MONITORING REPORT FORM (CDM-MR) *
Version 01 - in effect as of: 28/09/2010

CONTENTS

* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB 54 meeting report, annex 34).

MONITORING REPORT
Version 01; 09.06.2011

TITLE: "PROJECT FOR THE CATALYTIC REDUCTION OF N2O EMISSIONS WITH A SECONDARY CATALYST INSIDE THE AMMONIA REACTOR OF THE NO. 9 NITRIC ACID PLANT AT AFRICAN EXPLOSIVES LTD ("AEL"), SOUTH AFRICA"

Reference Number: 1171
Monitoring period: No 04, 02.07.2010 – 15.04.2011

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

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 N_2O 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 N_2O abatement catalyst.

Brief description of the installed technology and equipments

The employed secondary N_2O 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, N_2O Analyzer, and respective data logging facilities. The AMS as well as its installation complies with the requirements of the European Norm EN 14181 as required by the methodology.

Relevant dates for the project activity

Registration Date: 05.11.2007

Installation of AMS: The N_2O Analyzer was installed in May 2007. The stack gas flow meter was installed in June 2006

Baseline Campaign: BL – Campaign "H15" 05.09.2007 – 06.11.2007

Installation of secondary catalyst: 09.11.2007

Starting Date of Project Activity: 09.11.2007

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

Project Campaigns covered by current Monitoring/Verification Period:

	8. Campaign	PC8 - 21.09.2010-10.02.2011
	9. Campaign	PC9 - 11.02.2011-15.04.2011

Total emission reductions achieved in this monitoring period

The total amount of emission reductions achieved in this monitoring period is 41,789 t CO_2e.

A.2. Project Participants

Name of Party involved	Project Participants	Party involved considered as project participant

South Africa (host)	African Explosives Ltd	No
United Kingdom	N.serve Environmental Services GmbH	No
Switzerland	N.serve Environmental Services GmbH	No

A.3. Location of the project activity:

The project activity is located in: Modderfontein (approx. 20 km north-east of Johannesburg). Postal address: PO Modderfontein 1645. Coordinates of the plant are 26°05'26'' South and 28°10'17'' East.

A.4. Technical description of the project

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

1.) secondary N_2O abatement technology
2.) Automated Monitoring System (AMS) for continuous N2O measurement which is fully in compliance with European standard EN 14181 (see Section C for more detail)
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 (see Section C for more detail)

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 80% in the following reaction:

2N2O → 2N2 + O2

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

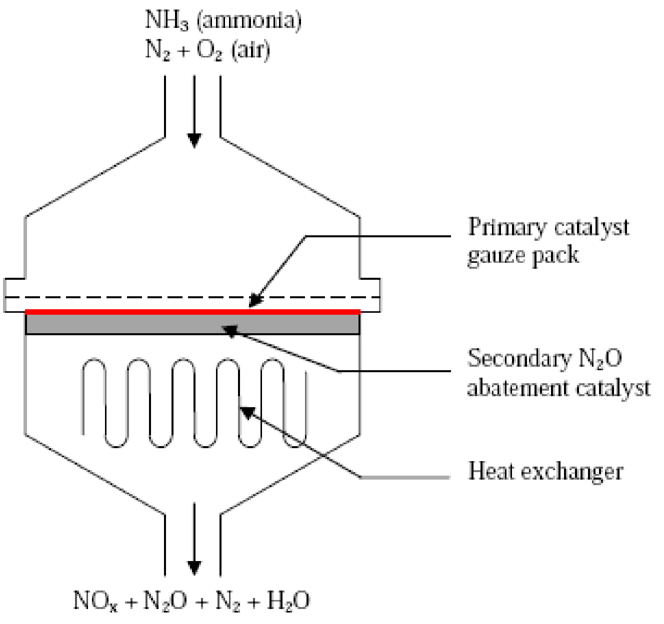
The catalyst does not require additional heat or other energy over and above the temperature that is present inside the Ammonia Oxidation Reactor anyway. There are no additional greenhouse gases or other emissions generated by the reactions on at the N2O abatement catalyst.

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.

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

This project activity is based on Approved Baseline and Monitoring methodologies AM0034 (Version 2): "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants". Furthermore, the project draws on approved baseline methodology AM0028 (Version 04.2) for the baseline scenario selection and employs the "Tool for the demonstration and assessment of additionality".

A.6. Registration date of the project activity:

Registration Date of project activity: 05.11.2007

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

Crediting period: 10 years; Start date: 05.11.2007

A.8. Name of responsible person(s)/entity(ies):

Contact information of the person(s)/entity(ies) responsible for completing the monitoring report form (CDM-MR).

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SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

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

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 demonstrate 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 of the event	End of the event	Campaign		Short description
			AEL designation	Project campaign	
1	21.09.2010		H28	8	Start of new campaign
2	28.09.2010	30.09.2010	H28	8	Plant tripped on compressor HP vibrations Shutdown
3	17.10.2010	20.10.2010	H28	8	Shutdown
4	30.10.2010	27.01.2011	H28	8	Shutdown
6	27.01.2011		H28	8	Plant trip
7	28.01.2011	29.01.2011	H28	8	Plant trip
8	02.02.2011	10.02.2010	H28	8	Primary gauze torn - leading to higher N_2O levels
9	10.02.2011		H28	8	Gauze change
10	11.02.2011		H29	9	Start of new campaign
11	15.04.2011		H29	9	Power Failure - Gauze change

NO events or incidents of any relevance in regard to impacting the applicability of the methodology occurred during this 4th monitoring period.

B.2. Revision of the monitoring plan

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The monitoring plan has not been revised.

B.3. Request for deviation applied to this monitoring period

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No deviation was applied to this monitoring period.

B.4. Notification or request of approval of changes

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No notifications or request for approval of changes of the project activity as described in the registered CDM-PDD have been made.

SECTION C. Description of the monitoring system

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1. General Description of the AMS

A complete Automated Monitoring System (AMS) to monitor the mass emissions of N_2O at the stack of AELs No.9 nitric acid plant was installed and has been operated since 2007. The Manufacturer and type of the N_2O Analyser is ABB AO2040 Uras 14 NDIR analyser. 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 is in 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 analyzer 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 N_2O concentration in the stack is an ABB AO2040 Uras 14 NDIR analyser

5. Flow Meter

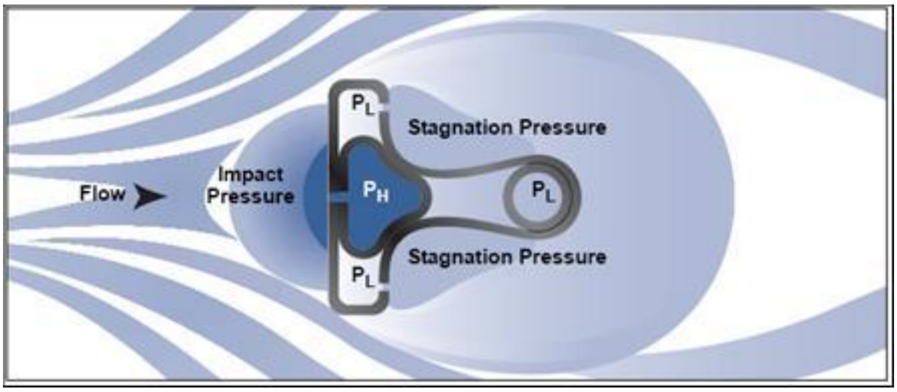
The Emerson Rosemount Flow Meter Annubar®, model no. 485, relies on the Averaging Pilot Tubes (APTs).

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. Monitoring plan and responsibilities

The emission reductions achieved by the project activity are monitored based on the approved monitoring methodology AM0034 (Version 2) as prepared by N.serve Environmental Services GmbH. It is the appropriate monitoring methodology to be used in conjunction with the baseline methodology AM0034, “Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants”. Its applicability depends on the same prerequisites as the mentioned baseline methodology.

AM0034 requires the use of the European Norm EN14181 (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 ongoing 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 to see if there are 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. Albrecht von Ruffer, Managing Director of N.serve, is responsible for the correct analysis of the delivered data in accordance with the methodology.

7. Application of EN 14181 procedures to the project

In the following, it is described how the procedures given in EN14181 for QAL1, 2 and 3 have been practically applied at AEL No. 9 plant.

QAL 1

In accordance with EN14181 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 N_2O 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 certified[1] 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 SO_2 . At the time of commissioning of the AMS by AEL no AMS was available that had been certified according with EN 14181 QAL1 for N_2O measurements. However, ABB has conducted and successfully completed the QAL1 tests[2] for the follow-up model of this analyser module within the same analyser series (ABB AO2040 Uras 26). Since there are no major technical differences between the two analyser models it

[1] TÜV Süddeutschland Bau und Betrieb GmbH (Report number 170 608), March 2003

[2] TÜV Süd Industrie Service GmbH, München (Report number 821029) June 2006

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). According to EN14181, 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.

A series of QAL2 specific reference measurements using a the SRM method as per EN 14181 for guidance has been carried out at the plant for both above mentioned analysers seperately by an accredited testing house (TÜV SÜD Industrie Service GmbH, Germany) to ensure the AMS' suitability, establish the calibration curve and test the variability of the measurements. The results of these SRM are available to the DOE as part of the verification process. The AMS calibration function as well as the total uncertainty of the AMS was determined. The results were applied in the calculation of EF_{BL} and EF_n.

In June 2009 and in July 2010 an AST Test has been successfully performed by an accredited testing house. The test was performed in accordance with EN14181. The AST is a series of measurements that need to be conducted by independent measurement equipment in parallel to the existing AMS.

8. 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.

Calibration Gas

A certified N_2O Calibration gas (balance being N_2) with a precision of ± 2% is used in the span calibrations. The calibration gas is certified by an independent laboratory (Modderfontein Laboratory Services).

Modderfontein Laboratory Services (Pty) Ltd. is an independent chemical analysis laboratory which is certified by the South African Bureau of Standards (SABS).

Analyser Zero and Span Calibrations

According to the QAL 1 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.

Flow meter calibration procedures

The flow meter is calibrated at least once per year (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 device which will not have drift. Therefore, it is sufficient to regularly inspect the physical condition of the Annubar. 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.

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.

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.

8. 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 weeks data (2-second, hourly and daily averages) onto an external disc drive. That way there are already four copies of the original and unchanged data stored in four different locations. In addition, the hourly data are sent to N.serve on a regular basis (e. g. after each campaign) where they are also stored.

The SCADA system automatically produces comma separated files stored in Microsoft Excel of the 2-second values and it also automatically produces hourly and daily average values for each of the measured parameters. The hourly averages are the basis of the analysis of the data for the purpose of the calculation of the emissions factors for the baseline and for the project campaigns. These are then extracted and converted into excel files which can then be imported into the N.serve Database Management System (N.DBMS).

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	**B.1 $NCSG_{BC}$**
Data unit:	**mg/Nm^3**
Description:	N_2O concentration in the stack gas during the baseline campaign.
Source of data used:	ABB AO2040 URAS 14 Continuous Emissions Analyser
Value(s) :	Value applicable for **regular project campaigns** exceeding CL_{normal} or CL_{BL}: **1,764.44** Value applicable for Project Campaign 8 : **1,725.20** Value applicable for Project Campaign 9 : **1,764.44**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Additional comment:	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 to be applied to all NCSG measurements. Therefore, the mean NCSG value will be multiplied by 0.97 before going into the calculation of BE_{BC}.

Data / Parameter:	**B.2 VSG_{BC}**
Data unit:	**Nm^3/h**
Description:	Normal gas volume flow rate of the stack gas during the baseline campaign.
Source of data used:	Gas Volume Flow meter, Emerson Rosemount Annubar® Model 485 combined with pressure transmitter Rosemount 3051S
Value(s) :	**42,983**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	The QAL2 test as well as the AST 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 and AST tests 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. 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}.

Data / Parameter:	**B.3 BE_{BC}**
Data unit:	**tN_2O**
Description:	Total N_2O mass flow during baseline campaign
Source of data used:	Calculation from measured data.
Value(s) :	Value applicable for **regular project campaigns** exceeding CL_{normal} or CL_{BL}: **104.315** Value applicable for Project Campaign 8 : **101.995** Value applicable for Project Campaign 9 : **104.315**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.4 OH_{BC}**
Data unit:	**hours**
Description:	Operating hours
Source of data used:	Production log
Value(s) :	**1,474**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.5 NAP_{BC}**
Data unit:	**$tHNO_3$**
Description:	Metric tonnes of 100% concentrated nitric acid produced during the baseline campaign.
Source of data used:	Nitric acid flow meter Manufacturer: EMERSON, Type: Coriolis mass flow meter CMF 200 Laboratory results for verification purposes
Value(s) :	**17,718**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	The nitric acid flow meter is subject of external calibration procedures every 3 years.

Data / Parameter:	**B.6 TSG**
Data unit:	**°C**
Description:	Temperature in the stack gas
Source of data used:	Stack temperature probe as part of the VSG flow meter.
Value(s) :	**Not applicable**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	The TSG result is automatically applied for calculating VSG at standard

	conditions

Data / Parameter:	**B.7 PSG**
Data unit:	mbar (absolute)
Description:	Pressure in the stack
Source of data used:	Stack pressure as part of the VSG flow meter.
Value(s) :	**Not applicable**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	The PSG result is automatically applied for calculating VSG at standard conditions

Data / Parameter:	**B.8 EF_{BL}**
Data unit:	**tN2O / tHNO3**
Description:	Emissions factor for baseline period
Source of data used:	Calculated from measured data (tons of N_2O emitted / tons of nitric acid produced)
Value(s) :	Value applicable for **regular project campaigns** exceeding CL_{normal} or CL_{BL}: **0.00564** Value applicable for Project Campaign 8 : **0.00551** Value applicable for Project Campaign 9 : **0.00564**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.9 UNC**
Data unit:	**%**
Description:	Calculated overall uncertainty of the Automated Monitoring System (AMS)
Source of data used:	UNC is determined by conducting reference measurements by an independent testing laboratory with EN ISO/IEC 17025 accreditation (QAL2).
Value(s) :	**4.20%**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline / Project emission calculations.
Additional comment:	None

Data / Parameter:	**B.10 AFR**
Data unit:	**tNH_3/h**
Description:	Ammonia gas flow rate to the ammonia oxidation reactor
Source of data used:	Differential pressure measurement (orifice plate) Type: D/P
Value(s) :	Not applicable, monitored data of AFR will be used to determine if plant was operating outside of AFR_{max}.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.

Additional comment:	None

Data / Parameter:	**B.11 AFR_{max}**
Data 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 used:	AFR data
Value(s) :	**3.877 tNH_3/h**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.12 AIFR**
Data unit:	**% v/v**
Description:	Ammonia to air ratio into the ammonia oxidation reactor
Source of data used:	Measurements of AFR and primary air flow rates (measured by differential pressure measurement).
Value(s) :	**Not applicable, monitored data of AIFR will be used to determine if plant was operating outside of $AIFR_{max}$.**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.13 CL_{BL}**
Data unit:	**tHNO3**
Description:	Length of the baseline campaign measured in metric tonnes of 100% concentrated nitric acid produced during that baseline campaign.
Source of data used:	NAP_{BC}
Value(s) :	**12,718**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.14 CL_{normal}**
Data unit:	**tHNO3**
Description:	Average length of the historic campaigns measured in metric tonnes of 100% concentrated nitric acid produced during the historic campaigns.
Source of data used:	Flow meter measurements as described in NAP.
Value(s) :	**24,026.2**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline / Project emission calculations.
Additional comment:	None

Data / Parameter:	**B. 15 $AIFR_{max}$**
Data unit:	**% v/v**
Description:	Maximum Ammonia to air ratio into the ammonia oxidation reactor.
Source of data used:	AIFR Data
Value(s) :	**11.5**

Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.16 OT_h**
Data unit:	**°C**
Description:	Oxidation temperature for each hour during the baseline campaign
Source of data used:	Monitoring results of a thermocouple inside the ammonia oxidation reactor.
Value(s) :	**Not applicable**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.17 OT_{normal}**
Data unit:	**°C (min and max)**
Description:	Normal range operating temperature
Source of data used:	Design specifications and operating manual of the No. 9 nitric acid plant (Technical Manual (TM24 June 1977, p94).
Value(s) :	**810 °C (min) to 915 °C (max)**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.18 OP_h**
Data unit:	**kPa (gauge)**
Description:	Oxidation Pressure for each hour during the baseline campaign
Source of data used:	Monitoring results of a pressure transmitter on the ammonia oxidation reactor (ammonia to air mixer).
Value(s) :	**Not applicable.**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.19 OP_{normal}**
Data 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 used:	Design specifications and operating manual of the No. 9 nitric acid plant (Technical Manual (TM24 June 1977, p94).
Value(s) :	**860 (min) to 910 (max)**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.20 GS_{normal}**
Data unit:	**Name of Supplier**
Description:	Gauze supplier for the operating condition (i.e. historic) campaigns
Source of data used:	Monitored / Invoices
Value(s) :	**W.C. Heraeus**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.21 GS_{BL}**
Data unit:	**Name of Supplier**
Description:	Gauze supplier for the baseline condition campaign
Source of data used:	Monitored / Invoices
Value(s) :	**W.C. Heraeus**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.23 GC_{normal}**
Data 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 used:	Monitored / Gauze supplier invoices
Value(s) :	**Platinum (Pt) 59%; Rhodium (Rh) 4%; Palladium (Pd) 37%**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations.
Additional comment:	None

Data / Parameter:	**B.24 GC_{BL}**
Data 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 used:	Monitored / Gauze supplier invoices
Value(s) :	**Platinum (Pt) 59%; Rhodium (Rh) 4%; Palladium (Pd) 37%**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline / Project emission calculations.
Additional comment:	None

Data / Parameter:	**B.26 EF_{reg}**
Data unit:	**$tN_2O/tHNO_3$**
Description:	Emissions cap for N_2O from nitric acid production set by government regulation
Source of data used:	Department of Environmental Affairs and Tourism
Value(s) :	**None**
Indicate what the data	Baseline / Project emission calculations.

are used for (Baseline/ Project/ Leakage emission calculations)	
Additional comment:	None.

D.2. Data and parameters monitored

Data / Parameter:	**NCSG**
Data unit:	**mg / m³** (convertible from ppmv, if required)
Description:	N_2O concentration in 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:	ABB AO2040 URAS 14 Continuous Emissions Analyser
Value(s) of monitored parameter:	Value applicable for Project Campaign 8 : **84.08** Value applicable for Project Campaign 9 : **113.25**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: *ABB AO2040 URAS 14 Continuous Emissions Analyser, non-dispersive infrared analyser* Measurement accuracy (for N_2O): *2.69 % (per QAL 2 test)* Serial Number: 3.346854.7 Calibration frequency: - *External calibration: QAL2 every 5 years*; - *Internal calibration: twice per week manual calibration with test gas* Date of last external calibration: *QAL2 Test –07.-13.02.2008 valid until 2013*
Measuring/ Reading/ Recording frequency:	Continuously (every 2 seconds)
Calculation method (if applicable):	AM0034 requires the determination of the concentration of N_2O 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 where subjected to the following statistical analysis: a) Calculate the sample mean (x) b) Calculate the sample standard deviation (s) c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation) d) Eliminate all data that lie outside the 95% confidence interval e) Calculate the new sample mean from the remaining NCSG values 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 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.
QA/QC procedures applied:	Manual zero and span calibrations are carried out regularly by the instrumentation department of AEL.

Data / Parameter:	**VSG**
Data unit:	**Nm^3/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 8 : **41,780** Value applicable for Project Campaign 9 : **39,972**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: Emerson Rosemount Annubar® Model 485 combined with pressure transmitter Rosemount 3051S Overall measurement accuracy: 2.65*% (per QAL 2 test)* Serial Number: 0305RT32A11B3 Calibration frequency: - *External calibration: QAL2 every 5 years*; - *Internal calibration:Every 4 month (only during plant shut down)* Date of last external calibration: *QAL2 Test –07.-13.02.2008 valid until 2013* *Date of internal calibrations: 19.07.2010, 24.11.2010*
Measuring/ Reading/ Recording frequency:	Continuously (every 2 seconds).
Calculation method (if applicable):	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). VSG data taken during times when the plant was out of operation were eliminated. 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: a) Calculate the sample mean (x) b) Calculate the sample standard deviation (s) c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation)

	d) Eliminate all data that lie outside the 95% confidence interval e) Calculate the new sample mean from the remaining VSG values 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 PE_n.
QA/QC procedures applied:	The flow meter is calibrated every 5 years by external QAL2 test according to EN 14181.

Data / Parameter:	**PE_n**
Data unit:	**tN_2O**
Description:	Total mass N_2O 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 8 : **3.701** Value applicable for Project Campaign 9 : **6.442**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 applied:	Not applicable.

Data / Parameter:	**OH_n**
Data 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:	Value applicable for Project Campaign 8 : **1,129** Value applicable for Project Campaign 9 : **1,525**
Indicate what the data are used for (Baseline/ Project/ Leakage emission	Project emission calculations.

calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Not applicable.
Measuring/ Reading/ Recording frequency:	The total operating hours are logged continuously.
Calculation method (if applicable):	Since the design plant operating temperature is between 800°C and 915°C, by definition the plant is offline if the temperature recorded is at or below 800°C. For practical purposes, each hour for which the ammonia oxidation temperature (OTh) was recorded to be below 810°C is excluded from the determination of OH.
QA/QC procedures applied:	The production logging process is subject to ISO 9001 procedures

Data / Parameter:	**NAP**
Data unit:	**$tHNO_3$**
Description:	Metric tonnes of 100% concentrated nitric acid during each project campaign.
Measured /Calculated /Default:	Measured / Calculated.
Source of data:	Nitric acid flow meter Emerson coriolis mass flow meter Laboratory results.
Value(s) of monitored parameter:	Value applicable for Project Campaign 8 : **13,855** Value applicable for Project Campaign 9 : **18,596**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Emerson coriolis mass flow meter CMF 200 Overall measurement accuracy: *<=0.1%* Serial Number: 12032709 Calibration frequency: every 3 years Date of last calibrations: 24.02.2009 valid until 02. 2012 09.03.2011 valid until 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 mass flow meter according to the following procedures: The density and temperature as measured by the mass flow meter is used to calculate 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 applied:	The mass flow meter is calibrated in regular intervals.

Data / Parameter:	**TSG**
Data 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.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: PT 100_385 3-wire RTD - part of the Gas Volume Flow meter Overall measurement accuracy: 2.55*% (per QAL2 test)* Serial Number: *not available* Calibration frequency: - *External calibration: QAL2 every 5 years*; - *Internal calibration:Every 4 month (only during plant shut down)* Date of last external calibration: *QAL2 Test –07.-13.02.2008 valid until 2013* *Date of internal calibrations: 19.07.2010, 24.11.2010*
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 aquisition system and are applied to each VSG value for calculation of normal volume flow.
QA/QC procedures applied:	The temperature probe is part of the flow meter. The flow meter is calibrated annually by AST and QAL2 test according to EN 14181.

Data / Parameter:	**PSG**
Data unit:	**mbar (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.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: part of the Gas Volume Flow meter, Rosemount 3051TA1A2B21BB4I1M5Q4 Overall measurement accuracy: 0.7% *(per QAl2 test)* Serial Number: 338640.1.1 Calibration frequency: Calibration frequency: - *External calibration: QAL2 every 5 years*; - *Internal calibration:Every 4 month (only during plant shut down)*

	Date of last external calibration: *QAL2 Test –07.-13.02.2008 valid until 2013* *Date of internal calibrations: 19.07.2010, 24.11.2010*
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 applied:	The pressure probe is part of the flow meter. The flow meter is calibrated by QAL2 test according to EN 14181.

Data / Parameter:	$\mathbf{EF_n}$
Data unit:	$\mathbf{tN_2O/tHNO_3}$
Description:	Emissions factor for campaign n.
Measured /Calculated /Default:	Calculated.
Source of data:	Calculation from total mass N_2O emissions of campaign n (PE_n) and total nitric acid production (NAP_n)
Value(s) of monitored parameter:	Value applicable for Project Campaign 8 : **0.00027** Value applicable for Project Campaign 9 : **0.00035**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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_2O emissions during that campaign by the total production of 100% concentrated nitric acid during that same campaign. For campaign *n* the campaign specific emission factor is: $EF_n = PE_n / NAP_n$
QA/QC procedures applied:	Not applicable.

Data / Parameter:	$\mathbf{EF_{ma,n}}$
Data unit:	$\mathbf{tN_2O/tHNO_3}$
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:	Value applicable for Project Campaign 8 : **0.00151** Value applicable for Project Campaign 9 : **0.00138**

Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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: $EF_{ma,n} = (EF_1 + EF_2 + \ldots + EF_n) / n$ 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 applied:	Not applicable.

Data / Parameter:	**EF_p**
Data unit:	**$tN_2O/tHNO_3$**
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:	Value applicable for Project Campaign 8 : **0.00151** Value applicable for Project Campaign 9 : **0.00138**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 applied:	Not applicable.

Data / Parameter:	**EF_{min}**
Data 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	Calculated.

/Default:	
Source of data:	EF_n
Value(s) of monitored parameter:	**0.00027**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 used EF_{min} and not EF_n.
QA/QC procedures applied:	Not applicable.

Data / Parameter:	$\mathbf{CL_n}$
Data unit:	**$tHNO_3$**
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:	Value applicable for Project Campaign 8 : **13,855** Value applicable for Project Campaign 9 : **18,596**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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_2O 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_2O 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 applied:	See comments for NAP above

Data / Parameter:	**OP_h**
Data unit:	**kPa (gauge)**
Description:	Oxidation Pressure for each hour
Measured /Calculated /Default:	Measured.
Source of data:	Monitoring results of a pressure transmitter on the ammonia oxidation reactor (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.**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Not applicable.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: Overall measurement accuracy: Serial Number: Calibration frequency: Date of last calibration,
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 applied:	The instrument is subject to yearly internal calibrations. The QA/QC procedures are part of the ISO 9001 procedures.

Data / Parameter:	**OT_h**
Data 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.**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Not applicable.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: Overall measurement accuracy: Serial Number: Calibration frequency: Date of last calibration:
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 applied:	The instrument is subject to yearly internal calibrations, which are part of the ISO 9001 procedures.

Data / Parameter:	**AFR**
Data unit:	**tNH_3/h**
Description:	Ammonia gas flow rate to the ammonia oxidation reactor.
Measured /Calculated /Default:	Measured.
Source of data:	Differential pressure measurement (orifice plate) 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**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Not applicable.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: differential pressure measurement principle Overall measurement accuracy: Serial Number: Calibration frequency: Date of last calibration:
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 applied:	The instrument is subject to yearly internal calibrations, which are part of the ISO 9001 procedures.

Data / Parameter:	**AIFR**
Data 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**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Not applicable.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Equipment for Air Flow-rate to AOR: Type: Overall measurement accuracy: Serial Number: Calibration frequency: Date of last calibration
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 applied:	Not applicable.

Data / Parameter:	**$GS_{project}$**

Data 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**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Not applicable.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	Not applicable.
QA/QC procedures applied:	Not applicable.

Data / Parameter:	**$GC_{project}$**
Data 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 8: Platinum (Pt) 59.7%; Rhodium (Rh) 3.9%, Palladium (Pd) 37.4%** **Project campaign 9: Platinum (Pt) 60.1%; Rhodium (Rh) 3.9%, Palladium (Pd) 36.0%**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Not applicable.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	Not applicable.
QA/QC procedures applied:	Not applicable.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

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Analysis of Historical campaign data

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 Annex 1 for details.

Historic data of daily NH_3 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 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
Maximim ammonia to air ratio: 0,115 or 11,5 %

This permitted range is then applied in the baseline evaluation in Query 5 below.

The analysis of the historical campaigns is now complete. Next, the analysis of the baseline data can be conducted applying the results of the analysis of the historical data.

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.

Baseline Query 1 (Raw data): Analysis of the raw baseline data without any operating limits applied

In a first step, a number of statistical calculations are carried out for the historical and baseline data using Query 1:

- Number of data sets
- Minimum value
- Maximum value
- Mean value and/or sum (depending on the character of the parameter)
- Standard deviation
- 95% confidence interval

The resulting Access table is shown below:

AEL No 9:

Query 1: Without parameter limits

ProjId	CampType	Count(DT)	Count(AFR)	Max(AFR)	Max(AIFR)	Min(Oph)	Max(Oph)	Min(OTh)	Max(OTh)	Sum(NAP)	AnzahlvonNAP
6	B	1.475,00	1.474,00	3,52	0,10	368.287,00	911.356,00	824,02	901,39	17.718,00	63

For convenience of handling, the data from this Access table is exported into Excel for further analysis. The result of this export is shown below:

N.DBMS Baseline Calculation w/o BL cut	AEL No. 9, Johannesburg, South Africa				Campaign:		H15	05.09.07	- 06.11.07
Baseline campaign	**Query 1: Without parameter limits**								
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count	1,475	1,474	1,474	1,474	1,474	1,474		1,474	
Minimum		0.98	0.057	368,287	824	1,011		23,444	
Maximum		3.52	0.104	911,356	901	1,949		43,971	
Mean		3.41	0.102	883,915	900	1,710		42,889	
Standard deviation		0.08	0.001	21,262	3	231		813	
Sum	1,475								17,718
Baseline emissions	**BE**		= *VSG * NCSG * Oh * 10^{-9}*					t N2O	**108.2**
Emission factor	**EF**		= *BE / NAP * 10^{3}*					kg N2O / t HNO3	**6.10**

This table gives the raw results for NAP, OH, NCSG, VSG and EFBL.
According to this Query 1, the NAP value of the baseline campaign is 17,718 tonnes.

Baseline Query 2: Elimination of faulty data outside operational limits

In this query (Query 2), the operational limits of the plant are applied. Lines of data in which at least one value indicates that the plant is out of operation (trip values) are completely eliminated from further analysis. During the project, the following "trip conditions" are used:
Since the design plant operating temperature is between 800°C and 915°C, by definition the plant is offline if the temperature recorded is at or below 800°C. For practical purposes, each hour for which the ammonia oxidation temperature (OTh) was recorded to be below 810°C is excluded from the determination of operating hours and all NCSG and VSG data is excluded from the further analysis if the temperature is below 810 °C.

N.DBMS Baseline Calculation w/o BL cut	AEL No. 9, Johannesburg, South Africa				Campaign:		H15	05.09.07	- 06.11.07
Baseline campaign	**Query 2: With limits on historical data**								
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count	1,474	1,474	1,474	1,474	1,474	1,474		1,474	
Remaining share of data sets	100%	100%	100%	100%	100%	100%			
Minimum		0.98	0.057	368,287	824	1,011		23,444	
Maximum		3.52	0.104	911,356	901	1,949		43,971	
Mean		3.41	0.102	883,915	900	1,710		42,889	
Standard deviation		0.08	0.001	21,262	3	231		813	
95% confidence level		0.15	0.003	41,674	5	453		1,594	
Sum	1,474								17,718
Limits acc. to consistency check									
Lower limit					810				
Upper limit									

According to this Query 2, the OH value of the baseline campaign is 1,474 hours.

Baseline Query 5: Applying the permitted operating range from historical data

After conducting Queries 2 and 5 which effect the elimination of

- all invalid (i.e. obviously inconsistent) baseline data sets
- all baseline data sets registered while the plant was operating outside the historic operational parameters

95% of all original data sets remain.

The remaining data sets are those recorded when the plant was operating normal.

N.DBMS Baseline Calculation w/o BL cut AEL No. 9, Johannesburg, South Africa				Campaign:	H15	05.09.07		- 06.11.07	
Baseline campaign	**Query 5: Permitted range from hist. campaigns applied to BL data, invalid data sets excluded.**								
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count	1,404	1,404	1,404	1,404	1,404	1,404		1,404	
Remaining share of data sets	95%	95%	95%	95%	95%	95%		95%	
Minimum		3.32	0.100	860,471.0	899	1,011		41,788	
Maximum		3.52	0.104	909,709.0	901	1,934		43,971	
Mean		3.41	0.102	885,957	900	1,710		42,969	
Standard deviation		0.03	0.001	11,372.8	0	231		481	
95% Confidence Interval		0.07	0.001	22,290.7	0	453		942	
Sum	1,474								17,718
Limits acc. to consistency check									
Lower limit				860,000	810				
Upper limit		3.877	0.115	910,000	915				
Baseline emissions	**BE**	*= VSG * NCSG * Oh * 10^{-9}*						t N2O	**108.3**
Emission factor	**EF**	*= BE / NAP * 10^{3}*						kg N2O / t HNO3	**6.11**

This query excludes those NCSG and VSG data from the calculation of BE that were taken during times when the plant was operating outside of the permitted operating range during the baseline campaign. Only those VSG and NCSG values were taken into account for which a matching AFR, AIFR, OPh and OTh value was available.

The remaining share of the operating data after Query 5 is 95% of the raw data and therefore meets the criterion set by AM0034 that the plant must be operating within the permitted range at least 50% of the time during the baseline campaign.

Query 6 a + b: Application of 95% confidence interval, AMS UNC and calculation of EFBL

The 95% confidence level of NCSG and VSG values is derived, thereby excluding outliers and determining the mean values that are to be applied to the calculation of BE. Also the correction factors for NCSG and VSG that are determined during QAL2 test are applied.

N.DBMS Baseline Calculation w/o BL cut AEL No. 9, Johannesburg, South Africa				Campaign:	H15	05.09.07		- 06.11.07	
Baseline campaign	**Query 6a+b: Confidence levels for NCSG and VSG**								
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count						1,283		1,370	
Minimum		3.322	0.100	860,471.0	899	1,259		42,028	
Maximum		3.521	0.104	909,709.0	901	1,934		43,909	
Mean		3.411	0.102	885,957.2	900	**1,764**		**42,983**	
Standard deviation						154		459	
95% Confidence Interval									
Sum	**1,474**								**17,718**
Limits acc. to consistency check									
Lower limit				860,000	810	1,256.8		42,027	
Upper limit		3.877	0.115	910,000	915	2,163.1		43,911	
		Correction factors resulting from QAL2				**0.970**		**0.962**	
Baseline emissions	**BE**	*= VSG * NCSG * Oh * 10^{-9}*						t N2O	**104.3**
Emission factor	**EF**	*= BE / NAP * 10^{3} * (1 - UNC/100)*						kg N2O / t HNO3	**5.640**
Uncertainty	UNC								**4.20**

Resulting EFBL

The EFBL derived from this analysis of historic and baseline data is 5.64 kg N_2O/tHNO3.

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}, then all N_2O values measured during the baseline campaign can be used for the calculation of EF_{BL}. If $CL_n < CL_{normal}$, EF_{BL} has to be recalculated by eliminating those N_2O 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 9 the CL_n is longer than CL_{BL}, therefore no adjustment of the Baseline emissions factor EF_{BL} is necessary.

New calculation of Baseline emissions factor due to $CL_n < CL_{BL}$

Since for the project campaign 8 (PC8) $CL_n < CL_{BL}$, 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}

N.DBMS Baseline Calculati Project:	AEL No. 9, Johannesburg, South Africa					Campaign:	H15	05.09.07	- 06.11.07
Baseline campaign	**Query 6a+b: Confidence levels for NCSG and VSG**					137		141	
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**	**NCSG**	**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count	1,404	1,404	1,404	1,404	1,404	1,042		1,370	
Minimum		3.322	0.100	860,471	899	1,201		42,028	
Maximum		3.521	0.104	909,709	901	1,934		43,909	
Mean		3.411	0.102	885,957	900	**1,725**		**42,983**	
Standard deviation		0	0	11,373	0	196		459	
95% confidence level *(1.96 * Std.dev.)*									
Sum	**1,474**								**17,718**
Limits acc. to consistency check						24.10.2007 06:00			
Lower limit				860,000	810.0	1,198.6		42,027	
Upper limit		3.877	0.115	910,000	915.0	2,147.9		43,911	
					Correction factors resulting from QAL2	**0.970**		**0.962**	
Baseline emissions	**BE**		*= VSG * NCSG * Oh * 10^{-9}*					t N2O	**102.0**
Emission factor	**EF**		*= BE / NAP * 10^{3} * (1 - UNC/100)*					kg N2O / t HNO3	**5.51**
Uncertainty	UNC								**4.20**

As a result of this recalculation the new EF_{BL} to be applied for project campaign 8 (PC8) is 5.51 kg N_2O /t HNO_3

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 ($tN_2O/tHNO_3$)
EF_{reg} Emissions level set by newly introduced policies or regulations ($tN_2O/tHNO_3$).

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. Project emissions calculation

>>

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_2O in the stack gas for the project campaign (mgN_2O/m_3)
PE_n	Total N_2O emissions of the n^{th} project campaign (tN_2O)
OH	Is the number of hours of operation in the specific monitoring period (h)

Based on the total N_2O 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 (kg N_2O/t HNO_3)
PE_n	Total N_2O emissions of the n^{th} project campaign (tN_2O or kg N_2O)
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

Query 1 (Raw data): Analysis of the raw campaign data

This set of data shows a summary of the collected raw data for the complete project campaign.

N.DBMS Project Campaign Calculatio	Project:	AEL No. 9, Johannesburg, South Africa				Campaign:	H 28	21.09.10 - 10.02.11
Project campaign 8	**Query 1: Without parameter limits**							148
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**	**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3	Nm3 / h	t HNO3
Count	1,314	1,314	1,314	1,314	1,314	1,314	1,314	
Minimum		0.00	0.00	351.00	800	0.00	1,065	
Maximum		3.49	0.8	907,766.0	901	1,221	43,558	
Mean		2.80	0.11	867,703.1	883	192	36,678	
Standard deviation		1.135	0.06	160,426.08	34	324	12,675	
95% confidence level *(1.96 * Std.dev.)*		*2.22*	*0.12*	*314,435.11*	*66*	*635*	*24,842*	
Sum	1,314							13,855
Limits acc. to consistency check								
Lower limit								
Upper limit								
			Correction factors resulting from QAL2			**0.970**	**0.962**	
Campaign emissions	**PE**		*= VSG * NCSG * Oh * 10^{-9}*				t N2O	**8.6**
Emission factor	**EF_n**		*= PE / NAP * 10^3*				kg N2O / t HNO3	**0.62**

This table gives the raw results for NAP, OH, NCSG, VSG and EF_n.

According to this Query 1, the NAP value of project campaign 8 (PC8) is 13,855 t of nitric acid.

N.DBMS Project Campaign Calculatio	Project:	AEL No. 9, Johannesburg, South Africa				Campaign:	H 29	11.02.11	- 15.04.11
Project campaign 9	**Query 1: Without parameter limits**								168
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count	1,536	1,536	1,536	1,536	1,536	1,536		1,536	
Minimum		0.02	0.00	358.00	801	0.00		2,318	
Maximum		3.34	0.4	914,145.0	902	354		43,036	
Mean		3.16	0.10	889,847.4	900	117		41,991	
Standard deviation		0.273	0.01	73,765.38	9	34		3,063	
95% confidence level *(1.96 * Std.dev.)*		*0.54*	*0.02*	*144,580.15*	*17*	*67*		*6,003*	
Sum	1,536								18,596
Limits acc. to consistency check									
Lower limit									
Upper limit									
			Correction factors resulting from QAL2			**0.970**		**0.962**	
Campaign emissions	**PE**		*= VSG * NCSG * Oh * 10^{-9}*					t N2O	**7.0**
Emission factor	**EF_n**		*= PE / NAP * 10^{3}*					kg N2O / t HNO3	**0.38**

This table gives the raw results for NAP, OH, NCSG, VSG and EF_n.
According to this Query 1, the NAP value of project campaign 9 (PC9) is 18,596 t of nitric acid.

Query 2: Elimination of faulty data outside operational limits

In this query (Query 2), the operational limits of the plant are applied. Lines of data in which at least one value indicates that the plant is out of operation (trip values) are completely eliminated from further analysis. The design "trip" temperature, i.e. the temperature inside the ammonia oxidation reactor below which the plant shuts down automatically has been applied to exclude such lines of data. During the project, the "trip temperature" of 810°C will be applied as the exclusion criterion for determining those hours during which the plant was offline during a campaign.

N.DBMS Project Campaign Calculatio	Project:	AEL No. 9, Johannesburg, South Africa				Campaign:	H 28	21.09.10	- 10.02.11
Project campaign 8	**Query 2: With operational limits**								152
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count	1,129	1,129	1,129	1,129	1,129	1,129		1,129	
Remaining share of data sets	85.9%	85.9%	85.9%	85.9%	85.9%	85.9%		85.9%	
Minimum		0.72	0.06	317,891.00	817	0		12,514	
Maximum		3.49	0.11	907,766.0	901	1,221		43,558	
Mean		3.26	0.10	897,507.4	896	223		41,667	
Standard deviation		0.173	0.004	32,618.710	5.9	340		1,656	
95% confidence level *(1.96 * Std.dev.)*		0.339	0.008	63,932.671	11.6	666		3,247	
Sum	1,129								13,855
Limits acc. to consistency check									
Lower limit					810				
Upper limit									
			Correction factors resulting from QAL2			0.9700		0.9620	
Campaign emissions	**PE**		*= VSG * NCSG * Oh * 10^{-9}*					t N2O	**9.8**
Emission factor	**EF_n**		*= PE / NAP * 10^{3}*					kg N2O / t HNO3	**0.70**

As a result of this query the number of operation hours OH of the project campaign 8 (PC8) is 1,129 h.

N.DBMS Project Campaign Calculation	Project:	AEL No. 9, Johannesburg, South Africa				Campaign:	H 29	11.02.11 - 15.04.11	
Project campaign 9	**Query 2: With operational limits**								172
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count	1,525	1,525	1,525	1,525	1,525	1,525		1,525	
Remaining share of data sets	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%		99.3%	
Minimum		1.24	0.10	362,460.00	836	53		19,252	
Maximum		3.34	0.10	914,145.0	902	354		43,036	
Mean		3.19	0.10	895,883.6	901	118		42,238	
Standard deviation		0.062	0.001	18,727.250	2.3	33		738	
95% confidence level *(1.96 * Std.dev.)*		0.122	0.002	36,705.411	4.5	65		1,447	
Sum	1,525								18,596
Limits acc. to consistency check									
Lower limit					810				
Upper limit									
			Correction factors resulting from QAL2			0.9700		0.9620	
Campaign emissions	**PE**		*= VSG * NCSG * Oh * 10^{-9}*					t N2O	**7.1**
Emission factor	**EF_n**		*= PE / NAP * 10^{3}*					kg N2O / t HNO3	**0.38**

As a result of this query the number of operation hours OH of the project campaign 9 (PC9) is 1,525 h.

Query 6: application of confidence interval to eliminate outliers

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.

N.DBMS Project Campaign Calculation	Project:	AEL No. 9, Johannesburg, South Africa				Campaign:	H 28	21.09.10 - 10.02.11	
Project campaign 8	**Q6: Q2 + confidence levels**					156		160	152
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count						959		1,121	
Remaining share of data sets									
Minimum		0.715	0.06	317,891.00	817	0		38,592	
Maximum		3.49	0.11	907,766.0	901	881		43,558	
Mean		3.26	0.10	897,507.4	896	84.08		41,780	
Standard deviation		0.173	0.004	32,618.710	5.9	90		740	
95% confidence level *(1.96 * Std.dev.)*		0.339	0.008	63,932.671	11.6	177		1,451	
Sum	1,129								13,855
Limits acc. to consistency check									
Lower limit					810	0.00		38,421	
Upper limit						888.88		44,914	
			Correction factors resulting from QAL2			0.9700		0.9620	
Campaign emissions	**PE**		*= VSG * NCSG * Oh * 10^{-9}*					t N2O	**3.701**
Emission factor	**EF_n**		*= PE / NAP * 10^{3}*					kg N2O / t HNO3	**0.27**

N.DBMS Project Campaign Calculation	Project:	AEL No. 9, Johannesburg, South Africa				Campaign:	H 29	11.02.11 - 15.04.11	
Project campaign 9	**Q6: Q2 + confidence levels**					176		180	172
Parameter	**OH**	**AFR**	**AIFR**	**Oph**	**OTh**	**NCSG**		**VSG**	**NAP**
Unit	h	t NH3 / h	ratio	Pa	°C	mg N2O / Nm3		Nm3 / h	t HNO3
Count						1,453		817	
Remaining share of data sets									
Minimum		1.236	0.10	362,460.00	836	53		34,221	
Maximum		3.34	0.10	914,145.0	902	182		41,984	
Mean		3.19	0.10	895,883.6	901	113.25		39,972	
Standard deviation		0.062	0.001	18,727.250	2.3	26		500	
95% confidence level *(1.96 * Std.dev.)*		0.122	0.002	36,705.411	4.5	52		980	
Sum	1,525								18,596
Limits acc. to consistency check									
Lower limit					810	52.89		40,792	
Upper limit						182.65		43,685	
			Correction factors resulting from QAL2			0.9700		0.9620	
Campaign emissions	**PE**		*= VSG * NCSG * Oh * 10^{-9}*					t N2O	**6.442**
Emission factor	**EF_n**		*= PE / NAP * 10^{3}*					kg N2O / t HNO3	**0.35**

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

The resulting project emissions (PE_n) and project emission factor (EF_n) for the project campaigns covered by this monitoring report are:

Campaign	PE	EF_n
Project Campaign 8 (PC8)	3.701 tN2O	0.27 $kgN_2O/tHNO_3$
Project Campaign 9 (PC9)	6.442 tN2O	0.35 $kgN_2O/tHNO_3$

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 N_2O 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 9 the CL_n is longer than CL_{BL}, therefore no adjustment of the Baseline emissions factor EF_{BL} is necessary.

Since for the project campaign 8 (PC8) $CL_n < CL_{BL}$, 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} See section : *New calculation of Baseline emissions factor due to $CL_n < CL_{BL}$* above.

E.3. Leakage calculation

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No leakage occurs under this project type.

E.4. Emission reductions calculation / table

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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 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 emission factor (EF_{min}). If any of the later project campaigns results in a EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall use EF_{min} and not EF_n. As this project campaign of this current monitoring period is only the 8th 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 N_2O according to:

$ER = (EF_{BL} – EF_P) * NAP *GWP\_N_2O\ (tCO_2e)$

Where:

Variable	**Definition**

ER	Emission reductions of the project for the specific campaign (tCO_2e)
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 ($kgN_2O/tHNO_3$)
EF_P	Emissions factor used to calculate the emissions from this particular campaign (i.e. the higher of $EF_{ma,n}$ and $_{EFn}$) ($kgN_2O/tHNO_3$)
GWP_N_2O	Global Warming Potential of N_2O (310 tCO_2e/tN_2O)

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 8	**Project campaign 9**
$NCSG_{BL}$	mg/Nm³	1725.20	1764.44
QAL2 NCSG		0.97	0.97
VSG_{BL}	Nm³/h	42983	42983
QAL2 VSG		0.96	0.96
OH_{BL}	h	1,474	1,474
NAP_{BL}	t HNO_3	17718.00	17718.00
BE	t N_2O	101.995	104.315
UNC		4.20	4.20
EF_{BL}	**kg N_2O/t HNO_3**	**5.51**	**5.64**
$NCSG_n$	mg/Nm³	84.08	113.25
QAL2 NCSG		0.97	0.97
VSG_n	Nm³/h	41780	39972
QAL2 VSG		0.96	0.96
OH_n	h	1,129	1,525
NAP_n	t HNO_3	13855.14	18595.80
PE_n	t N_2O	3.701	6.442
EF_n	kg N_2O/t HNO_3	0.27	0.35
$EF_{ma,n}$	kg N_2O/t HNO_3	1.51	1.38
EF_{min}	kg N_2O/t HNO_3	0.27	0.35
EF_p	**kg N_2O/t HNO_3**	**1.51**	**1.38**
NAPafter registration	**t HNO_3**	**13855.14**	**18595.80**
GWP	tCO_2e/tN_2O	310	310
ER	**tCO_2e**	**17216**	**24573**
Total ER for the monitoring period		**41789 t CO2e**	

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

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This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	**116,779 tonnes CO_2e per year i. e 66,228 for a period of 207 days**	**41,789 tonnes CO_2e during the monitoring period (207 days)**

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

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The achieved amount of emission reductions during this monitoring period is 41,789 tonnes of CO_2e and therefore lower than the estimated amount according to the PDD. The reason for this is a considerably lower nitric acid production compared to the estimations in the PDD.

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History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.

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Document Type: Guideline, Form
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