VERIFICATION / CERTIFICATION REPORT

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

UNFCCC Registration No. 1171

Monitoring Period
11 February 2008 to 04 August 2009

REPORT NO. 2010-9065

REVISION NO. 03

DET NORSKE VERITAS

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VERIFICATION / CERTIFICATION REPORT

Date of first issue: 18 January 2011	Project No.: PRJC-197666-2009-CCS-NOR
Approved by: Edwin Aalders	Organisational unit: DNV KEMA Energy & Sustainability Accredited Climate Change Services
Client: African Explosives Ltd	Client ref.: Hendrik Burger

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Summary:

DNV Climate Change Services AS has been contracted by African Explosives Ltd. to carry out verification and certification of the emission reductions reported for the "Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" (UNFCCC Ref. No. 1171) for the period 11 February 2008 to 04 August 2009.

In our opinion, the reported N_2O emission reductions for the period from 11 February 2008 to 04 August 2009, as reported in the revised monitoring report for the project of 20 April 2012 (version 10) are fairly stated. The published monitoring report was updated in order to reflect the issues raised during this verification and to comply with EB51 Annex 12 requirements. Furthermore, the monitoring report and the emision reduction calculation spreadsheets were udpated in response to the incompleteness messages of 3 November 2011 and of 01 March 2012. The PP has also updated the MR to the CDM-MR template version 01.

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

Hence, DNV Climate Change Services AS is able to certify that the emission reductions from the project during the period 11 February 2008 to 4 August 2009, amount to 67 604 tonnes of CO_2 equivalents.

Report No.: 2010-9065	Subject Group: Environment	
Report title: Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa		
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Abbreviations

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

1 INTRODUCTION

African Explosives Ltd. (hereafter AEL) has commissioned DNV Climate Change Services AS (DNV) to carry out the verification and certification of the emission reductions reported for the "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" (hereafter the project) for the period 11 February 2008 to 4 August 2009. This report contains the findings from the verification assignment and a certification statement for the certified emission reductions.

1.1 Objective

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

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

The objective of this verification was to verify and certify emission reductions reported for the "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" for the period 11 February 2008 to 4 August 2009.

1.2 Scope

The verification scope is:

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

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

The verification team has based the verification on the recommendations in the Validation and Verification Manual /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:	*“Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd (“AEL”), South Africa”*
Baseline and monitoring methodology:	*AM0034(version 02)*
Sectoral scope:	*5 “Chemical Industry”*
Project Entities:	*African Explosives Ltd.; N.serve Environmental Services GmbH.*
Location of the project activity:	*Modderfontein, Province of Gauteng, South Africa.*
UNFCCC Registration no.:	*1171*
Registration:	*05 November 2007*
Crediting period:	*05 November 2007 to 04 November 2017*
Period verified in this verification:	*11 February 2008 to 04 August 2009*

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 11 February 2008 to 04 August 2009 amount to 67 604 tonnes of CO_2 equivalent.

1.4 Methodology for determining emission reductions

The emission reductions for the project activity over a specific campaign are determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid over the campaign period and the GWP of N_2O. The nitric acid production (NAP) for the project campaign ($tHNO_3$), shall not exceed the design capacity in a calendar year.

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

In accordance to the applied methodology AM0034 version 2, the emission reductions for the project activity over a specific campaign are determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid over the campaign period and the GWP of N_2O as follows:

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

Where:

ER	Emission reductions of the project for the specific campaign (tCO_2e)
NAP	Nitric acid production during the project campaign ($tHNO_3$). The maximum value of NAP shall not exceed the design capacity.
EF_{BL}	Baseline emissions factor ($tN_2O/tHNO_3$)
EF_P	Emissions factor used to calculate the emissions from this particular campaign (i.e. the higher of $EF_{ma,n}$ and EF_n) – see below
GWP_{N2O}	Global warming potential of N_2O = 310

The average mass of N_2O baseline emissions per hour is estimated as the product of the nitrous oxide concentration in the stack gas (NCSG) and the volume flow rate in the stack gas (VSG). The N_2O emissions during the baseline campaign are estimated from the product of N_2O emission per hour and the total number of complete hours of operation of the baseline campaign using the following equation:

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

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

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

where:

EF_{BL}	Baseline N_2O emissions factor ($tN_2O/tHNO_3$)
BE_{BC}	Total N_2O emissions during the baseline campaign (tN_2O)
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas during the baseline campaign (mgN_2O/m^3)
OH_{BC}	Total number of operating hours of the baseline campaign (h)
VSG_{BC}	Mean gas volume flow rate at the stack in the baseline measurement period (m^3/h)

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

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

where:

VSG	Mean stack gas volume flow rate for the project campaign (m^3/h)
NCSG	Mean concentration of N_2O in the stack gas for the project campaign (mgN_2O/m^3)
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 estimated as follows:

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

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

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

Further a campaign-specific emissions factor shall be used to cap any potential long-term trend towards decreasing N_2O emissions that may result from a potential built up of platinum deposits. After the first ten campaigns of the crediting period of the project, the lowest EF_n observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in a EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall used EF_{min} and not EF_n As 10 project campaigns are not yet completed this is not applicable to this verification period.

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)	Kopperud	Trine	Norway	✓		✓	✓		✓
GHG Auditor	Cerri	Fausto	Italy	✓	✓	✓			
Technical reviewer (report rev 1)	Yang	Weidong	US					✓	✓
Technical reviewer (report rev 2)	Khawaja	Rafi-ud-din	Norway					✓	✓

Duration of verification

Preparations: *24 November 2009 to 27 November 2009*

Monitoring report publication: *8 December 2009*[1]

On-site verification: *10 December 2009*

Reporting and QA/QC (including resolving of outstanding issues)*:*
12 December 2009 to 20 June 2012

[1] Please note the publication is not within the 2 weeks as required from CDM-EB-52 were the Board requested the secretariat to introduce a requirement, in the appropriate procedure, for designated operational entities (DOEs) to publish a monitoring report at least two weeks prior to undertaking a verification site visit. The Board requested the DOEs to comply with this timeline in their on-going work.

2.1 Review of Documentation

The basis for the verification has been the monitoring report from the project for the period 11 February 2008 to 4 August 2009, dated 2 December 2009 /1/, the revised monitoring report version 7 dated 2 July 2011 /1/, and the further revised monitoring report (after incomplete messages) version 9 dated 06 December 2011 and version 10 dated 20 April 2012 /1/, the registered project design document (PDD) /2/, and the approved baseline and monitoring methodology applied by the project, AM0034, version 02 /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/, /4/ and /8/-/28/.

2.2 Site Visit

During the site visit of 10 December 2009, the following personnel were interviewed or assisted the verification team:

Name	*Organization*	*Position*
Hendrik Burger	African Explosives Ltd.	Production Manager Nitrates
Paul Eagar	African Explosives Ltd.	Nitrates Operation Manager
Alan Pikor	African Explosives Ltd.	Technical Services Manager
Martin Stilkenbaumer	N.serve	Monitoring Expert

2.2.1 Audit Programme

The following programme was used at the site visit:

09:00 Opening meeting

- Agree on program and availability of personnel

09:30 Stack gas – Assessment of monitoring equipment and calibration procedures incl. Plant inspection

- Remaining issues from 1. periodic verification
- Check measurements for baseline and project campaigns
    - Access to raw data for baseline and project campaigns (excel sheets) and trend curves
    - Calibration routines and documentation (log books and calibration certificates)
    - QAL 2 updated report and AST reports
    - Calibration documentation, QAL 3 zero/span checks
    - Inspection of analyser
    - Special events during baseline and project campaigns
    - Sampling of data to check data provided in monitoring period

12:00 NAP - Assessment of monitoring equipment and calibration procedures

- Nitric acid monitoring equipment
- Calibration routines and documentation
- Procedures for the calculation of 100% nitric acid
- Special events during baseline and project campaigns
- Sampling of data to check data provided in monitoring report and excel sheets

14:00 Ammonia oxidation catalyst

- Documentation of primary catalyst installed (baseline- and project campaigns)

15:00 Assessment of Management system and Quality assurance

- Remaining issues from previous verification
- Check updated procedures
- Internal audit reports
- Routines for handling, archiving and securing of all required data
- Regulation on N2O and NOx emissions
- NOx emissions observed during monitoring period
- QMS certification (any updates ?)

16:00 Emission reduction calculations

- Calculation excel sheet
- ERs compared to predicted in PDD (ref. new requirement in VVM para 189c)

18:00 Preparations for close-out meeting

18:30 Close-out meeting and presentation of findings

2.3 Assessment

The data presented in the monitoring report 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, and the management system were assessed during the site visit.

2.4 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.

Two CARs and one FAR were raised during this verification. Please refer to Appendix A of this report. All CARs were sufficiently addressed and closed.

3 VERIFICATION FINDINGS

This section summarises the findings from the verification of the emission reductions reported for the “Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd (“AEL”), South Africa” for the period 11 February 2008 to 04 August 2009.

The findings of the verification are documented in more detail in the verification checklist given in Appendix B of this report.

3.1 Remaining Issues, CARs, FARs from Previous Validation

One FAR is remaining from the previous verification of the project. Please refer to Appendix A of this report. The remaining FAR was closed.

3.2 Project Implementation

The project is implemented in accordance to the PDD and the baseline campaign started 05 September 2007 and was finalised on 06 November 2007. The first project campaign with secondary catalyst installed started on 09 November 2007 and ended 9 February 2008 (first monitoring period was from 5 November to 10 February). This monitoring period is from 11 February 2008 to 4 August 2009 and comprises 3 project campaigns as stated below.

Campaign PC2	19 February 2008 to 12 June 2008 (115 days)
Campaign PC3	08 July 2008 to 28 July 2008 (21 days)[2]
Campaign PC4	25 February 2009 to 04 August 2009 (161 days)

During the on-site visit the verification team inspected the installation of all instrumentation necessary for the monitoring of the emission reductions. DNV also verified the plant shut down and special events provided in the monitoring report /1/ by cross checking the raw data during those periods. It should be noted that no correction is needed during the plant downtimes listed in section B.1 of the MR. DNV can confirm there was no AMS downtime or malfunction during the verification period which would require correction to the measured data as per AM0034 requirements..

As per para 198 (a) of VVM version 01.2, DNV verified that the project is fully implemented according to the description in the registered PDD document version 2.0 dated 05 April 2007. The verification team confirmed, through visual inspection that all physical features of the proposed CDM project activity including data collection systems and storage have been implemented in accordance with the registered PDD. As per para 198 (b) of VVM version 01.2, DNV confirmed during the on-site visit that the CDM project is completely operational. Neither a notification nor approval of change has been requested to CDM Executive Board.

[2] It should be mentioned that the secondary catalyst was removed from the ammonia oxidation reactor in the period from 28 July 2008 to 25 February 2009 due to technical problems and no emission reductions are claimed for that period.

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

The emission reductions in this monitoring period are 67 604 tonnes of CO_2 equivalents in the period from 11 February 2008 to 04 August 2009 (i.e. 541 days). The yearly expected emission reductions according to the registered PDD are 116 779 tonnes of CO_2 equivalents. This corresponds to emission reductions of 173 089 tonnes of CO_2 equivalents in 541 days and hence the observed emission reductions are considerably lower than the expected. The reasons are that the secondary catalyst was removed from the operation for several months due to technical problems in plant operation (From 28 July 2008 to 25 February 2009), the abatement performance was lower than expected in the PDD (90%) and the baseline emission factors (0.00564 $tN_2O/tHNO_3$ for campaign PC2 and PC 4, and 0.00457 t N_2O/ t HNO_3 for campaign PC3) were lower than the estimated value that was given in the registered PDD (0.00601 $tN_2O/tHNO_3$).

3.4 Compliance of monitoring plan with monitoring methodology

DNV is able to confirm that the monitoring plan contained in the registered PDD "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa", version 2.0 of 5 April 2007 is in accordance with the approved methodology applied by the project activity, i.e. AM0034 (version 02). Neither a revision nor a deviation to the monitoring plan has been requested to CDM Executive Board.

3.5 Compliance of monitoring with the monitoring plan

DNV is able to confirm that the monitoring is complete and has been carried out in accordance with the monitoring plan contained in the registered PDD "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa", version 2.0 of 05 April 2007. The determination of the permitted operating ranges[3] (verified by the validating DOE), the baseline emission factor[4] (verified by DNV during the 1st verification), and the determination of the project emissions are verified and found to be in compliance to AM0034 version 02.

The results from the QAL 2 tests have been provided. The QAL 2 test covers the most important issues as per EN14181 and confirms the determination of the overall uncertainty used in the calculation of the baseline emission factor.

All parameters stated in the monitoring plan are monitored and reported appropriately.

The monitoring methodologies and sustaining records were sufficient to enable verification of the emissions reductions.

3 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.

4. The determination of permitted operating ranges was included in the scope of validation, however the baseline emission factor and normal campaign length were reported to be included in the scope of the verifying DOE /7/. DNV verified the baseline campaign and the CLnormal during the first verification /26/.

3.6 Assessment of Monitoring Parameters

3.6.1 Historical data and permitted operating conditions

In order to avoid that the operation of the nitric acid production plant is manipulated in a way to increase the N_2O generation, and thereby increasing the CERs, the ammonia flow, ammonia to air ratio, operating temperature and pressure in the ammonia oxidation reactor and the use of ammonia oxidation catalyst is monitored during one campaign length (baseline campaign) and compared to the historical values as determined in the PDD. The baseline N_2O emission factor (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, the emission factor is not valid and the baseline campaign needs to be repeated.

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

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

The emission reductions for the project activity over a specific campaign are determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid over the campaign period and the GWP of N_2O. The nitric acid production for the project campaign ($tHNO_3$), NAP, shall not exceed the design capacity during a calendar year.

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

The CDM Executive Board clarified in EB31 meeting that either validating or verifying DOE could undertake the task of determination of the permitted operating conditions for project activities using approved methodology AM0034. For this project the determination of the permitted ranges, normal gauze supplier and composition were included in the scope of the validating DOE /7/. However it was stated in the validation report that the verification of normal campaign length should be confirmed by the verifying DOE.

Data variable	**Reported value**	**Observation**
Design capacity	106 621 100% metric tonnes per year (292.112 metric tonnes per day operating 365 days per year).	Verified by validating DOE /7/
OT_{normal}	810°C to 915°C	Verified by validating DOE /7/
OP_{normal}	860 to 910 kPa (gauge)	Verified by validating DOE. /7/
AFR_{max}	3.877 t NH_3/h	Verified by validating DOE.

		/7/
$AIFR_{max}$	11.5 %	Verified by validating DOE. /7/
CL_{normal} t HNO_3	24 026.2 tonnes	Excel sheet with historical data was provided /30/. DNV was able to confirm the reported value is correct. Random picked data points were checked against production logs.
GS_{normal} Gauze supplier for the operation condition campaigns	W.C. Heraeus	Verified by validating DOE. /7/
GC_{normal} Gauze composition for the operation condition campaigns	Platium (Pt) 59% Rhodium (Rh) 4% Palladium (Pd) 37%	Verified by validating DOE. /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 as per the applied and approved methodology, AM0034 version 02.

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

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

- Stack gas flow rate and standardisation calculation
- Stack gas N_2O concentration and calculation of amount of N_2O
- Nitric acid produced
- Operating parameters of the ammonia oxidation reactor (temperature, pressure, ammonia input)

The instrument transmitters continuously provide an analogue signal (4 to 20 mA) from the N_2O analyzer and the stack gas flow meter including the stack gas temperature and pressure. The signals are converted by the Programmable Logic Controller (PLC) into a digital signal which is then fed into SCADA data acquisition and database system. Thus collected and processed data, i.e. calculation, raw data, calculated values, are stored in the server continuously and available in the network system as digital values. The AEL two nitric acid plants 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 in the plant transfers the data at least once a week into AEL’s main IT system as well as making a complete copy of that weeks 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).

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 at 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 the correct data is used DNV have been checking data from productions logs, and raw data taken from the SCADA system and compared to data and calculations 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 frequency and calibration 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 maximum emissions reductions can only be requested for the nitric acid production equal to the design capacity. For the N9 plant the design capacity is 106 621 t 100% HNO_3 per year (292.112 t per day x 365 days). Since the start of the crediting period the production of nitric acid has been as follows, with the campaign PC2, PC3, and PC4 covered in this monitoring period:

Campaign PC1 (9/11/2007-09/02/2008): 25 902 t 100% HNO_3

Campaign PC2 (19/02/2008-12/06/2008): 30 938 t 100% HNO_3

Campaign PC3 (08/07/2008-28/07/2008): 5 402 t 100% HNO_3

Campaign PC4 (25/02/2009-04/08/2009): 27 860 t 100% HNO_3

The total production during the three campaigns covered in this monitoring period is 64 200 t over the total period of 541 days (approx. 119 t 100% HNO_3 per day). The corresponding production at design capacity is 158 032 (292.112 t per day x 541 days). The production for this monitoring period is therefore below the design capacity for the plant.

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

Data variable	Tag. No.	Reported value Campaign P2	Reported value Campaign P3	Reported value Campaign P4	Assessment /Observation
VSG Normal gas volume flow rate of the stack gas during project campaign (Nm^3/h)	**FT-200**	41 172 Nm^3/h Range: 18-45 000 Nm^3/h	42 561 Nm^3/h Range: 18-45 000 Nm^3/h	42 457 Nm^3/h Range: 18-45 000 Nm^3/h	The stack gas flow rate is continuously measured with a flow meter: Emerson Rosemount Annubar Model 485 combined with pressure transmitter Rosemount 3051S Static pressure and process temperature are measured with a single pipe penetration, and compensated flow is calculated dynamically (Nm^3/h). All transmitters were properly installed. Specification of the flow meter is provided /9/. The flow meter was calibrated prior to shipment by the supplier Emerson Rosemount and thereafter regularly in accordance with AEL calibration requirements /22/. The overall conclusion in the QAL 2 report is that the stack gas flow meter is suitable to measure the stack gas flow and that the uncertainty is ± 2.65%, and the combined uncertainty after normalisation by PSG and TSG is 3.22% /10/.

					The standard reference method (SRM) showed a deviation to the installed flow meter. Correction factor from the TÜV SÜD Industrie Service GmbH QAL 2 report is 0.962 /10/. It has been verified that the same value is used in the calculation spread sheet for adjusting the total stack gas flow during the monitoring period. The measurement range of the flow meter is appropriate and the measured average flow rate is within the range expected for a nitric acid plant with a capacity of 292.112 metric tonnes per day. The calibration is documented/14/ /22/. Since the AST test was due on 07/02/2009 (one year after the QAL 2 test) /10/, but was performed on 11/06/2009) /14/, the maximum error of the VSG instrument is applied as per EB 52 Annex 60 guidelines. The combined uncertainty of VSG, TSG and PSG of 3.22% is applied to the normalised VSG data. Since there was no project campaign in operation from 07/02/2009 to 24/02/2009 (refer to section 3.5.3 above), the error was applied from 25/02/2009 to 11/06/2009 and is thus only applicable to campaign P4.

TSG (°C)	**TE–120**	Range: 0-500 °C The temperature is used for standardisation of volume flow rate in the stack.	Range: 0-500 °C The temperature is used for standardisation of volume flow rate in the stack.	Range: 0-500 °C The temperature is used for standardisation of volume flow rate in the stack.	The temperature in the stack gas is measured by a thermocouple type PT100_385 3-wire RTD Transmitter: Rosemount Model 644 RAI. The overall conclusion in the QAL 2 report is that the TSG equipment is suitable to measure the stack gas temperature and that the combined standard uncertainty is ± 2.55 % /10/. The calibration is documented /10/ /22/. Due to the delay in AST test from 07/02/2009 to 11/06/2009, the VSG data is corrected by applying the combined uncertainty of VSG, TSG and PSG (PSG and TSG data are not directly used in emission reduction calculations and therefore not corrected).
PSG (h Pa abs)	**PT-200**	Range 0 – 1000 hPa (abs). The pressure is used for standardisation of volume flow rate in the stack	Range 0 – 1000 hPa (abs). The pressure is used for standardisation of volume flow rate in the stack	Range 0 – 1000 hPa (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 3051Ta12B21BB4I1M5Q4. The overall conclusion in the QAL 2 report is that the PSG equipment is suitable to measure the stack gas pressure and that the combined standard uncertainty is ± 0.70 % /10/. The calibration is documented /10/ /22/. Due to the delay in AST test from 07/02/2009 to 11/06/2009, the VSG data is corrected by applying the combined uncertainty of

					VSG, TSG and PSG (PSG and TSG data are not directly used in emission reduction calculations and therefore not corrected).
NCSG N_2O concentration in the stack gas (mgN_2O/Nm^3 converted from ppmv)	**AT-110**	811.80 mg /Nm^3 Range: 0-2000 ppmv	280.68 mg /Nm^3 Range: 0-2000 ppmv	543.91 mg /Nm^3 Range: 0-2000 ppmv	The concentration of N_2O in the stack gas is continuously measured by the non dispersive infrared photometry (NDIR) analyser ABB AO2040-Uras14. The N_2O concentration is recorded every two seconds and hourly means are derived by the data acquisition system. Sufficient documentation has been provided for the fulfilment of QAL 1 /12//13/. According to the QAL 2 report, the combined uncertainty of the analyser is 2.69 % /10/. The standard reference method (SRM) showed a deviation to the AMS. Correction factor based on TÜV QAL 2 reference measurements were 0.970 /10/. It has been verified that the same value is used in the calculation spread sheet for adjusting the N_2O concentration during the monitoring period. The analyser passed the yearly AST test /14/. Due to the delay in AST test from 07/02/2009 to 11/06/2009, the NCSG data is corrected by applying

					the combined uncertainty of the analyser of 2.69%. It was verified that zero and span check during the project campaign was done twice a week by trained AEL personnel. Further calibration with standard gas 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 /16/. The calibration gas used for span check was 955 ppmv during the project campaigns. With a precision of ± 2%. The analyser room and equipment is inspected weekly. Weekly check lists and N_2O Maintenance Activities Log Book were made available during the site visit.
NAP t HNO_3 Nitric acid 100% concentrated produced over a project campaign	**FT-111**	**30 938** t HNO_3	**5 402** t HNO_3	**27 860** t HNO_3	The nitric acid is measured with a mass flow meter Coriolis Micro Motion CMF 200 from Emerson. 100% nitric acid is calculated from the measurements of flow from the mass flow meter, and the concentration. The concentration is measured as an integral part of the flow meter. The concentration is checked against manual measurement of concentration in laboratory. Calibration certificates are provided /22/. Equipment specification

					was provided at the site visit. The flow accuracy is ± 0.1 % of measured flow rate. Sampling of concentration measurements and values from mass flow meter were performed during the site visit including checks of transfer of data.
OH Operating hours during project campaign (hours)	N/A	**2 506**	**434**	**2 339**	The operating hours is determined from production logs. A trip value for the oxidation temperature of 810 ^{o}C is applied as the exclusion criterion for determining those hours where the plant was offline during the project campaign. OH was verified by DNV to be correctly reported /4/.
CL_n Campaign length of project campaign (HNO_3)	**FT-111**	**30 938**	**5 402**	**27 860**	The CL_n has the same value as reported for NAP above. The monitoring equipment is as description for NAP.
EF_n Emission factor for project campaign n $tN_2O/t\ HNO_3$	N/A	**0.00253**	**0.00090**	**0.00181**	The value has been calculated from monitoring data using the algorithm described in N.DBMS /11/. The calculations are exported to an excel file /4/. The spread sheet calculations have been checked and found to be correct. Hourly raw data was made available for verification.
$GS_{project}$ Gauze supplier for the project	N/A	**W.C. Heraeus**	**W.C. Heraeus**	**W.C. Heraeus**	At the site visit invoices were made available for verification of the catalyst supplier /18/.

campaign					
$GC_{project}$ Gauze composition for the project campaign	N/A	**Platium (Pt) 59 % Rhodium (Rh) 4 % Palladium (Pd) 37%**	**Platium (Pt) 59 % Rhodium (Rh) 4 % Palladium (Pd) 37%**	**Platium (Pt) 59 % Rhodium (Rh) 4 % Palladium (Pd) 37%**	At the site visit invoices were made available for verification of the catalyst composition used in campaign no. P2, P3 and P4 /18/. The composition used in the project campaigns was verified to be 59 % Pt, 4% Rh and 37% Pd. The composition is the same of the used in the baseline and historical campaigns.

3.6.4 Monitored data for baseline emissions within the project boundary

The verification of the baseline campaign data (campaign H15, from 5 September 2007 to 6 November 2007) and the determination of the baseline campaign emission factor were included in the scope of the verifying DOE /7/. The baseline emission factor is applicable for two campaigns (no. PC2 and PC4), since the length of the project campaigns (PC2 = 30 938 t 100% HNO_3 and P4 = 27 860 t 100% HNO_3) are both longer than the campaign length of the baseline campaign of 17 718 100% HNO_3 and also longer than the historic campaign CL_{normal} of 24 026.2 t 100% HNO_3. Hence the baseline emission factors used for these projects campaigns are 0.00564 tN_2O/HNO_3 /4/ /26/.

For project campaign PC3, since the length of the project campaigns is only 5 402 t 100%HNO_3, hence shorter than the campaign length of the baseline campaign of 17 718 t 100% HNO_3 and also shorter than the historic campaign of 24 026.2 t 100% HNO_3. Thus according to AM0034 the baseline emission factor for this campaign was re-calculated as 0.00457 t N_2O/HNO_3.

The baseline campaign data was verified by DNV during the first monitoring period. However, since the CERs for the 1st monitoring period have not been issued by UNFCCC yet, the data and calculation for the baseline campaign period and the 1st verification period /29/ are also submitted together with this issuance request. It is confirmed that the calculation of the baseline emission factor was correct following the requirement of EB51 Annex 12 (hence the preliminary values of baseline parameters in the registered PDD is re-calculated and verified by DNV).

Further details and information about calibration of the monitoring equipment are given in Appendix C.

The incompleteness message received on 01 March 2012 is referring to VVM v.1.2 para 184 (a) (ii) & EB 52 Annex 60) regarding delayed calibration. DNV is of the opinion that the calibration of stack gas flow (VSG) and N_2O concentration (NCSG) is covering the period of the baseline campaign since regular calibrations were performed (every 4 month for the VSG and bi weekly zero and span check and in addition calibration whenever a deviation exceeding 1% for the N_2O analyser was performed) /16/ /22/. The SRM during the QAL 2 test showed a deviation to the AMS (resulting in correction factor of 0.962 for VSG and 0.970 for NCSG). DNV has checked and confirmed the correction factors have correctly and retroactively been applied to the monitored data during the baseline campaign./10/. Further the overall uncertainty (UNC) of the

AMS of 4.2% was applied when calculating the EF_{BL} (the overall measurement accuracy of the N_2O analyser is 2.69% and for the stack gas flow 2.65%, and the overall uncertainty (UNC) is 4.2%) /10/. As per EB 52 Annex 60, in case of delayed calibration the DOE may conclude its verification, provided a conservative approach is adopted in the calculation of emission reductions either by a) applying the maximum permissible error of the instrument to the measured value, if the results of the delayed calibration do not show any errors in the measuring equipment, or the error is smaller than the maximum permissible error, or b) by applying the error identified in the delayed calibration test, if the error is beyond the maximum permissible error of the measuring equipment. The QAL 2 test includes a method to establish a calibration function and its variability based on a SRM ie. a comparison between a portable N_2O analyser (SRM) and the installed N_2O analyser (AMS), the deviation between the two analysers can be regarded as an "error" and this "errors" called correction factors in this report have been applied to all measured values during the baseline campaigns. Further the overall uncertainty (UNC) has also been applied in the calculation of the baseline emission factor (thus reducing the EF_{BL} by the overall uncertainty and hence this is conservative). Since the calibration of both NCSG and VSG were actually performed regularly during the baseline campaign period and as described above both the correction factors and UNC have conservatively been applied, DNV is of the opinion that the calibration requirements are in accordance to the methodology, monitoring plan and EB requirements.

Data variable	Tag. No.	Reported value for the baseline campaign period Applicable for PC 2 and PC4	Re-calculated value Campaign PC3	Assessment / Observation
VSG_{BC} Normal gas volume flow rate of the stack gas during baseline	**FT-200**	42 983 Nm^3/h	42 983 Nm^3/h	See comments in 3.6.3 VSG_{BC} was verified by DNV to be correctly reported /4/ /26/. The measurement range of the flow meter is appropriate and the measured average flow rate is within the range expected for a nitric acid plant with a capacity of 292.112 metric tonnes per day. The calibration is performed as per the monitoring plan in the registered PDD and documented /22/. DNV can confirm the correction factor determined in QAL 2 /10/ for VSG was retroactively and

				correctly applied to the data for VSG monitored during the baseline campaign /29/.
$NCSG_{BC}$ N_2O concentration in the stack gas (mgN_2O/Nm^3 converted from ppm)	**AT-110**	1 764.44 mg/Nm^3	1 429.10 mg/Nm^3	See comments in 3.6.3 $NCSG_{BC}$ for PC2 and PC4 is calculated correctly /4/. Re-calculated $NCSG_{BC}$ for campaign PC3 was verified by DNV and found to be correctly calculated /4/. The calibration is performed as per the monitoring plan in the registered PDD and documented /16/. DNV can confirm the correction factor determined in QAL 2 for NCSG /10/ was retroactively and correctly applied to the data for NCSG value monitored during the baseline campaign /29/.
OH_{BC} Operating hours of the plant	N/A	1 474 h	1 474 h	See comments in 3.6.3. OH_{BC} was verified by DNV to be correctly reported /4/.
NAP_{BC} t HNO3 Nitric acid 100% concentrated produced over a project campaign	**FT-111**	17 718 t/HNO_3	17 718 t/HNO_3	See comments in 3.6.3. NAP_{BC} was verified by DNV to be correctly reported /4/.
EF_{BL} Emission factor for baseline period $tN_2O/t\ HNO_3$	N/A	0.00564 $t\ N_2O/t\ HNO_3$	0.00457 $t\ N_2O/t\ HNO_3$	EF_{BL} was verified by DNV to be correctly calculated and reported according to EB 51 Annex 12 /4/. The re-calculated EF_{BL} for campaign PC3 was verified by DNV /4/.
AFR Ammonia gas flow rate to	FT101	Available in excel sheets /4/	Available in excel sheets /4/	AFR is continuously monitored. $NCSG_{BL}$ and VSG_{BL} values monitored when AFR is

the AOR				exceeding AFR_{max} are excluded prior to the calculation of the average values for $NCSG_{BL}$ and VSG_{BL} /4/. Calibration is performed in accordance to the procedure "C9NA 002 Nitrates calibration procedure". Calibration certificates were checked and DNV is able to confirm the calibration result is OK. The calibration is valid for the entire period for the baseline campaign /22/.
AIFR Ammonia to Air Ration	FT-100 (air flow)	Available in excel sheets /4/	Available in excel sheets /4/	AIFR is calculated from results of AFR (Tag No.: FT101) and Primary Air flow rate (Tag No.: FT100). $NCSG_{BL}$ and VSG_{BL} values monitored when AIFR is exceeding $AIFR_{max}$ are excluded prior to the calculation of the average values for $NCSG_{BL}$ and VSG_{BL}. /4/ Calibration is performed in accordance to the procedure "C9NA 002 Nitrates calibration procedure". Calibration certificates were checked and DNV is able to confirm the calibration result is OK. The calibration is valid for the entire period for the baseline campaign /22/.
OT_h Oxidation temperature for each hour	TC102-A TC102-B TC102-C TC102-D	Available in excel sheets /4/	Available in excel sheets /4/	OT_h is monitored hourly. $NCSG_{BL}$ and VSG_{BL} values monitored when OT_h is outside the permitted operating range are excluded prior to the calculation of the average values for $NCSG_{BL}$ and VSG_{BL}. /4/ Calibration is performed in accordance to the procedure "C9NA 002 Nitrates calibration procedure". Calibration certificates were checked and

				DNV is able to confirm the calibration result is OK. The calibration is valid the entire period for the baseline campaign /22/.
OP_h Oxidation Pressure for each hour	PT-100	Available in excel sheets /4/	Available in excel sheets /4/	OP_h is monitored hourly. $NCSG_{BL}$ and VSG_{BL} values monitored when OP_h is outside the permitted operating range are excluded prior to the calculation of the average values for $NCSG_{BL}$ and VSG_{BL} /4/. Calibration is performed in accordance to the procedure "C9NA 002 Nitrates calibration procedure". Calibration certificates were checked and DNV is able to confirm the calibration result is OK. The calibration is valid the entire period for the baseline campaign /22/.
GS_{BL} Gauze supplier for baseline campaign	N/A	W.C. Heraues	W.C. Heraues	Verified by validating DOE /7/.
GC_{BL} Gauze composition for baseline campaign	N/A	59% Pt 4% Rh 37% Pd	59% Pt 4% Rh 37% Pd	Verified by validating DOE /7/. This parameter was verified at the site visit during the first verification period. See comment for $GC_{project}$.

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	**4.2 %**	The overall uncertainties for the AMS have been reported in the QAL 2 report /10/.
$EF_{ma,n}$ Moving average emission factor derived over the time from campaign specific emission factors. $tN_2O/t\ HNO_3$	**Campaign PC2: 0.00224** **Campaign PC3: 0.00179** **Campaign PC4: 0.00179**	The moving average is calculated as the average of EF_n from campaigns no. PC1 (previous monitoring period) and campaign no. PC2 = (0.00195+0.00253)/2=0.00224 DNV has verified the data for the previous campaign PC1 and can confirm the calculation of the emission factor for the project campaign PC1 (0.00195 $tN_2O/tHNO_3$) is correct /29/. Further, the project campaign PC1 data covered under the previous monitoring period have been submitted with the issuance request for this 2nd monitoring period data covering the project campaigns PC2, PC3, and PC4. Similarly for campaign no. PC3: (0.00195+0.00253+0.00090)/3=0.00179 Similarly also for campaign no. PC4: (0.00195+0.00253+0.00090+0.00181)/4=0.00179 See comments in 3.5.3 for EF_n.
EF_{min} The lowest of EFn observed during the first ten campaigns of the project crediting period. $tN_2O/t\ HNO_3$	**NA**	This value is only relevant when the production campaign number is more than ten.
EF_p Emmision factor used for the specific campaign n $tN_2O/t\ HNO_3$	**Campaign PC2: 0.00253** **Campaign PC3: 0.00179** **Campaign PC4: 0.00181**	The higher of the two values $EF_{ma,n}$ and EF_n has correctly been applied in the emission reduction calculations.
EF_{reg} National regulation on N_2O emissions	**No regulation**	It was confirmed at the site visit that there is no N_2O regulation in South Africa. This parameter is reported in the monitoring report in Annex 1:"Data and parameters for calculation of Baseline campaign emissions". The N_2O regulation is followed up during the project campaigns and included in the monitoring report. Further African Explosives Ltd. has included procedure for following up any new regulations in its ISO 14001 systems /25/.

NO_x regulation		At the site visit the NO_x concentration was observed to be too below the regulation limit set by the Ministry of Environmental Protection is 400 ppm. /25/

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 Accuracy of Emission Reduction Calculations

The overall uncertainty for the AMS has been determined to be 4.2% /10/.

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

1) The hourly means of N_2O concentration and gas flow in the stack gas were calculated correctly, with the correct application of 95% confidence interval; and total N_2O emissions of the project campaign were calculated correctly. Correction factors of 0.962 for gas flow rate and 0.970 for N_2O concentration were properly applied. The maximum measurement uncertainty provided in QAL2 report was correctly applied to NSCG and VSG data during the period of delayed AST test from 07/02/2009 to 11/06/2009 /10/ /14/.
2) The nitric acid productions (100% HNO_3) for the baseline and project campaigns covered in the verification period were calculated correctly. The number of hours of operation in each project campaign covered in the verification period was also correctly calculated.
3) The project emission factor was correctly calculated by correct calculations and comparison of a campaign specific emission factor.
4) The baseline emission factor was correctly determined by comparing the campaign length with the average historic campaign length, and subsequently determining the corresponding baseline emission factor.
5) The emission reductions were then correctly calculated with consideration if the design capacity was exceeded in the specific project campaign.

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

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

3.8 Quality of Evidence to Determine Emission Reductions

The main monitoring parameters are automatically collected by the monitoring system. The raw data are stored as 2 second values at two different locations. All necessary documentation is collected, referenced and aggregated and is easily accessible in spread sheets generated by N.DBMS (N.serve Database Management System). Access to hourly raw data was made available to DNV /4/ in order to check the data presented through the N.DBMS.

Measurements are performed by calibrated equipment /10/ /22/ valid for the baseline campaign and the monitoring period. During the period of delayed AST test, the N_2O concentration and gas flow data have been conservatively corrected by the maximum error of the instrument. The key data has also been cross-checked via other sources, such as control room stations and on-site meters. There was no incident resulting in AMS downtime during the monitoring period. No assumptions are used, that have any influence on reported emission reductions.

The project proponent has provided excel sheets containing the raw data and calculations for the campaigns no. PC2, PC3 and PC4 /24/ /4/. These data were verified by DNV and DNV confirms the calculations of baseline emissions and project emissions have been carried out in accordance with the formulae and methods described in the monitoring plan and applied methodology. In AM0034 version 2 no leakage calculation is required.

3.9 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 N9 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 qualified internally. Data handling solutions involve redundancy, data manipulation protection, integrity check as well as proper archiving.

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

- QAL1: According to CDM-EB48 report, para 77, “for project activities where the automated monitoring system (AMS) for the measurement of N_2O is subject to compliance with EN14181 as stipulated in the applied methodologies, the Board further clarified that the suitability test QAL1 for the AMS by any entity is acceptable provided that a documentary evidence is submitted which confirms the measures and method conducted are in accordance with the provisions specified in ISO14956”. DNV was able to verify that the evaluation has been carried out by TÛV SUD before installation of AMS according to ISO14956 version 1.0, and the evaluation is deemed to be acceptable.[5] /12//13/.
- QAL2 (including AST): The installed AMS is tested and compared to a SRM. The QAL2 test was carried out by TÜV SUD Industrie Services in February 2008 (date of report 19 March 2008) /10/; TÜV SUD is ISO 17025:2005 accredited /26/. DNV can confirm the correction factors determined in QAL 2 was correctly applied to the data for NCSG and VSG monitored during the project campaign and retroactively applied to the data for $NCSG_{BC}$ and VSG_{BC} monitored during the baseline campaign. Further the maximum

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

uncertainty of the AMS (UNC) was correctly applied to the calculation of the baseline emissions factor as per the methodology.

- AST: The annuals surveillance test (AST) was performed in June 2009 and confirmed that operation of the AMS was acceptable and that the calibration functions for NCSG and VSG were still valid and that the requirements for variability are fulfilled /14/.
- QAL3: Span and zero checks are carried out twice a week.

4 CERTIFICATION STATEMENT

DNV Climate Change Services AS has been engaged by African Explosives Ltd. to verify the greenhouse gas (GHG) emission reductions reported for the "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" for the period 11 February 2008 to 4 August 2009.

Our opinion relates to the project's GHG emissions and resulting GHG emissions reductions reported in the revised monitoring report dated 20 April 2012 version 10. DNV does not express any opinion on the selected baseline scenario of the project or on the validated and registered PDD.

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 GHG verification statement on the reported GHG emission reductions from the project for the period 11 February 2008 to 4 August 2009 and on the calculation of GHG emission reductions from the project for the same period and the project's compliance with the approved methodology AM0034, version 02.

DNV conducted the verification on the basis of the monitoring methodology AM0034 version 02 "Catalytic reduction of N2O inside the ammonia burner of nitric acid plants", the monitoring plan contained in the registered Project Design Document Version 2.0, dated 05 April 2007 and the monitoring report (version 10) dated 20 April 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 was based on the requirements for verification contained in the Validation and Verification Manual (version 01.2).

DNV's verification approach draws on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these.

DNV planned and performed the verification by obtaining the information and explanations that we considered necessary to provide sufficient evidence and other information and explanations that DNV considers necessary to give reasonable assurance that the reported GHG emission reductions are fairly stated.

DNV is able to confirm that project is implemented in accordance with the registered project design document version 2.0. dated 5 April 2007, and that the monitoring plan is in accordance with the methodology AM0034 version 02 "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants" applied by the project. Furthermore, DNV confirms the monitoring is in accordance to the monitoring plan.

In our opinion, the GHG emission reductions of the "Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa", for the period from 11 February 2008 to 4 August 2009 are fairly stated in the monitoring report version 10 of 20 April 2012.

The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology AM0034 version 02 and the monitoring plan contained in the registered PDD of 05 April 2007.

DNV Climate Change Services AS is able to certify that the reported emission reductions from the project during the period from 11 February 2008 to 4 August 2009 amounted to 67 604 tonnes of CO_2 equivalents.

Oslo, 20 June 2012

Trine Kopperud	Edwin Aalders
CDM Verifier & Sector Expert	*Approver*
DNV Climate Change Services AS	DNV Climate Change Services AS

5 REFERENCES

/1/ CDM Monitoring Report: "Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa" (No 2), revision2 dated 02 December 2009, revision 7 dated 2 July 2011, revision 9 dated 6 December 2011, and revision 10 dated 20 April 2012.

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

/3/ CDM Project Spreadsheet for the verification period 11 February 2008 to 04 August 2009 Filename:

AEL No2_ghg_calculation_rev2_MS_100326.xls (including campaigns no. PC2, PC3 and PC4);

AEL 9 No 2_ghg-calculation_rev3_MS_100713.xls (revised).

/4/ Excel sheet (filename: AEL_No9_PC_Calc_V8_MS_100322.xls, AEL_No9_PC_Calc_V9b_MS_120420.xls (revised) derived from data analysis of hourly average monitoring data including:

-Calculation of baseline emission factor (including daily values for NAP production for baseline campaign H15)

-Calculation of project emission factors

-Calculations of emission reductions

-Raw data for baseline campaign H15 and project campaigns PC2, PC3 and PC4.

/5/ CDM Executive Board, Approved Monitoring methodology AM0034, version 02.

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

/7/ Validation report by TÜV SUD: "Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa", report no. 912444, 10 May 2007.

/8/ CDM Equipment List and TAG numbers issue of 08 December 2009.

/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 QAL 2 report. Author Erhard Krämer. Report n°. IS-US3-MUC dated 19 March 2008 (Test conducted from 07.02.2008 to 13.02.2008).

/11/ Martin Stilkenbäumer, N.serve: "Documentation of N.serve Database Management System for N_2O Destruction CDM Projects" version 1.3, 15.01.2008.

/12/ TÜV SÜD Suitability test report for German Standards , March 2003

/13/ TÜV SUD QAL 1 report Uras 26 (follow-up version of Uras 14), June 2006

/14/ MÜLLER-BBM report M80 456/1: "Report on performance test of continuously

operating measuring system on a nitric acid plant". (AST) dated 27 July 2009 (Test conducted from 10.06.2009 to 11.06.2009).

/15/ Afrox Ltd.: Certificates of analysis of calibration test gases during the monitoring period.

Analysis report dated 5 June 2007 (Afrox Cetification Cylinder No. 875450):

1005 ppmv N_2O valid until June 2008.

Analysis report dated 19 March 2008 (Afrox Certification Cylinder No. 948098):

955 ppmv N_2O valid until 19 February 2009.

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

/16/ Calibration reports N_2O analyser ABB AO2040 Uras 14:

- AT-110 N_2O Analyzer Calibration Cell Report from September 2007 to July 2009 (baseline campaign and project campaigns).

/17/ African Explosives Ltd. "Procedure for CDM data preparation" revision 00 of 13.02.2008.

/18/ Heraeus South Africa Ltd. Ammonia Oxidation Catalyst: Invoice No. 10330095, dated 10 February 2008 for campaign PC2.

Heraeus South Africa Ltd. Ammonia Oxidation Catalyst: Invoice No. 10330248: dated 5 July 2008 for campaign No. PC3.

Heraeus South Africa Ltd. Ammonia Oxidation Catalyst: Invoice No. 10310573 dated 5 January 2009 for campaign No. PC4

/19/ ISO 9001:2008 Certificate number LS 0243 issued by SABS Commercial Ltd. valid until 8 September 2012.

/20/ ISO 14001:2004 Certificate number EM 140394 issued by SABS Commercial Ltd. valid until 3 February 2012.

/21/ Instrument data sheets:

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

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

-N_2O analyser Tag. No. AT-110

/22/ Calibration Certificates:

Calibration certificates for stack gas parameters by AEL Ltd:

VSG - tail gas flow (FT-200):

Calibration dates: August 2007, November 2007, February 2008 (exact dates not available), 7 July 2008, 29 October 2008, 24 February 2009, 28 May 2009 and 17 November 2009. Validity of calibration: 3 years

- Internal check of stack gas flow meter 28 May.2009.

NCSG - N_2O concentration in the stack gas (AT-110): see reference /16/

TSG – Tail gas temperature (TE-120):

Calibration dates: August 2007, November 2007, February 2008 (exact dates not available), 7 July 2008, 29 October 2008, 24 February 2009, 28 May 2009 and 17 November 2009. Validity of calibration: 1 year

PSG- Tail gas pressure (PT-200):

Calibration dates: August 2007, November 2007, February 2008 (exact dates not

available), 7 July 2008, 29 October 2008, 24 February 2009, 28 May 2009 and 17 November 2009. Validity of calibration: 1 year

Nitric acid flow meter (FT-111):

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-111. Date 04.01.2007. Valid until 03.01.2010
- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-111. Date 11.04.2008. Valid until 10.01.2011
- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-111. Date 25.11.2008, 24 February 2009 Valid for 3 years until 23 February 2012.

Calibration certificates for AOR parameters equipment by AEL Ltd:

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

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

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

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

/23/ 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

/24/

DAP (Deutsches Akkreditierungssystem Prüfwesen GmbH: TÜV SÜD Accreditation for ISO 17025:2005 dated 13 july 2007. Valid until 22 May 2011.

/25/ Republic of South Africa – Department of Environmental Affairs and Tourism - Atmosphere pollution prevention Act 1965 of December 2003.

/26/ DNV: Verification report for 1st monitoring period for the project activity.

/27/ AEL Ltd.: Span gas tracking log, version1.

/28/ Route Calibration Services: Calibration certificate No. S 110. Dated 31.07.2009 (uncertainty of nitric acid flow meter).

/29/ CDM Project Spreadsheets for the verification period 05 November 2007 to 10 February 2010, including baseline campaign data:

AEL 9_PC_No1_Calc_V8b_MS_100708.xls

/30/ Historical NAP data:
No9 NAP per campaign_CLnormal_MS_20110321.xls

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APPENDIX A

CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS

Corrective action requests for this verification:

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 1	There is no formal evidence about the Gauze changing dates during the monitoring period.	The PP provided to DNV a document dated 15 December 2009 from Heraeus South Africa Ltd. containing the dates of gauze changing during the entire monitoring period.	The document was reviewed as proper evidence. This CAR is closed.
CAR 2	Some hours of monitoring data were missing in the datasets extracted from AEL data system. Further corrections are required as per EB 51 Annex 12.	After the site visit AEL was able to provide the missing data and the calculations were updated. Further the calculations were updated to be in accordance to EB 51 Annex 12.	DNV checked the updated calculations and they were found to be correct. This CAR is closed.

Clarification requests

CL ID	Clarification request	Response by Project Participants	DNV's assessment of response by Project Participants
N/A	N/A	N/A	N/A

Forward action requests from previous verification:

FAR ID	Forward action request	Response by Project Participants	DNV's assessment of response by Project Participants
FAR 2	The cabinet for standard calibration gas: It is recommended to have a list where the period for which calibration gas was used during a specific period is clearly stated.	AEL adopted a specific form for this purpose.	The document was provided and reviewed as proper /27/. The FAR is closed.

Forward action requests for this verification:

FAR ID	Forward action request	Response by Project Participants	DNV's assessment of response by Project Participants
FAR 1	It is found that incorrect transfer or missing values from production logs to excel sheet of operation data and stack monitoring data. The error is minor and does not have any effect on the emission reduction calculations.	AEL updated the respective procedure in order to avoid such mistakes in the future. The missing data was identified and reported to N.serve. N.serve updated the datasets and calculations including the missing data.	The calculations were verified and found to be correct. This part of the FAR is closed. The procedure to avoid transfer mistakes in future will be checked during the next verification

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 "Project for the catalytic reduction of N2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa". 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 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 *Project installation should be finished at time of initial verification in so far as the project should be ready to generate emission reductions afterwards.*		*The project is in fully operational.* *All monitoring equipment was properly installed and checked during the site visit.*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
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		*CDM registration: The project was registered 05 November 2007 UNFCCC reference number 1171.*	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.*		*The project has been implemented as described in the PDD. There are no major changes.*	OK
C.2. Project boundaries *Check whether the project boundaries are still in compliance with the ones indicated by the PDD.*		*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/ /12/ /13/ /14/ /15/ /14/	*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
C.4. Data uncertainty	/10/	*The overall uncertainty is determined by the QAL 2 test carried out by TÜV*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
How will data uncertainty be determined for later calculations of emission reductions? Is this in compliance with monitoring and metering equipment?		*SUD who is accredited according to ISO/IEC 17025.* *The N_2O NDIR analyser zero and span check is preformed twicec per week. 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 is determined in the QAL 2 report.* *The overall uncertainty of the AMS is 4.2%.*	
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/ /14/ /15/ /16/ /19/ /22/	*Maintenance and calibration routines for parameters related to the ammonia oxidation reactor are included in the African Explosives management system.* *CDM Procedures is developed for the calibration of stack gas analyser system.* *Stack gas flow meter and N_2O analyser: QAL 2/AST tests are performed according to the European standard EN14181 (main items). Standard reference method used for stack gas volume flow is according to ISO 10780.* *N_2O analyser: See C.4.* *Stack gas flow meter is calibrated at least once a year (usually every 4th month after each campaign) by the instrument department of AEL Ltd.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.*	/11/	*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 *Check how reports with relevance for the later determination of emission reductions will be generated*		*N.serve and AEL are 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.*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
		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 Nserve 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.*	/17/	*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.*	/23/	*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.*	
C.11. Troubleshooting procedures *Check whether there are possibilities of redundant*	/17/	*The CDM procedure "Procedure for CDM data preparation", revision 00, includes description of maintenance routines and analyzer faults including*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
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)		*actions to be taken internally in African Explosives.*	
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”.*	/17/	*All main parameters are directly measured every two seconds.* *The nitric acid is measured with a mass flow meter Coriolis type.* *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.* *During the verification Incorrect transfer or missing values from production logs to excel sheet of operation data and stack monitoring data were find.* *These errors are minor and did not have any effect on the emission reduction calculation.*	FAR 1
D.4. Significance and reporting risks *Assess the significance and reporting risks related*		*The risk associated with the main parameters used for the emission reduction calculations are regarded to below, see D.1.*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
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.			
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*	/25/	*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
E.5. Emergency procedures *Are there any procedures which will be applicable*		*N/A*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
if there is no access to relevant external data?			
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.*	/17/ /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.*	/17/ /19/ /20/ /23/	*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.*	/17/ /11/	*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.*	/17/ /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 verifying the project's performance in the context of*	/11/	*Data archiving is appropriate.* *The measured data from AMS are collected in the SCADA system on dedicated PD: The data are also transferred once a week to the plant main IT system for back up. The raw data is stored during the crediting period plus 2 years in the*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
consecutive verifications.		*process information system.* *Further hourly data is stored at the N.serve fileserver in a special section for the storage of monitoring data*	
G.6. Monitoring report *The system includes procedures for the calculation of emission reductions and the preparation of the monitoring report.*		*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. Albrecht von Ruffer, Managing Director 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 and AEL are 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.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
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.
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" /11/.
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.*	~~CAR 2~~ FAR 1	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 does 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.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
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.
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 ongoing 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" /11/ 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.

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

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APPENDIX C

VERIFICATION MONITORING PARAMETERS

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**NAP/NAP_{BC}** Nitric acid 100% concentrated produced over a baseline campaign/project campaign
Measuring frequency:	Continuously
Reporting frequency:	Every Hour
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Mass Flow Meter – Micro Motion CMF200 TAG: FT-111
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. The monitoring equipment (Coriolis mass flow meter) is common practice for measuring nitric acid and measurement uncertainty is 0.1% (as per the supplier).
Calibration frequency /interval:	Every three years
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure n° C09NA revision 1 "Calibration Procedures" of African Explosives Ltd.
Company performing the calibration:	Alpret Control Specialists Ltd.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes /22/
If applicable, has the reported data been cross-checked with other available data?	The data has been cross checked with NAP data from mass balance method.
How were the values in the monitoring report verified?	DNV performed samples checks of production log books
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK, all activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. One a month the results will be downloaded from SCADA to an excel file for analysis and calculation.

	The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**NCSG $NCSG_{BC}$/NCSG** N_2O concentration in the stack gas
Measuring frequency:	Continuously
Reporting frequency:	Every 2 seconds
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	ABB AO2040 Uras 14 TAG n° AT-110
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the N_2O analyser was not stated in the PDD as the installed analyser at the time of validation was a S.A. MIR 9000 analyser. However it was stated in the PDD that a new analyser ABB AO2040 Uras 14 will be installed in May 2007. The installed analyzer ABB AO2040 Uras 14 is widely used to measure N_2O concentration and have also passed QAL 1. The ABB AO2040 Uras 14 was used during the baseline and project campaign. The measurement accuracy is determined to be 2.69% (as per QAL 2 report) /10/
Calibration frequency /interval:	Internal calibration by AEL Ltd.: Bi-weekly: Zero and span check and calibration in case of deviation > 1% of range of analyzer.

	External calibration: QAL 2 by an authorized ISO 17025 institute every 5 years, AST test every year in between QAL 2 test.
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 n° C09NA revision 1 "Calibration Procedures" of African Explosives Ltd.
Company performing the calibration:	External calibration : QAL2 Report number IS-US3-MUC issued by TÜV SUD Industrie Services on date 19 March 2008 /10/. QAL 2 test are performed by external company accredited for ISO 17025 /10/ /24/. AST test: Müller-BBM Gmbh on 10-11/06/2009, report dated 27/07/2009 /14/. Internal calibration by AEL Nitrates Instrumentation Department: Biweekly Zero and span is done by AEL.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes /10//22/
Is(are) calibration(s) valid for the whole reporting period?	The QAL 2 test is valid until 2013. However the AST test was delayed from 07/02/2009 to 11/06/2009 and the maximum error of the instrument is applied during this period. The zero and span checks were performed bi-weekly during the monitoring period.
If applicable, has the reported data been cross-checked with other available data?	The data are cross-checked with the concentration measurement by a SRM during the QAL 2 test.
How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV /4/. Random picked data points were checked against data stored on the monitoring PC.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK, all activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in

	a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**TSG** (stack gas temperature)
Measuring frequency:	Every 2 seconds
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Thermocouple type PT100_385-wire RTD Transmitter: Rosemount Model 644 RAI Tag. No.: TE-120
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The monitoring equipment represents good monitoring practice. Measurement uncertainty: 2.55% (as per QAL 2 test report) /10/
Calibration frequency /interval:	Internal calibration at least once per year, usually every 4 months after each campaign /22/. QAL 2 test every 5 years, and AST test every year in between QAL 2 test.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency	Meter is calibrated as per ISO 9001 Procedure n° C09NA revision 1 “Calibration Procedures” of African Explosives

represent good monitoring practise?	Ltd./22/
Company performing the calibration:	QAL 2 test is performed in accordance with EN 14181 /10/. AST test: Müller-BBM Gmbh on 10-11/06/2009, report dated 27/07/2009 /14/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	The QAL 2 test is valid until 2013. However the AST test was delayed from 07/02/2009 to 11/06/2009 and the maximum combined uncertainty of PSG, TSG and VSG is applied on the VSG data during this period.
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. One a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or	NA

has a request for deviation been approved?	

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**PSG** (stack gas pressure)
Measuring frequency:	Every 2 seconds
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag No.	Rosemount pressure probe. Transmitter: Rosemount; type 3051Ta12B21BB4I1M5Q4 Tag no.: PT-200
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The monitoring equipment represents good monitoring practice. Measurement uncertainty: 0.7% (as per QAL 2 report) /10/.
Calibration frequency /interval:	Internal calibration at least once per year, usually every 4 months after each campaign. QAL 2 test every 5 year, and AST test every year in between QAL2 test.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure n° C09NA revision 1 “Calibration Procedures” of African Explosives Ltd./22/ QAL 2 test is performed in accordance with EN14181 /10/
Company performing the calibration:	AEL Nitrates Instrumentation Department /22/ and QAL 2 test is performed by external company accredited for ISO 17025 /10/ /24/. AST test: Müller-BBM Gmbh on 10-11/06/2009, report dated 27/07/2009 /14/.

Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	The QAL 2 test is valid until 2013. However the AST test was delayed from 07/02/2009 to 11/06/2009 and the maximum combined uncertainty of PSG, TSG and VSG is applied on the VSG data during this period.
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV. Random picked data points were checked against data stored on the monitoring PC.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. One a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**VSG_{BC}/VSG** Stack gas flow
Measuring frequency:	Every 2 seconds

Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag No.	Emerson Rosemount Annubar Model 485 with 3051 DP transmitter TAG n° FT-200
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the flow meter was not stated in the PDD. This analyzer is widely used to measure volume flow. Uncertainty is determined in QAL 2 to be ± 2.65 %
Calibration frequency /interval:	Internal calibration at least once per year usually every 4 months after each campaign. QAL 2 test every 5 years, and AST test every year in between QAL 2 test.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Internal calibration: Meter is calibrated as per ISO 9001 Procedure n° C09NA revision 1 “Calibration Procedures” of African Explosives Ltd./22/ QAL 2 test is performed by external company accredited for ISO 17025 /10/ /24/. AST test: Müller-BBM Gmbh on 10-11/06/2009, report dated 27/07/2009 /14/.
Company performing the calibration:	AST/QAL2 Report number IS-US3-MUC issued by TÜV SUD Industrie Services on date 19 March 2008. QAL 2 report. Author Erhard Krämer.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	The QAL 2 test is valid until 2013. However the AST test was delayed from 07/02/2009 to 11/06/2009 and the maximum combined uncertainty of PSG, TSG and VSG is applied on the VSG data during this period.
If applicable, has the reported data been cross-checked with other available data?	NA

How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV /4/. Random picked data points were checked against data stored on the monitoring PC.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. One a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

	Assessment/ Observation
Data / Parameters: (as in monitoring plan of PDD):	**OT_h, OP_h, AFR and AIFR** (AIFR is calculated from results of AFR (Tag No.: FT101) and Primary Air flow rate (Tag No.: FT100))
Measuring frequency:	Continously
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag No.	Thermocouples AOR: Type K-6 Multipoint thermocouple Tag. No.: TC-102-A, TC-102-B, TC-102-C, TC-102-D Pressure AOR: PT-100, Yokogawa type Press Tx

	Ammonia flowmeter: FT101, Yokogawa type orifice plate with D.P. transmitter Primary Air flow rate: FT100, Yokogawa D.P. transmitter.
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. The measurement accuracy is 1% for thermocouples, 1.7% for oxidation pressure, 1.25% for AFR and 1.66% for AIFR (air flow) as per calibration requirements at AEL. The monitoring equipment represent good monitoring practice.
Calibration frequency /interval:	Every 6 months for AFR, AIFR (Primary Air flow). Validity 7 month. Every 3 months for thermocouples. Validity 4 months
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure n° C09NA revision 1 “Calibration Procedures” of African Explosives Ltd.
Company performing the calibration:	African Explosives Ltd.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes. /22/
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Raw data from the monitoring period were provided and checked by DNV /4/. Random picked data points were checked against data stored on the monitoring PC (during 1st verification period).
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data are automatically stored in the SCADA Data Acquisition System. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation. The raw data will be saved on a DAT device and will be stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).

In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

APPENDIX D

CURRICULA VITAE OF THE VERIFICATION TEAM MEMBERS

***Weidong Yang** 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 processes.

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

She has experience of 4 years in validation and verification of CDM projects/JI and other 3rd party validation/verification services in several countries including China, Africa, India, Middle East and Eastern Europe.

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

Fausto Cerri

Fausto Cerri Holds a Bachelor Degree on Political Science from the Politecnico of Turin (IT), having an overall working experience of around 10 years. Prior to joining DNV having 5 years experience in the Iron Foundry Division of TEKSID S.p.A. (Coke and industrial gases) and another 5 years on the automotive sector with Promec Engineering and with ROI Automotive Technology.

In DNV he's gained experience of around 5 years in auditing activities for quality, environmental and ISO TS standards, as well as gaining 2 years in validation and verification of CDM projects/JI and other 3rd party validation/verification services.

His qualification, industrial experience and experience in CDM demonstrate him sufficient sectoral competence in the Iron and Steel, mechanical industries and coke technical areas.

Khawaja Rafi

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, ambient air quality analysis, 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/technical reviewer for technical area Renewables and as a CDM validator/verifier as well as a Technical Reviewer (TR) for technical area N2O (i.e. under Methodology group 11) under the Qualification Scheme of Climate Change Services of DNV.

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