AEL Ltd: Maintenance work list from 16 July 2009 to 1 October 2011

- o0o -

APPENDIX A

CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS

Corrective action requests

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
-	-	-	-

No CARs have been issued for this verification

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 is determined by mass flow meter measurements. However, as per the monitoring plan in the registered PDD, the NAP would be determined by 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 corrected values from the mass balance calculations. This approach does not seem to be as per the	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 8 February 2008 to 23 May 2009 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 NAP related data was re-calculated and raw data	DNV has reviewed the “CDM OI002 NAP procedure” /27/, 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. Furthermore, 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) and was closed appropriately. By reviewing the raw data /3/ and the daily production reports /17/, it was confirmed by DNV that the plant was shut down on 17-18 November 2012. In order to confirm the non-availability of the Coriolis flow meter from 19 November 2010 to 9 December 2010, DNV reviewed and confirmed the maintenance record /29/. The maintenance record confirms that Coriolis flow meter was faulty during this period and (after fixing it), the PP started using coriolis reading again to report NAP from 10 December 2010 onwards. NAP for this period was reported on the basis of mass balance calculation, which is deemed acceptable by DNV. From 10 December 2010 onwards, the NAP data reported by the coriolis meter was used, which was verified from the daily production reports. Moreover, the Coriolis flow meter was calibrated

	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 huge deviation found between the mass balance and the Coriolis flow meter values which needs to be justified. For example the values from 17 November 2010 to 10 December 2010 are all corrected values used in the ER spreadsheet and some of them are more than double than those reported through the data acquisition system. There was no evidence found for the value reported on 13/01/2011 that also needs to be provided.	provided for determination. During 17/11/2010 and 18/11/2010 the plant was shut down and no NAP values were recorded. From 19/11/2010 until 09/12/2010 the flow meter was faulty and the corrected values according to the mass balance were used. From 10/12/2010 the flow meter was fixed and the flow meter readings were used. For 28/02/2011 there was mistake in the data transfer. The correct value of 24t/d will be used instead of 0.24t/d. A scanned copy of the report for 13/01/2011 was provided.	in March 2011 and the calibration certificate was provided to DNV /28/. The certificate shows results of flow measurements before and after calibration. The two results show negligible deviations thus confirming proper functioning of the meter before and after the calibration. Therefore DNV considers the data reported by the Coriolis meter both before and after the calibration of March 2011 to be accurate. The correction of NAP made for 28 February 2012 was verified by reviewing the daily production report. The scanned copy of the daily production report from 13 January 2011 was provided to DNV in order to verify the reported NAP value. CL1 is closed.

CL 2	The stack gas concentrations of N_2O of around 125 mgN_2O/m^3 have been observed towards the start of the monitoring period that gradually went up to 200 mgN_2O/m^3 until 23 January 2011. This trend in N_2O concentration development could be explained by the decrease in ammonia conversion efficiency along the campaign length. However, there was a sudden drop in the N_2O concentration on 23 January 2011 to a lower value of around 150 mgN_2O/m^3 that continued to drop to around 130 mgN_2O/m^3 towards the end of the campaign. This needs to be explained.	From the downtime report, it is noted that on 23/01/2011 an unscheduled plant shut down happened. At this occasion plant pre start up checks were done by maintenance personnel. As part of these checks the surface area of the pelleted catalyst was improved and the catalyst was levelled this reduces or eliminates the possibilities of gas bypassing the catalyst bed. This resulted in improved abatement as the possibilities for gas to bypass the catalyst bed were reduced or eliminated. Also on production meeting minutes, there was a request (20.01.2011) to check expander bypass valve. A comment noted next to request was that it will be attended when plant is offline.	DNV reviewed the downtime report to verify the plant shut down and it is DNV's opinion that the argument presented is reasonable to explain the decrease in N_2O concentration and is hence acceptable. The same has been reported in the section B.1 of the updated MR. CL 2 is closed.

Forward action requests from previous verification

FAR ID	Forward action request	Summary of how FAR has been addressed in this reporting period	Assessment of how FAR has been addressed
FAR 2	The steps related hand-transferring of data should be used for improvement QA/QC procedures (for example typing of QAL 3 results to table for Shewart chart).	The transfer of data is improved by instituting files that are kept at the analysers. In the files will be the calibration reports and a member of the project team will once a week then transfer the data to the Excel file. This would prevent the instrumentation technician from having to use a book to first write down the results before transferring it to the calibration report.	The improvement in the transfer of data is verified by DNV. FAR 2 is closed.

Forward action requests from this verification

FAR ID	Forward action request
FAR 1	The composition of the gauzes has been verified from the internal spreadsheets maintained by AEL to be 55.7% Pt, 3.7% Rh, 40.6% Pd for November 2010 gauze change. The evidence supporting the information in the AEL spreadsheet should be maintained and provided for the future verifications

APPENDIX B

VERIFICATION CHECKLIST

Table 1: Verification Checklist

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
A. Opening Session			
A.1. Introduction to audits		*African Explosives Ltd. has contracted DNV Climate Change Services AS to carry out the first periodic verification of the CDM project "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" at African Explosives Ltd. in South Africa* *The agenda for the site visit was presented and African Explosives Ltd. introduced by giving general information about the production at the site.*	OK
A.2. Clarification of access to data archives, records, plans, drawings etc.	/3/ /4/	*Access to all relevant data has been granted to the verification team.* *Operating conditions and related parameters were provided by African Explosives Ltd.* *All other parameters related to the operation of the CDM project were available from records and spread sheets provided by N.serve.* *Finalised spread sheets including periodic campaign data have been provided.*	OK
A.3. Contractors for equipment and installation works *Who has installed the equipment? Who was contracted for planning etc.?*		*The equipment for N_2O concentration monitoring during the baseline campaign is supplied by Environment S.A and installed by local representative in South Africa.* *The equipment for N_2O concentration monitoring during the project campaigns is supplied by ABB and installed by ABB South Africa Ltd..* *The volume flow meter (Emerson Rosemount Annubar® Model 485 Flow Meter series was installed by African Explosives Ltd. personnel according to manufacturer's instructions.* *The secondary abatement catalyst supplier is W.C. Heraeus.* .	OK
A.4. Actual status of installation works		*The project is in fully operational.* *All monitoring equipments were properly installed and checked during the*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
Project installation should be finished at time of initial verification in so far as the project should be ready to generate emission reductions afterwards.		*site visit.*	
B. *Open issues indicated in validation report* *Especially in projects which are not yet registered at CDM-EB or JI-SB, there might be some outstanding issues which should have been indicated by the validation report.*			
B.1. Missing steps to final approval		*None*	OK
C. *Implementation of the project* *This part is covering the essential checks during the on-site inspection at the project's site, which is indispensably for an initial verification*			
C.1. Physical components *Check the installation of all required facilities and equipment as described by the PDD.*	/2/	*The project has been implemented as described in the PDD.*	OK
C.2. Project boundaries *Check whether the project boundaries are still in compliance with the ones indicated by the PDD.*	/2/	*The project boundaries are in compliance with the boundaries defined in the PDD.*	OK
C.3. Monitoring and metering systems *Check whether the required metering systems have been installed. The meters have to comply with appropriate quality standards applicable for the used technology.*	/10/ /11/ /13/ /15/	*All necessary measuring devices are installed and access to them was granted during the site visit. The key measurement equipment is the volume flow meter installed to measure the stack gas flow and the non-dispersive infrared photometry (NDIR) installed to measure N_2O. The monitoring equipment is tested according to the European standards EN14181.*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
C.4. Data uncertainty *How will data uncertainty be determined for later calculations of emission reductions? Is this in compliance with monitoring and metering equipment?*	/10/ /23/	*The overall uncertainty is determined by the QAL2 test carried out by TÜV SUD who is accredited according to ISO/IEC 17025.* *Zero and span check for the N_2O NDIR analysers is preformed bi-weekly. In case the deviation exceeds 1% the analyzer is calibrated. In addition manual calibration checks with certified calibration gas are performed regularly.* *The results of overall uncertainties are determined in the QAL2 report.* *The overall uncertainty of the AMS is 3.99%.*	OK
C.5. Calibration and quality assurance *Check how monitoring and metering systems are subject to calibration and quality assurance routines* *a) with installation* *b) during future operation*	/10/ /11/ /13/ /14/ /19/ /20/	*Maintenance and calibration routines for parameters related to the ammonia oxidation reactor are included in the African Explosives management system.* *CDM Procedures are developed for the calibration of stack gas analyser system.* *Stack gas flow meter and N_2O analyser: QAL2 tests are performed according to the European standard EN14181 (main items).* *N_2O analyser: See C.4.* *Stack gas flow meter: Calibrated prior to shipment by the supplier. Calibration at least yearly (usually every 7 month after each campaign).* *Yearly functionality test in accordance to EN 14181 (AST).* *Standard reference method used for stack gas volume flow is according to ISO 10780.* *Calibration certificates and certificates of calibration gases were made available for verification.*	OK
C.6. Data acquisition and data processing systems *Check the eligibility of used systems.*	/2/ /4/	*The analogue signal (4 to 20 mA) output from the N_2O analyzer and stack gas flow meter are converted into a digital signal which is then fed into the data acquisition system. The data acquisition system performs calculations to derive the hourly averages for each of the parameters. These are then extracted and converted into appropriate files which can be imported into the N.serve Database Management System (N.DBMS).*	OK
C.7. Reporting procedures	/4/	*N.serve is the formal focal point of communication with the Executive Board*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
Check how reports with relevance for the later determination of emission reductions will be generated		*and the UNFCCC secretariat.* *African Explosives is responsible for the operation of the nitric acid plant and to monitor the necessary data for verification.* *N.serve is responsible to compile the monitoring report based on the data provided by African Explosives (data files are imported into the N.serve Database Management System (N.DBMS).* *At N.serve the received data is stored at the N.serve fileserver in a special section for the storage of monitoring data. The files are protected against manipulation by a password. Martin Stilkenbäumer at N.serve is responsible for the correct data handling and processing.* *A spread sheet is generated with all parameters and calculations of emission reductions.*	
C.8. Documented instructions *Check whether the personnel performing tasks with sensitivity for the monitoring of emission reductions have access and knowledge of documented instructions, forming a part of the project's management system.*	/16/	*The personnel performing tasks with sensitivity for the monitoring and calculation of emission reductions have access and knowledge of relevant documented instructions. This was confirmed during site-visit.*	OK
C.9. Qualification and training *Check whether the personnel performing tasks with sensitivity for the monitoring of emission reductions has the appropriate competences, capabilities and qualifications to ensure the required data quality.*	/22/	*The personnel responsible for monitoring and calculation of emission reductions are appropriately trained and qualified.* *Specific training programs have been held for African Explosives Ltd. personnel for operating and maintenance of the CDM equipment.* *Training for the operation and maintenance of the CDM project related to the ammonia oxidation operation is included in African Explosives Ltd. Quality assurance management system.*	OK
C.10. Responsibilities *Check whether all tasks required to gather data and prepare a monitoring report with the necessary quality have been allocated to responsible employees.*		*See C.7.*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
C.11. Troubleshooting procedures *Check whether there are possibilities of redundant data monitoring in case of having problems with the used monitoring equipment. Such procedures may reduce risks for the buyers of emission reductions (e.g. the Client)*	/16/	*The CDM procedure "Procedure for CDM data preparation", revision 00, includes description of maintenance routines and analyzer faults including actions to be taken internally in African Explosives.*	OK
D. Internal Data *Identifying the internal GHG data sources and ways in which the data have been collected, calculated, processed, aggregated and stored should be part of initial verification to assess accuracy and reliability of the internal GHG data...*			
D.1. Type and sources of internal data *Acquire information on type and source of internal GHG data, which is used in calculations of emission reductions. E.g.." continuous direct measurements", "site-specific correlations", "periodic direct measurements", "use of models" and/or "use of default emissions factors".*	/16/ /27/	*All main parameters are directly measured every two seconds.* *The nitric acid is measured with a mass flow meter Coriolis MicroMotion CMF300 from Emerson.* *100% nitric acid is calculated from the measurements of flow from the mass flow meter, and the concentration. The concentration is measured automatically and the correct measurement is checked by manual test.* *The procedure describing the NAP calculation in the CDM procedure is corrected.*	OK
D.2. Data collection *How is data collected and processed? What are the means of quantifying emissions from the different data sources?*		*There is one main source of emissions: N_2O not decomposed.* *See C 6.*	OK
D.3. Quality assurance *Does internal data collection underlie sufficient quality assurance routines?*		*No data for the calculation of emission reductions are manually transferred.* *The quality of data collection seems appropriate.*	OK
D.4. Significance and reporting risks		*The risk associated with the main parameters used for the emission*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
Assess the significance and reporting risks related to the different internal data sources. Potential reporting risks may be related to the calculation methods, accuracy of data sources and data collection and/or the information systems from which data is obtained. The significance of and risks associated with the data source indicate the level of verification effort required at a later stage.		*reduction calculations are regarded to below, see D.1.*	
E. External Data *Especially for data of baseline emissions there might be the necessity to include external data sources. The access to such data and a proof of data quality should be part of initial verification. If it is deemed to be necessary, an entity delivering such data should be audited.*			
E.1. Type and sources of external data *Acquire information on type and source of external data, which is used in calculations of emission reductions*	/24/	*It was informed at the site visit that N_2O is not regulated in South Africa.*	OK
E.2. Access to external data *How is data transferred? How can reproducibility of data set be ensured?*		*N/A*	OK
E.3. Quality assurance *Does external data underlie any quality assurance routines?*		*N/A*	OK
E.4. Data uncertainty *Is it possible to assess the data uncertainty of external data? Are such routines included in reporting procedures?*		*N/A*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
E.5. Emergency procedures *Are there any procedures which will be applicable if there is no access to relevant external data?*		*N/A*	OK
F. Environmental and Social Indicators *A Monitoring Plan may comprise environmental and/or social indicators which could be necessary to monitor for the success of the project activity.*			
F.1. Implementation of measures *A project activity may demand for the installation of measures (e.g. filtering systems or compensation areas), which are exceeding the local legal requirements. A check of the implementation or realization of such measures should be part of the initial verification.*		*No environmental and social indicators are required for monitoring.*	OK
F.2. Monitoring equipment *Check where necessary whether the required metering systems have been installed. The meters have to comply with appropriate quality standards applicable for the used technology.*		*N/A*	OK
F.3. Quality assurance procedures *What quality assurance procedures will be applied for such data?*		*N/A*	OK
F.4. External data *Check the quality, reproducibility and uncertainty of external data.*		*N/A*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
G. *Management and Operational System* *In order to ensure a successful operation of a Client project and the credibility and verifiability of the ERs achieved, the project must have a well defined management and operational system.*			
G.1. Documentation *The system should be documented by manuals and instructions for all procedures and routines with relevance to the quality of emission reductions. The accessibility of such documentations to persons working on the project has to be secured.*	/16/ /18/ /19/ /20/	*Nitric acid production plant operations relevant for the quality of emission reductions are covered by African Explosives Ltd. QMS.* *Audit is performed twice a year.* *A CDM procedure is developed for the project activity.*	OK
G.2. Qualification and training *The system should describe the requirements on qualification and the need of training programs for all persons working on the emission reduction project. Performed training programs and certificates should be archived by the system.*	/18/ /19/ /20/ /22/	*Nitric acid production plant operations relevant for the quality of emission reductions are covered by African Explosives Ltd. QMS.* *Training certificates are available.*	OK
G.3. Allocation of responsibilities *The allocation of responsibilities should be documented in written manner.*	/4/ /18/	*See C.7.*	OK
G.4. Emergency procedures *The system should contain procedures which provide emergency concepts in case of unexpected problems with data access and/or data quality.*	/18/ /19/ /20/	*Nitric acid production plant operations relevant for the quality of emission reductions are covered by African Explosives Ltd. QMS.* *A CDM procedure is developed for the project activity.*	OK
G.5. Data archiving *The system should provide routines for the archiving of all data which is required for*	/4/	*Data archiving is appropriate.* *See description in section 3.6.2.*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
verifying the project's performance in the context of consecutive verifications.			
G.6. Monitoring report *The system includes procedures for the calculation of emission reductions and the preparation of the monitoring report.*	/4/	*Spread sheets have been developed for calculation of emission reductions.* *The responsibility for reporting (N.serve) and security of the data is appropriate.*	OK
G.7. Internal audits and management review *The system includes internal control procedures, which allow the identification and solution of problems at an early stage.*		*Comprehensive CDM procedures for troubleshooting and calibration routines have been developed for identifying of problems at an early stage.*	OK

Table 2: Data Management System/Controls

The project operator's data management system/controls are assessed to identify reporting risks and to assess the data management system's/control's ability to mitigate reporting risks.

The GHG data management system/controls are assessed against the expectations detailed in the table. A score is assigned as follows:

- Full - all best-practice expectations are implemented.
- Partial - a proportion of the best practice expectations is implemented
- Limited - this should be given if little or none of the system component is in place.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
A. Defined organisational structure, responsibilities and competencies		
A.1. Position and roles *Position and role of each person in the GHG data management process is clearly defined and implemented, from raw data generation to submission of the final data. Accountability of senior management must also be demonstrated.*	Full	African Explosives is responsible for the day-to-day operation of the AMS on site, including calibrations and maintenance. African Explosives has appointed the Instrument Department Manager as responsible person for these tasks. African Explosives derives hourly averages for all of the monitored parameters and transfer these data to N.serve. Martin Stilkenbäumer Monitoring Expert of N.serve is responsible for the correct analysis of the delivered data in accordance with the methodology.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
A.2. Responsibilities *Specific monitoring and reporting tasks and responsibilities are included in job descriptions or special instructions for employees.*	Full	N.Serve is the formal focal point of communication with the Executive Board and the UNFCCC secretariat. African Explosives is responsible for the operation of the nitric acid plant and to monitor the necessary data for verification. N.serve is responsible to compile the monitoring report based on the data provided by African Explosives (data files are imported into the N.serve Database Management System (N.DBMS). At N.serve the received data is stored at the N.serve fileserver in a special section for the storage of monitoring data. The files are protected against manipulation by a password. Martin Stilkenbäumer at N.serve is responsible for the correct data handling and processing.
A.3. Competencies needed *Competencies needed for each aspect of the GHG determination process are analysed. Personnel competencies are assessed and training programme implemented as required.*	Full	The personnel responsible for monitoring and calculation of emission reductions are appropriately trained and qualified. Specific training programs have been held for African Explosives Ltd. personnel for operating and maintenance of the CDM equipment. Training for the operation and maintenance of the CDM project related to the ammonia oxidation operation is included in African Explosives Ltd. Quality assurance management system.
B. Conformance with monitoring plan		
B.1. Reporting procedures *Reporting procedures should reflect the monitoring plan content. Where deviations from the monitoring plan occur, the impact of this on the data is estimated and the reasons justified.*	Full	The reporting procedures reflect the monitoring plan content. No deviation request was submitted for this monitoring period.
B.2. Necessary Changes *Necessary changes to the monitoring plan are identified and changes are integrated in local procedures as necessary.*		No material changes to the monitoring plan were identified.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
C. Application of GHG determination methods		
C.1. Methods used *There are documented description of the methods used to determine GHG emissions and justification for the chosen methods. If applicable, procedures for capturing emissions from non-routine or exceptional events are in place and implemented.*	Full	Methods used to determine GHG emissions are documented properly.
C.2. Information/process flow *An information/process flow diagram, describing the entire process from raw data to reported totals is developed.*	Full	Information process flow has been defined in detail in the "Documentation of N.Serve Database management System for N_2O destruction CDM Projects"
C.3. Data transfer *Where data is transferred between or within systems/spreadsheets, the method of transfer (automatic/manual) is highlighted - automatic links/updates are implemented where possible. All assumptions and the references to original data sources are documented.*	Full	Incorrect transfer or missing values from production logs to excel sheet of operation data and stack monitoring data were found. These errors are minor and do not have any effect on the emission reduction calculation. Reference to original data sources is documented.
C.4. Data trails *Requirements for documented data trails are defined and implemented and all documentation are physically available.*	Full	All necessary raw/intermediate data is maintained properly.
D. Identification and maintenance of key process parameters		
D.1. Identification of key parameters *The key physical process parameters that are critical for the determination of GHG emissions (e.g. meters, sampling methods) are identified.*	Full	The key physical parameters are identified.
D.2. Calibration/maintenance *Appropriate calibration/maintenance requirements are determined.*	Full	Necessary calibration and/or maintenance for the measurement equipment have been conducted according to the documented procedures.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
E. GHG Calculations		
E.1. Use of estimates and default data *Where estimates or default data are used, these are validated and periodically evaluated to ensure their on-going appropriateness and accuracy, particularly following changes to circumstances, equipment etc. The validation and periodic evaluation of this is documented.*	Full	The GWP of N_2O used to determine the GHG emission reduction is in line with IPCC (GWP=310).
E.2. Guidance on checks and reviews *Guidance is provided on when, where and how checks and reviews are to be carried out, and what evidence needs to be documented. This includes spot checks by a second person not performing the calculations over manual data transfers, changes in assumptions and the overall reliability of the calculation processes.*	Full	The collection of parameters used and the calculation of GHG emissions are automatically done.
E.3. Internal verification *Internal verifications include the GHG data management systems, to ensure consistent application of calculation methods.*	Full	Internal audits is described in detail in the “Documentation of N.serve Database management System for N_2O destruction CDM Projects” and comprises: · Data handling · Plausibility checks of raw data · Plausibility checks of emission factor calculations · Transfer of values from the calculations to the monitoring report
E.4. Internal validation *Data reported from internal departments should be validated visibly (by signature or electronically) by an employee who is able to assess the accuracy and completeness of the data. Supporting information on the data limitations, problems should also be included in the data trail.*	Full	See E.2.
E.5. Data protection measures *Data protection measures for databases/spreadsheets should be in place (access restrictions and editor rights).*	Full	The access to the raw data is restricted to especially selected personnel. At N.serve the received data is stored at the N.serve fileserver in a special section for the storage of monitoring data. The files are protected against manipulation by a password.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
E.6. IT systems *IT systems used for GHG monitoring and reporting should be tested and documented.*	Full	The SCADA and N.DBMS systems are confirmed to operate properly. The risk of errors is regarded as very low.

-o0o-

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 – MicroMotion CMF300 from Emerson TAG: FT-76010
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) /25/.
Calibration frequency /interval:	Every 3 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./21/
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes /21/
If applicable, has the reported data been cross-checked with other available data?	Yes, the NAP values are also determined from a mass balance method (see CL1)
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 is automatically transferred to the plant's process control system. The daily cumulative NAP is recorded and archived.

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):	**OTh** Oxidation temperature of AOR
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.	Thermocouple type K310S/steel TAG: TE- 76159/1; 76159/2; 76159/3; 76159/4; 76159/5
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. However the measurement uncertainty is 1% (as per AEL calibration requirements)
Calibration frequency /interval:	During project campaigns the thermocouples were calibration before or after each campaign (usually every 7 month) /21/
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?	Yes, the frequency represents good monitoring practice.
Company performing the calibration:	AEL internal calibration as per ISO 9001 Procedure no. C09NA revision 1 “Calibration Procedures” of 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 /21/
If applicable, has the reported data been cross-checked with other available data?	N/A
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 is automatically stored in the SCADA Data Acquisition System. Once a month the results are downloaded from SCADA to an excel file for analysis and calculation. The raw data is saved on a DAT device and 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?	N/A

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**OPh** Oxidation pressure during the baseline 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.	Yokogawa, type Pressure Tx TAG: PT-76002-1
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. However the measurement uncertainty is 1.7% (as per AEL calibration requirements)
Calibration frequency /interval:	Once every 7 month /21/

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?	Yes, the frequency represents good monitoring practice.
Company performing the calibration:	AEL internal calibration as per ISO 9001 Procedure no. C09NA revision 1 "Calibration Procedures" of 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 /21/
If applicable, has the reported data been cross-checked with other available data?	N/A
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 is automatically stored in the SCADA Data Acquisition System. Once a month the results are downloaded from SCADA to an excel file for analysis and calculation. The raw data is saved on a DAT device and 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?	N/A

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**AIFR** Ammonia to air ratio (determined from the ratio of AFR and primary oxidation air which is the parameter assessed below).

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.	Yokagawa type D.P. transmitter TAG: FT-76002/1
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. However the measurement uncertainty is 1.66% (as per AEL calibration requirements)
Calibration frequency /interval:	Once per 7 months /21/
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?	Yes, the frequency represents good monitoring practice.
Company performing the calibration:	AEL internal calibration as per ISO 9001 Procedure no. C09NA revision 1 "Calibration Procedures" of 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 /21/
If applicable, has the reported data been cross-checked with other available data?	N/A
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 is automatically stored in the SCADA Data Acquisition System. Once a month the results are downloaded from SCADA to an excel file for analysis and calculation. The raw data is saved on a DAT device and 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?	N/A

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**AFR** Ammonia gas flow rate to ammonia oxidation reactor
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.	Yokogawa D.P. Transmitter TAG: FT-76003/1
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. However the measurement uncertainty is 1.25 % (as per AEL calibration requirements)
Calibration frequency /interval:	Once per 7 months /21/
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?	Yes, the frequency represents good monitoring practice.
Company performing the calibration:	AEL internal calibration as per ISO 9001 Procedure no. C09NA revision 1 “Calibration Procedures” of 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
If applicable, has the reported data been cross-checked with other available data?	N/A
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 is automatically stored in the SCADA Data Acquisition System. Once a month the results are downloaded from SCADA to an excel file for analysis and calculation. The raw data is saved on a DAT device and 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?	N/A

	Assessment/Observation
Data / Parameter: (as in monitoring plan of PDD):	**$NCSG_{BC}$/NCSG** N_2O concentration in the stack gas
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.	MIR 9000 (baseline campaign) and ABB AO2000 Uras 14 (project campaigns). TAG no. AT-76020-2

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 represents good monitoring practice. The overall N_2O measurement uncertainty of the analyser MIR 9000 (used during baseline campaign) is 2.68 % and for ABB AO2000 Uras (used during project campaigns) is 2.69% /10/ /11/ /15/.
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: QAL2 every 5 years and AST every year
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:	TÜV SUD Industrie Services and MÜLLER-BBM /10/ /13/ Internal calibration by AEL Ltd. /21/. QAL2/AST is performed by external company accredited for ISO 17025 /23/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is (are) calibration(s) valid for the whole reporting period?	Yes /10/ /13/
If applicable, has the reported data been cross-checked with other available data?	The data is cross-checked with the concentration measurement by a SRM during the QAL2 test.
How were the values in the monitoring report verified?	Raw data of the Excel sheet "CDM Data No. 11 3MP_V3_20120216_MS.xlsx" from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring system.
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 is automatically stored in the SCADA Data Acquisition System. Once a month the results are downloaded from SCADA to an excel file for analysis and calculation. The raw data is saved on a DAT device and 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**
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 3-wire RTD Transmitter: Rosemount Model 644 RAI TAG. TE-76170
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?	Yes. Measurement uncertainty: 2.55% (as per QAL2 test report) /10/
Calibration frequency /interval:	Internal calibration at least once per year, usually every seven months after each campaign /21/. QAL2 test every 5 year.
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. /21/ QAL2/AST test is performed in accordance with EN 14181 /10/ /13/.

Company performing the calibration:	TÜV SUD Industrie Services and MÜLLER-BBM /10/ /13/ Internal calibration by AEL Ltd. /21/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes
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 of the Excel sheet "CDM Data No. 11 3MP_V3_20120216_MS.xlsx" from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring system.
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 is automatically stored in the SCADA Data Acquisition System. Once a month the results are downloaded from SCADA to an excel file for analysis and calculation. The raw data is saved on a DAT device and 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**
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 3051TA1A2B21BB4I1M5Q4 TAG. PT-76506
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?	Yes. Measurement uncertainty: 0.7% (as per QAL2 report) /10/.
Calibration frequency /interval:	Internal calibration at least once per year, usually every seven months after each campaign. QAL2 test every 5 year.
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. /21/ QAL2/AST test is performed in accordance with EN14181 /10/ /13/
Company performing the calibration:	TÜV SUD Industrie Services and MÜLLER-BBM /10/ /13/ Internal calibration by AEL Ltd. /21/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is (are) calibration(s) valid for the whole reporting period?	Yes
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 of the Excel sheet “CDM Data No. 11 3MP_V3_20120216_MS.xlsx” from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring system.
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 is automatically stored in the SCADA Data Acquisition System. Once a month the results are downloaded from SCADA to an

	excel file for analysis and calculation. The raw data is saved on a DAT device and 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 3051S transmitter TAG no. FT-76550
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 analyser is widely used to measure volume flow. Uncertainty is determined in QAL2 to be ± 2.84 % /10/
Calibration frequency /interval:	Internal calibration at least once per year usually every seven months after each campaign. QAL2 test every 5 years and AST every year
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?	Yes, the meter is calibrated as per ISO 9001 Procedure no C09NA revision 1 “Calibration Procedures” of African Explosives Ltd.
Company performing the calibration:	TÜV SUD Industrie Services and MÜLLER-BBM /10/ /13/

	Internal calibration by AEL Ltd. /21/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is (are) calibration(s) valid for the whole reporting period?	Yes /10/ /13/
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 of the Excel sheet “CDM Data No. 11 3MP_V3_20120216_MS.xlsx” from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring system.
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 is automatically stored in the SCADA Data Acquisition System. Once a month the results is downloaded from SCADA to an excel file for analysis and calculation. The raw data is saved on a DAT device and 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.

***Mr. Yang Weidong** holds a Master's Degree in Chemical Engineering and has studied MBA in general management, with an overall experience of around 20 years. Prior to joining DNV he had around 4 years' experience in chemical process industry covering technology, production, and quality control. He worked in research institute of pharmaceutical industry for about 8 years. His experience also covers the fields of quality management, environmental management and health & safety management. He has also been an IRCA registered lead auditor of management systems such as ISO 9001, ISO 140001 and OHSAS 18001 standards for various industrial sectors, including chemical process industry for 6 years.*

He has experience of around 4 years in validation and verification of numerous GHG emission projects and inventory in DNV, both in China and other countries. The GHG emission projects and inventory include various types, such as, CDM, VCS, CAR and CCAR.

His qualification, industrial experience and experience in CDM demonstrate his sufficient sectoral competence in chemical process and coal mine methane recovery and use.