VERIFICATION / CERTIFICATION REPORT

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

UNFCCC Registration No. 1364

Monitoring Period
08 FEBRUARY 2008 TO 23 MAY 2009

REPORT NO. 2010-1012
REVISION NO. 02

DET NORSKE VERITAS

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VERIFICATION / CERTIFICATION REPORT

Date of first issue: 11 February 2011	Project No.: PRJC-197668-2009-CCS-NOR
Approved by: Edwin Aalders	Organisational unit: DNV Climate Change and Environmental Services
Client: African Explosives Ltd	Client ref.: Hendrik Burger

DNV CLIMATE CHANGE SERVICES AS

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

Summary:

DNV Climate Change Services AS has been contracted by African Explosives Ltd. to carry out verification and certification of the emission reductions reported for the "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (UNFCCC Ref. No. 1364) for the period 08 February 2008 to 23 May 2009.

In our opinion, the reported N_2O emission reductions for the period from 08 February 2008 to 23 May 2009, as reported in the monitoring report for the project of 16 August 2011 (version 6) are fairly stated. The published monitoring report dated 2 December 2009 was updated to include updated emission reduction calculations as per EB51 Annex 12. Further the monitoring report was updated to address the issues raised during the verification and updates as requested in incompleteness message dated 05 April 2011. Further this verification report includes updates in response to the request for review received by DNV 24 November 2011.

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. As a consequence, DNV Climate Change Services AS is able to certify that the emission reductions from the project during the period 08 February 2008 to 23 May 2009, amount to 332 002 tonnes of CO_2 equivalents.

Report No.: 2010-1012	Subject Group: Environment	
Report title: N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa		
Work carried out by: Trine Kopperud, Fausto Cerri		
Work verified by: Weidong Yang		
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Abbreviations

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

1 INTRODUCTION

African Explosives Ltd. (hereafter AEL) has commissioned DNV Climate Change Services AS (DNV) has to carry out the verification and certification of the emission reductions reported for the "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" (hereafter the project) for the period 08 February 2008 to 23 May 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 the emission reductions reported for the "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", for the period from 08 February 2008 to 23 May 2009, equating to 332 002 tonnes of CO_2 equivalents.

1.2 Scope

The verification scope is:

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

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

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

1.3 Description of the Project Activity

Project Parties:	*South Africa and United Kingdom of Great Britain and Northern Ireland*
Titles of project activity:	*N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa*

Baseline and monitoring methodology:	*AM0034(version 02)*
Sectoral scope:	*5 "Chemical Industry"*
Project Entity:	*African Explosives Ltd.; N.serve Environmental Services Gmbh.*
Location of the project activity:	*Modderfontein 1645, Province of Gauteng, South Africa.*
UNFCCC Registration no.:	*1364*
Registration date:	*08 February 2008*
Project's crediting period:	*08 Feb 08 to 07 Feb 18 (Fixed)*
Period verified in this verification:	*08 Feb 2008 to 23 May 2009*

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

The project activity involves the installation of a secondary N_2O catalyst inside the ammonia oxidation reactor (burner) just beneath the precious metal catalyst gauze catalyst. The N_2O catalyst is selective and promotes the decomposition of N_2O to nitrogen and oxygen. Secondary abatement technologies will normally reduce the emissions by 70-90%.

The emission reductions reported from the project for the period from 08 February 2008 to 23 May 2009 amount to 332 002 tonnes of CO_2 equivalents.

1.4 Methodology for determining emission reductions

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

The baseline emission factor is determined ex-ante, and may necessarily be re-calculated when the length of a project campaign is shorter than the normal campaign length as defined by the historic campaigns. The flow-rate of stack gas, the concentration of N_2O in the stack gas, the operating hours, and the production output of 100% concentrated nitric acid need to be monitored, 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 use 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***	Administrative	Desk review	Site visit	Reporting	Supervision of work	Technical review	Sectoral competence
Project manager	Kopperud	Trine	Norway	✓						
Technical team leader & CDM verifier	Kopperud	Trine	Norway		✓		✓	✓		✓
GHG auditor	Cerri	Fausto	Italy		✓	✓	✓			
Technical reviewer	Weidong	Yang	US						✓	✓

Duration of verification

Preparations: *24 November 2009 to 27 November 2009*

Publication of first version of monitoring report: *04 December 2009*[1]

On-site verification: *11 December 2009*

Reporting, resolution of verification findings and QA/QC*:*

15 December 2009 to 21 August 2011. Further this version of the verification report was updated in response to the request for review received by DNV 24 November 2011.

[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 08 February 2008 to 23 May 2009, dated 02 December 2009 and the revised monitoring report dated 16 August 2011 /1/, the registered project design document (PDD) /2/, and the approved baseline and monitoring methodology applied by the project, AM0034, version 02 "*Catalytic reduction of N2O inside the ammonia burner of nitric acid plants*" /5/. The project operator has in addition supplied the verification team with procedures from its management system as well as other documentation and spreadsheets with all data necessary for verification of the emission reductions /3//4/ and /8/-/27/.

2.2 Site Visit

During the site visit of 11 December 2009 at African Explosives Ltd., the following personnel were interviewed or assisted the verification team:

Name	*Organization*	*Position*
Hendrik Burger	African Explosives Ltd.	Production Manager Nitrates
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 validation
- 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.

7 CARs, 2 CLs and 2 FARs were identified for this verification period. Please refer to Appendix A of this report for further details. All issues raised were sufficiently addressed.

3 VERIFICATION FINDINGS

This section summarises the findings from the verification of the emission reductions reported for the "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" for the period 08 February 2008 to 23 May 2009.

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

3.1 Remaining Issues, CARs, FARs from Previous Validation

This is the first verification activity. There were no remaining issues from validation /7/. The verification of permitted operating ranges was verified by the validating DOE. However the verification of the baseline campaign and the determination of the baseline emission factor following the requirement of EB51 Annex 12 were included in the scope of the verifying DOE[2]:

3.2 Project Implementation

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

A baseline campaign was operated from 20 July 2006 to 18 February 2007, which was used towards ex-ante estimate of emission reduction in the PDDAs confirmed in the validation report /7/, the data from this baseline campaign were not verified by the validating DOE, and the confirmation of the baseline campaign data to be used for ex-post emission reduction calculations was included in the scope of the verifying DOE. After the baseline campaign was

[2] According to the EB 31 minutes of meeting, either validating or verifying DOE can undertake the task of the determination of the permitted operating conditions for project activities using approved methodology AM0034.
The determinations of permitted operating ranges were included in the scope of validation /7/, however the baseline emission factor were updated according to EB 51 Annex 12 and these adjustments were verified by DNV. In addition, normal campaign length were updated after verifying calibration of equipment of mass flow meter used for NAP recording (refer to CAR 2).

completed, the project entity decided not to install the secondary catalyst yet to avoid incurring additional costs while the CDM validation process was still on going. This resulted in an intermediate campaign without secondary catalyst from 25 February 2007 to 18 August 2007. The project was submitted for registration on September 2007, and the first project campaign with secondary catalyst started on 12 September 2007 as the project was likely to get registered during this campaign.

During this monitoring period three production campaigns were completed:

Campaign PC1	12 September 2007 to 19 March 2008 (189 days)
Campaign PC2	20 March 2008 to 28 September 2008 (192 days)
Campaign PC3	04 October 2008 to 23 May 2009 (231 days)

Since the project was registered 08 February 2008 only emission reductions from 08 February 2008 to 19 March 2008 was included for campaign PC1.

During the on-site visit the verification team inspected the installation and could confirm that all instrumentation necessary for the monitoring of the emission reductions were installed.

As per para 198 (a) of VVM version 01.2, DNV verified that the project is fully implemented according to the description in the registered PDD document version 1.c. dated 25 September 2007. The verification team confirmed, through visual inspection that all physical features of the proposed CDM project activity including data collection systems and storage have been implemented in accordance with the registered PDD. As per para 198 (b) of VVM version 01.2, DNV confirmed during the on-site visit that the CDM project is completely operational. Neither a notification nor approval of change has been requested to CDM Executive Board.

3.2.1 Achieved emissions reductions compared to estimated emission reductions in the registered PDD

The emission reductions in this monitoring period is 332 002 tonnes of CO_2 equivalents in the period from 08 February 2008 to 23 May 2009 (i.e. 471 days). The yearly expected emissions reductions according to the registered PDD is 265 460 tonnes of CO_2 equivalents. This corresponds to emission reductions of 342 553 tonnes of CO_2 equivalents in 471 days and hence the observed emission reduction is lower than expected. The reasons are that the abatement performance of the secondary catalyst was lower (approx. 75 - 80%) than expected in the PDD (90%). The actual baseline emission factor (0.00465 $tN_2O/tHNO_3$) being slightly higher than the estimated value (0.00403 $tN_2O/tHNO_3$) in the registered PDD (this is because the QAL 2 correction factors were not available when the PDD was completed).

3.3 Compliance of monitoring plan with monitoring methodology

DNV is able to confirm that the monitoring plan contained in the registered PDD "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa", version 1.c. of 25 September 2007 is in accordance with the approved methodology applied by the project activity, i.e. AM0034 (version 02). Neither a revision nor a deviation to the monitoring plan has been requested to CDM Executive Board.

3.4 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 "N_2O abatement project at nitric acid

plant No. 11 at African Explosives Ltd. (AEL), South Africa", version 1.c. of 25 September 2007.

The determination of the permitted operating ranges, the baseline emission factor 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.

3.5 Assessment of Monitoring Parameters

3.5.1 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 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 (the previous five campaigns if available), 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 design capacity of the nitric acid production should be used for the emission reduction calculations if the nitric acid production of a project campaign ($tHNO_3$), NAP, exceeds the design capacity. The ex-ante determined baseline emission factor may need to be re-calculated when a project campaign is less than the historic campaign. The emission reductions for a monitoring period are the sum of emission reductions for each campaign within the monitoring period.

The table below is summarising the data required to be determined *ex-ante* /1/.

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/.

Data variable	**Reported value**	**Observation**
Design capacity	282 875 100% metric tonnes per year (775 metric tonnes per day operating 365 days per year).	Verified by validating DOE /7/
OTnormal	820°C to 905°C	Verified by validating DOE /7/
OPnormal	365 kPa to 450 kPa (gauge)	Verified by validating DOE /7/
AFRmax	9.094 t NH_3/h	Verified by validating DOE /7/
AIFRmax_	11.5 %	Verified by validating DOE /7/
CLnormal t HNO_3	127 302.4 tons	Excel sheet with historical data was provided /4/. DNV was able to confirm that the reported value in the MR is correct. Random picked data points were checked against production logs.
GSnormal Gauze supplier for the operation condition campaigns	W.C. Heraeus	Verified by validating DOE /7/
GCnormal Gauze composition for the operation condition campaigns	Platium (Pt) 56.5% Rhodium (Rh) 3.8% Palladium (Pd) 39.7%	Verified by validating DOE /7/ However DNV checked the composition during site visit of the 1st verification and confirmed the composition to be as given in registered PDD.

3.5.2 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 3.5.3 to 3.5.6 below. Further detailed information on recording frequency and calibration are given in Appendix C.

3.5.3 Monitored data for project emissions within the project boundary

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

According to AM0034 the emissions reductions can only be requested for the nitric acid production up to the design capacity. For the N11 plant the design capacity is 282 875 t 100% HNO_3 per year (775 t per day x 365 days) /7/. Since the start of the crediting period the production of nitric acid has been as follows:

Campaign PC1 (12/09/2007-19/03/2008): 128 190 t 100% HNO_3 (the production from start of crediting period 08 February 2008 to 19 March 2008 was 28 050 t 100% HNO_3)

Campaign PC2 (20/03/2008-28/09/2008): 131 941 t 100% HNO_3

Campaign PC3 (04/10/2008-23/05/2009): 138 917 t 100% HNO_3 (ending 23 May 2009)

The total production is 298 908 over the total monitoring period of 471 days (approx. 635 t 100% HNO_3 per day). The corresponding production at design capacity is 365 025 (775 t per day x 471 days). The production is therefore below the design capacity for the plant.

The baseline emission factor is applicable for calculation of emissions reductions for all the three project campaigns (see 3.4.3).

The following equipment and related documentation has been assessed as follows (further details on each monitoring parameter are given in Appendix C):

Data variable	**Tag. No.** **Range**	**Reported value Campaign PC1**	**Reported value Campaign PC2**	**Reported value Campaign PC3**	**Assessment /Observation**
VSG Normal gas volume flow rate of the stack gas during project campaign (Nm^3/h)	**FT-76550** Range: 0-150 000 Nm^3/h	78 691 Nm^3/h	78 346 Nm^3/h	74 170 Nm^3/h	The stack gas flow rate is continuously measured with a flow meter: Emerson Rosemount AnnubarR Model 485 with 3051 DP transmitter. 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 /22/. The calibration frequency is once per year (however usually every 7 month after each campaign). 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 combined standard uncertainty is ± 2.84 % /10/. The standard reference method (SRM) showed a deviation to the installed flow meter. Correction factors based on this values from the TÜV SÜD Industrie Service GmbH QAL 2 report is 1.010 /10/. It has been verified that the same value is used in the calculation spreadsheet for adjusting the total stack gas flow during the monitoring period. The functionality test AST conducted in June 2009 confirmed the calibration function as determined in QAL 2 is still valid as per the result of this test and further that the requirements for variability are fulfilled

					/14/. The measurement range of the flow meter is appropriate. The calibration is documented /10/.
PSG	PT-76506 Range 0 - 1000 hPa (abs).	The pressure is used for standardisation of volume flow rate in the stack	The pressure is used for standardisation of volume flow rate in the stack	The pressure is used for standardisation of volume flow rate in the stack	The pressure in the stack gas is measured by a Rosemont pressure probe. Transmitter: Rosemount; type 3051Ta12B21BB4I1M5Q 4 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/.
TSG	TE-76170 Range: 0-500 ^oC	The temperature is used for standardisation of volume flow rate in the stack	The temperature is used for standardisation of volume flow rate in the stack	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-wire RTD Transmitter: Rosemont 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/.
NCSG N_2O concentration in the stack gas (mgN_2O/Nm^3	**AT-76020-2** Range: 0-2000 ppmv	398 mg N_2O/m^3 (202 ppmv)	344 mg N_2O/m^3 (175 ppmv)	436 mg N_2O/m^3 (222 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/. According to the QAL 2 report, the combined relative fault of the analyser is 2.69 % /10/. After the baseline campaign the N_2O analyzer was replaced and the QAL 2 was repeated. The standard reference method (SRM) showed a deviation to the AMS. Correction factor based on TÜV QAL 2 reference measurements were 0.99 /10/. It has been verified that the same value is used in the calculation spreadsheet for adjusting the N_2O concentration during the monitoring period. The analyser passed the yearly functionality AST test (part of EN14181) /14/ It was verified that zero and span check during the project campaign was done twice a week. 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 1000 ppmv. With a precision of ± 1%. The expiration date is 01 September 2012. The analyser room and equipment is inspected weekly. Weekly check lists and N_2O Maintenance Activities Log Book were made available during the site visit.
NAP t HNO_3 Nitric acid 100% concentrated produced over a project campaign	**FT-76010**	**28 050**[3] t HNO_3	**131 941** t HNO_3	**138 917** t HNO_3	The nitric acid is measured with a mass flow meter Coriolis MicroMotion CMF300 from Emerson. 100% nitric acid is calculated from the measurements of flow from the mass flow meter, and the concentration. The concentration is measured by 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 rate. Sampling of concentration measurements and values from mass flow meter

[3] For campaign PC1 the nitric acid used in the calculation of emissions reduction is only counted from the date of registration

					were performed during the site visit including checks of transfer of data. An analysis was provided to DNV showing the comparison of the NAP values determined from tank level/mass balance method and NAP values obtained from Coriolis mass flow meters. The analysis was checked by DNV and found appropriate.
OH Operating hours during project campaign	N/A	**4 340**	**4 392**	**4 925**	The operating hours is determined from production logs. A trip value for the oxidation temperature of 820 ^{o}C is applied as the exclusion criterion for determining those hours where the plant was offline during the project campaign.
CLn Campaign length of project campaign	**FT-76010**	**128 190**	**131 941**	**138 917**	The monitoring equipment is as descriped for NAP.
EF_n Emission factor for project campaign $tN_2O/t\ HNO_3$	N/A	**0.001061**	**0.000896**	**0.001146**	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 spreadsheet 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/. Supplier of

campaign					primary catalyst is W.C. Heraeus.
$GC_{project}$ Gauze composition for the project campaign	N/A	**Platium (Pt) 56.0% Rhodium (Rh) 3.8% Palladium (Pd) 40.2%**	**Platium (Pt) 56.0% Rhodium (Rh) 3.8% Palladiu m (Pd) 40.2%**	**Platium (Pt) 56.0% Rhodium (Rh) 3.8% Palladium (Pd) 40.2%**	At the site visit invoices were made available for verification of the catalyst composition used in campaign no. PC1, PC2 and PC3 /18/. Type of primary catalyst is Heraeus FTC Plus. The composition used in the baseline campaigns was verified to be 56.5 % Pt, 3.8% Rh and 39.7 % Pd. The compositions used in the project campaigns are hence the same type as used in the baseline campaign.

3.5.4 Monitored data for baseline emissions within the project boundary

As stated in the registered PDD, the production campaign for the period 20 July 2006 to 18 February 2007 was selected as baseline campaign and all baseline parameters were monitored during this period according to the methodology. However the verification of the baseline campaign raw data and the confirmation of the baseline campaign emission factor were included in the scope of the verifying DOE /7/. During the on-site verification, DNV has verified the raw data of the baseline campaign defined in the PDD and it was confirmed that operating conditions were within the permitted range more than 50% of the time. Therefore, according to the methodology the baseline campaign from 20 July 2006 to 18 February 2007 is valid and does not need to be repeated.

Following the baseline campaign, an intermediate campaign was operated without secondary catalyst from 25 February 2007 to 18 August 2007 because the project was not yet registered. According to the methodology (page 4), the baseline campaign shall be established “for one complete campaign prior to project implementation”. Therefore, DNV is of the opinion that it is not required by the methodology to repeat the baseline campaign, nor to use the latest campaign before the project is implemented. Nevertheless, the operating data, stack gas flow and N_2O concentrations measured during this intermediate campaign can be used to cross check the emission factor for the selected baseline campaign. DNV has verified the raw data and calculation of the emission factor for the intermediate campaign /28/, and can confirm that the selected baseline campaign is the most reasonable and the most conservative baseline for the project activity.

The baseline emission factor is applicable for the all three project campaigns, since the length of the project campaigns are longer than the normal campaign length (CL_{normal} equal to 127 302.4 t

100% HNO_3). The campaign length for the baseline was equal to 134 700 100% HNO_3 hence the N2O concentration values (NCSG) recorded after reaching the normal campaign length was excluded from the calculation of the average NCSG value. The baseline campaign data was also verified by DNV during this first monitoring period. 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 on each monitoring parameter are given in Appendix C.

Data variable	Tag. No.	Reported value for the baseline campaign period	Assessment / Observation
VSG_{BC} Normal gas volume flow rate of the stack gas during baseline	**FT-76550**	72 468 Nm^3/h	See comments in 3.5.3 VSG_{BC} was verified by DNV to be correctly reported /4/
$NCSG_{BC}$ N_2O concentration in the stack gas (mgN_2O/Nm^3)	**AR-76020-2**	1 630 mg/m^3	The concentration of N_2O in the stack gas is continuously measured by the non dispersive infrared photometry (NDIR) analyser MIR 9000. 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/. According to the QAL 2 rep ort, the combined relative uncertainty of the analyser is 2.68% /10/. The standard reference method (SRM) showed a deviation to the AMS. Correction factor based on TÜV QAL 2 reference measurements were 1.104 /10/. It has been verified that the same value is used in the calculation spread sheet for adjusting the N_2O concentration during the baseline campaign. It was verified that zero and span

			check during the project campaign was done at least every 2 weeks. 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 1000 ppmv was certified by AFROX to 1036.7 ppm. With a precision of ± 2%. The expiration date is 12 September 2007. 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. $NCSG_{BC}$ was verified by DNV to be correctly reported /4/
OH_{BC} Operating hours of the plant	N/A	4 950 h	See comments in 3.5.3 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-76010**	134 700 $tHNO_3$	See comments in 3.5.3 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	0.004647 $t\ N_2O/\ t\ HNO_3$	EF_{BL} was verified by DNV to be correctly calculated and reported according to EB 51 Annex 12 /4/
GS_{BL} Gauze supplier for baseline campaign	N/A	W.C. Heraues	Verified by validating DOE.

GC_{BL} Gauze composition for baseline campaign	N/A	56.5 % Pt 3.8% Rh 39.7% Pd	Verified by validating DOE. Type of primary catalyst is Heraeus FTC Plus. This parameter was verified at the site visit.
OPh Hourly oxidation pressure during the baseline campaign	PT-76002-1	N/A OPh is measured to check if the parameter is within the permitted operating range.	It was verified that the oxidation pressure was within the permitted operating range more than 50% of the time of the baseline campaign. The monitoring equipment operated normally and was adequately calibrated during the baseline campaign /22/. More details is given in Appendix C.
OTh Hourly oxidation temperature during the baseline campaign	TE- 76159/1 76159/2 76159/3 76159/4 76159/5	N/A OTh is measured to check if the parameter is within the permitted operating range.	It was verified that the oxidation temperature was within the permitted operating range more than 50% of the time of the baseline campaign. The monitoring equipment operated normally and was adequately calibrated during the baseline campaign /22/. More details is given in Appendix C.
AFR Ammonia gas flow rate to ammonia oxidation reactor	FT-76003/1	N/A AFR is measured to check if the parameter is within the permitted operating range.	It was verified that the ammonia flow was below the permitted maximum value more than 50% of the time of the baseline campaign. The monitoring equipment operated normally and was adequately calibrated during the baseline campaign /22/. More details is given in Appendix C.
AIFR Ammonia to Air ratio into ammonia oxidation reactor during baseline campaign		N/A AIFR is monitored to check if the parameter is within the permitted operating range.	It was verified that the Ammonia to Air ratio was below the permitted maximum value more than 50% of the time of the baseline campaign. The monitoring equipment operated normally and was adequately calibrated during the baseline campaign /22/. More details is given in Appendix C.

3.5.5 Other factors and calculated parameters

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

Data variable	Reported value	Assessment/ Observation
UNC	**3.99 %**	The overall uncertainties for the AMS have been reported in the QAL 2 report /10/.
EFma,n Moving average emission factor derived over the time from campaign specific emission factors. $tN_2O/t\ HNO_3$	**Campaign PC1: 0.00106** **Campaign PC2: 0.00098** **Campaign PC3: 0.00103**	The moving average is calculated as the average of EFn from campaigns no. PC1 and campaign no. PC2 = (0.00106+0.00090)/2=0.00098 Similarly for campaign no. PC3: (0.00106+0.00090+0.00115)/3=0.00103 See comments in 3.4.2
EFmin The lowest of EFn observed during the first ten campaigns of the project crediting period. $tN_2O/t\ HNO_3$	**N/A**	This value is not applicable until 10 campaigns have been finalised.
EFp Emission factor used for the specific campaign n $tN_2O/t\ HNO_3$	**Campaign PC1: 0.001061** **Campaign PC2: 0.000979** **Campaign PC3: 0.001146**	The higher of the two values EFma,n and EF_n has correctly been applied in the emission reduction calculations.
EFreg 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 the ISO 14001 procedure for

		following up any new environmental regulations /25/.
NOx regulation		At the site visit the NOx concentration was observed to be below the value set by the Ministry of Environmental Protection (400 ppm). /25/

3.5.6 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.

3.6 Accuracy of Emission Reduction Calculations

The overall uncertainty for the AMS has been determined to be 3.99 % /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 1.01 for gas flow rate and 1.104 and 0.99 for N_2O concentration for the baseline campaign and project campaign respectively were properly applied.
2) The nitric acid productions (100% HNO_3) for the baseline and project campaigns covered in the monitoring period were calculated correctly. The number of hours of operation in the project campaign covered in the monitoring period was also correctly calculated.
3) The project emission factors were correctly calculated.
4) The baseline emission factor was correctly determined according to AM0034. The plant operated more than 50% of the time within the permitted operating conditions and hence the selected baseline campaign was valid for the determination of the baseline emission factor.
5) Any N_2O values measured during hours were the plant operated outside the permitted ranges was excluded from the calculation of the baseline emission factor. Since CL_{BL} > CL_{normal} all N_2O values measured beyond the reach of CL_{normal} was excluded when calculating the average NCSG used for the calculation of the baseline emission factor.
6) Further the project campaign CL_n was longer than the CL_{normal}, for all the three project campaigns in this monitoring period, thus the original baseline emission factor was valid to be used for the calculation of the emission reductions.
7) The emissions reductions were correctly calculated with consideration if the design capacity was exceeded in the project campaigns.

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.

During the verification some mistakes of manual data transfer were identified; however these errors were minor and did not have any effect on the emission reduction calculation.

3.7 Quality of Evidence to Determine Emission Reductions

The main monitoring parameters are automatically collected by the monitoring system. The raw data are stored as 2 second values at two different locations. All necessary documentation is collected, referenced and aggregated and is easily accessible in spreadsheets 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. These data were verified by DNV.

Measurements are performed by calibrated equipment and are valid for the baseline campaign and the entire monitoring period. The key data can also be cross-checked via other sources, such as control room stations and on-site meters. No assumptions are used, that have any material influence on reported emission reductions.

The project proponent has provided Excel sheets containing the raw data and calculations for the campaign number P1, P2 and P3 /4/. These data were verified and DNV confirms the calculations of baseline emissions and project emissions have been carried out in accordance with the formulae and methods described in the monitoring plan and applied methodology. In accordance with AM0034 version 2 no leakage calculation is required.

3.8 Management System and Quality Assurance

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

The nitric acid plant N11 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:

- QAL 1: 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 EN ISO14956”. DNV was able to verify that the evaluation has been carried out by a third party laboratory/testing institute with 17025 accreditation /12/ before installation of the AMS and the evaluation

is deemed to be acceptable.4

- QAL2: The installed AMS is tested and compared to a SRM. The QAL2 tests were carried out by TÜV SUD Industrie Services August 2007 (for MIR 9000 analyser) and February 2008 /10/; TÜV SUD is ISO 17025:2005 accredited /24/.
- QAL3: Span and zero checks are carried out twice a week.
- AST: The AST test 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/.

[4] The test for the MIR 9000 analyser used during the baseline campaign was done according to the standard: prEN 15267-3 (2007): "Air quality - Certification of automated measuring systems - Part 3: Performance criteria and test procedures for automated measuring systems for monitoring emissions from stationary sources" the follow-up regulation of EN 14956. The test for the URAS 14/ URAS 26 used during project campaigns are based on EN ISO 14956.

4 CERTIFICATION STATEMENT

DNV Climate Change Services AS (DNV) has been engaged by African Explosives Ltd. to verify the greenhouse gas (GHG) emission reductions reported for the "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" for the period 08 February 2008 to 23 May 2009.

Our opinion relates to the project's GHG emissions and resulting GHG emissions reductions reported in the revised monitoring report dated 16 August 2011 version 6. 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 opinion on the GHG emissions from the project for the period 08 February 2008 to 23 May 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 version 1.c., dated 25 September 2007 and the monitoring report (version 06) dated 16 August 2011.

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 as defined under the Kyoto Protocol, Marrakech accord, as well as those defined by the CDM Executive board.

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 1.c. dated 25 September 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 "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" for the period 08 February 2008 to 23 May 2009 are fairly stated in the monitoring report version 06 of 16 August 2011.

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 version 1.c. of 25 September 2007.

DNV Climate Change Services AS is able to certify that the reported emission reductions from the project during the period from 08 February 2008 to 23 May 2009 amounted to 332 002 tonnes of CO_2 *equivalents.*

Oslo, 16 December 2011

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

REFERENCES

/1/ CDM Monitoring Report: “N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa”, dated 02 December 2009 (published).
Revised final version 6 dated 16 August2011.

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

/3/ CDM Project Spreadsheet for the verification period 08 February 2008 to 23 May 2009 Filename:
AEL 11 No 1_ghg-calculation_rev3_MS_100714.xls (including project campaigns no. PC1, PC2 and PC3)
AEL 11 No 1_ghg-calculation-rev3_MS_100714.xls

/4/ Excel sheet (filename: AEL_No11_PC_Calc_V2_MS_100322.xls, AEL_No11_PC_Calc_V3e4_MS_20110207.xls) derived from data analysis of hourly average monitoring data including :
-Calculation of project emission factors
-Calculations of emission reductions
Excel sheet (filename: Campaign data AEL 11_20110207_MS.xls) for hourly data of baseline campaign and project campaigns.
Excel sheet including NAP values from mass balance method and mass flow meter.

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

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

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

/8/ 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 no. IS-US3-MUC/th dated 06 September 2007. (QAL 2 for MIR 9000 analyser used in the baseline campaign, period of test 01.08.2007 to 04.08.2007). Valid until 2012.
TÜV SUD Industrie Services QAL 2 report. Author Erhard Krämer. Report no. IS-US3-MUC/th dated 09 July 2008. (QAL 2 for Uras 14 analyser used in the project campaigns, period of test 09.02.2008 to 11.02.2008). Valid until 2013.

/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 SUD QAL 1 report Uras 14
TÛV Rheinland: Report on the laboratory test of the Multigas analyzer MIR 9000 CLD Option of the company Environment S.A. for the measurement of NO/NOx, NO_2; CO_2; O_2; N_2O and CH_4. (QAL 1)

/13/ TÜV SUD Indsutrie Service: Letter confirming required frequency for zero/span check (QAL3) for Uras 26 (follow-up version of Uras 14).

/14/ MÜLLER-BBM report M80 456/2: “Report on performance test of continuously operating measuring system on a nitric acid plant”. AST conducted in 11 June 2009 to 12 June 2009, date of report 28 July 2009.

MÜLLER BBM is accredited by Deutschen Akkreditierungs Rat (DAP) confirming competence in accordance to DIN EN ISO/IEC 17025:2005. DAR registration no. DAP-PL-2465.20. The accreditation is valid from 16 June 2008 to 09 February 2010.

/15/ Afrox Ltd.: Certificates of analysis of calibration gases during baseline campaign.

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

/16/ Calibration reports N_2O analyser MIR 9000:

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

Calibration reports N_2O analyser ABB Uras 14:

- AT-76020-2 N_2O Analyzer Calibration Cell Report form February 2008 to May 2009.

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

/18/ Invoice No. 10330467: Heraeus South Africa Ltd. Ammonia Oxidation Catalyst, dated 09 September 2007 for campaign P1.

Invoice No. 10330836: Heraeus South Africa Ltd. Ammonia Oxidation Catalyst 19 March 2008 for campaign No. P2.

Invoice No. 10310945: Heraeus South Africa Ltd. Ammonia Oxidation Catalyst 30 September 2008 for campaign No. P3

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

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

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

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

/21/ Instrument data sheets:

-Nitric acid flow meter Tag. No. FT-76011.

-Stack gas flow meter Tag.No. FT-76550

-N_2O analyser Tag. No. AT-76020-2

/22/ Calibration Certificates:

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

During baseline (20.07.2006 – 18.02.2007) and project campaign period:

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-76010. Date 25.04.2006.

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-76010. Date 06.09.2007.

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-76010. Date 11.04.2008.

- ALPRET Controls Specialists: Nitric acid flow meter Tag. No. FT-76010. 24.02.2009.

-Internal calibration by AEL Ltd.:

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

Date of calibration during baseline campaign:

14.03.2007 (prior to this new calibrated thermocouples were installed for each campaign)

Thermocouple Products (PTY): Invoice for thermocouple dated 17 August 2006.

Dates of calibration during project campaigns:

05.09.2007; 29.01.2008; 19.03.2008; 30.09.2008; 16.02.2009; 30.05.2009

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

Dates of calibration during baseline campaign:

31.05.2006; 01.11.2006; 19.02.2007

Dates of calibration during project campaigns:

03.09.2007; 19.03.2008; 30.09.2008; 16.02.2009; 27.05.2009

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

Dates of calibration during baseline campaign:

31.05.2006; 01.11.2006; 19.02.2007

Dates of calibration during project campaigns:

03.09.2007; 19.03.2008; 30.09.2008; 16.02.2009; 27.05.2009

Primary air to ammonia oxidation reactor (used to calculate AIFR):

Dates of calibration during baseline campaign:

31.05.2006; 01.11.2006; 19.02.2007

Dates of calibration during project campaigns:

03.09.2007; 19.03.2008; 30.09.2008; 16.02.2009; 27.05.2009**Stack gas flow meter Tag. No. FT-76550 (VSG/VSG_{BC}), stack gas temperature Tag. No. TE-76170 (TSG), stack gas pressure Tag. No. PT-76506 (PSG):**

During Baseline period 20.07.2006 – 18.02.2007:

Dates of calibration :19.07.2006 and 23.02.2007

-*During Project campaigns:*

Dates of calibration :01.09.2007; 01.03.2008; 04.10.2008; 10.03.2009; 28.05.2009; 14.10.2009

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

/24/ DAP (Deutsches Akkreditierungssystem Prüfwesen GmbH: TÜV SÜD Accreditation for ISO 17025:2005 dated 13 July 2007. DAP registration number DAP-PL-2885.80. Valid until 22 May 2011.

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

/26/ Route Calibration Services: Calibration certificate No. S 110. Dated 31.07.2009 (uncertainty of nitric acid flow meter).

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

/28/ Excel sheets for intermediate campaign raw data and Baseline calculation from intermediate campaign dated 30 November 2011.

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APPENDIX A

CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS

Corrective action requests

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 1	QAL 1 for N_2O analysers to be provided. Further the QAL 2 reports should be made available to DNV.	The QAL1 and QAL 2 reports have been provided.	DNV have received the QAL 1 report (for Uras 26 which is an updated version of Uras 14 with the same physical components) and QAL 1 statement for MIR 9000. Further DNV received QAL2 reports. This CAR is closed.
CAR 2	The PDD states both mass balance calculation and Coriolis flow meter as the data source for the determination of NAP during the project activity. At the site visit it was observed that insufficient calibration certificates were available for the tank level radars. The PP is requested to clarify the methodology used for determination of NAP values.	An analysis was done in order to compare the NAP values determined from tank level/mass balance method and NAP values obtained from Coriolis mass flow meters. The analysis showed that the accuracy of the mass balance calculation and the Coriolis flow meter was equally acceptable, hence the use of Coriolis mass flow meters will be used for determination of NAP. The determination NAP related data was re-calculated and raw data provided for determination.	DNV has checked the provided analysis and confirmed the accuracy of NAP values from the Coriolis mass flow meter was equally good as the mass balance method. DNV further verified the re-calculations of HNO_3 production (NAP) related data as NAP_{BL}, CL_{BL} and CL_n. DNV confirms the values are correctly calculated /4/. This CAR is closed.

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 3	Calibration frequency and procedures to be provided for N_2O analyser. This information is not available in the registered PDD as at the time of request for registration it was only informed a new analyzer should be installed (probably ABB Uras 14 as described in PDD page 50 footnote 32). The recommended calibration frequency from supplier for the analyzer should be provided.	Documentation for the recommended calibration frequency was made available to DNV.	DNV was able to verify from the documentation provided that the recommended frequency of zero/span calibration is every three weeks. However AEL do the zero/span checks twice a week./14/ This CAR is closed.
CAR 4	Formal procedures missing for: -Training -Handling unexpected problems - Access to data -Archive of data -Follow-up regulation	A set of procedures for the mentioned missing items have been provided to DNV.	A set of procedures were made available as follows: CDM Nitrated – DPI 030 CDM Operation – DPI 031 CDM AST – DPI 032 CDM Verification _ DPI 033 CDM Training AMS – DPI 036 Continuous Improvement _DPI 14 –Q Further the AEL procedure no. CS/H/002 revision 3 "Environmental Management" point 5 describes the law updating and the regulation register for following up regulations. DNV was able to confirm that the missing items were sufficiently included in the procedures. This CAR is closed.

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 5	Calibration of ammonia oxidation pressure was not included in the schedule for calibrations.	The PP provided the CDM procedure DPI 033 Verification where the schedule of calibration of ammonia oxidation pressure is included.	The procedure was provided and checked by DNV. This CAR is closed.
CAR 6	DCS programming: Normalization of stack gas needs to be checked and re-programmed in the DCS. New data for flow is to be provided.	A DCS print out was provided to DNV. Further in the AST report (Müller BBM 2009) it is attested that the normalization is done correctly. Please refer to the Statement about correct normalization in 9.3 on page 36 of the AST report. Secondly a comparison between normalized SRM results (from AST test or QAL2 test) with the recorded VSG results in the data acquisition system shows that the normalization to standard conditions (by TSG and PSG is done correctly).	DNV was able to check and verify from the documents received that the normalisation of stack gas flow was corrected. This was also confirmed in QAL 2 and AST reports. This CAR is closed.
CAR 7	There is no formal evidence about the Gauze changing dates during the monitoring period and during the baseline.	The PP provided to DNV a document dated 15 December 2009 from Heraeus South Africa Ltd. containing the dates of gauze changes during the entire monitoring period and the baseline.	DNV checked the documents provided. The requested information is made available This CAR is closed.

Forward action requests:

FAR ID	Forward action request	Response by Project Participants	DNV's assessment of response by Project Participants
FAR 1	Social responsibility: The social fund as described in the registered PDD should be provided in order to show the share of sales of CERs will be transferred to specified projects.	The contribution from the CDM project to social investment will be determined and controlled according to the guidelines set out in the AEL Corporate Social Responsibility Programme and the presentation "SOCIAL INVESTMENT AT AEL". The social investment is enacted by the AEL Social Investment committee that is responsible for all the management of all AEL's social investment programs.	The PP has provided the guidelines as set out in the AEL Corporate Social Responsible Programme. This FAR is closed.
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.

Clarification requests

CL ID	Clarification request	Response by Project Participants	DNV's assessment of response by Project Participants
CL 1	The uncertainty of NAP should be clarified.	The uncertainty is included in the certification of the equipment used by the company that Alpret uses to calibrate the NAP flow meters.	DNV received the certificate and was able to verify the uncertainty. /26/ This CL is closed.
CL 2	Inconsistency in NDIR and GC measurements for N_2O concentration was observed during the site visit. This should be clarified.	An investigation was done and it was observed that the inconsistency between NDIR and GC was related to the problem of getting a representative sampling from the stack gas. As there is not a requirement in AM00034 to also measure the N_2O concentration by gas chromatography (GC) and further this the QAL 2 test is performed and reports proper function of the NDIR, the PP decided not to proceed with the plausibility test with GC.	DNV find the explanation reasonable. This CL is closed.

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 AS to carry out the first periodic verification of the CDM project "N_2O abatement project at nitric acid plant No. 11 at African Explosives Ltd. (AEL), South Africa" at African Explosives Ltd. in South Africa* *The agenda for the site visit was presented and African Explosives Ltd. introduced by giving general information about the production at the site.*	OK
A.2. Clarification of access to data archives, records, plans, drawings etc.	/3/ /4/	*Access to all relevant data has been granted to the verification team.* *Operating conditions and related parameters were provided by African Explosives Ltd.* *All other parameters related to the operation of the CDM project were available from records and spread sheets provided by N.serve.* *Finalised spread sheets including periodic campaign data have been provided.*	OK
A.3. Contractors for equipment and installation works *Who has installed the equipment? Who was contracted for planning etc.?*		*The equipment for N_2O concentration monitoring during the baseline campaign is supplied by Environment S.A and installed by local representative in South Africa.* *The equipment for N_2O concentration monitoring during the project campaigns is supplied by ABB and installed by ABB South Africa Ltd..* *The volume flow meter (Emerson Rosemount Annubar® Model 485 Flow Meter series was installed by African Explosives Ltd. personnel according to manufacturer's instructions.* *The secondary abatement catalyst supplier is W.C. Heraeus.* .	OK
A.4. Actual status of installation works *Project installation should be finished at time of initial verification in so far as the project should be*		*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)
ready to generate emission reductions afterwards.			
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 08 February 2008 UNFCCC reference number 1364.*	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.*	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

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
C.4. Data uncertainty *How will data uncertainty be determined for later calculations of emission reductions? Is this in compliance with monitoring and metering equipment?*	/10/	*The overall uncertainty is determined by the QAL 2 test carried out by TÜV SUD who is accredited according to ISO/IEC 17025.* *Zero and span check for the N_2O NDIR analysers is preformed bi-weekly. In case the deviation exceeds 1% the analyzer is calibrated. In addition manual calibration checks with certified calibration gas are performed regularly.* *The results of overall uncertainties are determined in the QAL 2 report.* *The overall uncertainty of the AMS is 3.99%.*	OK
C.5. Calibration and quality assurance *Check how monitoring and metering systems are subject to calibration and quality assurance routines* *a) with installation* *b) during future operation*	/10/ /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 are developed for the calibration of stack gas analyser system.* *Stack gas flow meter and N_2O analyser: QAL 2 tests are performed according to the European standard EN14181 (main items).* *N_2O analyser: See C.4.* *Stack gas flow meter: Calibrated prior to shipment by the supplier. Calibration at least yearly (usually every 7 month after each campaign).* *Yearly functionality test in accordance to EN 14181 (AST).* *Standard reference method used for stack gas volume flow is according to ISO 10780.* *Calibration certificates and certificates of calibration gases were made available for verification.*	~~CAR 2~~ ~~CAR 3~~ ~~CAR 5~~ 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*		*N.serve is the formal focal point of communication with the Executive Board and the UNFCCC secretariat.*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
determination of emission reductions will be generated		*African Explosives is responsible for the operation of the nitric acid plant and to monitor the necessary data for verification.* *N.serve is responsible to compile the monitoring report based on the data provided by African Explosives (data files are imported into the N.serve Database Management System (N.DBMS).* *At N.serve the received data is stored at the N.serve fileserver in a special section for the storage of monitoring data. The files are protected against manipulation by a password. Martin Stilkenbäumer at N.serve is responsible for the correct data handling and processing.* *A spread sheet is generated with all parameters and calculations of emission reductions.*	
C.8. Documented instructions *Check whether the personnel performing tasks with sensitivity for the monitoring of emission reductions have access and knowledge of documented instructions, forming a part of the project's management system.*	/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	/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)
Check whether there are possibilities of redundant data monitoring in case of having problems with the used monitoring equipment. Such procedures may reduce risks for the buyers of emission reductions (e.g. the Client)		*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 MicroMotion CMF300 from Emerson.* *100% nitric acid is calculated from the measurements of flow from the mass flow meter, and the concentration. The concentration is measured automatically and the correct measurement is checked by manual test.* *The procedure describing the NAP calculation in the CDM procedure is corrected.*	OK
D.2. Data collection *How is data collected and processed? What are the means of quantifying emissions from the different data sources?*		*There is one main source of emissions:* *N_2O not decomposed.* *See C 6.*	OK
D.3. Quality assurance *Does internal data collection underlie sufficient quality assurance routines?*		*No data for the calculation of emission reductions are manually transferred.* *The quality of data collection seems appropriate.* *During the verification some 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.*	OK

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
D.4. Significance and reporting risks *Assess the significance and reporting risks related to the different internal data sources. Potential reporting risks may be related to the calculation methods, accuracy of data sources and data collection and/or the information systems from which data is obtained. The significance of and risks associated with the data source indicate the level of verification effort required at a later stage.*		*The risk associated with the main parameters used for the emission reduction calculations are regarded to below, see D.1.*	OK
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*	/27/	*It was informed at the site visit that N_2O is not regulated in South Africa.*	OK
E.2. Access to external data *How is data transferred? How can reproducibility of data set be ensured?*		*N/A*	OK
E.3. Quality assurance *Does external data underlie any quality assurance routines?*		*N/A*	OK
E.4. Data uncertainty *Is it possible to assess the data uncertainty of external data? Are such routines included in reporting procedures?*		*N/A*	OK

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

OBJECTIVE	Ref.	COMMENTS	Concl.(incl FARs/CARs)
G. Management and Operational System *In order to ensure a successful operation of a Client project and the credibility and verifiability of the ERs achieved, the project must have a well defined management and operational system.*			
G.1. Documentation *The system should be documented by manuals and instructions for all procedures and routines with relevance to the quality of emission reductions. The accessibility of such documentations to persons working on the project has to be secured.*	/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.*	~~CAR 4~~ 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 data is collected in the DCS (distributed control system) for 3 weeks (real time system for the operators). The raw data is stored during the crediting period plus 2 years in the process information system and back-up is kept in a fire resistance safe in the control room.*	OK

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

Table 2: Data Management System/Controls

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

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

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

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
A. Defined organisational structure, responsibilities and competencies		
A.1. Position and roles *Position and role of each person in the GHG data management process is clearly defined and implemented, from raw data generation to submission of the final data. Accountability of senior management must also be demonstrated.*	Full	African Explosives is responsible for the day-to-day operation of the AMS on site, including calibrations and maintenance. African Explosives has appointed the Instrument Department Manager as responsible person for these tasks. African Explosives derives hourly averages for all of the monitored parameters and transfer these data to N.serve. 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 is the formal focal point of communication with the Executive Board and the UNFCCC secretariat. African Explosives is responsible for the operation of the nitric acid plant and to monitor the necessary data for verification. N.serve is responsible to compile the monitoring report based on the data provided by African Explosives (data files are imported into the N.serve Database Management System (N.DBMS). At N.serve the received data is stored at the N.serve fileserver in a special section for the storage of monitoring data. The files are protected against manipulation by a password. Martin Stilkenbäumer at N.serve is responsible for the correct data handling and processing.
A.3. *Competencies needed* *Competencies needed for each aspect of the GHG determination process are analysed. Personnel competencies are assessed and training programme implemented as required.*	Full	The personnel responsible for monitoring and calculation of emission reductions are appropriately trained and qualified. Specific training programs have been held for African Explosives Ltd. personnel for operating and maintenance of the CDM equipment. Training for the operation and maintenance of the CDM project related to the ammonia oxidation operation is included in African Explosives Ltd. Quality assurance management system.
B. Conformance with monitoring plan		
B.1. Reporting procedures *Reporting procedures should reflect the monitoring plan content. Where deviations from the monitoring plan occur, the impact of this on the data is estimated and the reasons justified.*	Full	The reporting procedures reflect the monitoring plan content. No deviation request was submitted for this monitoring period.
B.2. Necessary Changes *Necessary changes to the monitoring plan are identified and changes are integrated in local procedures as necessary.*		No materialchanges to the monitoring plan were identified.

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

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
E. GHG Calculations		
E.1. Use of estimates and default data *Where estimates or default data are used, these are validated and periodically evaluated to ensure their 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.
E.5. Data protection measures *Data protection measures for databases/spreadsheets should be in place (access restrictions and editor rights).*	Full	The access to the raw data is restricted to especially selected personnel. At N.serve the received data is stored at the N.serve fileserver in a special section for the storage of monitoring data. The files are protected against manipulation by a password.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including Forward Action Requests)
E.6. IT systems *IT systems used for GHG monitoring and reporting should be tested and documented.*	Full	The 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 – MicroMotion CMF300 TAG: FT-76010
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. The monitoring equipment (Coriolis mass flow meter) is common practice for measuring nitric acid and measurement uncertainty is 0.1% (as per the supplier).
Calibration frequency /interval:	Every 3 years.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure no. C09NA revision 1 "Calibration Procedures" of African Explosives Ltd.
Company performing the calibration:	Alpret Control Specialists Ltd./22/
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?	Yes, the NAP values are also determined from a mass balance method (see CAR 2).
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. Once a month the results will be downloaded from SCADA to an excel file for analysis and calculation.

	The raw data is saved on a DAT device andstored 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):	**OTh** Oxidation temperature of AOR
Measuring frequency:	Continuously
Reporting frequency:	Every Hour
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Thermocouple type K310S/steel TAG: TE- 76159/1; 76159/2; 76159/3; 76159/4; 76159/5
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. However the measurement uncertainty is 1% (as per AEL calibration requirements)
Calibration frequency /interval:	Normal practice prior to 2007 was the install new thermocouples for each campaign. This was hence the practice for the baseline campaign./22/ During project campaigns the thermocouples were calibration before or after each campaign (usually every 7 month)./22/
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Yes, the frequency represents good monitoring practice.
Company performing the calibration:	AEL internal calibration as per ISO 9001 Procedure no. C09NA

	revision 1 “Calibration Procedures” of African Explosives Ltd.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes /22/
If applicable, has the reported data been cross-checked with other available data?	N/A
How were the values in the monitoring report verified?	DNV performed samples checks of production log books.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data 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 is saved on a DAT device and stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	N/A

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**OPh** Oxidation pressure during the baseline campaign
Measuring frequency:	Continuously
Reporting frequency:	Every Hour
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Yokogawa, type Pressure Tx TAG: PT-76002-1
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. However the measurement uncertainty is 1.7% (as per AEL calibration requirements)
Calibration frequency /interval:	Once every 7 month /22/
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Yes, the frequency represent good monitoring practice.
Company performing the calibration:	AEL internal calibration as per ISO 9001 Procedure no. C09NA revision 1 “Calibration Procedures” of African Explosives Ltd.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes /22/
If applicable, has the reported data been cross-checked with other available data?	N/A
How were the values in the monitoring report verified?	DNV performed samples checks of production log books.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data 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 is saved on a DAT device and stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	N/A

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**AIFR** Ammonia to air ratio (determined from the ratio of AFR and primary oxidation air which is the parameter assessed below).
Measuring frequency:	Continuously
Reporting frequency:	Every Hour
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Yokagawa type D.P. transmitter TAG: FT-76002/1
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. However the measurement uncertainty is 1.66% (as per AEL calibration requirements)
Calibration frequency /interval:	Once per 7 months /22/
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Yes, the frequency represents good monitoring practice.

Company performing the calibration:	AEL internal calibration as per ISO 9001 Procedure no. C09NA revision 1 “Calibration Procedures” of African Explosives Ltd.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes /22/
If applicable, has the reported data been cross-checked with other available data?	N/A
How were the values in the monitoring report verified?	DNV performed samples checks of production log books.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data 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 is saved on a DAT device and stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	N/A

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**AFR** Ammonia gas flow rate to ammonia oxidation reactor
Measuring frequency:	Continuously
Reporting frequency:	Every Hour
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes

Type of monitoring equipment: Tag.No.	Yokogawa D.P. Transmitter TAG: FT-76003/1
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the monitoring is not stated in the PDD. However the measurement uncertainty is 1.25 % (as per AEL calibration requirements)
Calibration frequency /interval:	Once per 7 months /22/
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Yes, the frequency represents good monitoring practice.
Company performing the calibration:	AEL internal calibration as per ISO 9001 Procedure no. C09NA revision 1 “Calibration Procedures” of African Explosives Ltd.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes
If applicable, has the reported data been cross-checked with other available data?	N/A
How were the values in the monitoring report verified?	DNV performed samples checks of production log books.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	OK. All activities are regulated by QA/QC Procedures. The data 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 is saved on a DAT device and stored in a strongbox in the IT office. All data necessary for the emission reduction calculation are digitally transferred from the Plant data system (SCADA) to the dedicated relational database management system (N.DBMS).
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or	N/A

has a request for deviation been approved?	

	Assessment/Observation
Data / Parameter: (as in monitoring plan of PDD):	**$NCSG_{BC}$/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.	MIR 9000 (baseline campaign) and ABB AO2000 Uras 14 (project campaigns). TAG no. AT-76020-2
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy represents good monitoring practice. The combined relative fault of the analyser is 2.68 % and 2.69% for MIR 9000 and ABB AO2000 Uras respectively /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:QAL2 by an authorized ISO 17025 institute every 5 year.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Analyzer is calibrated as per ISO 9001 Procedure n° C09NA revision 1 “Calibration Procedures” of African Explosives Ltd.
Company performing the calibration:	External calibration : QAL 2 by TÜV SUD Industrie Services. QAL 2 report. Author Erhard Krämer. Report n°. IS-US3-MUC/th dated 06 September 2007.(QAL 2 for MIR 9000 analyser used in the baseline

	campaign). Valid until 2012 -QAL 2 by TÜV SUD Industrie Services. QAL 2 report. Author Erhard Krämer. Report n°. IS-US3-MUC/th dated 09 July 2008. (QAL 2 for Uras 14 analyser used in the project campaigns). Valid until 2013. . AEL Nitrates Instrumentation Department: Internal calibration (biweekly zero and span check) QAL 2 tesst are performed by external company accredited for ISO 17025 /10/ /24/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes
If applicable, has the reported data been cross-checked with other available data?	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 of the Excel sheet "Campaign data AEL 11.xls" 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. 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	NA

has a request for deviation been approved?	

	Assessment/ Observation
Data / Parameter: (as in monitoring plan of PDD):	**TSG**
Measuring frequency:	Every 2 seconds
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Thermocouple type PT100_385-wire RTD Transmitter: Rosemont Model 644 RAI TAG. TE-76170
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	Yes. Measurement uncertainty: 2.55% (as per QAL 2 test report) /10/
Calibration frequency /interval:	Internal calibration at least once per year, ususally every seven months after each campaign /22/. QAL 2 test every 5 year.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure no. C09NA revision 1 “Calibration Procedures” of African Explosives Ltd. /22/ QAL 2 test is performed in accordance with EN 14181 /10/.
Company performing the calibration:	AEL Nitrates Instrumentation Department QAL 2 test is performed by external company accredited for ISO 17025 /10/ /24/.

Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Raw data of the excel sheet “Campaign data AEL 11.xls” 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. 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):	**PSG**
Measuring frequency:	Every 2 seconds
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes

Type of monitoring equipment: Tag.No.	Rosemont pressure probe. Transmitter: Rosemount; type 3051Ta12B21BB4I1M5Q4 TAG. PT-76506
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	Yes. Measurement uncertainty: 0.7% (as per QAL 2 report) /10/.
Calibration frequency /interval:	Internal calibration at least once per yer, usually every seven months after each campaign. QAL 2 test every 5 year.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	Meter is calibrated as per ISO 9001 Procedure 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 QAL 2 test is performed by external company accredited for ISO 17025 /10/ /24/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Raw data of the excel sheet “Campaign data AEL 11.xls” 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. 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):	**VSG_{BC}/VSG** Stack gas flow
Measuring frequency:	Every 2 seconds
Reporting frequency:	Hourly average
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment: Tag.No.	Emerson Rosemount Annubar Model 485 with 3051 DP transmitter TAG no. FT-76550
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	The accuracy of the flow meter was not stated in the PDD. This analyser is widely used to measure volume flow. Uncertainty is determined in QAL 2 to be ± 2.84 %
Calibration frequency /interval:	Internal calibration at least once per year usually every seven months after each campaign. QAL 2 test every 5 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:	QAL2 Report number IS-US3-MUC issued by TÜV SUD Industrie Services on date 06 September 2007. Author Erhard

	Krämer. /10/ Internal calibration by AEL Ltd. /22/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
Is(are) calibration(s) valid for the whole reporting period?	Yes
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	Raw data of the excel sheet "Campaign data AEL11.xls" 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. 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 process.

***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, 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.