



**Monitoring report form
(Version 04.0)**

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT

Title of the project activity	PROJECT FOR THE CATALYTIC REDUCTION OF N ₂ O EMISSIONS WITH A SECONDARY CATALYST INSIDE THE AMMONIA REACTOR OF THE NO. 9 NITRIC ACID PLANT AT AFRICAN EXPLOSIVES LTD ("AEL"), SOUTH AFRICA
Reference number of the project activity	1171
Version number of the monitoring report	03
Completion date of the monitoring report	01/07/2014
Registration date of the project activity	05/11/2007
Monitoring period number and duration of this monitoring period	- Number 7 - 12/03/2012 – 13/03/2013 - 367 days
Project participant(s)	- African Explosives Ltd - N.serve Environmental Services GmbH
Host Party(ies)	South Africa
Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)	- Sectoral scope: Chemical industries (5) - AM0034 (Version 2)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	117,419 tCO ₂ e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	63,822 tCO ₂ e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	48,571
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	15,251

SECTION A. Description of project activity**A.1. Purpose and general description of project activity**

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Purpose of the project activity and measures taken to reduce GHG emissions

The sole purpose of the project activity is to significantly reduce former levels of N₂O emissions from the production of nitric acid at AEL's nitric acid plant No. 9 ("AEL-9") in Modderfontein, South Africa, by implementation of a secondary N₂O abatement catalyst.

Brief description of the installed technology and equipment

The employed secondary N₂O abatement catalyst technology is supplied by Johnson Matthey PLC. Continuous monitoring of emission reductions is assured by an Automated Measuring System (AMS), consisting of stack gas volume flow meter, N₂O Analyser, and respective data logging facilities. The AMS as well as its installation complies with the requirements of the European Standard EN 14181 as required by the methodology.

Relevant dates for the project activity

Registration Date: 05/11/2007

Installation of AMS: The N₂O Analyser was installed in May 2007. The stack gas flow meter was installed in June 2006

Baseline Campaign: "H15"¹ : 05/09/2007 – 06/11/2007

Installation of secondary catalyst: 09/11/2007

Starting Date of Project Activity: 09/11/2007

Project Campaigns completed prior to current monitoring period:

Project Campaigns:	1. Campaign	PC1 - 09/11/2007-09/02/2008
	2. Campaign	PC2 - 19/02/2008-12/06/2008
	3. Campaign	PC3 - 08/07/2008-28/07/2008
	4. Campaign	PC4 - 25/02/2009-04/08/2009
	5. Campaign	PC5 - 05/08/2009-01/11/2009
	6. Campaign	PC6 - 30/11/2009-07/03/2010
	7. Campaign	PC7 - 08/04/2010-01/07/2010
	8. Campaign	PC8 - 21/09/2010-10/02/2011
	9. Campaign	PC9 - 11/02/2011-15/04/2011
	10. Campaign	PC10 - 20/04/2011-14/07/2011
	11. Campaign	PC11 – 26/07/2011-18/12/2011
	12. Campaign	PC12 – 04/01/2012-11/03/2012

Project Campaigns covered by current Monitoring/Verification Period:

13. Campaign	PC13 – 20/06/2012-11/10/2012
14. Campaign	PC14 – 13/10/2012-10/02/2013
15. Campaign	PC15 – 12/02/2013-11/03/2013

Total emission reductions achieved in this monitoring period

The total amount of emission reductions achieved in this monitoring period is 63,931 t CO₂e.

¹ H15 refers to AEL internal designation of the different production campaigns

A.2. Location of project activity

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Host Party: South Africa

Region/State/Province: Gauteng / Modderfontain

City/Town/Community: City of Johannesburg

Physical/Geographical location: 26°05'26" South, 28°10'17" East

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
South Africa (host)	African Explosives Ltd ("AEL")	No
United Kingdom of Great Britain and Northern Ireland	N.serve Environmental Services GmbH ("N.serve")	No
Switzerland	N.serve Environmental Services GmbH,	Switzerland

A.4. Reference of applied methodology and standardized baseline

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- a) AM0034 "Catalytic reduction of N₂O inside the ammonia burner of nitric acid plants"
Version 2

For the baseline selection: AM0028 "Catalytic N₂O destruction in the tail gas of Nitric Acid
or Caprolactam Production Plants" Version 03

- b) "Tool for the demonstration and assessment of additionality" Version 2

A.5. Crediting period of project activity

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Type: Non-renewable crediting period

Start date: 05/11/2007

End date 04/11/2017

Length: 10 years 0 months

A.6. Contact information of responsible persons/ entities

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Contact information of the person responsible for completing the CDM-MR-FORM:

Organization name	N.serve Environmental Services GmbH
Street/P.O. Box	Grosse Theaterstr. 14
Building	-
City	Hamburg
State/Region	Hamburg
Postcode	20354
Country	Germany
Telephone	+494030997860
Fax	+4940309978610
E-mail	contact@nserve.net
Website	www.nserve.net
Contact person	Nikolaus Gutknecht-Stöhr
Title	Head of Portfolio Manager
Salutation	Mr
Last name	Gutknecht-Stöhr
Middle name	
First name	Nikolaus
Department	Portfoliomanagement
Mobile	+49163 314 2825
Direct fax	+4940309978610
Direct tel.	+4940309978615
Personal e-mail	gutknecht@nserve.net

The entity is also a project participant as listed in Appendix 1 below.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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Description of the installed technology, technical processes and equipment

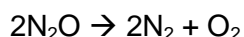
The project activity entails the installation and implementation of the following technical equipment and quality measures:

- 1.) secondary N₂O abatement technology
- 2.) Automated Monitoring System (AMS) for continuous N₂O measurement which is fully in compliance with European norm EN 14181 (for a detailed description, see Section C)
- 3.) training of local staff on installation, operation and maintenance of catalyst and monitoring equipment, etc. as well as implementation of quality check and quality assurance measures

Catalyst Technology

AEL has contracted with Johnson Matthey PLC who exclusively markets a secondary catalyst technology that has been developed by YARA International ASA (Norway). AEL installed the YARA 58 Y 1® catalyst system consisting of an additional base metal catalyst that is installed below the standard precious metal gauze pack.

The catalyst has been tried and tested in a number of nitric acid plants in Europe. The abatement efficiency has been shown to be better than 70 - 90% in the following reaction:



No contamination of the nitric acid with Cobalt or any of the other catalyst materials has been observed.

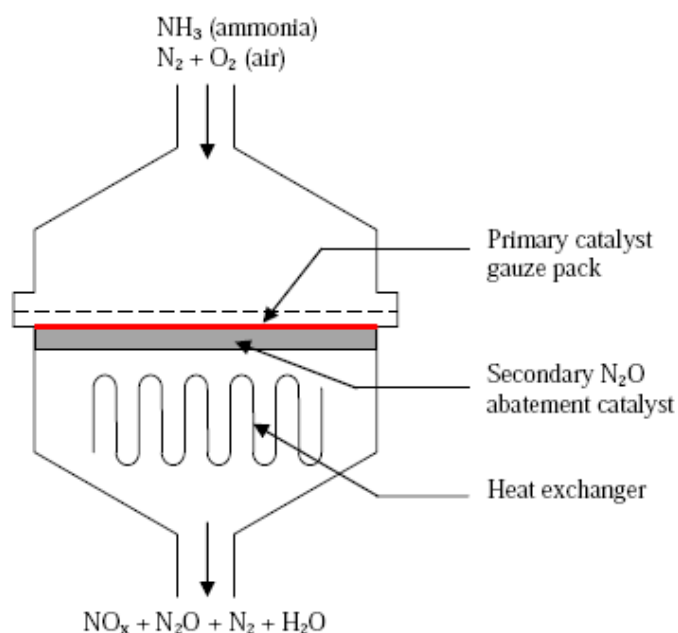
The catalyst does not require additional heat or other energy over and above the temperature that is present inside the Ammonia Oxidation Reactor anyway. There are no additional greenhouse gases or other emissions generated by the reactions on at the N_2O abatement catalyst.

This technology has been implemented inside the AEL-9 ammonia oxidation reactor.

The precious metal gauze pack – i.e. the primary catalyst required for the actual production of nitric acid – has been supplied to AEL by Heraeus Ltd. for a number of years. The precious metal composition of that gauze pack remains unchanged during the crediting period of the project.

N_2O abatement catalyst installation

The secondary catalyst itself is easily installable during a routine plant shut-down and gauze change. The pellets are poured into the support basket / heat shield arrangement and raked level. The gauze pack is then installed above this bed using the support mechanism provided by the heat shield.



AEL's nitric acid plant No.9 operates at a pressure of around 8.6 - 9 bars inside the ammonia oxidation reactor.

Information on the implementation and actual operation of the project activity, including relevant dates

The determination of the permitted operating conditions for operating temperature, operating pressure, maximum ammonia flow rate, maximum ammonia to air ratio normal gauze supplier and normal gauze composition was undertaken by the validating DOE (as it was clarified by the CDM EB in EB31 meeting that either validating or verifying DOE could undertake the task of determination of the permitted operating conditions). However, the normal campaign length as well as the determination of the baseline emission factor was in the scope of the verifying DOE. These parameters were determined and verified within the course of the first verification. The baseline campaign that was operated from 05/09/2007 until 06/11/2007.

The secondary catalyst was installed on the 09/11/2007, which is the starting date of the project activity. The project got registered by UNFCCC on the 05/11/2007, which is the starting date of the crediting period.

For a more detailed list of secondary catalyst installation, AMS installation, continued operating periods and other relevant dates for the project activity, see Section A.1, paragraph “*Relevant dates for the project activity*” above.

The events or situations that occurred during the monitoring period that may impact the applicability of the applied methodology

As to the characteristics of this specific project type certain production related events and incidents may affect the performance of the project or influence the monitoring of emission reductions in addition to possible failure of the installed monitoring equipment. The below table and lists demonstrates all relevant events and incidents related to production and/or emission monitoring which have occurred during actual operation within this specific monitoring period, as well as the measures taken for addressing any resulting problems and issues.

Start date and hour	End date and hour	Campaign	Short Description
19/06/2012 00:00	20/06/2012 00:00	PC13	Plant downtime for maintenance
20/06/2012 00:00		PC13	New campaign start with fresh primary gauze, start of project campaign 13
20/06/2012 11:00	20/06/2012 22:00	PC13	Plant offline due to compressor trip
24/06/2012 18:00	03/07/2012 18:00	PC13	Repairs to steam turbine
03/07/2012 21:00	04/07/2012 02:00	PC13	Plant trip
15/07/2012 06:00	25/07/2012 17:00	PC13	Plant offline due to capacity control
08/08/2012 12:00	08/08/2012 20:00	PC13	Plant trip on faulty gauze temperature probe.
13/08/2012 09:00	13/08/2012 21:00	PC13	Plant trip on LP compressor surge.
14/08/2012 08:00	14/08/2012 16:00	PC13	Plant trip
15/08/2012 09:00	16/08/2012 23:00	PC13	Repair leaking BFW heaters.
24/08/2012 06:00	25/08/2012 11:00	PC13	tripped due to air failure
17/09/2012 18:00	21/09/2012 02:00	PC13	Plant down to repair ammonia superheater and BFW bottles
22/09/2012 16:00	23/09/2012 03:00	PC13	Plant trip due to instrument air failure
11/10/2012 04:00		PC13	End of campaign and primary gauze change
13/10/2012 12:00		PC14	New campaign start with fresh primary gauze, start of project campaign 14
25/10/2012 13:00	23/11/2012 20:00	PC14	Plant offline due to low ammonia stock.

14/12/2012 15:00	16/01/2013 08:00	PC14	Plant offline due to low ammonia stock.
10/02/2013 05:00		PC14	End of campaign and primary gauze change
12/02/2013 23:00		PC15	New campaign start with fresh primary gauze, start of project campaign 15
13/02/2013 15:00	13/02/2013 19:00	PC15	Plant tripped on compressor.
26/02/2013 00:00	04/03/2013 23:00	PC15	Plant offline due to no steam available
11/03/2013 08:00		PC15	Plant tripped due to weak acid strength. Discovered that the converter basket and gauze is damaged. End of campaign and primary gauze change

No events or incidents of any relevance in regard to impacting the applicability of the methodology occurred during this monitoring period.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

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No temporary deviations from the registered monitoring plan or applied methodology have been applied during this monitoring period.

B.2.2. Corrections

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No corrections to project information or parameters fixed at validation have been approved during this monitoring period or submitted with this monitoring report.

B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

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The Emerson coriolis mass flow meter for NAP measurement has been replaced by a Flexim Ultrasonic flow meter. The request for permanent change from the registered PDD has been submitted along with this monitoring report.

Further, the procedure for computation of nitric acid production has been revised in the updated PDD: The density and temperature as measured by the flow meter, which also determines the concentration of the nitric acid produced. This value is then used to convert the total mass flow to 100% nitric acid produced. The correct measurement of acid concentration is checked by manual tests.

B.2.4. Changes to project design of registered project activity

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No changes to project design of the project activity have been approved during this monitoring period or submitted with this monitoring report.

B.2.5. Changes to start date of crediting period

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No changes to the start date of the crediting period have been approved during this monitoring period or submitted with this monitoring report.

B.2.6. Types of changes specific to afforestation or reforestation project activity

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Not applicable

SECTION C. Description of monitoring system

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1. General Description of the AMS

A complete Automated Monitoring System (AMS) to monitor the mass emissions of N₂O at the stack of AELs No. 9 nitric acid plant was installed and has been operated since May 2007. A new stack gas flow meter was installed in June 2006.

2. Sample point

The location of the sample point was selected to provide ease of access and a location close to the analyser. The most suitable position was chosen in the tail gas of the plant downstream of all process equipment.

3. Sample Conditioning System

The gas sample is continuously taken via a heated probe and filter unit and a heated sample line. Before entering the analyser the gas is treated by a dryer unit to avoid possible moisture effects.

4. Analyser

The analyser installed at AEL No. 9 nitric acid plant to continuously monitor N₂O concentration in the stack is an ABB AO2040 Uras 14 NDIR analyser.

5. Stack gas flow meter

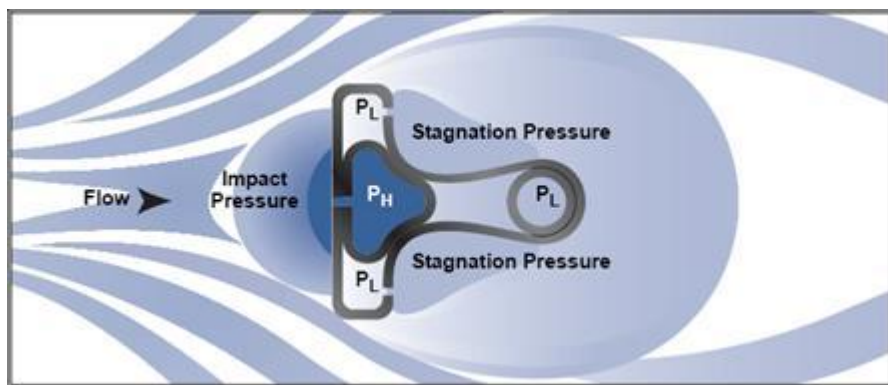
The Emerson Rosemount Flow Meter Annubar®, model no. 485, relies on the Averaging Pilot Tubes (APTs).

The Rosemount Annubar® 485 is a device used to measure the flow-velocity of a liquid, gas or steam fluid that passes through a pipe. It measures by creating a differential pressure (DP) that is proportional to the square of the velocity of the fluid in the pipe, in accordance with Bernoulli's theorem. This DP is measured and converted into a flow rate using a secondary device, such as a DP pressure transmitter.

The Annubar generates a DP by partially blocking the flow. The velocity of the fluid is decreased and stalled as it reaches the upstream surface of the Annubar sensor, thus creating the Impact Pressure. The Rosemount 485 Annubar® senses the impact pressure by utilizing a frontal slot design, which opens into the high pressure chamber.

This high pressure chamber connects directly into the DP transmitter for measurement.

As the fluid continues around the Annubar sensor, it creates a lower velocity profile on the back of the sensor, creating the low/suction pressure downstream. Individual ports, located on the backside of the Annubar sensor measure this low pressure. Working on the same principle as with high pressure, an average low pressure value is obtained in the low pressure chamber that connects directly into the transmitter for measurement. The resulting differential pressure is the difference between the impact (high) pressure reading and the suction (low) pressure reading as seen below.



6. Nitric acid production measurement

NAP is continuously measured and determined by a Flexim ultrasonic flow meter. The product density and temperature as measured by the flow meter, which also determines the concentration of the nitric acid produced. This value is then used to convert the total mass flow to 100% nitric acid produced. The correct measurement of acid concentration is checked by manual tests. A request for a post registration change has been submitted along with this monitoring report.

7. Monitoring plan and responsibilities

The emission reductions achieved by the project activity are monitored based on the approved baseline and monitoring methodology AM0034 (Version 2) "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants" as prepared by N.serve Environmental Services GmbH. AM0034 requires the use of the European Standard EN 14181 (2004) "Stationary source emissions - Quality assurance of automated measuring systems" as a guidance for installing and operating the Automated Monitoring System (AMS) in the nitric acid plants for the monitoring of N_2O emissions.

As an operator of the nitric acid plants since 1932 and of the No. 9 nitric acid plant since 1968, AEL staff in general and its Instrument Department in particular is accustomed to operating technical equipment to a high level of quality standards.

The Production Manager (PM) has the overall responsibility for the on-going operation of the project.

The Engineering Team Manager Electrical/Instrument (ETM E/I) is responsible for the day-to-day calibration procedure and any adjustments required to the instruments as a result of the calibrations.

The Process Controller (PC) checks the analyser regularly for any abnormal occurrences. These checks are done using a plausibility checklist, which is filled in and filed, in the control room. If there are any problems the ETM E/I is notified so that the problem can be rectified.

Operation, maintenance, calibration and service intervals are being carried out by staff from the instrumentation department according to the vendor's specifications.

All monitoring procedures at AEL are also conducted and recorded in accordance with the well established procedures under ISO 9001/14001 which is regularly audited by the South African Bureau of Standards, an independent auditing firm accredited for ISO 9001/14001 certification.

AEL derives hourly averages for all of the monitored parameters and delivers these data to N.serve. Martin Stilkenbäumer at N.serve, is responsible for the correct analysis of the delivered data in accordance with the methodology.

8. Application of EN 14181 procedures to the project

In the following, it is described how the procedures given in EN 14181 for QAL1, 2 have been practically applied at AEL No. 9 plant. QAL 3 procedures are described in section 9 below.

QAL 1

In accordance with EN 14181 an AMS shall have been proven suitable for its measuring task (composition of the flue gas) by use of the QAL1 procedure as specified by EN ISO 14956. Using this standard, it shall be proven that the total uncertainty of the results obtained from the AMS meets the specification for uncertainty stated in the applicable regulations. Such suitability testing has to be carried out under specific conditions by an independent third party on a specific testing site. A test institute shall perform all relevant tests on two identical AMS. These two AMS have to be tested in the laboratory and field.

The analyser installed at AEL No. 9 nitric acid plant to continuously monitor N₂O concentration in the stack is an ABB AO2040 Uras 14 NDIR analyser. According to ABB's own certificate, this analyser has an accuracy of better than 1% of range. This analyser has been certified² as meeting the requirements (QAL1) of the German emissions standards 17th BImSchV and 13th BImSchV (waste incineration plants, large furnaces and others) for the components NO, CO and SO₂. At the time of commissioning of the AMS by AEL no AMS was available that had been certified according with EN 14181 QAL1 for N₂O measurements. However, TÜV SÜD conducted and successfully completed the QAL1 tests³ for the follow-up model of this analyser module within the same analyser series (ABB AO2000 Uras 26). Since there are no major technical differences between the two analyser models it can be assumed that the Analyser installed at the AEL No. 9 nitric acid plant meets the requirements of the QAL1 test in the same way as the follow-up model.

QAL2 and Standard Reference Measurements (SRM)

QAL2 is a procedure for the determination of the calibration function and its variability, and a test of the variability of the measured values of the AMS compared with the uncertainty given by legislation. The QAL2 tests are performed on suitable AMS that have been correctly installed and commissioned on-site (as opposed to QAL 1 which is conducted off-site). QAL 2 tests are to be performed at least every 5 years according to EN 14181 but also after major changes to the plant or changes or repairs to the AMS, which will influence the results obtained significantly.

A calibration function is established from the results of a number of parallel measurements performed with a Standard Reference Method (SRM). The variability of the measured values obtained with the AMS is then evaluated against the required uncertainty. According to EN 14181, both the QAL 2 procedures and the SRM need to be conducted by an independent "testing house" or laboratory which has to be accredited to EN ISO/IEC 17025.

An annual surveillance test (AST) is performed between QAL2 tests to demonstrate that the AMS functions correctly, its performance remains valid and that the calibration function and variability derived during the QAL2 remains as previously determined.

9. AMS calibration and QA/QC procedures

AEL is certified according to ISO 9001 and 14001 standards for quality and environmental management respectively. The procedures for monitoring, regular calibrations and QA/QC are fully embedded into the procedures required by ISO 9001/14001 and documented in the applicable ISO handbooks. The South African Bureau of Standards (SABS) is the designated auditor for these standards at AEL. Therefore, all of the monitoring equipment is subjected to the regular "SABS testing loops" as part of the ISO 9001/14001 procedures.

QAL 3

QAL3 is a procedure which is used to check drift and precision in order to demonstrate that the AMS is in control during its operation so that it continues to function within the required specifications for uncertainty.

This is achieved by conducting periodic zero and span checks on the AMS and then evaluating the results obtained using control charts. Zero and span adjustments or maintenance of the AMS, may be necessary depending on the results of this evaluation.

² TÜV Süddeutschland Bau und Betrieb GmbH (Report number 170 608), March 2003

³ TÜV Süd Industrie Service GmbH, München (Report number 821029) June 2006

Analyser Zero and Span Calibrations

The N₂O analyser is calibrated once per year by external QAL2 or AST test according to EN 14181. In addition according to the QAL1 reports and manufacturers specifications it is recommended to perform a zero/span calibration once every three weeks for the ABB URAS 14 analyser, however AEL decided to do it twice per week in order to have a closer control over the instrument. For the zero calibration pure nitrogen is used, for the span calibration a certified calibration gas is used. The results of the calibrations are recorded according to the related CDM procedure.

Calibration Gas

A certified N₂O Calibration gas (balance being N₂) with a precision of $\pm 2\%$ is used in the span calibrations. The calibration gas is certified by the suppliers laboratory.

Flow meter calibration procedures

The flow meter is calibrated once per year by external QAL2 or AST test according to EN 14181. In addition the flow meter is calibrated at least once per campaign usually every 4 months after each campaign (the plant has to be shut down to conduct calibration) by the Instrument Department of AEL. The pressure transmitter is disconnected from the Annubar and the transmitter is then connected to an absolute pressure simulator that has been approved by the South Africa Bureau of Standards (SABS).

If the deviation exceeds 1% of range, then the pressure transmitter is recalibrated and the previous procedure repeated.

The Annubar itself does not need to be calibrated since it is a physical devise which will not have drift. Therefore, it is sufficient to regularly inspect the physical condition of the Annubar. Therefore, the Annubar is taken out of the stack once per year for physical inspection.

The results of these calibration procedures are then recorded in the Calibration Procedure log sheet.

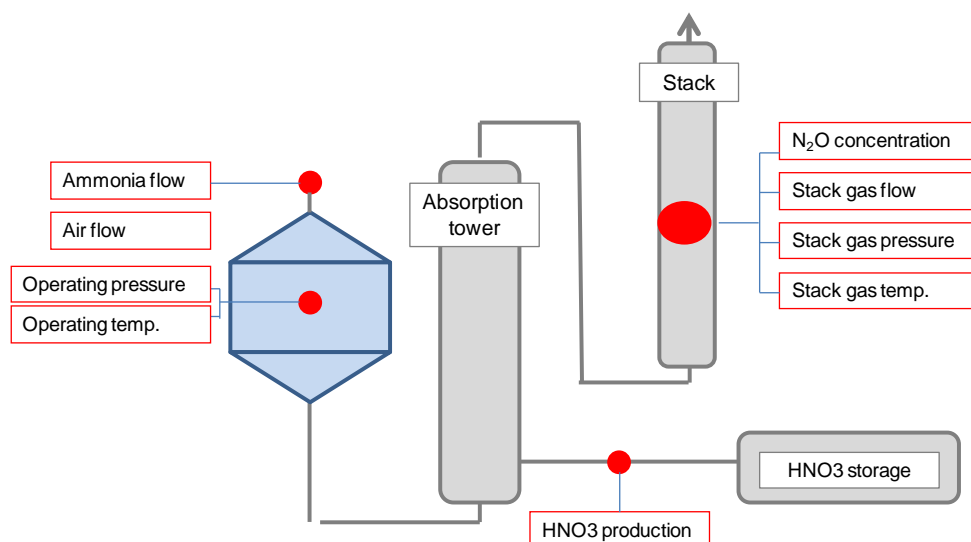


Figure: Monitoring Points for all relevant Parameters (NCSG, VSG, TSG, PSG, NAP, OTh, OPh, AFR, AIFR)

Training

Operations staff at the nitric acid plant who are responsible for the operation of the AMS and regular calibrations, visual and physical checks have been trained appropriately by the AMS vendors and AELs' own instrumentation engineers.

9.1. Data Acquisition System and Emergency Procedures

The analogue signal (4 to 20 mA) output from the Analyser and Flow meter are converted by the Programmable Logic Controller (PLC) into a digital signal which is then fed into the SCADA data acquisition and database system.

Each of AEL's two nitric acid plants has its own SCADA system on a dedicated PC near the respective plant itself. However, the two SCADA PCs are directly connected to each other and each of the PCs receives all of the measured data from the AMS and stores them. That way there is a constant redundancy of data acquisition and storage. In addition, the instrumentation engineer transfers the data at least once a week into AEL's main IT system as well as making a complete copy of that week's data (2-second, hourly and daily averages) onto an external disc drive. That way there are already four copies of the original and unchanged data stored in four different locations. In addition, the hourly data is sent to N.serve on a regular basis (e. g. after each campaign) where it is 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).

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 N.serve's 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.

The N.DBMS is designed to conduct all the calculation steps required by the methodology in order to derive the baseline and project emissions factors and to calculate the amount of emission reductions resulting from the project activity.

The use of the N.DBMS system is described in the PDD and therefore part of the validated monitoring plan. However for the purpose transparency and easy cross checks all calculations are provided in an EXCEL calculation sheet.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

(Copy this table for each piece of data and parameter.)

Data / Parameter:	B.1 NCSG_{BC}⁴
Unit:	mg/Nm³
Description:	N ₂ O concentration in the stack gas during the baseline campaign.
Source of data:	ABB AO2040 URAS 14 Continuous Emissions Analyser

⁴ Please note that all baseline data and historic campaign data sets have been determined after the registration as a different baseline had been selected. Please refer to section E.1. below for further detail.

Value(s) applied:	<p>Value applicable for regular project campaigns exceeding CL_{normal} or CL_{BL}: 1,764.44</p> <p>Value applicable for Project Campaign 13 : 1,764.44</p> <p>Value applicable for Project Campaign 14 : 1,757.83</p> <p>Value applicable for Project Campaign 15 : 1,441.02</p>
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	<p>A complete QAL2 audit in accordance with EN 14181 was conducted on the AMS in February 2008. During the QAL2 reference measurements it was determined that the analyser consistently overestimates the N_2O concentration in the stack. As a result from the QAL2 calibration curve, it was determined that a correction factor of 0.97 will have been applied to all NCSG measurements. Therefore, the mean NCSG value will be multiplied by 0.97 before going into the calculation of BE_{BC}.</p> <p>Calibration information During Baseline period 05/09/2007 – 06/11/2007:</p> <p>Bi-weekly Zero and span check and calibration in case of deviation >1% of range of analyser against zero gas and certified calibration gas cylinder (internal calibration by AEL) Documentation in form of calibration reports and shewart charts. First check for baseline period: 04/09/2007 During the baseline period: check performed twice per week Last check for baseline period: 05/11/2007 Next check after baseline period: 08/11/2007</p> <p>Date of last external calibration: QAL2 Test – 07/02/2008 - 13/02/2008 valid until February 2013 The calibration error as determined during the QAL2 test was retroactively applied to the NCSG results for the baseline period in a conservative manner. Moreover the overall uncertainty of the AMS was applied in a conservative manner to the results of baseline emissions.</p>

Data / Parameter:	B.2 VSG_{BC}
Unit:	Nm³/h
Description:	Normal gas volume flow rate of the stack gas during the baseline campaign.
Source of data:	Gas Volume Flow meter, Emerson Rosemount Annubar® Model 485 combined with pressure transmitter Rosemount 3051S
Value(s) applied:	42,983

Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	<p>The QAL2 test, performed by an independent 3rd party laboratory with EN ISO/IEC 17025 accreditation, include the test of the correct measurement of stack gas temperature and stack gas pressure by comparison of the AMS results of these parameters with the results of the reference measurement instruments of the testing laboratory. Moreover during the QAL2 test the correct normalization of the stack gas flow (VSG) to standard conditions is verified by comparison of the AMS results for normalized flow with the reference measurement results for normalized flow.</p> <p>During the QAL2 reference measurements it was determined that the flow meter consistently overestimates the total gas volume flow in the stack. As a result from the QAL2 calibration curve, it was determined that a correction factor of 0.962 will have to be applied to all VSG measurements. Therefore, the result of the above statistical analysis, i.e. the mean VSG value will be multiplied by 0.962 before going into the calculation of BE_{BC}.</p> <p>Calibration information During Baseline period 05/09/2007 – 06/11/2007:</p> <p>Internal calibrations: after each campaign (usually every 4 months) Date of internal calibration: 08/2007*) Date of internal calibration: 11/2007*)</p> <p>*) exact dates not available only month and year noted on calibration document</p> <p>Date of last external calibration: QAL2 Test – 07/02/2008 – 13/02/2008 valid until February 2013 The calibration error as determined during the QAL2 test was retroactively applied to the NCSG results for the baseline period in a conservative manner. Moreover the overall uncertainty of the AMS was applied in a conservative manner to the results of baseline emissions.</p>

Data / Parameter:	B.3 BE_{BC}
Unit:	tN₂O
Description:	Total N ₂ O mass flow during baseline campaign
Source of data:	Calculation from measured data.
Value(s) applied:	<p>Value applicable for regular project campaigns exceeding CL_{normal} or CL_{BL}: 104.315</p> <p>Value applicable for Project Campaign 13: 104.315 Value applicable for Project Campaign 14: 103.924 Value applicable for Project Campaign 15: 85.194</p>
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.4 OH_{BC}
Unit:	hours

Description:	Operating hours
Source of data:	Production log and Process Control System.
Value(s) applied):	1,474
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.5 NAP_{BC}
Unit:	tHNO₃
Description:	Metric tonnes of 100% concentrated nitric acid produced during the baseline campaign.
Source of data:	Nitric acid flow meter Manufacturer: EMERSON, Type: Coriolis mass flow meter CMF 200 Laboratory results for verification purposes
Value(s) applied):	17,718
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	The nitric acid flow meter is subject of external calibration procedures every 3 years. Calibration information During Baseline period 05/09/2007 – 06/11/2007: External calibration by: ALPRET Controls Specialists Date 04/01/2007 and 11/04/2008; although the calibration is valid for 3 years, it is done more frequently

Data / Parameter:	B.6 TSG
Unit:	°C
Description:	Temperature in the stack gas
Source of data:	Stack temperature probe as part of the VSG flow meter.
Value(s) applied):	Not applicable
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	The TSG result is automatically applied for calculating VSG at standard conditions Calibration information During Baseline period 05/09/2007 – 06/11/2007 : Internal calibrations: after each campaign (usually every 4 months), validity of calibration 1 year Date of internal calibration: 08/2007*) Date of internal calibration: 11/2007*) *) exact dates not available only month and year noted on calibration document Date of last external calibration: QAL2 Test – 07/02/2008 - 13/02/2008 valid until 06/02/2013

Data / Parameter:	B.7 PSG
Unit:	Pa (absolute)
Description:	Pressure in the stack
Source of data:	Stack pressure as part of the VSG flow meter.
Value(s) applied:	Not applicable
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	<p>The PSG result is automatically applied for calculating VSG at standard conditions Calibration information During Baseline period 05/09/2007 – 06/11/2007 :</p> <p>Internal calibrations: after each campaign (usually every 4 months) validity of calibration 1 year Date of internal calibration :08/2007*) Date of internal calibration :11/2007*)</p> <p>*) exact dates not available only month and year noted on calibration document</p> <p>Date of last external calibration: QAL2 Test –07/02/2008 - 13/02/2008 valid until 06/02/2013</p>

Data / Parameter:	B.8 EF_{BL}
Unit:	tN₂O / tHNO₃
Description:	Emissions factor for baseline period
Source of data:	Calculated from measured data (tons of N ₂ O emitted / tons of nitric acid produced)
Value(s) applied:	<p>Value applicable for regular project campaigns exceeding CL_{normal} or CL_{BL}: 0.00564</p> <p>Value applicable for Project Campaign 13: 0.00564 Value applicable for Project Campaign 14: 0.00562 Value applicable for Project Campaign 15: 0.00461</p>
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.9 UNC
Unit:	%
Description:	Calculated overall uncertainty of the Automated Monitoring System (AMS)
Source of data:	UNC is determined by conducting reference measurements by an independent testing laboratory with EN ISO/IEC 17025 accreditation (QAL2).
Value(s) applied:	4.20

Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.10 AFR
Unit:	tNH₃/h (converted from originally measured Nm³/h)
Description:	Ammonia gas flow rate to the ammonia oxidation reactor
Source of data:	Differential pressure measurement (orifice plate) Type: D/P
Value(s) applied:	Not applicable, monitored data of AFR will be used to determine if plant was operating outside of AFR _{max} .
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	Calibration information During Baseline period 05/09/2007 – 06/11/2007 : Calibration frequency: Once every six months (validity 7 months). (only during plant shutdown between campaigns) Date of last calibrations: 04/09/2007, 10/02/2008

Data / Parameter:	B.11 AFR _{max}																																			
Unit:	tNH ₃ /h (converted from originally measured Nm ³ /h)																																			
Description:	Maximum Ammonia gas flow rate to the ammonia oxidation reactor																																			
Source of data:	AFR data																																			
Value(s) applied:	<p>3.877</p> <p>Historic data of daily NH₃ consumption was used to obtain determine the range of AFR for the five historic campaigns.</p> <p>Table: Maximum NH₃ gas flow to the AOR</p> <table><tr><th>Campaign No.</th><th>Start Date</th><th>End date</th><th>Total NH₃ consumed</th><th>Maximum NH₃ consumed per day</th></tr><tr><td></td><td></td><td></td><td>tonnes</td><td>tonnes</td></tr><tr><td>H6</td><td>04/06/04</td><td>16/09/04</td><td>7,448.377</td><td>93.131</td></tr><tr><td>H7</td><td>24/09/04</td><td>27/12/04</td><td>7,372.149</td><td>89.508</td></tr><tr><td>H8</td><td>14/03/05</td><td>21/06/05</td><td>7,828.5427</td><td>92.187</td></tr><tr><td>H9</td><td>23/09/05</td><td>20/12/05</td><td>6,838.168</td><td>90.425</td></tr><tr><td>H10</td><td>17/02/06</td><td>20/07/06</td><td>6,907.924</td><td>91.204</td></tr></table> <p>After removing the top 2.5 percentile values the maximum daily flow rate was 93.037 metric tonnes. This corresponds to an hourly flow rate of 3,877 kg/h or 5,110 Nm³/h. The ammonia flow in Nm³/h is used in the ratio calculation.</p>	Campaign No.	Start Date	End date	Total NH ₃ consumed	Maximum NH ₃ consumed per day				tonnes	tonnes	H6	04/06/04	16/09/04	7,448.377	93.131	H7	24/09/04	27/12/04	7,372.149	89.508	H8	14/03/05	21/06/05	7,828.5427	92.187	H9	23/09/05	20/12/05	6,838.168	90.425	H10	17/02/06	20/07/06	6,907.924	91.204
Campaign No.	Start Date	End date	Total NH ₃ consumed	Maximum NH ₃ consumed per day																																
			tonnes	tonnes																																
H6	04/06/04	16/09/04	7,448.377	93.131																																
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H9	23/09/05	20/12/05	6,838.168	90.425																																
H10	17/02/06	20/07/06	6,907.924	91.204																																
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks																																			
Additional comment:	None																																			

Data / Parameter:	B.12 AIFR
Unit:	% v/v
Description:	Ammonia to air ratio into the ammonia oxidation reactor

Source of data:	Measurements of AFR and primary air flow rates (measured by differential pressure measurement).
Value(s) applied:	Not applicable, monitored data of AIFR will be used to determine if plant was operating outside of AIFR_{max}.
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	Calibration information During Baseline period 05/09/2007 – 06/11/2007 : Calibration frequency: Once every six months (validity 7 months). (only during plant shutdown between campaigns) Date of last calibrations: 04/09/2007, 10/02/2008

Data / Parameter:	B.13 CL_{BL}
Unit:	tHNO ₃
Description:	Length of the baseline campaign measured in metric tonnes of 100% concentrated nitric acid produced during that baseline campaign.
Source of data:	NAP _{BC}
Value(s) applied:	17,718
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	Adjustment of Baseline Campaign Length (CL_{BL}) As CL _{BL} > CL _{normal} , N ₂ O values that were measured beyond the length of CL _{normal} during the production of the quantity of nitric acid (i.e. the final tonnes produced) have been eliminated from the calculation of EF _{BL} .

Data / Parameter:	B.14 CL _{normal}																																
Unit:	tHNO ₃																																
Description:	Average length of the historic campaigns measured in metric tonnes of 100% concentrated nitric acid produced during the historic campaigns.																																
Source of data:	Flow meter measurements as described in NAP.																																
Value(s) applied:	<p>24,026.2</p> <p>During the five historic campaigns, the following amounts of metric tonnes of 100% concentrated nitric acid have been produced:</p> <table><tr><th>Campaign No.</th><th>Start Date</th><th>End date</th><th>Production (tHNO₃)</th></tr><tr><td colspan="4">tonnes</td></tr><tr><td>H6</td><td>04/06/04</td><td>16/09/04</td><td>24,443.3</td></tr><tr><td>H7</td><td>24/09/04</td><td>27/12/04</td><td>24,041.6</td></tr><tr><td>H8</td><td>14/03/05</td><td>21/06/05</td><td>26,945.1</td></tr><tr><td>H9</td><td>23/09/05</td><td>20/12/05</td><td>24,326.1</td></tr><tr><td>H10</td><td>17/02/06</td><td>20/07/06</td><td>20,374.6</td></tr><tr><td>Mean</td><td></td><td></td><td>24,026.2</td></tr></table> <p>Therefore, the average historic campaign length (CL_{normal}) is 24,026.2 tonnes of 100% concentrated nitric acid.</p>	Campaign No.	Start Date	End date	Production (tHNO ₃)	tonnes				H6	04/06/04	16/09/04	24,443.3	H7	24/09/04	27/12/04	24,041.6	H8	14/03/05	21/06/05	26,945.1	H9	23/09/05	20/12/05	24,326.1	H10	17/02/06	20/07/06	20,374.6	Mean			24,026.2
Campaign No.	Start Date	End date	Production (tHNO ₃)																														
tonnes																																	
H6	04/06/04	16/09/04	24,443.3																														
H7	24/09/04	27/12/04	24,041.6																														
H8	14/03/05	21/06/05	26,945.1																														
H9	23/09/05	20/12/05	24,326.1																														
H10	17/02/06	20/07/06	20,374.6																														
Mean			24,026.2																														

Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B. 15 AIFR_{max}
Unit:	% v/v
Description:	Maximum Ammonia to air ratio into the ammonia oxidation reactor.
Source of data:	AIFR Data
Value(s) applied:	11.5 Since no historical data were recorded and available, the allowable NH ₃ to Air ratio is taken from the controller data sheet (No 9 Ratio Controller, August 1997). The range is 8.4% v/v - 11.5% v/v, therefore the maximum ammonia to air ratio is 11.5%.
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.16 OT_h
Unit:	°C
Description:	Oxidation temperature for each hour during the baseline campaign
Source of data:	Monitoring results of a thermocouple inside the ammonia oxidation reactor.
Value(s) applied:	Not applicable
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	Calibration information During Baseline period 05/09/2007 – 06/11/2007: Calibration frequency: Once every campaign (validity 7 months). (only during plant shutdown between campaigns) Date of last calibrations: 04/09/2007, 10/02/2008

Data / Parameter:	B.17 OT_{normal}
Unit:	°C (min and max)
Description:	Normal range operating temperature
Source of data:	Design specifications and operating manual of the No. 9 nitric acid plant (Technical Manual (TM24 June 1977, p94)).
Value(s) applied:	810 to 915
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.18 OP_h
Unit:	kPa (gauge)
Description:	Oxidation Pressure for each hour during the baseline campaign
Source of data:	Monitoring results of a pressure transmitter on the ammonia oxidation reactor (ammonia to air mixer).
Value(s) applied:	Not applicable.

Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	Calibration information During Baseline period 05/09/2007 – 06/11/2007: Calibration frequency: Once every six month (validity 7 months). (only during plant shutdown between campaigns) Date of last calibrations: 04/09/2007, 10/02/2008

Data / Parameter:	B.19 OP_{normal}
Unit:	kPa (gauge) min and max
Description:	Normal range of operating pressure in the ammonia oxidation reactor as determined during the historic campaigns analysis.
Source of data:	Design specifications and operating manual of the No. 9 nitric acid plant (Technical Manual (TM24 June 1977, p94)).
Value(s) applied:	860 to 910
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.20 GS_{normal}
Unit:	Name of Supplier
Description:	Gauze supplier for the operating condition (i.e. historic) campaigns
Source of data:	Monitored / Invoices
Value(s) applied:	W.C. Heraeus
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.21 GS_{BL}
Unit:	Name of Supplier
Description:	Gauze supplier for the baseline condition campaign
Source of data:	Monitored / Invoices
Value(s) applied:	W.C. Heraeus
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.23 GC_{normal}
Unit:	%
Description:	Gauze composition during the historic operating campaigns expressed as percentage by weight of the precious metals Platinum, Rhodium and, if applicable, Palladium comprising the Ammonia Oxidation Catalyst gauzes.
Source of data:	Monitored / Gauze supplier invoices

Value(s) applied:	Platinum (Pt) 59%; Rhodium (Rh) 4%; Palladium (Pd) 37% Record of Gauze compositions installed during the historic campaigns ⁵ : <table border="1"> <thead> <tr> <th rowspan="2">Campaign</th><th rowspan="2">Gauze Supplier</th><th colspan="3">Gauze Composition</th></tr> <tr> <th>Pt (%)</th><th>Rh (%)</th><th>Pd (%)</th></tr> </thead> <tbody> <tr><td>H6</td><td>Heraeus</td><td>59</td><td>4</td><td>37</td></tr> <tr><td>H7</td><td>Heraeus</td><td>59</td><td>4</td><td>37</td></tr> <tr><td>H8</td><td>Heraeus</td><td>59</td><td>4</td><td>37</td></tr> <tr><td>H9</td><td>Heraeus</td><td>59</td><td>4</td><td>37</td></tr> <tr><td>H10</td><td>Heraeus</td><td>59</td><td>4</td><td>37</td></tr> <tr> <td colspan="2">Average</td><td>59</td><td>4</td><td>37</td></tr> </tbody> </table>				Campaign	Gauze Supplier	Gauze Composition			Pt (%)	Rh (%)	Pd (%)	H6	Heraeus	59	4	37	H7	Heraeus	59	4	37	H8	Heraeus	59	4	37	H9	Heraeus	59	4	37	H10	Heraeus	59	4	37	Average		59	4	37
Campaign	Gauze Supplier	Gauze Composition																																								
		Pt (%)	Rh (%)	Pd (%)																																						
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H9	Heraeus	59	4	37																																						
H10	Heraeus	59	4	37																																						
Average		59	4	37																																						
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks																																									
Additional comment:	None																																									

Data / Parameter:	B.24 GC_{BL}
Unit:	%
Description:	Gauze composition during the baseline campaign expressed as percentage by weight of the precious metals Platinum, Rhodium and, if applicable, Palladium comprising the Ammonia Oxidation Catalyst gauzes.
Source of data:	Monitored / Gauze supplier invoices
Value(s) applied:	Platinum (Pt) 59; Rhodium (Rh) 4; Palladium (Pd) 37
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None

Data / Parameter:	B.26 EF_{reg}
Unit:	tN₂O/tHNO₃
Description:	Emissions cap for N ₂ O from nitric acid production set by government regulation
Source of data:	Department of Environmental Affairs and Tourism
Value(s) applied:	None
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks
Additional comment:	None.

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

Data / Parameter:	NCSG
Unit:	mg / Nm³ (convertible from ppmv, if required)
Description:	N ₂ O concentration in the stack gas during each project campaign.

⁵ The figures shown here are rounded figures. More exact figures are commercially sensitive information but can be inspected by the DOE during the site visit and can be made available to the CDM EB upon request.

Measured/ Calculated / Default:	Measured/Calculated - every 2 sec. used for calculation of campaign mean (average, after exclusion of extreme values and outliers)
Source of data:	ABB AO2040 URAS 14 Continuous Emissions Analyser
Value(s) of monitored parameter:	Value applicable for Project Campaign 13: 205.93 Value applicable for Project Campaign 14: 120.20 Value applicable for Project Campaign 15: 68.26
Monitoring equipment:	<p>Type: <i>ABB AO2040 URAS 14 Continuous Emissions Analyser, non-dispersive infrared analyser</i></p> <p>Measurement accuracy (for N₂O): 2.69 % (per QAL 2 test)(see additional comment below)</p> <p>Serial Number: 3.346854.7</p> <p>Calibration frequency:</p> <ul style="list-style-type: none"> - <i>External calibration: QAL2 every 5 years;</i> - <i>External calibration: AST every year;</i> - <i>Internal check: twice per week manual zero and span check and calibration in case of deviation >1% of range of analyser against zero gas and certified calibration gas cylinder (internal calibration by AEL) Documentation in form of calibration reports and Shewart charts.</i> <p>First check for monitoring period: 13/03/2012</p> <p>During the monitoring period: checks performed twice per week</p> <p>Last check for monitoring period: 04/02/2013</p> <p>Next check after monitoring period: 14/03/2013</p> <p>Date of last external calibration:</p> <p><i>QAL2 Test (including AST) – 21/06/2011 - 24/06/2011 valid until 20/06/2016</i></p> <p><i>AST Test 04/07/2012 valid until 03/07/2013</i></p> <p>Calibration delay: The AST was due 21/06/2012 (1 year after the last AST). In order to adhere the guidelines for assessing compliance with the calibration frequency requirements as stipulated in paragraph 238 of VVS the maximum permissible error of the instruments for NCSG and VSG were applied. The error was applied in a conservative manner for the period between the scheduled AST and the actual date of the AST. The error was applied for the period from 21/06/2012 to 03/07/2012.</p> <p>No internal span checks were performed for the period 05/02/2013 – 13/03/2013. In order to adhere the guidelines for assessing compliance with the calibration frequency requirements as stipulated in paragraph 238 of VVS the maximum permissible error of the instrument for NCSG was applied. The error was applied in a conservative manner for the period from 05/02/2013 to 13/03/2013.</p>
Measuring/ Reading/ Recording frequency:	Continuously (every 2 seconds)

Calculation method (if applicable):	<p>AM0034 requires the determination of the concentration of N₂O in the stack gas. NCSG is continuously monitored with an NDIR gas analyser and monitoring results are taken and recorded for every two seconds of plant operation. Hourly means for NCSG are derived by the data acquisition system. NCSG data taken during times when the plant was out of operation were eliminated. Also readings that were taken during malfunction of the monitoring system were eliminated. The remaining hourly average values were subjected to the following statistical analysis:</p> <ol style="list-style-type: none"> Calculate the sample mean (x) Calculate the sample standard deviation (s) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation) Eliminate all data that lie outside the 95% confidence interval Calculate the new sample mean from the remaining NCSG values <p>During the QAL2 reference measurements it was determined that the analyser consistently overestimates the N₂O concentration in the stack. As a result from the QAL2 calibration curve, it was determined that a correction factor of 0.97 will have to be applied to all NCSG measurements. Therefore, the result of the above statistical analysis, i.e. the mean NCSG value will be multiplied by 0.97 before going into the calculation of PE_n.</p>
QA/QC procedures:	<p>Bi-weekly zero and span check and calibration in case of deviation >1% of range of analyser against zero gas and certified calibration gas cylinder (internal calibration by AEL)</p> <p>every 5 years QAL2 test (including AST) according to EN 14181 (External by qualified institute)</p> <p>yearly AST test according to EN 14181 (External by qualified institute)</p>
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	<p>The measurement uncertainty of the AMS as calculated as a result of several components and influence factors in the QAL1 test is 2,64 % (TÜV SÜD report 691317 from 30.06.2006; cited in TÜV SÜD QAL2 report 1116706, Appendix N2O page 12)</p> <p>The measurement uncertainty as calculated during the initial QAL 2 test in 2008 is 2.69 %. This value is deemed to be the maximum permissible error. (TÜV SÜD report 1116706, page 9)</p> <p>During the delayed AST test in 2012 It was concluded that all requirements regarding measurement uncertainty are fulfilled and the tests of variability and validity are passed. Therefore it can be concluded that the instrument showed no errors during delayed calibration according to paragraph 238 of VVS and the maximum permissible error as described above (2.69 %) needs to be applied to the measurement value (Müller-BBM report M100097/01).</p>

Data / Parameter:	VSG
Unit:	Nm³/h
Description:	Normal gas volume flow rate of the stack gas during each project campaign.

Measured/ Calculated / Default:	Measured/Calculated - every 2 sec. used for calculation of campaign mean (average, after exclusion of extreme values and outliers)
Source of data:	Gas volume flow meter, Emerson Rosemount Annubar® Model 485 combined with pressure transmitter Rosemount 3051S
Value(s) of monitored parameter:	Value applicable for Project Campaign 13: 42,302 Value applicable for Project Campaign 14: 41,809 Value applicable for Project Campaign 15: 41,643
Monitoring equipment:	<p>Type: Emerson Rosemount Annubar® Model 485 combined with pressure transmitter Rosemount 3051S</p> <p>Overall measurement accuracy: 2.65% (<i>accuracy for the flowmeter per QAL 2 test, before correction of the result to standard conditions by TSG and PSG; after correction to standard conditions the value is 3.22 %</i>)(see additional comment below)</p> <p>Serial Number: 0305RT32A11B3</p> <p>Calibration frequency:</p> <ul style="list-style-type: none"> - External calibration: QAL2 every 5 years; - External calibration: AST every year; - Internal calibrations: after each campaign (usually every 4 months) validity of calibration is 7 month <p>Date of internal calibration: 12/04/2012; 13/06/2012; 11/10/2012 03/01/2013; 11/02/2013</p> <p>Date of last external calibration: QAL2 Test (including AST) – 21/06/2011 - 24/06/2011 valid until 20/06/2016 AST Test 04/07/2012 valid until 03/07/2013</p> <p>Calibration delay: The AST was due 21/06/2012 (1 year after the last AST). In order to adhere the guidelines for assessing compliance with the calibration frequency requirements as stipulated in paragraph 238 of VVS the maximum permissible error of the instruments for VSG was applied. The combined error for Stack gas flow, TSG and PSG was applied to the results for VSG. The error was applied in a conservative manner for the period between the scheduled AST test and the actual date of the AST test. The error was applied for the period from 21/06/2012 to 03/07/2012.</p>
Measuring/ Reading/ Recording frequency:	Continuously (every 2 seconds).

Calculation method (if applicable):	<p>AM0034 requires the determination of the gas volume flow (VSG) in the stack. VSG is continuously monitored with a flow meter and monitoring results are taken and recorded for every two seconds of plant operation. Hourly means for VSG are derived by the data acquisition system. Temperature and pressure is also continuously measured in the stack and the VSG values subsequently adjusted to derive the VSG at normal conditions (i.e. standard pressure and temperature).</p> <p>VSG data taken during times when the plant was out of operation were eliminated.</p> <p>The resulting hourly average VSG values are now expressed in Nm^3/h as required by AM0034 and where subsequently subjected to the following statistical analysis:</p> <ol style="list-style-type: none"> Calculate the sample mean (\bar{x}) Calculate the sample standard deviation (s) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation) Eliminate all data that lie outside the 95% confidence interval Calculate the new sample mean from the remaining VSG values <p>During the QAL2 reference measurements it was determined that the flow meter consistently underestimates the total gas volume flow in the stack. As a result from the QAL2 calibration curve, it was determined that a correction factor of 1.02 will have to be applied to all VSG measurements. Therefore, the result of the above statistical analysis, i.e. the mean VSG value will be multiplied by 1.02 before going into the calculation of PE_n.</p>
QA/QC procedures:	<p>Internal calibration at least once per campaign usually every 4 months after each campaign (the plant has to be shut down to conduct calibration) by the Instrument Department of AEL.</p> <p>Every 5 years QAL2 test (including AST) according to EN 14181 (External by qualified institute)</p> <p>Yearly AST test according to EN 14181 (External by qualified institute)</p>
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	<p>The measurement uncertainty of the AMS as calculated by the supplier 2,50 % (Emerson Engineering Report ER-5396 from August 9, 2006 page 8)</p> <p>The measurement uncertainty as calculated during the initial QAL 2 test in 2008 is 3,22 %. This value is deemed to be the maximum permissible error. (TÜV SÜD report 1116706, page 10)</p> <p>During the delayed AST test in 2012 It was concluded that all requirements regarding measurement uncertainty are fulfilled and the tests of variability and validity are passed. Therefore it can be concluded that the instrument showed no errors during delayed calibration according to paragraph 238 of VVS and the maximum permissible error as described above (3.22 %) needs to be applied to the measurement value (Müller-BBM report M100097/01).</p>

Data / Parameter:	PE_n
Unit:	tN₂O
Description:	Total mass N ₂ O emissions in each project campaign.
Measured/ Calculated / Default:	Calculated.
Source of data:	Calculated from measured values.
Value(s) of monitored parameter:	Value applicable for Project Campaign 13 : 17.643 Value applicable for Project Campaign 14 : 6.887 Value applicable for Project Campaign 15 : 1.299
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	$PE_n = VSG * NCSG * 10^{-9} * OH$ A special correction function is applied to the results for NCSG and VSG values. These correction factors were determined during the QAL2 test according to EN 14181.
QA/QC procedures:	Not applicable.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	OH_n
Unit:	Hours
Description:	Total operating hours during each project campaign
Measured/ Calculated / Default:	Measured.
Source of data:	Production log and continuous monitoring.
Value(s) of monitored parameter:	Project Campaign 13: 2,047 Project Campaign 14: 1,385 Project Campaign 15: 462
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	The total operating hours are logged continuously.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	The production logging process is subject to ISO 9001 procedures
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	NAP
Unit:	tHNO₃

Description:	Metric tonnes of 100% concentrated nitric acid during each project campaign.
Measured/ Calculated / Default:	Measured / Calculated.
Source of data:	Nitric acid flow meter Flexim Ultrasonic flow meter Laboratory results.
Value(s) of monitored parameter:	Project Campaign 13: 25,757 Project Campaign 14: 16,531 Project Campaign 15: 5,628
Monitoring equipment:	Flexim Ultrasonic flow meter G709 Overall measurement accuracy: $\leq 1\%$ Serial Number: 33619 Calibration frequency: every 3 years Date of last calibration, 11/03/2011 valid until 10/03/2014
Measuring/ Reading/ Recording frequency:	NAP is determined by continuous measurement of the HNO_3 production and concentration
Calculation method (if applicable):	NAP is determined by a flow meter according to the following procedures: The density and temperature as measured by the flow meter, which also determines the concentration of the nitric acid produced. This value is then used to convert the total mass flow to 100% nitric acid produced. The correct measurement of acid concentration is checked by manual tests.
QA/QC procedures:	The flow meter is calibrated in regular intervals. NAP results are crosschecked against process parameters as ammonia consumption and against product stock levels and product consumption
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	<p>The design capacity of the plant is 292.112 metric tonnes per day, operating 365 days per year. This equals a total production of 107,205 tonnes for a period of 367 days. Therefore the factual production of 47,993 tonnes during this monitoring period is below the design capacity of the plant.</p> <p>The Flexim Ultrasonic flow meter has been installed since 02/08/2011 in parallel to the mass flow meter, initially for testing purposes. Since the start of the first project campaign of this monitoring period (PC13) on 20/06/2012 and thus for this entire monitoring period, the values from the new ultrasonic flow meter were recorded and utilized for the calculation. An updated PDD to apply for post registration changes has been submitted along with the issuance request.</p>

Data / Parameter:	TSG
Unit:	°C
Description:	Temperature in the stack gas
Measured/ Calculated / Default:	Measured.
Source of data:	Stack temperature probe situated directly next to the volume flow meter;
Value(s) of monitored parameter:	Not applicable, directly used for normalization of tail gas volume flow measurement.

Monitoring equipment:	<p>Type: PT 100_385 3-wire RTD - part of the Gas Volume Flow meter</p> <p>Overall measurement accuracy: 2.55% (<i>per QAL2 test</i>)</p> <p>Serial Number: <i>not available</i></p> <p>Calibration frequency:</p> <ul style="list-style-type: none"> - <i>External calibration: QAL2 every 5 years;</i> - <i>External calibration: AST every year;</i> <i>Internal calibration: after each campaign (usually every 4 months)</i> <i>validity of calibration is 7 month</i> <p>Date of internal calibration: 12/04/2012; 13/06/2012; 11/10/2012 03/01/2013; 11/02/2013</p> <p>Date of last external calibration:</p> <p>QAL2 Test (including AST) – 21/06/2011 - 24/06/2011 valid until 20/06/2016</p> <p>AST Test 04/07/2012 valid until 03/07/2013</p> <p>Calibration delay: The AST was due 21/06/2012 (1 year after the last AST). In order to adhere the guidelines for assessing compliance with the calibration frequency requirements as stipulated in paragraph 238 of VVS the maximum permissible error of the instruments for VSG was applied. The combined error for Stack gas flow, TSG and PSG was applied to the results for VSG. The error was applied in a conservative manner for the period between the scheduled AST test and the actual date of the AST test. The error was applied for the period from 21/06/2012 to 03/07/2012.</p>
Measuring/ Reading/ Recording frequency:	Continuously (every 2 seconds)
Calculation method (if applicable):	AM0034 requires the determination of gas volume flow at normal conditions in the stack. In order to calculate from the measured VSG values to VSG at normal conditions, the actual temperature in the stack is measured by a temperature probe as part of the flow meter. The resulting measurements are transferred to the data acquisition system and are applied to each VSG value for calculation of normal volume flow.
QA/QC procedures:	<p>Internal calibration at least once per campaign usually every 4 months after each campaign (the plant has to be shut down to conduct calibration) by the Instrument Department of AEL. The validity of the internal calibrations is 1 year.</p> <p>every 5 years QAL2 test (including AST) according to EN 14181 (External by qualified institute)</p> <p>yearly AST test according to EN 14181 (External by qualified institute)</p>
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	PSG
Unit:	Pa(absolute)
Description:	Pressure in the stack
Measured/ Calculated / Default:	Measured.

Source of data:	Stack pressure probe situated directly next to the volume flow meter.
Value(s) of monitored parameter:	Not applicable, directly used for normalization of tail gas volume flow measurement.
Monitoring equipment:	<p>Type: part of the Gas Volume Flow meter, Rosemount 3051TA1A2B21BB41M5Q4 Overall measurement accuracy: 0.7% (per QAL2 test) Serial Number: 338640.1.1 Calibration frequency: - External calibration: QAL2 every 5 years; - External calibration: AST every year; Date of internal calibration: 12/04/2012; 13/06/2012; 11/10/2012 03/01/2013; 11/02/2013</p> <p>Date of last external calibration: QAL2 Test (including AST) – 21/06/2011 - 24/06/2011 valid until 20/06/2016 AST Test 04/07/2012 valid until 03/07/2013</p> <p>Calibration delay: The AST was due 21/06/2012 (1 year after the last AST). In order to adhere the guidelines for assessing compliance with the calibration frequency requirements as stipulated in paragraph 238 of VVS the maximum permissible error of the instruments for VSG was applied. The combined error for Stack gas flow, TSG and PSG was applied to the results for VSG. The error was applied in a conservative manner for the period between the scheduled AST test and the actual date of the AST test. The error was applied for the period from 21/06/2012 to 03/07/2012.</p>
Measuring/ Reading/ Recording frequency:	Continuously (every 2 seconds).
Calculation method (if applicable):	AM0034 requires the determination of gas volume flow at normal conditions in the stack. In order to calculate from the measured VSG values to VSG at normal conditions, the actual pressure in the stack has to be determined and transferred to the DURAG system and applied to each VSG value for calculation of normal volume flow.
QA/QC procedures:	<p>Internal calibration at least once per campaign usually every 4 months after each campaign (the plant has to be shut down to conduct calibration) by the Instrument Department of AEL. The validity of the internal calibrations is 1 year.</p> <p>every 5 years QAL2 test (including AST) according to EN 14181 (External by qualified institute)</p> <p>yearly AST test according to EN 14181 (External by qualified institute)</p>
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	EF _n
Unit:	tN ₂ O/tHNO ₃
Description:	Emissions factor for campaign n.
Measured/ Calculated / Default:	Calculated.

Source of data:	Calculation from total mass N ₂ O emissions of campaign n (PE _n) and total nitric acid production (NAP _n)
Value(s) of monitored parameter:	Project Campaign 13: 0.000685 Project Campaign 14: 0.000417 Project Campaign 15: 0.000231
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	The campaign specific emissions factor for each campaign during the project's crediting period is calculated by dividing the total mass of N ₂ O emissions during that campaign by the total production of 100% concentrated nitric acid during that same campaign. For campaign <i>n</i> the campaign specific emission factor is: $EF_n = PE_n / NAP_n$
QA/QC procedures:	Not applicable.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	EF_{ma,n}
Unit:	tN₂O/tHNO₃
Description:	Moving average emissions factor derived over time from campaign specific emissions factors.
Measured/ Calculated / Default:	Calculated.
Source of data:	Calculation from campaign specific emissions factors (EF _n)
Value(s) of monitored parameter:	Project Campaign 13: 0.001207 Project Campaign 14: 0.001150 Project Campaign 15: 0.001089
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	In order to take into account possible long-term emissions trends over the duration of the project activity and to take a conservative approach the moving average emission factor is determined as follows: $EF_{ma,n} = (EF_1 + EF_2 + \dots + EF_n) / n$ This process is repeated for each campaign such that a moving average, EF _{ma,n} is established over time, becoming more representative and precise with each additional campaign.
QA/QC procedures:	Not applicable.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	EF_p
Unit:	tN₂O/tHNO₃

Description:	Emissions factor used for the specific campaign n to determine the emission reductions of that campaign
Measured/ Calculated / Default:	Calculated.
Source of data:	Calculation of EF_n and $EF_{ma,n}$.
Value(s) of monitored parameter:	Project Campaign 13: 0.001207 Project Campaign 14: 0.001150 Project Campaign 15: 0.001089
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	To calculate the total emission reductions achieved in a campaign, the higher of the two values $EF_{ma,n}$ and EF_n shall be applied as the emission factor relevant for the particular campaign to be used to calculate emissions reductions (EF_P). Thus: If $EF_{ma,n} > EF_n$ then $EF_P = EF_{ma,n}$ If $EF_{ma,n} < EF_n$ then $EF_P = EF_n$
QA/QC procedures:	Not applicable.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	EF_{min}
Unit:	$tN_2O/tHNO_3$
Description:	EF_{min} is equal to the lowest EF_n observed during the first 10 campaigns of the project crediting period.
Measured/ Calculated / Default:	Calculated.
Source of data:	Calculations from EF_n
Value(s) of monitored parameter:	0.000267
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	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 .
QA/QC procedures:	Not applicable.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	EF_{reg}
Unit:	tN₂O/tHNO₃
Description:	Emissions cap for N ₂ O from nitric acid production set by government regulation
Measured/ Calculated / Default:	Default
Source of data:	Government policies
Value(s) of monitored parameter:	No regulations or other requirements exist
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Each reporting period
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Not applicable.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	CL_n
Unit:	tHNO₃
Description:	Length of each project campaign measured in metric tonnes of 100% concentrated nitric acid produced during that campaign.
Measured/ Calculated / Default:	Measured.
Source of data:	NAP
Value(s) of monitored parameter:	Project Campaign 13: 25,757 Project Campaign 14: 16,531 Project Campaign 15: 5,628
Monitoring equipment:	See comments for NAP above
Measuring/ Reading/ Recording frequency:	See comments for NAP above
Calculation method (if applicable):	In accordance with AM0034 the project length (CL _n) has to be compared to the established average historic campaign length (CL _{normal}); and if the length of each individual project campaign CL _n is longer than or equal to the average historic campaign length CL _{normal} , then all N ₂ O values measured during the baseline campaign can be used for the calculation of EF (subject to the elimination of data from the operational parameters analysis). If CL _n < CL _{normal} , recalculate EF _{BL} by eliminating those N ₂ O values that were obtained during the production of tonnes of nitric acid beyond the CL _n (i.e. the last tonnes produced) from the calculation of EF _n .
QA/QC procedures:	See comments for NAP above
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks

Additional comment:	The design capacity of the plant is 292.112 metric tonnes per day, operating 365 days per year. This equals a total production of 107,205 tonnes for a period of 367 days. Therefore the factual production of 47,993 tonnes during this monitoring period is below the design capacity of the plant.
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Data / Parameter:	OP_h
Unit:	kPa (gauge)
Description:	Oxidation Pressure for each hour
Measured/ Calculated / Default:	Measured.
Source of data:	Pressure probe at ammonia to air mixer.
Value(s) of monitored parameter:	Not applicable. Used to determine when plant is operating outside of permitted range during baseline campaign or if the plant is out of operation.
Monitoring equipment:	Type: Yokogawa Press Tx – pressure transmitter Overall measurement accuracy: 1.7 % Serial Number: 12C805780329 Calibration frequency: Once every six months. (only during plant shutdown between campaigns) - Date of last calibration: 12/04/2012, 18/07/2012, 25/10/2012, 03/01/2013, 16/05/2013
Measuring/ Reading/ Recording frequency:	The measurement results are taken by the data acquisition and evaluation system. The system directly calculates hourly averages.
Calculation method (if applicable):	See above
QA/QC procedures:	The instrument is subject to yearly internal calibrations. The QA/QC procedures are part of the ISO 9001 procedures.
Purpose of data:	Not applicable
Additional comment:	

Data / Parameter:	OT_h
Unit:	°C
Description:	Oxidation temperature in the ammonia oxidation reactor (AOR) for each hour.
Measured/ Calculated / Default:	Measured.
Source of data:	Thermocouples inside the ammonia oxidation reactor
Value(s) of monitored parameter:	Not applicable. Used to determine when plant is operating outside of permitted range during baseline campaign or if the plant is out of operation.

Monitoring equipment:	Type: Thermocouple products; K-6 Multipoints Thermocouple Assembly Overall measurement accuracy: 1 % Serial Number: TP3138 Calibration frequency: Once every campaign (only during plant shutdown between campaigns) Date of last calibration: 01/02/2012; 12/04/2012; 18/07/2012; 25/10/2012; 03/01/2013; 16/05/2013
Measuring/ Reading/ Recording frequency:	The measurement results are taken by the data acquisition and evaluation system. The system directly calculates hourly averages.
Calculation method (if applicable):	See above.
QA/QC procedures:	The instrument is subject to yearly internal calibrations, which are part of the ISO 9001 procedures.
Purpose of data:	Not applicable
Additional comment:	

Data / Parameter:	AFR
Unit:	kgNH₃/h (converted from originally measured Nm³/h)
Description:	Ammonia gas flow rate to the ammonia oxidation reactor.
Measured/ Calculated / Default:	Measured.
Source of data:	Differential pressure measurement Manufacturer: Yokogawa Type: D/P
Value(s) of monitored parameter:	Not applicable, monitored data of AFR will be used to determine if the plant operating outside of AFR_{max} during the baseline campaign or for plausibility checks
Monitoring equipment:	Type: Yokogawa Orifice plate with D.P. transmitter Overall measurement accuracy: 1.25 % Serial Number: 91H520733822 Calibration frequency: Once every six months. (only during plant shutdown between campaigns) Date of last calibration: 12/04/2012, 18/07/2012, 25/10/2012, 03/01/2013, 16/05/2013
Measuring/ Reading/ Recording frequency:	The measurement results are taken by the data acquisition and evaluation system. The system directly calculates hourly averages.
Calculation method (if applicable):	See above
QA/QC procedures:	The instrument is subject to yearly internal calibrations, which are part of the ISO 9001 procedures.
Purpose of data:	Not applicable
Additional comment:	

Data / Parameter:	AIFR
Unit:	% v/v
Description:	Ammonia to air ratio into the ammonia oxidation reactor

Measured/ Calculated / Default:	Calculated (primary air flow measured as basis for AIFR).
Source of data:	Calculation for each hour of plant operation based on measurements of AFR and primary air flow rates.
Value(s) of monitored parameter:	Not applicable, monitored data of AIFR will be used to determine if the plant operating outside of AIFR_{max} during the baseline campaign or for plausibility checks
Monitoring equipment:	Equipment for Air Flow-rate to AOR: Type: Yokogawa Orifice plate with D.P. transmitter Overall measurement accuracy: 1.66% Serial Number: F570EK384627 Calibration frequency: Once every six months. (only during plant shutdown between campaigns) Date of last calibration: 12/04/2012, 18/07/2012, 25/10/2012, 03/01/2013, 16/05/2013
Measuring/ Reading/ Recording frequency:	The measurement results are taken by the data acquisition and evaluation system. The system directly calculates hourly averages.
Calculation method (if applicable):	The calculation of AIFR is based on the measurement of AFR and primary air flow-rate. The AFR measurement is described in section AFR above. The measurement of primary air flow-rate to AOR is based on differential pressure measurement principle.
QA/QC procedures:	Not applicable.
Purpose of data:	Not applicable.
Additional comment:	

Data / Parameter:	GS_{project}
Unit:	Name of Supplier
Description:	Gauze supplier for the project campaign
Measured/ Calculated / Default:	Not applicable.
Source of data:	Monitored / Invoices
Value(s) of monitored parameter:	W.C. Heraeus
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Not applicable.
Purpose of data:	Not applicable.
Additional comment:	

Data / Parameter:	GC_{project}
Unit:	%

Description:	Gauze composition during the project campaign expressed as % by weight of the precious metals Platinum, Rhodium and, if applicable, Palladium comprising the Ammonia Oxidation Catalyst gauzes.			
Measured/ Calculated / Default:	Not applicable.			
Source of data:	Monitored / Gauze supplier invoices			
Value(s) of monitored parameter:		Project campaign 13	Project campaign 14	Project campaign 15
	Platinum (Pt)	59.98%	60.01%	59.74%
	Rhodium (Rh)	3.91%	3.91%	3.90%
	Palladium (Pd)	36.11%	36.08%	36.36%
Monitoring equipment:	Not applicable.			
Measuring/ Reading/ Recording frequency:	Not applicable.			
Calculation method (if applicable):	Not applicable.			
QA/QC procedures:	Not applicable.			
Purpose of data:	Not applicable.			
Additional comment:				

D.3. Implementation of sampling plan

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Not applicable

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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The results of the N.DBMS data analysis are exported to EXCEL spreadsheets for further analysis and presentation.

It should be noted that all values presented in excel tables are displayed (in the tables) as rounded values due to the function of excel as a program. However, actual calculations have been conducted using the exact values, which explains possible differences compared to calculating with the rounded parameter values as displayed in the tables. This applies to all presented excel tables not only those related to baseline emission calculations.

Analysis of Historical campaign data and determination of permitted operating ranges

The monitoring results for Oxidation Temperature and Pressure have been routinely discarded in the past and are therefore not available to establish the normal range. As a substitute, the technical manuals of the No. 9 nitric acid plant were used to derive these normal ranges. See section D.1 for details.

Historic data of daily NH₃ consumption was used to determine the range of AFR for the five historic campaigns (excluding abnormal campaigns). After removing the top 2.5 percentile values the maximum daily flow rate was derived which was then converted into an hourly Ammonia flow rate, which was used to determine AIFR.

The parameters CL_{normal} , GS_{normal} , GC_{normal} and AFR_{max} were derived from the 5 historic campaigns that were defined in the PDD. The 5 campaigns are:

H6	04/06/2004	16/09/2004
H7	24/09/2004	27/12/2004
H8	14/03/2005	21/06/2005
H9	23/09/2005	20/12/2005
H10	17/02/2006	20/07/2006

The following data was established from the above mentioned sources as permitted operating conditions:

Oxidation temperature (min – max):	810 °C – 915 °C
Oxidation pressure (min – max):	860,000 Pa – 910,000 Pa
Maximum ammonia flow rate:	3.877 t/h
Maximum ammonia to air ratio:	0,115 or 11,5%
CL_{normal} :	24,026.2 tHNO ₃

Analysis of Baseline campaign data

As the baseline campaign for AEL No. 9 the campaign AEL No 9 H15 was used. The baseline campaign was in operation in the period 05/09/2007 – 06/11/2007. The baseline monitoring data, baseline calculation and baseline results were determined during the first verification and were verified by the DOE during the first verification.

The results are as follows:

NCSG _{BL}	mg/Nm ³	1,764.44
QAL2 NCSG		0.97
VSG _{BL}	Nm ³ /h	42,983
QAL2 VSG		0.962
OH _{BL}	h	1,474
NAP _{BL}	t HNO ₃	17,718
BE	t N ₂ O	104.315
UNC		4.20
EF _{BL}	kg N ₂ O/t HNO ₃	5.64

Resulting EF_{BL}

The EF_{BL} derived from this analysis of historic and baseline data is 5.64 kgN₂O/tHNO₃.

Sample calculation for baseline emissions (BE) and Emission factor (EF):

BE [tN₂O] = 42,983 [Nm³/h] * 0.962 * 1,764.44 * 0.97 [mg/Nm³] * 10⁻⁹ * 1,474 [h] = 104.315 [tN₂O]

EF [kgN₂O/tHNO₃] = 104.315 [tN₂O] / 17,718 [tHNO₃] * 10³ * (1 – 4.2/100) = 5.64 [kgN₂O/tHNO₃]

Note that small deviations occur due to rounding. Please refer to the calculation excel file for details.

Adjustment of Baseline Emission Factor if $CL_n < CL_{normal}$

If the length of an individual project campaign CL_n is longer than or equal to the average historic campaign length CL_{normal} or longer or equal than the baseline campaign length CL_{BL} , then all N₂O values measured during the baseline campaign can be used for the calculation of EF_{BL}. If $CL_n < CL_{normal}$ or CL_{BL} , EF_{BL} has to be recalculated by eliminating those N₂O values that were obtained

during the production of tonnes of nitric acid beyond the CL_n (i.e. the last tonnes produced) from the calculation of EF_{BL} .

For the project campaign 13 the CL_n is longer than CL_{BL} , therefore no adjustment of the Baseline emissions factor EF_{BL} is necessary.

For the project campaigns 14 and 15 $CL_n < CL_{normal}$ and $CL_n < CL_{BL}$, EF_{BL} is recalculated by eliminating those N_2O values that were obtained during the production of tonnes of nitric acid beyond the CL_{BL} (i.e. the last tonnes produced) from the calculation of EF_{BL} . This was the case at 01/11/2007 23:00 for project campaign 14 and at 26/09/2007 00:00 for project campaign 15 therefore all N_2O data measured after this hour were excluded for the recalculation of EF_{BL} .

The results are as follows:

		PC 14	PC 15
$NCSG_{BL}$	mg/Nm ³	1,757.83	1,441.02
QAL2 NCSG		0.97	0.97
VSG_{BL}	Nm ³ /h	42,983	42,983
QAL2 VSG		0.962	0.962
OH_{BL}	h	1,474	1,474
NAP_{BL}	t HNO ₃	17,718	17,718
BE	t N ₂ O	103.924	85.194
UNC		4.20	4.20
EF_{BL}	kg N₂O/t HNO₃	5.62	4.61

Adjustment of Baseline emissions factor due to EF_{reg}

Should N_2O emissions regulations that apply to nitric acid plants be introduced in the host country or jurisdiction covering the location of the project activity, such regulations shall be compared to the calculated baseline emission factor for the project (EF_{BL}). If the regulatory limit is lower than the baseline factor determined for the project, the regulatory limit shall serve as the new baseline emission factor, that is:

if $EF_{BL} > EF_{reg}$,

then the baseline N_2O emission factor shall be EF_{reg} for all calculations.

where:

Variable Definition

EF_{BL} Baseline emissions factor (tN₂O/tHNO₃)

EF_{reg} Emissions level set by newly introduced policies or regulations (tN₂O/tHNO₃).

Such EF_{reg} shall be determined according to the nature of the regulation (e.g. in terms of absolute emission, by-product rate, concentration in stack gas), as described in the approved methodology AM0028.

There is currently no N_2O regulation for nitric acid plants in South Africa therefore no adjustment of the Baseline emissions factor EF_{BL} is necessary.

E.2. Calculation of project emissions or actual net GHG removals by sinks

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Project emissions are calculated according to the following formula:

$$PE_n = VSG * NCSG * 10^{-9} * OH$$

Variable	Definition
VSG	Mean stack gas volume flow rate for the project campaign (m ³ /h)
NCSG	Mean concentration of N ₂ O in the stack gas for the project campaign (mgN ₂ O/m ³)
PE _n	Total N ₂ O emissions of the n th project campaign (tN ₂ O)
OH	Is the number of hours of operation in the specific monitoring period (h)

Based on the total N₂O emissions of each project campaign the specific project campaign emission factor is calculated as:

$$EF_n = PE_n / NAP_n$$

Where:

Variable	Definition
EF _n	Project Emission Factor for n th project campaign (kgN ₂ O/tHNO ₃)
PE _n	Total N ₂ O emissions of the n th project campaign (tN ₂ O or kgN ₂ O)
NAP _n	Campaign length of the n th project campaign (tHNO ₃)

Before calculation of the Project Emissions (PE) the same statistical analysis as for the calculation of the baseline emission factor (EF_{BL}) is applied to the monitoring raw data (hourly average values) of each project campaign.

The respective correction functions for NCSG and VSG as determined during the relevant QAL2 test are applied within the calculation.

Analysis of Project campaign data

The following table shows the number of data sets and the respective amount of NAP during the campaigns included in this monitoring period:

Campaign	Data sets	NAP (in tHNO ₃)
PC13	2,760	25,757
PC14	2,928	16,531
PC15	744	5,628

Incomplete and implausible monitoring data sets have been eliminated. The following exclusion criteria according to plant operation trip values were applied; all datasets recorded during times when the plant was not in operation are excluded:

$$OT_h > 810 \text{ }^{\circ}\text{C}$$

The remaining number of datasets is the number of operating hours. The table below shows the operating hours for each campaign included in this monitoring period:

Campaign	Operating hours (OH)
PC13	2,047
PC14	1,385
PC15	462

By applying the 95% confidence interval on the remaining NCSG and VSG values mavericks and outliers are excluded. The 95% confidence interval for NCSG and VSG values is derived and the outliers excluded individually for VSG and NCSG. Hence, the remaining number of data sets may differ between NCSG and VSG. The resulting mean values for NCSG and VSG are applied for calculation of the Project emissions (PE).

Relevant Project Emissions (PE_n) and respective Project Emission Factors (EF_n)

The resulting values for NCSG_n, VSG_n, OH_n, NAP_n, project emissions (PE_n) and project emission factor (EF_n) for the project campaigns covered by this monitoring report are:

		Project campaign 13 (PC13): 19/06/2012 - 11/10/2012	Project campaign 14 (PC14): 12/10/2012 - 10/02/2013	Project campaign 15 (PC15): 12/02/2013 - 13/03/2013
NCSG _n	mg/Nm ³	205.93	120.20	68.26
QAL2 NCSG		0.97	0.97	0.97
VSG _n	Nm ³ /h	42,302	41,809	41,643
QAL2 VSG		1.020	1.020	1.020
OH _n	h	2,047	1,385	462
NAP _n	t HNO ₃	25,757	16,531	5,628
PE _n	t N ₂ O	17.643	6.887	1.299
EF _n	kg N ₂ O/t HNO ₃	0.685	0.417	0.231

Please refer to the submitted excel calculation spread sheet for further detail of the calculation.

Project Campaign Length

If the length of each individual project campaign CL_n is longer than or equal to the average historic campaign length CL_{normal} or to the baseline campaign length whichever is shorter, then all N₂O values measured during the baseline campaign can be used for the calculation of EF (subject to the elimination of data from the operational limits analysis, see above under recalculation of Baseline Emission factor).

For the project campaign 13 the CL_n is longer than CL_{BL}, therefore no adjustment of the Baseline emissions factor EF_{BL} is necessary.

For the project campaigns 14 and 15 CL_n < CL_{normal} and CL_n < CL_{BL}, EF_{BL} is recalculated by eliminating those N₂O values that were obtained during the production of tonnes of nitric acid beyond the CL_{BL} (i.e. the last tonnes produced) from the calculation of EF_{BL}. This was the case at 01/11/2007 23:00 for project campaign 14 and at 26/09/2007 00:00 for project campaign 15 therefore all N₂O data measured after this hour were excluded for the recalculation of EF_{BL}.

Sample calculation for campaign emissions (PE) and Emission factor (EF_n) for the 13th project campaign:

$$PE [tN_2O] = 42,302 [Nm^3/h] * 1.020 * 206 [mg/Nm^3] * 0.970 * 2,047 [h] * 10^{-9} = 17.6 [tN_2O]$$

$$EF [kgN_2O/tHNO_3] = 17.6 [tN_2O] / 25,757 [tHNO_3] * 10^3 = 0.68 [kgN_2O/tHNO_3]$$

Note that small deviations occur due to rounding. The figures stated here reflect the correct values as of the excel calculation. Please refer to the calculation excel file for details.

Sample calculation for campaign emissions (PE) and Emission factor (EF_n) for the 14th project campaign:

$$PE [tN_2O] = 41,809 [Nm^3/h] * 1.020 * 120 [mg/Nm^3] * 0.970 * 1,385 [h] * 10^{-9} = 6.9 [tN_2O]$$

$$EF [kgN_2O/tHNO_3] = 6.9 [tN_2O] / 16,531 [tHNO_3] * 10^3 = 0.42 [kgN_2O/tHNO_3]$$

Note that small deviations occur due to rounding. The figures stated here reflect the correct values as of the excel calculation. Please refer to the calculation excel file for details.

Sample calculation for campaign emissions (PE) and Emission factor (EF_n) for the 15th project campaign:

$$PE [tN_2O] = 41,643 [Nm^3/h] * 1.020 * 68 [mg/Nm^3] * 0.970 * 462 [h] * 10^{-9} = 1.3 [tN_2O]$$

EF [kgN ₂ O/tHNO ₃] =	1.3 [tN ₂ O]	/	5,628 [tHNO ₃]	*	10 ³	=	0.23 [kgN₂O/tHNO₃]
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Note that small deviations occur due to rounding. The figures stated here reflect the correct values as of the excel calculation. Please refer to the calculation excel file for details.

E.3. Calculation of leakage

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No leakage occurs under this project type.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Emission reductions

A **moving average emissions factor** must be calculated at the end of a campaign n as follows:

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

This process is repeated for each campaign such that a moving average, $EF_{ma,n}$, is established over time, becoming more representative and precise with each additional campaign.

To calculate the total emission reductions achieved in a campaign according to the formula below, the higher of the two values $EF_{ma,n}$ and EF_n shall be applied as the emission factor relevant for the particular campaign to be used to calculate emissions reduction s (EF_p). Thus:

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

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

In addition a campaign-specific **minimum emissions factor** (EF_{min}) shall be used to cap any potential long-term trend towards decreasing N₂O 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 emission factor (EF_{min}). If any of the later project campaigns results in an EF_n that is lower than EF_{min} , the calculation of the emission reductions for that particular campaign shall use EF_{min} and not EF_n . As the project campaigns of this current monitoring period includes only the 9th project campaign consideration of EF_{min} is not yet of relevance.

The emission reductions for the project activity during this monitoring period are determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid over the campaign period and the GWP of N₂O according to:

$$ER = (EF_{BL} - EF_p) * NAP * 10^{-3} * GWP_{N_2O} \text{ (tCO}_2\text{e)}$$

Sample calculation of emission reductions:

13 th PC: ER [tCO ₂ e] =	(5.640 - 1.207) [kg N ₂ O/t HNO ₃]	*	25,757 [t HNO ₃]	*	10 ⁻³	*	310 =	35,400	[tCO₂e]
PC14 started in 2012 and was finished in 2013, hence the calculation is split:									
14 th PC 2012: ER [tCO ₂ e] =	(5.619 - 1.150) [kg N ₂ O/t HNO ₃]	*	9,508 [t HNO ₃]	*	10 ⁻³	*	310 =	13,171	[tCO₂e]
14 th PC 2013: ER [tCO ₂ e] =	(5.619 - 1.150) [kg N ₂ O/t HNO ₃]	*	7,023 [t HNO ₃]	*	10 ⁻³	*	298 =	9,353	[tCO₂e]
15 th PC: ER [tCO ₂ e] =	(4.606 - 1.089) [kg N ₂ O/t HNO ₃]	*	5,628 [t HNO ₃]	*	10 ⁻³	*	298 =	5,898	[tCO₂e]

Note that small deviations occur due to rounding. The figures stated here reflect the correct values as of the excel calculation. Please refer to the calculation excel file for details. The final result is rounded down.

Where:

Variable	Definition
ER	Emission reductions of the project for the specific campaign (tCO ₂ e)

NAP	Nitric acid production for the project campaign (tHNO ₃). The maximum value of NAP shall not exceed the design capacity.
EF _{BL}	Baseline emissions factor (kgN ₂ O/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) (kgN ₂ O/tHNO ₃)
GWP _{N₂O}	Global Warming Potential of N ₂ O (tCO ₂ e/tN ₂ O)

The resulting emission reductions (ER) for each of the project campaigns covered by this monitoring report and all relevant monitoring results are summarized in the table below:

		Project campaign 13 (PC13): 19/06/2012 - 11/10/2012	Project campaign 14 (PC14): 12/10/2012 - 10/02/2013	Project campaign 15 (PC15): 12/02/2013 - 13/03/2013
NCSG _{BL}	mg/Nm ³	1,764.44	1,757.83	1,441.02
QAL2 NCSG		0.97	0.97	0.97
VSG _{BL}	Nm ³ /h	42,983	42,983	42,983
QAL2 VSG		0.962	0.962	0.962
OH _{BL}	h	1,474	1,474	1,474
NAP _{BL}	t HNO ₃	17,718	17,718	17,718
BE	t N ₂ O	104.315	103.924	85.194
UNC		4.20	4.20	4.20
EF _{BL}	kg N ₂ O/t HNO ₃	5.64	5.62	4.61
NCSG _n	mg/Nm ³	205.93	120.20	68.26
QAL2 NCSG		0.97	0.97	0.97
VSG _n	Nm ³ /h	42,302	41,809	41,643
QAL2 VSG		1.020	1.020	1.020
OH _n	h	2,047	1,385	462
NAP _n	t HNO ₃	25,757	16,531	5,628
NAP _n (2012)	t HNO ₃	25,757	9,508	
NAP _n (2013)	t HNO ₃		7,023	5,628
PE _n	t N ₂ O	17.643	6.887	1.299
EF _n	kg N ₂ O/t HNO ₃	0.685	0.417	0.231
EF _{ma,n}	kg N ₂ O/t HNO ₃	1.21	1.15	1.09
EF _{min}	kg N ₂ O/t HNO ₃	0.267	0.267	0.267
EF _p	kg N ₂ O/t HNO ₃	1.207	1.150	1.089
GWP2012	tCO ₂ e/tN ₂ O	310.00	310.00	
GWP2013	tCO ₂ e/tN ₂ O		298.00	298.00
ER ₂₀₁₂	tCO ₂ e	35,400	13,171	
ER ₂₀₁₃	tCO ₂ e		9,353	5,898
Total until 31/12/2012	tCO₂e	48,571		
Total from 01/01/2013	tCO₂e	15,251		
Total ER for the monitoring period		63,822		

Note that in accordance with the methodology, the project emission factor has to be calculated for the entire campaign PC14 (from 12/10/2012 to 10/02/2013). The split between the actual values achieved up to 31/12/2012 and from 01/01/2013 onwards has been calculated in accordance with NAP prior to 31/12/2012 and after 01/01/2013.

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
PC 13	45,035	9,635	0	35,400
PC 14 ₂₀₁₂	16,562	3,390	0	13,171
PC 14 ₂₀₁₃	11,761	2,407	0	9,353
PC 15	7,725	1,826	0	5,898
Total	81,083	17,259	0	63,822

Note that small deviations occur due to rounding. The figures stated here reflect the correct values as of the excel calculation. Please refer to the calculation excel file for details. The final result for each campaign is rounded down.

AM0034 requires calculating emission reductions by establishing product related baseline and project emission factors and multiplying the difference with the nitric acid production. The baseline emissions and the project emissions stated in the summary of calculations have been calculated only for the purpose of this table. The calculations are not in line with the methodology. However, the values are correct besides the rounding issue described above. The total of 63,822 tCO₂e prevails as it has been calculated in accordance with the methodology.

Comparison of design capacity and actually achieved production during this monitoring period

The design capacity of the plant is 292.112 metric tonnes per day, operating 365 days per year. This equals a total production of 107,205 tonnes for a period of 367 days. Therefore the factual production of 47,916 tonnes during this monitoring period is below the design capacity of the plant.

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO ₂ e)	117,419 (calculated for a monitoring period of 367 days)	63,822 (calculated for a monitoring period of 367 days)

E.6. Remarks on difference from estimated value in registered PDD

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Not applicable as the actual GHG emission reductions achieved during this monitoring period are below the values estimated in ex-ante calculation of the registered PDD.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO ₂ e)	48,571	15,251

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Responsible person/ entity for completing the CDM-MR-FORM
Organization name	African Explosives Ltd.
Street/P.O. Box	PO Modderfontein
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City	Modderfontein
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Country	South Africa
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Fax	
E-mail	
Website	www.explosives.co.za
Contact person	Trevor Roberts
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Salutation	Mr
Last name	Roberts
Middle name	
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Personal e-mail	Trevor.roberts@aelms.com

Project participant and/or responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input checked="" type="checkbox"/> Responsible person/ entity for completing the CDM-MR-FORM
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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		