

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

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

MONITORING REPORT
version 5 04/01/2012

Sasol Nitrous Oxide Abatement Project
UNFCCC reference number: 0961
Third monitoring period from 10/08/2008 to 3/08/2009

SECTION A. General description of the project activity

A.1. Brief description of the project activity: >>

The project activity takes place at two nitric acid plants owned by Sasol Nitro, Sasolburg and Secunda and involves the installation of a secondary catalyst to abate N₂O inside the ammonia burner once it is formed.

Nitrous oxide (N₂O) is an undesired by-product gas from the manufacture of nitric acid. Nitrous oxide is formed during the catalytic oxidation of ammonia. Over a suitable catalyst, a maximum 98% (typically 92-96%) of the ammonia fed is converted to nitric oxide (NO). The remainder participates in undesirable side reactions that lead to the production of nitrous oxide, among other compounds. Waste N₂O from nitric acid production is typically released into the atmosphere, as it does not have any economic value or toxicity at typical emission levels. N₂O is an important greenhouse gas which has a high global warming potential (GWP) of 310.

Sasolburg and Secunda plants installed a secondary catalyst beneath the primary one, inside the ammonia burner, which destroys the N₂O transforming it into N₂ and O₂. In order to monitor the emissions, the plants installed an Automated Monitoring System (AMS) at the stack, consisting of an Infrared Gas Analyzer and a Gas Flow meter.

Relevant dates for the project activity:

Registration date: May 25, 2007

Crediting period: May 25, 2007 to May 24, 2014 (7 years, renewable)

Relevant dates for Sasolburg plant:

Baseline campaign took place: between June 12, 2006 and March 5, 2007.

First project campaign took place from March 7, 2007 to October 1, 2007.

Second project campaign took place from October 3, 2007 to April 5, 2008.

Third project campaign took place from April 21, 2008 to December 7, 2008.

Fourth project campaign took place from December 11, 2008 to August 3, 2009

Relevant dates for Secunda plant:

Baseline campaign took place from August 29, 2006 and March 23, 2007.

First project campaign took place from April 18, 2007 to January 5, 2008.

Second project campaign took place from January 12, 2008 to August 9, 2008.

Third project campaign took place from August 31, 2008 to April 26, 2009.

Fourth project campaign took place from May 1, 2009 to January 31, 2010.

This monitoring report involves project activity from: August 10, 2008 to August 3, 2009 (both days included). The abovementioned period splits as follows:

Sasolburg plant:

- Part of the -third project campaign- from August 10, 2008 to Dec 7, 2008
- Fourth project campaign- from December 11, 2008 to August 3, 2009

Secunda plant:

- Third project campaign- from August 31, 2008 to April 26, 2009.
- Part of the fourth project campaign- from May 1, 2009 to August 3, 2009.

Total emission reductions achieved in this monitoring period: 489,639 tonne CO₂e

A.2. Project Participants

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Name of Party involved	Project participant (as applicable)	Party involved considered as project participant
United Kingdom	MGM Carbon Portfolio S.a.r.l	No
Republic of South Africa (host)	Sasol Nitro, a division of Sasol Chemical Industries Limited. Private entity. Project Developer.	No
Republic of South Africa (host)	Sasol Financing (Pty) Limited	No

A.3. Location of the project activity:

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The project activity takes place at Sasolburg and Secunda nitric acid plants.

Sasolburg plant is located in cnr Bunsen and Bergius street, Sasolburg 1974, (S26°49.542' E027°51.609') Free State, Republic of South Africa.

Secunda plant is located in Sasol Nitro, Nitrogen Road, Secunda, 2302 (S26°35'30.80", E29°10'55.79") Mpumalanga, Republic of South Africa.

A.4. Technical description of the project

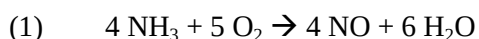
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The Ostwald process

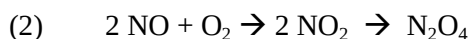
Nowadays, all commercial Nitric Acid is produced by the oxidation of ammonia, and subsequent reaction of the oxidation products with water, through the Ostwald process.

The basic Ostwald process involves 3 chemical steps:

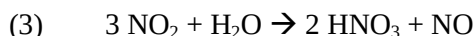
A) Catalytic oxidation of ammonia with atmospheric oxygen, to yield Nitrogen Monoxide (or Nitric Oxide).



B) Oxidation of the Nitrogen Monoxide to Nitrogen Dioxide or Dinitrogen Tetroxide



C) Absorption of the Nitrogen Oxides with water to yield Nitric Acid



Reaction 1 is favored by lower pressure and higher temperature. Nevertheless, at too high temperature, secondary reactions take place that lower yield (affecting nitric production); then, an optimal is found between 850-950 °C, affected by other process conditions and catalyst chemical composition (figure 1)¹. Reactions 2 and 3 are favored by higher pressure and lower temperatures.

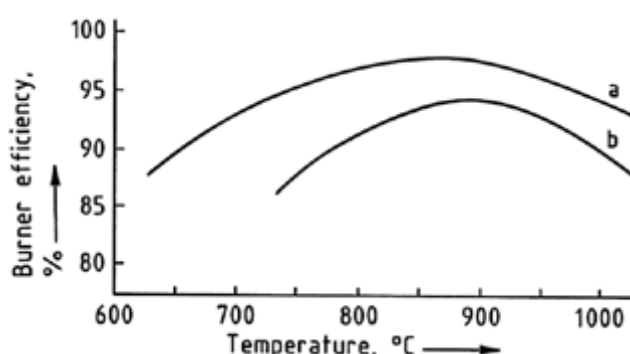


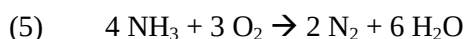
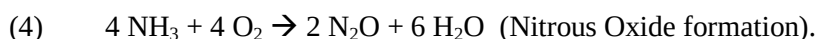
Figure 1. Conversion of Ammonia to Nitrogen Monoxide on Platinum Gauze as a function of temperature a) 100 kPa; (b) 400 kPa [1]

The way in which these three steps are implemented, characterizes the various Nitric Acid processes found throughout the industry. In mono pressure or single pressure processes ammonia combustion and nitrogen oxide absorption take place at the same working pressure. In dual pressure or split pressure plants the absorption pressure is higher than the combustion pressure.

Nitrous Oxide formation

Nitrous oxide is formed during the catalytic oxidation of Ammonia. Over a suitable catalyst, a maximum 98% (typically 92-96%) of the fed Ammonia is converted to Nitric Oxide (NO) according to reaction (1) above. The remainder participates in undesirable side reactions that lead to Nitrous Oxide (N₂O), among other compounds.

Side reactions during oxidation of Ammonia:



N₂O abatement technology classification

¹ Thieman et al., "Nitric Acid, Nitrous Acid, and Nitrogen Oxides", *Ullmann's Encyclopedia of Industrial Chemistry 6th Edition*, Wiley-VCH Verlag GmbH & Co. KGaA. All rights reserved.

The potential technologies (proven and under development) to treat N_2O emissions at Nitric acid plants, have been classified as follows, based on the process location of the control device:

Primary: N_2O is prevented from forming in the oxidation gauzes.

Secondary: N_2O once formed, is eliminated anywhere between the outlet of the ammonia oxidation gauzes and the inlet of the absorption tower.

Tertiary: N_2O is removed at the tail gas, after the absorption tower and previous to the expansion turbine.

Quaternary: N_2O is removed following the expansion turbine, and before the stack.

Selected technology for the project activity

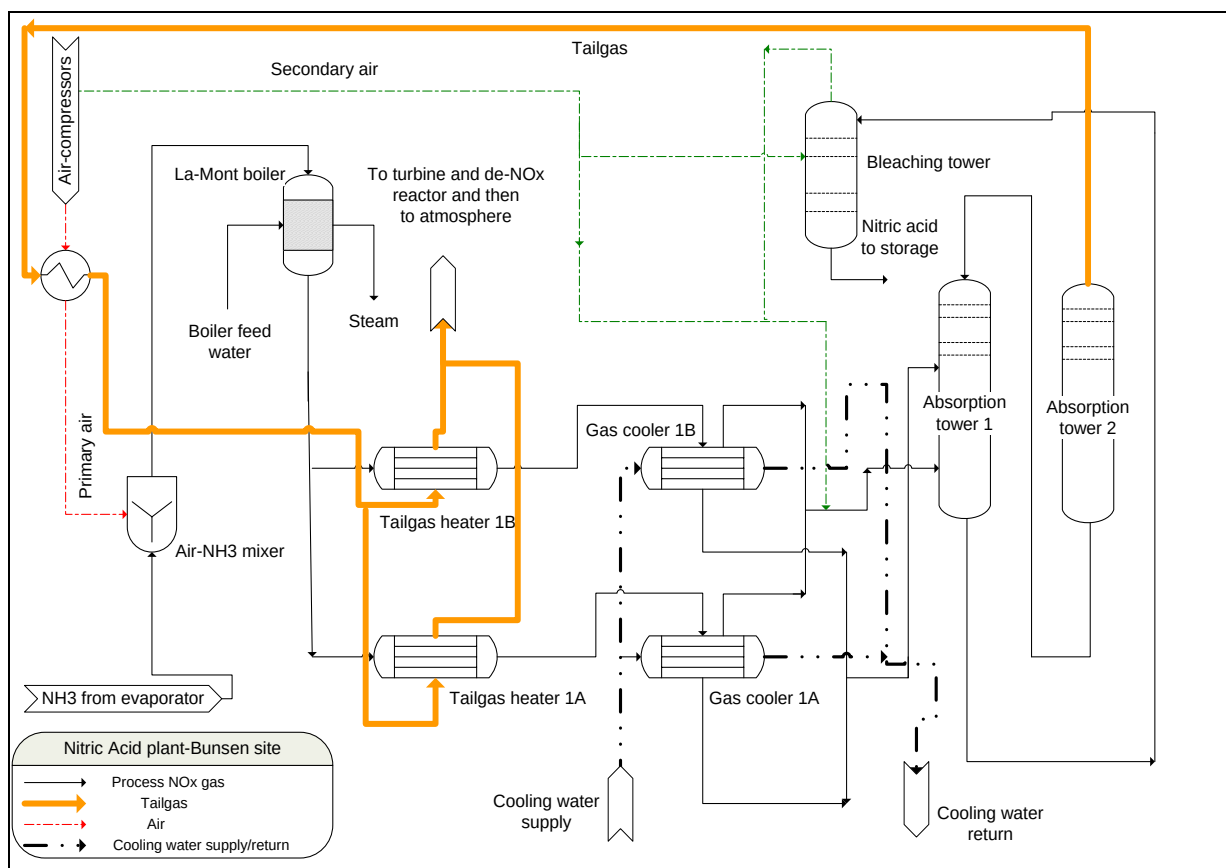
General description

The current project activity involves the installation of a new (not previously installed) catalyst below the oxidation gauzes (a “secondary catalyst”) whose sole purpose is the decomposition of N_2O ; the secondary approach has the following advantages:

- The catalyst does not consume electricity, steam, fuels or reducing agents (all sources of leakage) to eliminate N_2O emissions; thus, operating costs are negligible and the overall energy balance of the plant is not affected.
- Installation is extremely simple and does not require any new process unit or re-design of existing ones (only in a few cases, the reactor basket needs some minor modifications to accommodate the new catalyst).
- Installation is also very fast, so it is done simultaneously with a primary gauze changeover; thus, the plant has no loss in production due to incremental down time.
- Considerably lower capital cost when compared to other approaches.

Sasol’s plants installed a secondary catalyst developed by W.C. Heraeus GmbH (Hanau, Germany; hereinafter called “Heraeus”)

After extensive research, Heraeus has developed a “secondary” catalyst that decomposes N_2O without affecting Nitric Acid production. The active element of the catalyst is a proprietary coat of precious metals (the same elements already present in the oxidation gauzes) deposited over ceramic pieces made of alfa-alumina (a common reactor material used, for e.g., Raschig rings) of several shapes and sizes. The catalyst has a very high activity for N_2O decomposition; in a typical medium pressure plant, a catalyst weight of 30 kg/m² of cross sectional surface is sufficient to reduce N_2O concentration well below 100 ppmv. Theoretically, any given level of N_2O abatement can be reached, but in practice the abatement will be limited by practical and economical considerations. Heraeus secondary catalyst is not designed as catchment for precious metals, so it does not adsorb any material lost from the primary gauzes.



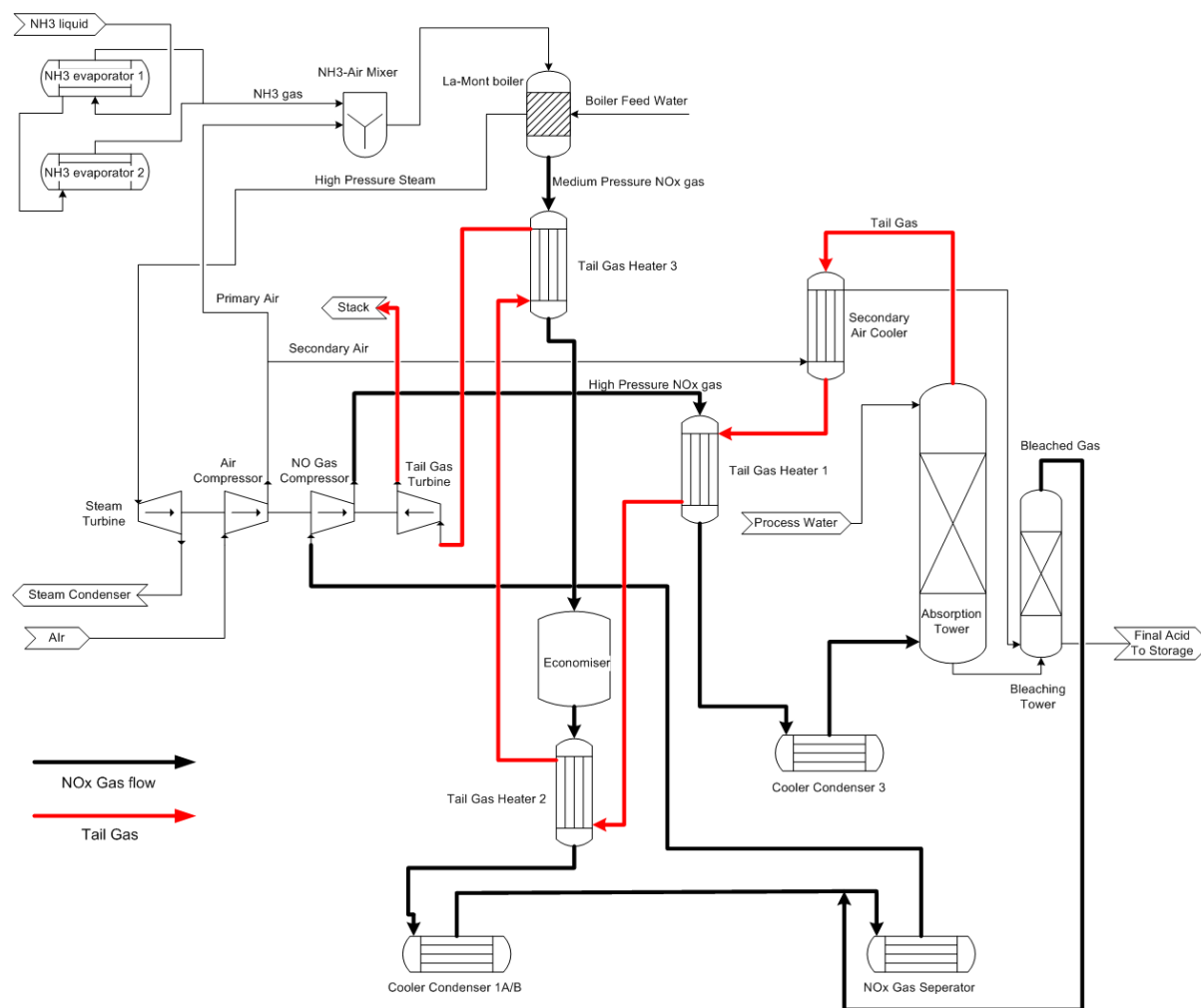


Figure 3 Secunda process flow diagram.

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

The selected methodology is AM0034 “Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants” version 02. (EB 27)

AM0028 “Catalytic reduction of N_2O in the tail gas of Nitric Acid or Caprolactam Productions Plants” is used to select the baseline scenario”.

The “Tool for the demonstration and assessment of additionality” version 02 (EB 22) is used to demonstrate additionality.

A.6. Registration date of the project activity:

CDM Registration

“Sasol Nitrous Oxide Abatement Project”.Ref. N° 0961.

Date of registration: May 25, 2007.

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

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The crediting period started on 25/05/2007. The length of the crediting period is 7 years, renewable.

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

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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

The project is fully implemented at both plants according to the description presented in the PDD.

All physical features of the proposed CDM project activity including data collecting systems and storage have been implemented in accordance with the registered PDD. The project activity is completely operational.

Nitric acid production has been undertaken since 1973 at Sasolburg plant and since 1984 at Secunda plant.

The first campaigns with the secondary catalyst installed started on:

- March 7, 2007 at Sasolburg plant
- April 18, 2007 at Secunda plant.

Event logs for the project campaigns

Secunda plant:

The following table contains the relevant events that occurred during third and fourth project campaigns.

Operation logbook

Date	Event	Impact on N2O data generation/acquisition OR N2O abatement performance	Reference Document
31-Aug-08	Plant trip	Plant trip - Partial data acquisition	Operations logbook
1-Sep-08	Plant Offline		Operations logbook
2-Sep-08	Plant Offline		Operations logbook

3-Sep-08	Plant Offline		Operations logbook
4-Sep-08	Plant startup	Plant startup - Partial data acquisition	Operations logbook
10-Sep-08	Plant Stop	Plant trip - Partial data acquisition	Operations logbook
From 11-Sep-08 to 17-Sep-08	Plant Offline	Plant offline - No data was acquired	Operations logbook
18-Sep-08	Plant startup		Operations logbook
From 20-Sep-08 to 24-Sep-08	Plant Offline		Operations logbook
25-Sep-08	Plant startup		Operations logbook
20-Oct-08	Plant trip		Operations logbook
21-Oct-08	Plant offline		Operations logbook
22-Oct-08	Plant startup		Operations logbook
From 1-Jan-09 to 6-Jan-09	Normal Operation	Analyser faulty	Operations logbook
12-Jan-09	Plant Offline		Operations logbook
13-Jan-09	Plant Offline		Operations logbook
14-Jan-09	Plant Offline		Operations logbook
15-Jan-09	Plant Offline		Operations logbook
From 22-Jan-09 to 2-Feb-09	Normal Operation	Analyser faulty	Operations logbook
3-Feb-09	Plant Offline		Operations logbook
4-Feb-09	Plant Offline		Operations logbook
5-Feb-09	Plant Offline		Operations logbook
6-Feb-09	Plant Offline		Operations logbook
1-May-09	Normal Operation	Plant startup - Partial data acquisition	Operations logbook
30-May-09	Plant Offline	Plant stopped 22 hours on line - Partial data acquisition	Operations logbook
From 31-May-09 to 25-Jun-09	Plant Offline	Shutdown	Operations logbook

26-Jun-09	Plant Offline	Start-up, plant tripped due to high vacuum 8 hours online, fault analyser	Operations logbook
27-Jun-09	Plant Offline	Start-up-fault analyser	Operations logbook
28-Jun-09	Normal Operation	Analyser faulty	Operations logbook
29-Jun-09	Normal Operation	Analyser faulty	Operations logbook
30-Jun-09	Plant Offline	Anti surge trip, Start-up online for 9 hours	Operations logbook
1-Jul-09	Plant Offline	High evaporator level trip, Start-up online for 17 hours	Operations logbook
15-Jul-09	Plant Offline	Solnoid on ammonia pressure controller froze	Operations logbook
18-Jul-09	Plant Offline	Plant trip: Thermocouple failure	Operations logbook
19-Jul-09	Plant Offline	Start-up	Operations logbook
20-Jul-09	Plant Offline	Plant trip: Instrument trip, surge on air compressor	Operations logbook
21-Jul-09	Plant Offline	Start-up	Operations logbook
9-Aug-09	Plant Offline	AmmoniumNitrate storage tank valves leaking plant online for 7.5 hours	Operations logbook
10-Aug-09	Plant Offline	AmmoniumNitrate storage tank valves leaking and plant startup online for 10.5 hours	Operations logbook
11-Aug-09	Normal Operation	Analyser faulty	Operations logbook
8-Sep-09	Plant Offline	Ratio trip on ammonia control online for 17 hours	Operations logbook
9-Sep-09	Plant Offline	Lamont repairs	Operations logbook
10-Sep-09	Plant Offline	Lamont repairs	Operations logbook
11-Sep-09	Plant Offline	Ammonia ratio trip online for 12.5 hours	Operations logbook
12-Sep-09	Plant Offline	Ratio trip tailgas turbine caught fire	Operations logbook
13-Sep-09	Plant Offline	Ratio trip tailgas turbine caught fire online for 23.25 hours	Operations logbook
20-Sep-09	Plant Offline	Quick release solenoid on blow off corroded online for 15 hours	Operations logbook
26-Oct-09	network failure	Analyser faulty	Operations logbook
31-Dec-09	Plant offline	Level indicator failure on cooler condensor online for 15.75 hours	Operations logbook
1-Jan-10	Plant offline	Tube leaks on Lamont Boiler	Operations logbook

2-Jan-10	Plant offline	Tube leaks on Lamont Boiler	Operations logbook
3-Jan-10	Plant offline	Tube leaks on Lamont Boiler	Operations logbook
4-Jan-10	Plant offline	Tube leaks on Lamont Boiler	Operations logbook
5-Jan-10	Plant offline	Tube leaks on Lamont Boiler	Operations logbook
6-Jan-10	Calibration - Zero and Span checks	Tube leaks on Lamont Boiler	Operations logbook
7-Jan-10	Plant offline	Power failure on incoming supply 15 hours online	Operations logbook
31-Jan-10	Plant offline	catalyst change	Operations logbook

Sasolburg plant

The following table contains the relevant events that occurred during the third project campaign.

Date	Lost time	Event	Reference Document
24-Apr-08	4,5	Vibrations	Nox logbook Report
26-Apr-08	8,00	Vibrations	Nox logbook Report
27-Apr-08	22,5	Vibrations	Nox logbook Report
28-Apr-08	24,0	Vibrations	Nox logbook Report
29-Apr-08	0,15	Vibrations	Nox logbook Report
30-Apr-08	2,29	Vibrations	Nox logbook Report
01-May-08	3,26	Compressor Vibrations	Nox logbook Report
09-May-08	3,18	Cooling Water Flow	Nox logbook Report
22-May-08	0,20	Power Dip	Nox logbook Report
23-Jun-08	0,3	High Gauze Temp	Nox logbook Report
22-Aug-08	3,00	11KV Trip Plant	Nox logbook Report
16-Sep-08	2,00	NH3 pressure fall 201B	Nox logbook Report

24-Sep-08	0,00	Compressor Trip	Nox logbook Report
25-Sep-08	1,50	Compressor Trip	Nox logbook Report
26-Sep-08	7,00	Compressor Discharge	Nox logbook Report
18-Oct-08	7,50	Lighting Trip Compressor. Clean Oil Cooler	Nox logbook Report
26-Nov-08	4,33	HIC 106-Selonoid + Low Gauze Temp	Nox logbook Report
07-Dec-08	6,51	Shutdown New Catalyst, Gauzes & Basket	Nox logbook Report
08-Dec-08	24,00	Shutdown New Catalyst, Gauzes & Basket	Nox logbook Report
09-Dec-08	24,00	Shutdown New Catalyst, Gauzes & Basket	Nox logbook Report
10-Dec-08	24,00	Shutdown New Catalyst, Gauzes & Basket	Nox logbook Report
11-Dec-08	17,18	Shutdown New Catalyst, Gauzes & Basket	Nox logbook Report

The following table contains the relevant events that occurred during the fourth campaign.

Date	Lost time	Event	Reference Document
14-Dec-08	0,25	High Gauze Temp	Nox logbook Report
29-Dec-08	5,12	Compressor Tripped Out (Faulty cut off valves)	Nox logbook Report
30-Dec-08	3,10	Compressor Tripped Out (Faulty cut off valves)	Nox logbook Report
26-Jan-09	5,50	DCS HIC 106 - Software	Nox logbook Report
27-Jan-09	4,20	XV 105 - People doing lagging	Nox logbook Report
14-Feb-09	0,30	Trip Flow Ration Nap	Nox logbook Report
19-Mar-09	3,41	AN Factory Export pumps shaft broke	Nox logbook Report
20-May-09	9,20	Contractors damage electical feed cable to utilities building.	Nox logbook Report
24-May-09	2,00	Boiler feed water pump tripped	Nox logbook Report
03-Aug-09	8,50	Gauze Change	Nox logbook Report
04-Aug-09	24,00	Gauze Change	Nox logbook Report

05-Aug-09	24,00	Gauze Change	Nox logbook Report
06-Aug-09	24,00	Gauze Change	Nox logbook Report
07-Aug-09	24,00	Gauze Change	Nox logbook Report
08-Aug-09	16,50	Gauze Change	Nox logbook Report

B.2. Revision of the monitoring plan

The monitoring plan has not been revised.

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

No deviation applied to this monitoring period.

B.4. Notification or request of approval of changes

N.A.

SECTION C. Description of the monitoring system

The current CDM project “Sasol Nitrous Oxide Abatement Project” measures on a quasi-continuous basis (uninterrupted sampling of flue gases with concentration and normalized flow analysis on short, discrete time periods) the N₂O mass flow leaving the Nitric acid plant through an Automated Measuring System (AMS) using technologies and procedures in accordance with AM0034: “Catalytic reduction of N₂O inside the Ammonia burner of nitric acid plants”.

Both Sasolburg and Secunda plants are currently ISO 9001/2000 and ISO 14001/2004 certified. The monitoring procedures (deployed as per the current monitoring plan and being an integral part of it), are fully integrated into Sasol’s Quality and Environmental Management System. As a producer of fertilizers, explosives and related products, Sasol Nitro management and staff are committed to comply with the requirements of the ISO 9001:2000 Quality Management System and to continually improve the effectiveness of the system.

The proposed CDM project is closely monitored, metered and recorded. The management and operation of the nitrous oxide abatement project at the two Sasol plants are the responsibility of each plant. The emission reductions are verified by an independent entity, the Designated Operational Entity (DOE). A regular reporting of the emission reductions generated by the project is sent to the CERs owner, coincidentally with the DOE verification.

An illustrative scheme of the operational and management structure that monitor the proposed CDM project activity is as follows:

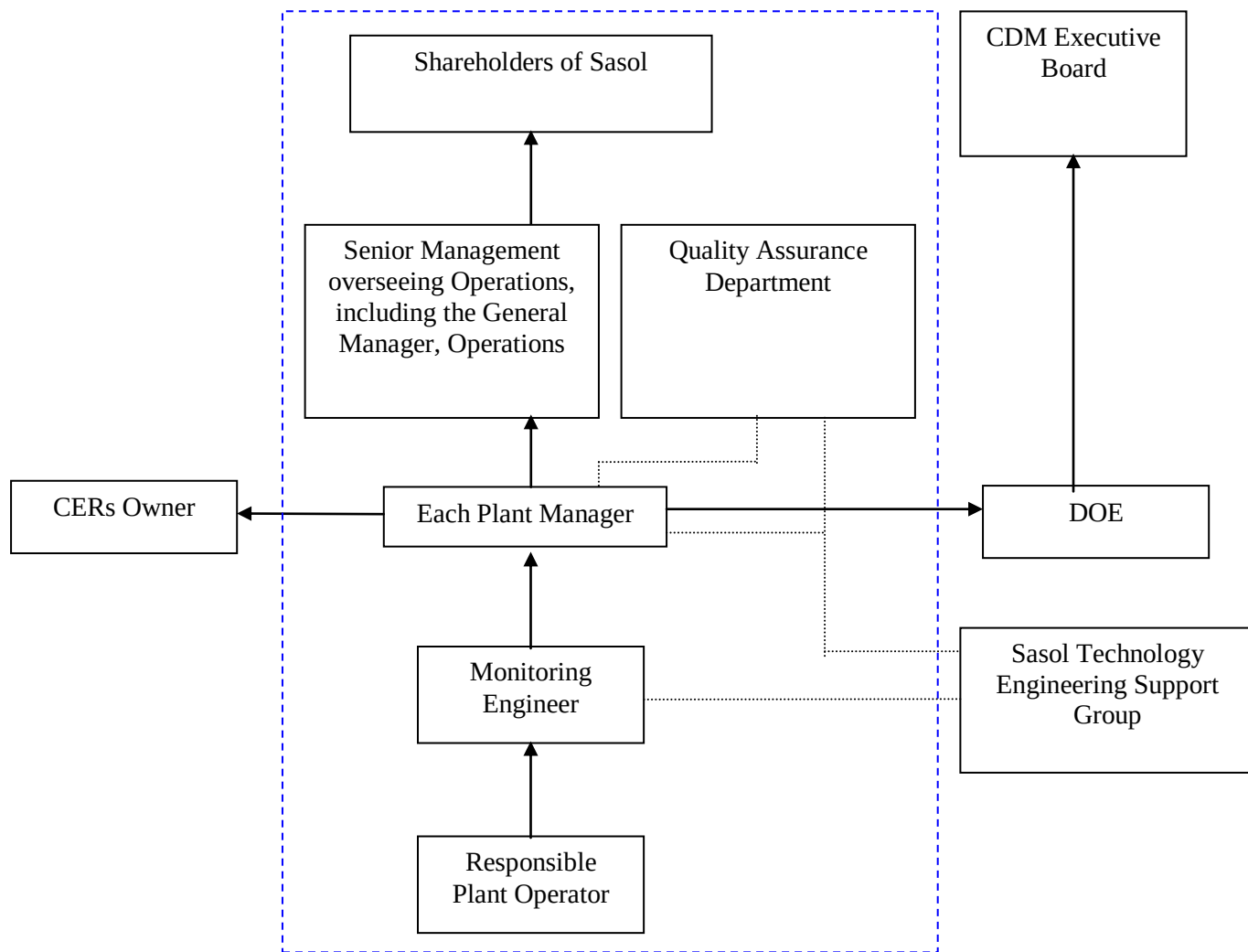


Figure 4: Scheme of operational and management structure

Note: the dashed line shows the operational and management structure boundaries of the project.

The relation between the project operational and management structure, and other actors of the CDM project activity, is as follows:

- At each plant, the responsible Plant Operator is in charge of the supervision of automated measuring system (AMS) and the data acquisition system (DAS) that are installed to measure and acquire both emission and process data. Supported by the DAS, the Plant Operator reports the relevant data to the Monitoring Engineer.
- The Monitoring Engineer is a member of the plant staff structure that is also in charge of processing the data generated by the data acquisition system. The Monitoring Engineer receives the relevant plant data from the responsible Plant Operator. These data are entered into a spreadsheet especially designed for the monitoring plan. The Project Developer supports the Monitoring Engineer at analyzing data and assures appropriate and consistent procedural application during report preparation.
- The Plant Manager of the respective plant is responsible to ensure that the CDM project activity at plant level is implemented in compliance with the PDD and other relevant standards. The Plant Manager routinely reports to the General Manager Operations as to the overall progress of the CDM project activity. At any time that the Plant Manager wants or needs to follow the implementation of the CDM project activity, he/she asks for a report from the Monitoring Engineer. For every single period, the Plant Manager sends a report which basically is the monitoring plan spreadsheet to the CERs owner, as well as to the corresponding DOE.

- Sasol Technology Engineering Support Group can at any time be used as a support function to the Monitoring Engineer in case of personnel loss or changes. The relevant Plant Manager and QA Department also have Sasol Technology available as a resource for assistance when required.
- The DOE then send the corresponding verification report to the CDM Executive Board in order to evaluate it and enable the issuance of the CERs.
- Shareholders of Sasol Nitro also receive a copy of the report sent to the DOE annually from the plant manager.

Description of the AMS

Both Sasolburg and Secunda plants have installed continuous gas analyzers model AO2000 from the supplier ABB, while the specific module to measure N₂O is a non-dispersive infrared instrument called URAS 14.

For stack flow measurement, Sasolburg plant has installed an ultrasound principle unit, model Flowsick 100 manufactured by Sick and Secunda plant has installed an Annubar principle (multiple pressure differential) unit, model 3095 manufactured by Rosemount Inc. (USA).

Good monitoring practice and performance characteristics

The European Norm EN 14181:2004 is recommended as guidance regarding the selection, installation and operation of the AMS under Monitoring Methodology AM0034, and stipulates three quality assurance levels (QALs):

QAL1: Suitability of the AMS for the specific measuring task

The EN 14181: 2004 QAL1 reports were provided by the equipment manufacturers considering the performance characteristics as measured by a qualified technical inspection authority and the specific installation characteristics and site conditions at each plant. The QAL1 reports confirmed that the N₂O analyzers (in both cases an AO 2000- URAS 14 NDIR supplied by ABB GmbH) are suitable for performing the indicated analysis (N₂O concentration). Reports were audited during validation and are available at the sites for future audits.

QAL2: Validation of the AMS following its installation

QAL2 describes a procedure for the determination of the calibration function and its variability, by means of a certain number of parallel measurements, performed with a standard reference method. The testing laboratory performing the measurements with the standard reference method shall have an accredited quality assurance system according to EN ISO/IEC 17025 or relevant (national) standards.

QAL2 tests were performed in 2007, at both plants by SGS Environmental Services (ISO 17025 certified lab). The QAL2 reports are available for DOE review. The reports conclude that the monitoring systems at both plants comply with QAL1 and QAL2 demands of EN 14181.

In order to keep records of AMS data before and after QAL2 test as generated (unmanipulated data), the corrective formulae (calibration functions) were applied during data processing (with the aid of spreadsheets), meaning that calibration functions were not programmed on the distributed control system (DCS) of the plants (which function as data acquisition systems).

QAL3: Ongoing quality assurance during operation

QAL3 of EN 14181: 2004 checks for drift and precision, in order to demonstrate that the AMS is in control during its operations so that it continues to function within the required specification for

uncertainty. This is achieved by conducting periodic zero and span checks on the AMS, and evaluating results obtained using control charts. Results of periodic calibrations were analyzed graphically with the aid of Shewart charts. All monitoring equipment has been serviced and maintained according to the manufacturer's instructions and international standards by qualified personnel. Calibration and maintenance records are well kept at both Sasol plants and available for auditing purposes.

AST: annual surveillance test (AST)

The AST is a procedure to evaluate whether the measured values obtained from the AMS still meet the required uncertainty criteria, as evaluated during the QAL2 test. Just as with the QAL2, it also requires a limited number of parallel measurements using an appropriate standard reference method.

An AST was performed by SGS Environmental Services (ISO 17025 certified lab) at both plants in August 2008. The AST report is available for DOE review. The report concludes the following: The QA/QC system at both plants complies with the requirements of EN 14181 QAL3; all the analyzers passed the test of variance, suitability and linearity; the flow meters passed the test on variance and suitability; and data given by the instruments at the stack comply with the data registered in the data acquisition system.

Relevant monitoring points:

The following diagrams show the location of all relevant monitoring points.

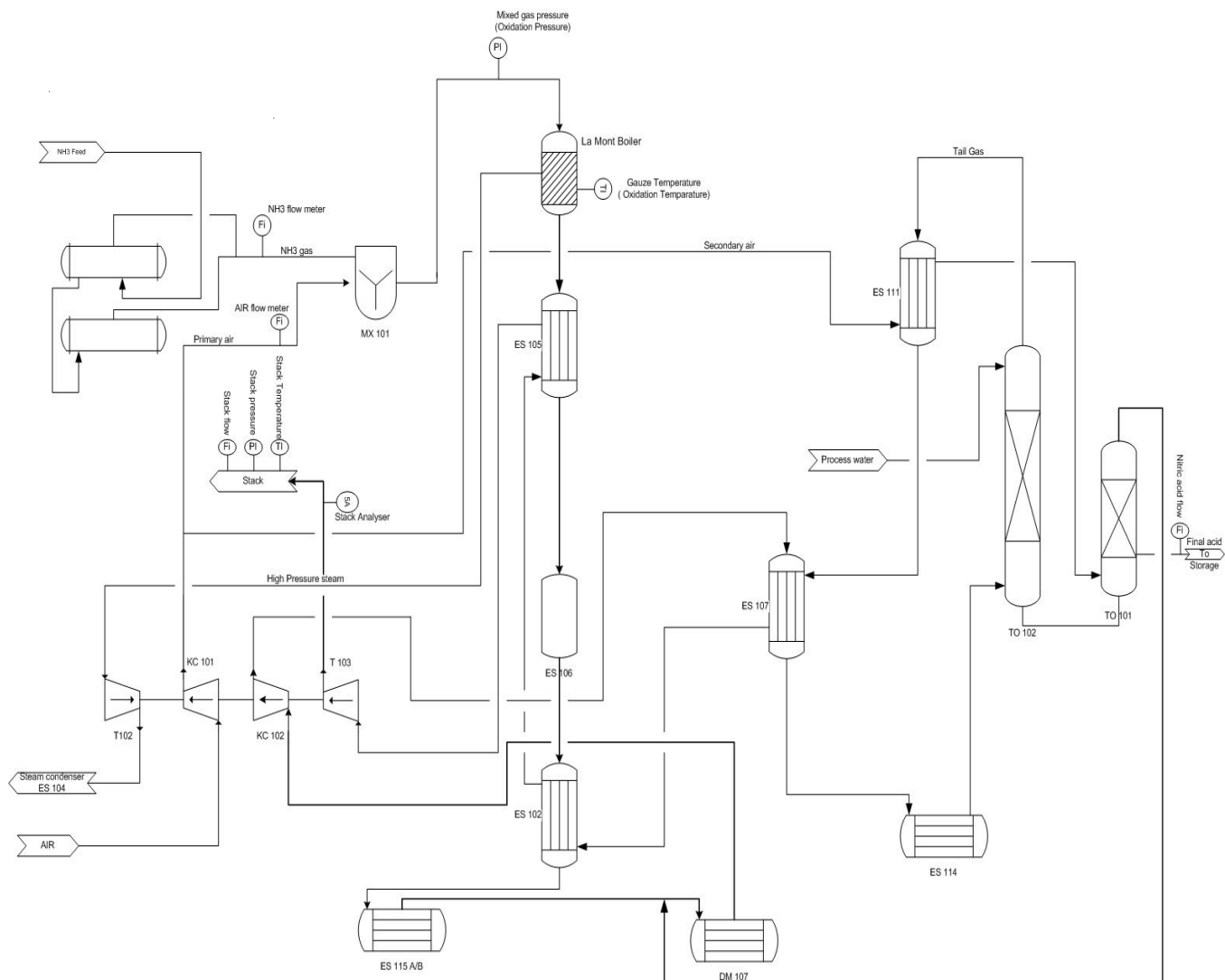


Figure 5: Location of monitoring points at Secunda plant.

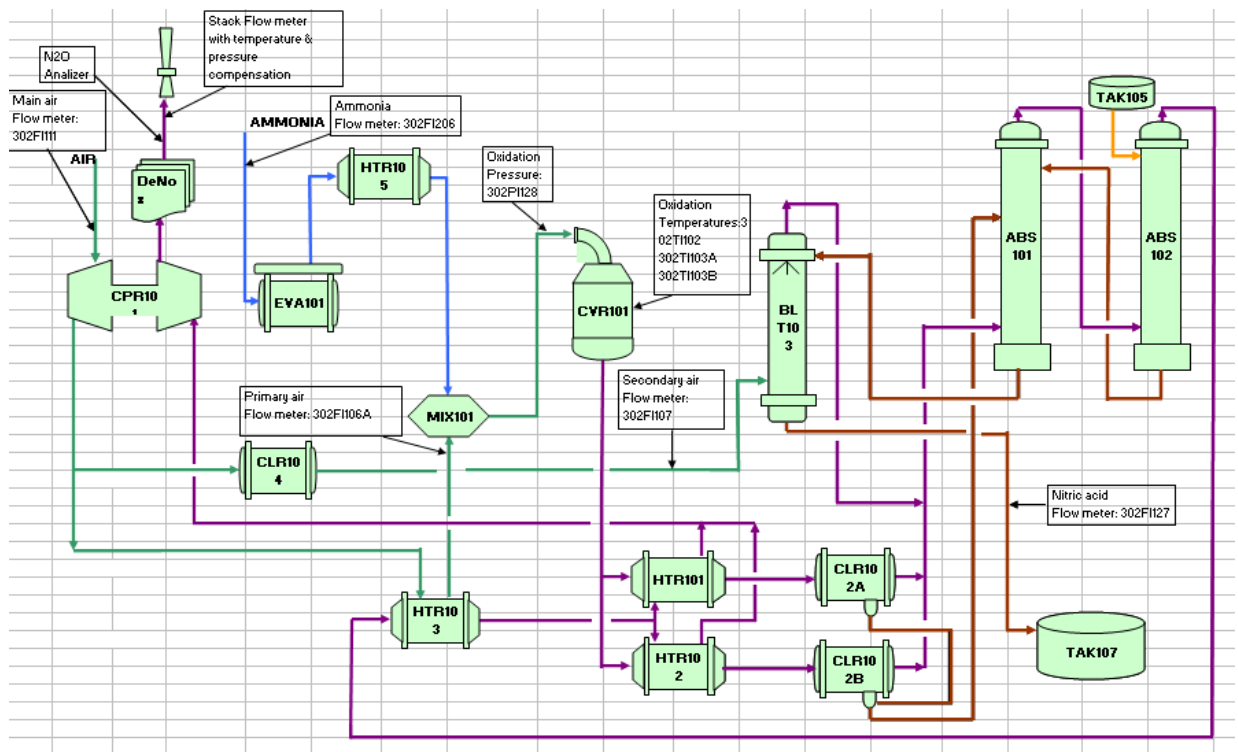


Figure 6: Location of monitoring points at Sasolburg plant

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. 11 AFR_{max}
Data unit:	kg NH ₃ /hour
Description:	Maximum Ammonia Flow Rate
Source of data used:	Specified by the ammonia oxidation catalyst manufacturer at both plants.
Value(s) :	For Sasolburg: 6,771 For Secunda: 10,630
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	None

Data / Parameter:	B. 14 CL_{normal}
Data unit:	tonne 100% HNO ₃
Description:	The normal campaign length is defined as the average campaign length for the historic campaigns used to define operating conditions (the previous 5 campaigns).
Source of data used:	Calculated from historical process data
Value(s) :	Sasolburg: 114,727 Secunda: 183,602
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and Project
Additional comment:	None

Data / Parameter:	B. 15 AIFR_{max}
Data unit:	kg NH ₃ /kg air
Description:	Maximum Ammonia to Air Flow Rate
Source of data used:	specified by the ammonia oxidation catalyst manufacturer at both plants
Value(s) :	For Sasolburg: 0.084 For Secunda: 0.063
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	None

Data / Parameter:	B. 17 OT_{normal}
Data unit:	°C
Description:	Normal Operating Temperature
Source of data used:	Calculated from historical process data (Sasolburg) and from plant design data (Secunda).
Value(s) :	For Sasolburg: 703- 884 For Secunda: 860-920

Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	Temperature range

Data / Parameter:	B. 19 OP_{normal}
Data unit:	Pa (abs)
Description:	Normal Operating Pressure
Source of data used:	Calculated from Plant design data for both plants.
Value(s) :	For Sasolburg: 370,000 – 450,000 For Secunda: 250,000 – 500,000
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	Pressure range

Data / Parameter:	B. 20 GS_{normal}
Data unit:	N.A.
Description:	Gauze supplier during operating condition campaigns (the previous five campaigns).
Source of data used:	Historical process data
Value(s) :	W.C. Heraeus
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and Project
Additional comment:	None

Data / Parameter:	B. 23 GC_{normal}
Data unit:	%
Description:	Gauze composition for the operation condition campaigns (the previous five campaigns).
Source of data used:	Historical process data
Value(s) :	For Secunda: Pt 54.0 to 55.0 %, Rh 3.5 to 3.8 %, Pd 41.0 to 43.0 % For Sasolburg: Pt 54.0 to 56.0 %, Rh 3.6 to 3.9 %, Pd 40.0 to 42.0%.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and Project
Additional comment:	None

D.2. Data and parameters monitored	
Data / Parameter:	P. 1 NCSG
Data unit:	mg N ₂ O/Nm ³ (converted from ppm if necessary)
Description:	N ₂ O concentration in the stack gas for the project campaign

Measured /Calculated /Default:	Measured		
Source of data:	AMS (infrared gas analyzer) at Sasolburg and Secunda plants.		
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 768 mg N ₂ O/ Nm ³ Secunda: 1271 mg N ₂ O/ Nm ³ <u>Fourth project campaign:</u> Sasolburg: 137 mg N ₂ O/ m ³ Secunda: 1007 mg N ₂ O/ m ³		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	Type	Infrared Gas Analyser	Infrared Gas Analyser
	Accuracy	2%	2%
	serial number	24031-0-331004300000	24031-0-331004300000
	calibration frequency	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)
	last calibration date	15/02/2007 (QAL2) 11/08/2008 ² (AST) 28/08/2009 ³ (AST)	20/02/2007 (QAL2) 07/08/2008 ² (AST) 26/08/2009 ³ (AST)
	Validity of QAL2	3 years	3 years
	In the reports of both AST (performed in 2008 and 2009), SGS, accredited laboratory, stated that the calibrations functions obtained at the QAL2 done in 2007 were still valid, and that the instruments had successfully been maintained. The delays had not any negative impact on the accuracy of measurements taken from the relevant instruments, and the ER calculation is not affected by them.		

² The registered PDD specified that the surveillance tests would be performed at least once every 3 years. Sasol Nitro was, at the time of Project registration, of opinion that surveillance tests every three years would be adequate considering the reliability of the instruments installed, and this has been validated by the corresponding DOE. The QAL2 test performed in 2007 confirmed the reliability of the instruments. It should be considered that there was not a suitable and accredited lab in South Africa to conduct QAL2 and ASTs, which implies that these services had to be acquired from Europe resulting in higher costs, problems on availability and larger time of scheduling. In 2008, when Sasol Nitro first acquired the services of TUV SUD for first verification, TUV SUD requested that Sasol Nitro should adopt the practice of conducting surveillance tests every year, which by then has become the norm in application of AM0034. Sasol Nitro was one of the first companies to apply AM0034 and final interpretation of some elements of this methodology became clearer after registration of Sasol Nitro's Project. Sasol Nitro agreed to TUV's requirement in 2008, which then lead to the AST being conducted in August 2008. The results of the QAL2 and AST's conducted to date confirm reliability of the instruments. Whilst some uncertainty on interpretation of AM0034 with Project registration, and lab availability, impacted the time frame between QAL2 and ASTs, there are no indications that this had any negative impact on the accuracy of measurements taken from the relevant instruments.

³ The delayed observed between both ASTs was due to European lab availability to perform the test.

Measuring/ Reading/ Recording frequency:	Every two seconds
Calculation method (if applicable):	N.A.
QA/QC procedures applied:	According to standard EN 14181. AST is done on an annual basis and QAL3 is done on a weekly basis.

Data / Parameter:	P.2 VSG		
Data unit:	Nm ³ /hour		
Description:	Volume flow rate in the stack gas for the project campaign		
Measured /Calculated /Default:	Measured		
Source of data:	AMS (flow meter) at Sasolburg and Secunda plants		
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 71,358 Nm ³ / hour Secunda: 108,397 Nm ³ / hour <u>Fourth project campaign:</u> Sasolburg: 72,180 Nm ³ / hour Secunda: 113,425 Nm ³ / hour		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	Type	Ultrasound principle device	ANNUBAR device (multiple pressure differential principle)
	Accuracy	1-5%	0.1%
	serial number	5428742	0135A
	calibration frequency	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)
	last calibration date	15/02/2007 (QAL2) 11/08/2008 (AST) ⁴ 28/08/2009 (AST) ⁵	20/02/2007 (QAL2) 07/08/2008 (AST) ⁴ 26/08/2009 (AST) ⁵
	Validity of QAL2	3 years	3 years
	In the reports of both AST (performed in 2008 and 2009), SGS, accredited laboratory, stated that the calibrations functions obtained at the QAL2 done in 2007 were still valid, and that the instruments had successfully been maintained. The delays had not any negative impact on the accuracy of measurements taken from the relevant instruments, and the ER calculation is not affected by them.		

⁴ Please, refer to footnote 2.

⁵ Please, refer to footnote 3.

Measuring/ Reading/ Recording frequency:	Every two seconds
Calculation method (if applicable):	N.A.
QA/QC procedures applied:	According to standard EN 14181. AST is done on an annual basis.

Data / Parameter:	P.3 N₂O emission of nth project campaign, PE_n
Data unit:	tonne N ₂ O
Description:	N ₂ O emission for project campaign
Measured /Calculated /Default:	Calculated
Source of data:	calculated from monitored data
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 295.56 tonne N ₂ O Secunda: 667.75 tonne N ₂ O <u>Fourth project campaign:</u> Sasolburg: 55.57 tonne N ₂ O Secunda: 639.74 tonne N ₂ O
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Once
Calculation method (if applicable):	Calculated using equation number 3 of AM0034 ver 02.
QA/QC procedures applied:	N.A.

Data / Parameter:	P. 4 OH
Data unit:	Hour
Description:	Total operating hours for the project campaign
Measured /Calculated /Default:	Measured
Source of data:	Process control system of Sasolburg and Secunda plants
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 5,394 hours Secunda: 4,846 hours <u>Fourth project campaign:</u> Sasolburg: 5,606 hours Secunda: 5,600 hours
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Daily
Calculation method (if applicable):	The distributed control system of the plant records effective operating time of the plant by monitoring periods time when both ammonia and air flows signals (coming from the devices installed to measure flow of both parameters) have reached their normal operational levels.
QA/QC procedures applied:	Critical instruments are calibrated on a routine basis according to the quality assurance system of the plant (ISO 9001).

Data / Parameter:	P. 5 NAP		
Data unit:	tonne 100% HNO ₃		
Description:	Total nitric acid production for the project campaign		
Measured /Calculated /Default:	Measured		
Source of data:	Production logs of Sasolburg and Secunda plants		
Value(s) of monitored parameter:	<u>Third Project campaign:</u> Sasolburg:121,814 tonne 100% HNO ₃ Secunda: 156,596 tonne 100% HNO ₃ <u>Fourth project campaign:</u> Sasolburg: 122,293 tonne 100% HNO ₃ Secunda: 196,248 tonne 100% HNO ₃		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	Type	Coriolis type mass flow measurement	Coriolis type mass flow measurement
	accuracy	0.1%	0.02%
	serial number	3747530(Transmitter) 12034695(Sensor)	C200BD20000
	calibration frequency	Yearly	exchange and check instrument with every gauge change as from 2009
	last calibration date	11-Apr-2008	18-Jan-2008
		23-Oct-2009	06-Jun-09
	validity	2 years	3 years
Measuring/ Reading/ Recording frequency:	Daily		
Calculation method (if applicable):	Daily production is measured by using a very accurate mass flow meter (Coriolis principle), and correcting by the average of several (3 to 5) concentration checkups performed in analytical lab.		
QA/QC procedures applied:	Mass balance at the end-product storage tanks is performed on a monthly basis; cross checking of production from mass balance with direct flow measurement is performed routinely. Critical instruments are calibrated on a routine basis according to the quality assurance system of the plant (ISO 9001).		

Data / Parameter:	P. 6 TSG		
Data unit:	°C		
Description:	Temperature of the stack gas during the project campaign		
Measured /Calculated /Default:	Measured		
Source of data:	AMS (Flow meter) at Sasolburg and Secunda plants.		
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 224°C Secunda: 99°C <u>Fourth project campaign:</u> Sasolburg: 222 °C Secunda: 96 °C		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	Type	I Temp PCP TMT 181	RTD
	accuracy	0.08%	0.10%
	serial number	6C039D 0411	Not accessible
	calibration frequency	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)
	last calibration date	15/02/2007 (QAL2) 11/08/2008 (AST) ⁶ 28/08/2009 (AST) ⁷	20/02/2007 (QAL2) 07/08/2008 (AST) ⁶ 26/08/2009 (AST) ⁷
	Validity of QAL2	3 years	3 years
	In the reports of both AST (performed in 2008 and 2009), SGS, accredited laboratory, stated that the calibrations functions obtained at the QAL2 done in 2007 were still valid, and that the instruments had successfully been maintained. The delays had not any negative impact on the accuracy of measurements taken from the relevant instruments, and the ER calculation is not affected by them.		
Measuring/ Reading/ Recording frequency:	Every two seconds		
Calculation method (if applicable):	N.A.		
QA/QC procedures applied:	According to standard EN 14181. AST is done on an annual basis.		

⁶ Please, refer to footnote 2.

⁷ Please, refer to footnote 3.

Data / Parameter:	P. 7 PSG		
Data unit:	Bar		
Description:	Pressure of the stack gas during the project campaign		
Measured /Calculated /Default:	Measured		
Source of data:	AMS (flow meter) at Sasolburg and Secunda plants		
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 0.851 bar Secunda: 0.869 bar <u>Fourth project campaign:</u> Sasolburg: 0.860 bar Secunda: 0.868 bar		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	Type	Rosemount type 3051	Pressure Transmitter
	accuracy	2%	0.10%
	serial number	1494518	Not accessible
	calibration frequency	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)
	last calibration date	15/02/2007 (QAL2) 11/08/2008 (AST) ⁸ 28/08/2009 (AST) ⁹	20/02/2007 (QAL2) 07/08/2008 (AST) ⁸ 26/08/2009 (AST) ⁹
	Validity of QAL2	3 years	3 years
	In the reports of both AST (performed in 2008 and 2009), SGS, accredited laboratory, stated that the calibrations functions obtained at the QAL2 done in 2007 were still valid, and that the instruments had successfully been maintained. The delays had not any negative impact on the accuracy of measurements taken from the relevant instruments, and the ER calculation is not affected by them.		
Measuring/ Reading/ Recording frequency:	Every two seconds		
Calculation method (if applicable):	N.A.		
QA/QC procedures applied:	According to standard EN 14181. AST is done on an annual basis.		

⁸ Please refer to footnote 2.

⁹ Please, refer to footnote 3

Data / Parameter:	P. 8 EF_n
Data unit:	tonne N ₂ O / tonne 100% HNO ₃
Description:	Project emission factor calculated from monitored data for the project campaign
Measured /Calculated /Default:	Calculated
Source of data:	calculated from monitored data
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 0.00243 tonne N ₂ O / tonne 100% HNO ₃ . Secunda: 0.00426 tonne N ₂ O / tonne 100% HNO ₃ . <u>Fourth project campaign:</u> Sasolburg: 0.00045 tonne N ₂ O / tonne 100% HNO ₃ . Secunda: 0.00326 tonne N ₂ O / tonne 100% HNO ₃ .
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Once
Calculation method (if applicable):	Calculated using equation number 4 of AM0034 ver 02.
QA/QC procedures applied:	N.A.

Data / Parameter:	P. 9 EF_{ma,n}
Data unit:	tonne N ₂ O/tonne 100% HNO ₃
Description:	Moving average emission factor
Measured /Calculated /Default:	Calculated
Source of data:	Calculated from campaign emission factors
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 0.00169 tonne N ₂ O / tonne 100% HNO ₃ . Secunda: 0.00279 tonne N ₂ O / tonne 100% HNO ₃ . <u>Fourth project campaign:</u> Sasolburg: 0.00138 tonne N ₂ O / tonne 100% HNO ₃ . Secunda: 0.00291 tonne N ₂ O / tonne 100% HNO ₃
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Calculated at the end of each project campaign
Calculation method (if applicable):	Calculated using equation number 5 of AM0034 ver 02.
QA/QC procedures applied:	N.A.

Data / Parameter:	P. 12 CL_n
Data unit:	tonne 100% HNO ₃
Description:	The project campaign length for the <i>n</i> th campaign (CL _n) is defined as the nitric acid produced during the <i>n</i> th campaign (see project nitric acid production).
Measured /Calculated /Default:	Calculated
Source of data:	Sasolburg and Secunda production log books.
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 121,814 tonnes HNO ₃ Secunda: 156,596 tonnes HNO ₃ <u>Fourth project campaign:</u> Sasolburg: 122,293 tonne 100% HNO ₃ Secunda: 196,248 tonne 100% HNO ₃
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Calculated once at the end of the project campaign
Calculation method (if applicable):	Daily production is measured by using a volume flow meter (Coriolis principle), and correcting by the average of several (3 to 5) concentration checkups performed in analytical lab
QA/QC procedures applied:	Mass balance at the end-product storage tanks is performed on a monthly basis; cross checking of production measured by mass balance vs direct flow measurement is performed routinely on both plants. Critical instruments are calibrated on a routine basis according to the quality assurance system of the plant (ISO 9001).

Data / Parameter:	P. 13 EF_p
Data unit:	tonne N ₂ O/tonne 100% HNO ₃
Description:	Emission factor used to calculate the emission from the particular campaign.
Measured /Calculated /Default:	Calculated
Source of data:	Calculated using campaign emission factors.
Value(s) of monitored parameter:	<u>Third project campaign:</u> Sasolburg: 0.00243 tonne N ₂ O / tonne 100% HNO ₃ . Secunda: 0.00426 tonne N ₂ O / tonne 100% HNO ₃ <u>Fourth project campaign:</u> Sasolburg: 0.00138 tonne N ₂ O / tonne 100% HNO ₃ Secunda: 0.00326 tonne N ₂ O / tonne 100% HNO ₃
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration	N.A.

frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	Calculated at the end of each project campaign
Calculation method (if applicable):	Calculated using campaign emission factors (using equation 6 of AM0034 ver 02.). EF_p will be determined as the higher of $EF_{ma,n}$ and EF_n .
QA/QC procedures applied:	N.A.

Data / Parameter:	P. 14 EF_{min}
Data unit:	tonne N_2O /tonne 100% HNO_3
Description:	Lowest EF_n observed during the first 10 campaigns
Measured /Calculated /Default:	Calculated
Source of data:	Calculated from monitoring data
Value(s) of monitored parameter:	N.A.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	After first ten campaigns of the project crediting period
Calculation method (if applicable):	N.A.
QA/QC procedures applied:	N.A.

Data / Parameter:	B. 1 $NCSG_{BC}$		
Data unit:	mg N_2O /Nm ³ (converted from ppm if necessary)		
Description:	Mean concentration of N_2O in the stack gas for the baseline campaign		
Measured /Calculated /Default:	Measured		
Source of data:	AMS (infrared gas analyzer) of Sasolburg and Secunda plants		
Value(s) of monitored parameter:	Sasolburg: 3,085 mg N_2O / Nm ³ Secunda: 1,474 mg N_2O / Nm ³ Value applied for Third project campaign at Secunda plant: 1,445 mg N_2O / Nm ³		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	type	Infrared Gas Analyser	Infrared Gas Analyser
	accuracy	2%	2%
	serial number	24031-0-331004300000	24031-0-331004300000

	calibration frequency	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)
	last calibration date	15/02/2007 (QAL2) 11/08/2008 (AST) ¹⁰ 28/08/2009 (AST) ¹¹	20/02/2007 (QAL2) 07/08/2008 (AST) ¹⁰ 26/08/2009 (AST) ¹¹
	Validity of QAL2	3 years	3 years
	In the reports of both AST (performed in 2008 and 2009), SGS, accredited laboratory, stated that the calibrations functions obtained at the QAL2 done in 2007 were still valid, and that the instruments had successfully been maintained. The delays had not any negative impact on the accuracy of measurements taken from the relevant instruments, and the ER calculation is not affected by them.		
Measuring/ Reading/ Recording frequency:	Every two seconds		
Calculation method (if applicable):	N/A		
QA/QC procedures applied:	According to standard EN 14181. AST is done on an annual basis and QAL3 is done on a weekly basis.		

Data / Parameter:	B. 2 VSG_{BC}		
Data unit:	Nm ³ /hour		
Description:	Mean gas volume flow rate in the stack gas during the baseline campaign		
Measured /Calculated /Default:	Measured		
Source of data:	AMS (flow meter) at Sasolburg and Secunda plants		
Value(s) of monitored parameter:	Sasolburg: 71,377 Nm ³ /h Secunda: 116,409 Nm ³ /h		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	type	Ultrasound principle device	ANNUBAR device (multiple pressure differential principle)
	accuracy	1-5%	0.1%
	serial number	5428742	0135A
	calibration frequency	QAL2 : Every 3 years	QAL2 : Every 3

¹⁰ Please, refer to footnote 2.

¹¹ Please, refer to footnote 3.

		AST : Annually (it is not performed the years when QAL2 is performed)	years AST : Annually (it is not performed the years when QAL2 is performed)
	last calibration date	15/02/2007 (QAL2) 11/08/2008 (AST) ¹² 28/08/2009 (AST) ¹³	20/02/2007 (QAL2) 07/08/2008 (AST) ¹² 26/08/2009 (AST) ¹³
	Validity of QAL2	3 years	3 years
In the reports of both AST (performed in 2008 and 2009), SGS, accredited laboratory, stated that the calibrations functions obtained at the QAL2 done in 2007 were still valid, and that the instruments had successfully been maintained. The delays had not any negative impact on the accuracy of measurements taken from the relevant instruments, and the ER calculation is not affected by them.			
Measuring/ Reading/ Recording frequency:	Every two seconds		
Calculation method (if applicable):	N/A		
QA/QC procedures applied:	According to standard EN 14181. AST is done on an annual basis.		

Data / Parameter:	B. 3 Total N₂O emission during the baseline campaign, BE_{BC}
Data unit:	tonne N ₂ O
Description:	N ₂ O emission for Baseline campaign
Measured /Calculated /Default:	Calculated
Source of data:	Monitored data
Value(s) of monitored parameter:	Sasolburg: 1,307.8 tonne N ₂ O Secunda: 825.3 tonne N ₂ O Value applied for third project campaign: Secunda: 809.78 tonne N ₂ O
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Calculated at least once at the end after the baseline campaign
Calculation method (if applicable):	Calculated using equation number 1 of AM0034 ver 02.
QA/QC procedures applied:	N.A.

¹² Please refer to footnote 2.

¹³ Please, refer to footnote 3.

Data / Parameter:	B. 4 OH_{BC}
Data unit:	Hour
Description:	Total operating hours for the baseline campaign
Measured /Calculated /Default:	measured
Source of data:	Process control system of Sasolburg and Secunda plants
Value(s) of monitored parameter:	Sasolburg: 5,940 hours Secunda: 4,810 hours
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Daily
Calculation method (if applicable):	The distributed control system of each plant (Sasolburg and Secunda) record effective operating time of the plant by monitoring periods when the plants are producing nitric acid.
QA/QC procedures applied:	Operating time of the plant is cross checked against production logbook data. Critical instruments are calibrated on a routinely basis according to the quality assurance system of the plant (ISO 9001).

Data / Parameter:	B. 5 NAP_{BC}		
Data unit:	tonne 100% HNO ₃		
Description:	Total nitric acid production for the baseline campaign		
Measured /Calculated /Default:	Measured		
Source of data:	Production logs of Sasolburg and Secunda plants		
Value(s) of monitored parameter:	Sasolburg: 130,069 tonne 100%HNO ₃ Secunda: 172, 879 tonne 100% HNO ₃		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	Type	Coriolis type mass flow measurement	Coriolis type mass flow measurement
	accuracy	0.1%	0.02%
	serial number	3747530(Transmitter) 12034695(Sensor)	C200BD20000
	calibration frequency	Yearly	exchange and check instrument with every gauze change
	last calibration date	The equipment was installed new at the beginning of the baseline campaign	16-Aug-2006
		29-Sep-2007	20-Mar-2007
	validity	2 years	1 year

Measuring/ Reading/ Recording frequency:	Daily
Calculation method (if applicable):	Daily production is measured by using a very accurate mass flow meter (Coriolis principle), and correcting by the average of several (3 to 5) concentration checkups performed in analytical lab.
QA/QC procedures applied:	Mass balance at the end-product storage tanks is performed on a monthly basis; cross checking of production from mass balance with direct flow measurement is performed routinely. Critical instruments are calibrated on a routine basis according to the quality assurance system of the plant (ISO 9001).

Data / Parameter:	B. 6 TSG_{BC}		
Data unit:	°C		
Description:	Temperature of the stack gas during the baseline campaign		
Measured /Calculated /Default:	Measured		
Source of data:	AMS (flow meter) at Sasolburg and Secunda plants		
Value(s) of monitored parameter:	Sasolburg: 214.2°C Secunda: 95.5 °C		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	Type	I Temp PCP TMT 181	RTD
	accuracy	0.08%	0.10%
	serial number	6C039D 0411	Not accessible
	calibration frequency	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)
	last calibration date	15/02/2007 (QAL2) 11/08/2008 (AST) ¹⁴ 28/08/2009 (AST) ¹⁵	20/02/2007 (QAL2) 07/08/2008 (AST) ¹⁴ 26/08/2009 (AST) ¹⁵
	Validity of QAL2	3 years	3 years
	In the reports of both AST (performed in 2008 and 2009), SGS,		

¹⁴ Please, refer to footnote 2.

¹⁵ Please, refer to footnote 3.

	accredited laboratory, stated that the calibrations functions obtained at the QAL2 done in 2007 were still valid, and that the instruments had successfully been maintained. The delays had not any negative impact on the accuracy of measurements taken from the relevant instruments, and the ER calculation is not affected by them.
Measuring/ Reading/ Recording frequency:	Every two seconds
Calculation method (if applicable):	N/A
QA/QC procedures applied:	According to standard EN 14181. AST is done on an annual basis.

Data / Parameter:	B. 7 PSG_{BC}		
Data unit:	Bar		
Description:	Pressure of the stack gas during the baseline campaign		
Measured /Calculated /Default:	measured		
Source of data:	AMS (flow meter) at Sasolburg and Secunda plants		
Value(s) of monitored parameter:	Sasolburg: 0.841 bar Secunda: 0.868 bar		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	type	Rosemount type 3051	Pressure Transmitter
	accuracy	2%	0.10%
	serial number	1494518	Not accessible
	calibration frequency	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)	QAL2 : Every 3 years AST : Annually (it is not performed the years when QAL2 is performed)
	last calibration date	15/02/2007 (QAL2) 11/08/2008 (AST) ¹⁶ 28/08/2009 (AST) ¹⁷	20/02/2007 (QAL2) 07/08/2008 (AST) ¹⁶ 26/08/2009 (AST) ¹⁷
	Validity of QAL2	3 years	3 years
	In the reports of both AST (performed in 2008 and 2009), SGS, accredited laboratory, stated that the calibrations functions obtained at the QAL2 done in 2007 were still valid, and that the instruments had successfully been maintained.		

¹⁶ Please, refer to footnote 2.

¹⁷ Please, refer to footnote 3.

	The delays had not any negative impact on the accuracy of measurements taken from the relevant instruments, and the ER calculation is not affected by them.
Measuring/ Reading/ Recording frequency:	Every two seconds
Calculation method (if applicable):	N/A
QA/QC procedures applied:	According to standard EN 14181. AST is done on an annual basis.

Data / Parameter:	B. 8 EF_{BL}
Data unit:	tonne N ₂ O/tonne 100% HNO ₃
Description:	Baseline N ₂ O Emission Factor
Measured /Calculated /Default:	Calculated
Source of data:	Calculated from monitored data
Value(s) of monitored parameter:	Sasolburg: 0.00966 tonne N ₂ O / tonne 100% HNO ₃ . Secunda: 0.00457 tonne N ₂ O / tonne 100% HNO ₃ . Baseline emission factor for third project campaign at Secunda plant was recalculated according to project campaign length. Value applied is: 0.00448 tonne N ₂ O / tonne 100% HNO ₃ .
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Calculated once at the end of the baseline campaign
Calculation method (if applicable):	Calculated using equation number 2 of AM0034 ver 02.
QA/QC procedures applied:	N.A.

Data / Parameter:	B. 9 UNC
Data unit:	%
Description:	Overall Uncertainty of the Monitoring System.
Measured /Calculated /Default:	calculated
Source of data:	Calculated in the QAL2 test
Value(s) of monitored parameter:	For Sasolburg: 3.89% For Secunda: 4.14%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration	N.A.

frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	N.A.
Calculation method (if applicable):	Data obtained from QAL2 test carried out by SGS
QA/QC procedures applied:	N.A.

Data / Parameter:	B. 10 AFR		
Data unit:	kg NH ₃ /hour		
Description:	Ammonia Gas Flow Rate to AOR		
Measured /Calculated /Default:	Measured		
Source of data:	Process control system of Sasolburg and Secunda plants		
Value(s) of monitored parameter:	Sasolburg: 5,904 kg NH ₃ /hour Secunda: 9,187 kg NH ₃ /hour		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	type	orifice	differential pressure transmitter
	accuracy	5%	0.10%
	serial number	1526279 & 1526306 & 1458162	824567
	calibration frequency	Yearly	Yearly/ Main Shutdown
	last calibration date	29-Jun-2006	26-Aug-2006
		19-Jun-2007	04-Jan-2007
	validity	1 year	1 year
Measuring/ Reading/ Recording frequency:	Continuously		
Calculation method (if applicable):	At both plants, ammonia flow to oxidation reactor is tracked by a mass flow measuring device (orifice plate principle) with automatic pressure and temperature compensation; the signal from the device is acquired by the Distributed Control System and stored electronically at a given time interval.		
QA/QC procedures applied:	Overall mass balances of ammonia to the plant are performed on a monthly basis to cross check flows and overall conversion efficiency. Critical instruments are calibrated on a routinely basis according to the quality assurance system of the plant (ISO 9000).		

Data / Parameter:	B. 12 AIFR		
Data unit:	kg NH ₃ /kg air		
Description:	Ammonia to air flow ratio to the ammonia oxidation reactor		
Measured /Calculated /Default:	Measured		
Source of data:	Process control system of Sasolburg and Secunda plants		
Value(s) of monitored parameter:	Sasolburg: 0.061 kg NH ₃ /kg air Secunda: 0.061 kg NH ₃ /kg air		
Indicate what the data	Baseline		

are used for (Baseline/ Project/ Leakage emission calculations)			
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	type	orifice	differential pressure transmitter
	accuracy	5%	0.10%
	serial number	1526279 & 1526306 & 1458162	824567
	calibration frequency	Yearly	Yearly/ Main Shutdown
	last calibration date	29-Jun-2006	26-Aug-2006
		19-Jun-2007	04-Jan-2007
	validity	1 year	1 year
	type	orifice	differential pressure transmitter
	accuracy	5%	0.10%
	serial number	not identifiable	824567
	calibration frequency	Yearly	Yearly/ Main Shutdown
	last calibration date	29-Jun-2006	26-Aug-2006
		19-Jun-2007	04-Jan-2007
	validity	1 year	1 year
Measuring/ Reading/ Recording frequency:	Every hour		
Calculation method (if applicable):	Air flow to oxidation reactor is tracked by 2 mass flow measuring devices in series (orifice plate principle); the signal from the device is acquired by the Distributed Control System and stored electronically at a given time interval. The Ammonia to Air ratio is calculated based on the actual flow analysis from the individual streams.		
QA/QC procedures applied:	Overall mass balances of ammonia to the plant are performed on a routine basis to cross check flows and overall conversion efficiency.		

Data / Parameter:	B. 13 CL_{BL}
Data unit:	tonne 100% HNO ₃
Description:	Campaign length is defined as the total number of tonnes of nitric acid at 100% concentration produced with one set of gauzes.
Measured /Calculated /Default:	calculated
Source of data:	Plant production log book
Value(s) of monitored parameter:	Sasolburg: 130,069 tonne 100%HNO ₃ Secunda: 172, 879 tonne 100% HNO ₃
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.

Measuring/ Reading/ Recording frequency:	Calculated after the end of each campaign.
Calculation method (if applicable):	Daily production is measured by using a flow meter (Magnetic head principle), and correcting by the average of several (3 to 5) concentration checkups performed in analytical lab
QA/QC procedures applied:	Mass balance at the end-product storage tanks is performed on a monthly basis; cross checking of production measured by mass balance vs direct flow measurement is performed routinely on both plants. Critical instruments are calibrated on a routine basis according to the quality assurance system of the plant (ISO 9001).

Data / Parameter:	B. 16 OT _h			
Data unit:	°C			
Description:	Oxidation temperature of the ammonia reactor for each hour			
Measured /Calculated /Default:	Measured			
Source of data:	Process control system of Sasolburg and Secunda plants			
Value(s) of monitored parameter:	Sasolburg: 878°C Secunda: 870°C			
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline			
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda	
	type	Thermocouples (K-type)	Thermocouples (K-type)	
	accuracy	0.08%	0.10%	
	serial number	N/A	N/A	
	calibration frequency	Yearly	Yearly/ Main Shutdown	
	last calibration date	29-Jun-2006	26-Aug-2006	
		19-Jun-2007	04-Jan-2007	
	validity	1 year	1 year	
Measuring/ Reading/ Recording frequency:	Every hour			
Calculation method (if applicable):	N.A.			
QA/QC procedures applied:	New thermocouples are installed on a routine basis when required (off or open signal – meaning the unit is broken).			

Data / Parameter:	B. 18 OP_h			
Data unit:	Pa abs			
Description:	Oxidation pressure of the ammonia reactor for each hour			
Measured /Calculated /Default:	Measured			
Source of data:	Process control system of Sasolburg and Secunda plants			
Value(s) of monitored parameter:	Sasolburg: 400,000 Pa Secunda: 470,000 Pa			
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline			

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Plant	Sasolburg	Secunda
	type	Pressure transducer	Pressure transducer
	accuracy	2%	0.10%
	serial number	1526307	0423C2562941007001
	calibration frequency	Yearly	Yearly/ Main Shutdown
	last calibration date	29-Jun-2006	26-Aug-2006
		19-Jun-2007	04-Jan-2007
	validity	1 year	1 year
Measuring/ Reading/ Recording frequency:	Every hour		
Calculation method (if applicable):	N.A.		
QA/QC procedures applied:	Critical instruments are calibrated on a routine basis according to the quality assurance system of the plant (ISO 9001).		

Data / Parameter:	B. 21 GS_{BL}
Data unit:	N.A.
Description:	Procurement offices of Sasolburg and Secunda plants
Measured /Calculated /Default:	N.A.
Source of data:	Nitric acid plant procurement office
Value(s) of monitored parameter:	Sasolburg: W.C. Heraeus Secunda: W.C. Heraeus
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Once
Calculation method (if applicable):	N.A.
QA/QC procedures applied:	N.A.

Data / Parameter:	B. 22 GS_{project}
Data unit:	N.A.
Description:	Gauze supplier for the project campaign
Measured /Calculated /Default:	N.A.
Source of data:	Procurement offices of Sasolburg and Secunda Plants
Value(s) of monitored parameter:	For third and fourth project campaigns: Sasolburg: W.C. Heraeus Secunda: W.C. Heraeus
Indicate what the data are used for (Baseline/ Project/ Leakage emission)	Project

calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Once for each campaign
Calculation method (if applicable):	N.A.
QA/QC procedures applied:	N.A.

Data / Parameter:	B. 24 GC_{BL}
Data unit:	%
Description:	Gauze composition for the baseline campaign
Measured /Calculated /Default:	Information provided by the supplier.
Source of data:	Nitric acid plant procurement office and/or gauze supplier technical service department
Value(s) of monitored parameter:	Sasolburg: Pt 54.0 to 56.0 %, Rh 3.6 to 3.9 %, Pd 40.0 to 42.0%. Secunda: Pt 54.0 to 55.0 %, Rh 3.5 to 3.8 %, Pd 41.0 to 43.0 %
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	Once
Calculation method (if applicable):	N.A.
QA/QC procedures applied:	N.A.

Data / Parameter:	B. 25 GC_{project}
Data unit:	%
Description:	Gauze composition for the project campaign
Measured /Calculated /Default:	N.A.
Source of data:	Procurement offices of Sasolburg and Secunda plants
Value(s) of monitored parameter:	For third and fourth project campaign: Sasolburg: Pt 54.0 to 56.0 %, Rh 3.6 to 3.9 %, Pd 40.0 to 42.0%. Secunda: Pt 54.0 to 55.0 %, Rh 3.5 to 3.8 %, Pd 41.0 to 43.0 %
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.

Measuring/ Reading/ Recording frequency:	Once for each campaign
Calculation method (if applicable):	N.A.
QA/QC procedures applied:	N.A.

Data / Parameter:	B. 26 EF_{reg}
Data unit:	kg N ₂ O/tonne HNO ₃
Description:	Emission Level Set by Incoming Policies or Regulations, local and national regulations on N ₂ O and NO _x emissions
Measured /Calculated /Default:	
Source of data:	Local and national regulations
Value(s) of monitored parameter:	No local or national regulation has been introduced during the project period.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency:	To be recorded on date of introduction or change of regulation
Calculation method (if applicable):	N.A.
QA/QC procedures applied:	N.A.

The project does not generate any leakage.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

For baseline emission factor determination, N₂O concentration and gas volume flow were monitored throughout the baseline campaign. Hourly average readings for N₂O concentration and gas flow volume (calculated from data monitored every 2 seconds) were collected. Error readings (e.g. downtime or malfunction) and extreme values were eliminated from the output data series.

Normal operating condition determination

To ensure that data obtained during baseline campaign are representative of the actual GHG emissions from the source plant, a set of process parameters known to affect N₂O generation have been set on the basis of design data and the ammonia oxidation catalyst manufacturer. Those parameters, called by the methodology normal operating conditions, are: oxidation temperature, oxidation pressure, ammonia flow to the reactor and ammonia flow to air flow ratio.

Only those N₂O measurements taken when the plant was operating within the permitted range were considered in the calculation of baseline emissions.

After eliminating data measured when the plant was operating outside the permitted conditions, the following statistical procedure was applied.

- Calculated the sample mean ($\bar{x}$);
- Calculated the sample standard deviation (s);
- Calculated the 95% confidence interval (equal to 1.96 times the standard deviation);
- Eliminated all data that lay outside the 95% confidence interval;
- Calculated the new sample mean from the remaining values (volume of stack gas (VSG) and N_2O concentration of stack gas (NCSG)).

Then, baseline emissions were calculated using the following formulae:

$$BE_{BC} = VSG_{BC} \cdot NCSG_{BC} \cdot 10^{-9} \cdot OH_{BC}$$

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}} \left(1 - \frac{UNC}{100}\right)$$

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, in, tN ₂ O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm ³ /h
$NCSG_{BC}$	Mean concentration of N ₂ O in the stack gas in the baseline measurement period, in mg N ₂ O/Nm ³
OH_{BC}	Number of operating hours in the baseline measurement period, in h
EF_{BL}	Baseline emission factor, in tN ₂ O/tHNO ₃
NAP_{BC}	Nitric acid production during the baseline campaign, in tHNO ₃
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

Another parameter that is measured and must be compared with the normal value is the campaign length.

Normal campaign length (CL_{normal}) values are:

Sasolburg: 114,727 tonnes HNO₃

Secunda: 183,602 tonnes HNO₃

According to AM0034, the baseline campaign length must be lower than or equal to CL_{normal} .

In the case of a project campaign, the campaign length must be greater than or equal to CL_{normal} . If the project campaign length is shorter than CL_{normal} the baseline emission factor must be recalculated eliminating N₂O values obtained beyond CL_n . (This data treatment was clearly detailed in Annex 12 of EB51).

At Sasolburg plant the baseline campaign took place between June 12, 2006 and March 5, 2007.

EF_{BL} calculation was made using values of $NCSG_{BC}$ from June 12, 2006 to February 3, 2007 in order not to exceed normal campaign length.

To follow the calculations see the following spreadsheet:

- “Sasolburg Baseline Emission Factor rev3.xls”

At Secunda plant the baseline campaign took place between August 29, 2006 and March 23, 2007.

The third project campaign was shorter than normal campaign length. Hence, the EF_{BL} was recalculated using values of $NCSG_{BC}$ measured between August 29, 2006 and March 3, 2007.

To follow the calculations see the following spreadsheets:

- “Secunda Baseline Emission Factor Re Calculation for Third project campaign- ver 2.0.xls”
- “Secunda Baseline Emission Factor Calculation 15 April 08.xls”

Sasolburg plant:

Baseline emission factor

$$BE_{BC} = 71,377 \cdot 3,085 \cdot 10^{-9} \cdot 5,904 = 1307.8 \text{ tonne } N_2O$$

$$EF_{BL} = \frac{1307.8}{130,069} \left(1 - \frac{3.89}{100}\right) = 0.00966 \text{ tonne } N_2O / \text{ tonne } HNO_3$$

Secunda plant:

Baseline emission factor applied for third project campaign

$$BE_{BC} = 116,409 \cdot 1,445 \cdot 10^{-9} \cdot 4,810 = 808.96 \text{ tonne } N_2O$$

$$EF_{BL} = \frac{808.96}{172,879} \left(1 - \frac{4.14}{100}\right) = 0.00448 \text{ tonne } N_2O / \text{ tonne } HNO_3$$

Baseline emission factor applied for fourth project campaign

$$BE_{BC} = 116,409 \cdot 1,474 \cdot 10^{-9} \cdot 4,810 = 825.29 \text{ tonne } N_2O$$

$$EF_{BL} = \frac{825.29}{172,879} \left(1 - \frac{4.14}{100}\right) = 0.00457 \text{ tonne } N_2O / \text{ tonne } HNO_3$$

E.2. Project emissions calculation

For project emission factor determination, N_2O concentration and gas volume flow for each plant were monitored throughout the project campaign. Hourly average readings for N_2O concentration and gas volume flow (calculated from data monitored every 2 seconds) were collected. Error readings (e.g. downtime or malfunction) and extreme values were eliminated from the output data series. Next, the same statistical evaluation that was applied to the baseline data series was applied to the project data series.

The mean values of N_2O concentration at the stack gas and volume flow rate at the stack gas were used in the following formula (Eq. 3 from AM0034) to calculate project emissions:

$$PE_n = VSG_n \cdot NCSG_n \cdot 10^{-9} \cdot OH_n$$

$$EF_n = \frac{PE_n}{NAP_n}$$

Where

PE_n	Total project emissions of the nth campaign, in t N_2O
VSG_n	Mean stack gas volume flow rate for the nth project campaign, in Nm ³ /h
$NCSG_n$	Mean concentration of N_2O in the stack gas for the project campaign, in mg N_2O /Nm ³

OH_n	Number of operating hours in the project campaign, in h
EF_n	Emission factor calculated for the n^{th} campaign, in tN ₂ O/tHNO ₃
NAP_n	Nitric acid production in the n^{th} campaign, in t 100% HNO ₃

At Sasolburg plant the third and fourth project campaigns took place as follows:

Third project campaign: April 21, 2008 to December 7, 2008.

Fourth project campaign: December 11, 2008 to August 3, 2009.

At Secunda plant the third and fourth project campaigns took place as follows:

Third project campaign: August 31, 2008 to April 26, 2009.

Fourth project campaign: May 1, 2009 to January 31, 2010.

The amount of CERs requested in the present Monitoring Report includes partial third project campaign (from August 10, 2008 to December 7, 2008) and complete fourth project campaign of Sasolburg plant; complete third project campaign and partial fourth project campaign (from May 1, 2009 to August 3, 2009) of Secunda plant.

Derivation of a moving average emission factor

The methodology proposes the calculation of a moving average emission factor in order to take a conservative approach in emission reduction calculation. The maximum value between EF_n for the specific project campaign and the $EF_{ma,n}$ shall be used in the emission reduction calculation as EF_p emission factor.

$EF_{ma,n}$ is calculated as follows:

$$EF_{ma,n} = \frac{EF_1 + EF_2 + \dots + EF_n}{n} (\text{tonneN}_2\text{O} / \text{tonneHNO}_3)$$

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

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

Where

EF_n	Emission factor calculated for the n^{th} campaign, in tonne N ₂ O/tonne HNO ₃
$EF_{ma,n}$	Moving average (ma) emission factor after n^{th} campaign, including the current campaign, in tonne N ₂ O/tonne HNO ₃
n	Number of campaigns to date
EF_p	Emission factor that will be applied to calculate the emission reductions from this specific campaign, in tonne N ₂ O/tonne HNO ₃

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

Project Campaign Length

a) Longer Project Campaign

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 project campaign can be used for the calculation of EF.

b) Shorter Project Campaign

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 .

For third project campaign at Secunda plant $CL_n < CL_{normal}$, and then the EF_{BL} was re calculated accordingly.

Values obtained for both plants are:

Sasolburg plant

Third project campaign

$$PE_n = 71,358 \cdot 767.89 \cdot 10^{-9} \cdot 5,393.98 = 295.56 \text{ tonne } N_2O$$

$$EF_n = \frac{295.56}{121,814} = 0.00243 \text{ tonne } N_2O / \text{ tonne } HNO_3$$

$$EF_{ma,n} = \frac{0.00118 + 0.00147 + 0.00243}{3} = 0.00169 \text{ tonne } N_2O / \text{ tonne } HNO_3$$

As EF_n is higher than $EF_{ma,n}$, $EF_p = EF_n = 0.00243 \text{ tonne } N_2O / \text{ tonne } HNO_3$

Fourth project campaign

$$PE_n = 72,180 \cdot 137.3 \cdot 10^{-9} \cdot 5,606 = 55.57 \text{ tonne } N_2O$$

$$EF_n = \frac{55.57}{122,293} = 0.00045 \text{ tonne } N_2O / \text{ tonne } HNO_3$$

$$EF_{ma,n} = \frac{0.00118 + 0.00147 + 0.00242 + 0.00045}{4} = 0.00138 \text{ tonne } N_2O / \text{ tonne } HNO_3$$

As $EF_{ma,n}$ is higher than EF_n , $EF_p = EF_{ma,n} = 0.00138 \text{ tonne } N_2O / \text{ tonne } HNO_3$

Secunda plant

Third project campaign

$$PE_n = 108,397 \cdot 1,271 \cdot 10^{-9} \cdot 4,846 = 667.75 \text{ tonne } N_2O$$

$$EF_n = \frac{667.75}{156,596} = 0.00426 \text{ tonne } N_2O / \text{ tonne } HNO_3$$

$$EF_{ma,n} = \frac{0.00215 + 0.00197 + 0.00426}{3} = 0.00279 \text{ tonne } N_2O / \text{tonne } HNO_3$$

As EF_n is higher than $EF_{ma,n}$, $EF_p = EF_n = 0.00426 \text{ tonne } N_2O / \text{tonne } HNO_3$

Fourth project campaign

$$PE_n = 113,425 \cdot 1,007 \cdot 10^{-9} \cdot 5,600 = 639.74 \text{ tonne } N_2O$$

$$EF_n = \frac{639.74}{196,248} = 0.00326 \text{ tonne } N_2O / \text{tonne } HNO_3$$

$$EF_{ma,n} = \frac{0.00215 + 0.00197 + 0.00426 + 0.00326}{4} = 0.00291 \text{ tonne } N_2O / \text{tonne } HNO_3$$

As EF_n is higher than $EF_{ma,n}$, $EF_p = EF_n = 0.00326 \text{ tonne } N_2O / \text{tonne } HNO_3$

Complete project emission factor calculations are in the following documents:

- “Sasolburg Third project campaign (10 Aug 08 to 07 Dec 08)-ver 3.0.xls”
- “Sasolburg Fourth Project Campaign- ver 3.0.xls”
- “Secunda Third Project Campaign- ver 3.0.xls”
- “Secunda Fourth Project Campaign (1May 09 to 3Aug 09)- ver 3.0.xls”.

E.3. Leakage calculation

N.A.

E.4. Emission reductions calculation / table

As indicated, the present Monitoring Report involves the following period: From August 10, 2008 to August 3, 2009.

According to AM0034 version 2, the emission reductions for the project activity over a specific campaign are determined as follows:

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O}$$

Where

ER_n	Emission reductions of the project for the n th campaign, tCO ₂ e
EF_{BL}	Baseline emission factor, in tN ₂ O/tHNO ₃
EF_p	Project emission factor, applicable to the n th campaign, in tN ₂ O/tHNO ₃
NAP_n	Nitric acid production during the n th campaign of the project activity, in tHNO ₃
GWP_{N_2O}	Global warming potential of N ₂ O, set as 310 tCO ₂ e/tN ₂ O for the 1 st commitment period

Values obtained for the project are:

Sasolburg plant

Third project campaign

$$ER_n = (0.00966 - 0.00243) \cdot 63,848 \cdot 310 = 143,101 \text{ tonneCO}_2e$$

Fourth project campaign:

$$ER_n = (0.00966 - 0.001383) \cdot 122,293 \cdot 310 = 313,807 \text{ tonneCO}_2e$$

Secunda plant

Third project campaign

$$ER_n = (0.00448 - 0.00426) \cdot 156,596 \cdot 310 = 10,679 \text{ tonneCO}_2e$$

Fourth project campaign

$$ER_n = (0.00457 - 0.00326) \cdot 54,303 \cdot 310 = 22,052 \text{ tonneCO}_2e$$

Then, the total amount of emission reductions due to the implementation of the project activity during the monitoring period is:

$$ER = 143,101 + 313,807 + 10,679 + 22,052 = 489,639 \text{ tonneCO}_2e$$

Complete emission reduction calculations are in the following documents:

- “Sasolburg Third project campaign (10 Aug 08 to 07 Dec 08)-ver 3.0.xls”

- “Sasolburg Fourth Project Campaign- ver 3.0.xls”
- “Secunda Third Project Campaign- ver 3.0.xls”
- “Secunda Fourth Project Campaign (1May 09 to 3Aug 09)- ver 3.0.xls”.

Comment: The numbers included in this monitoring report were copied from the abovementioned spreadsheets.

The calculations in the spreadsheets were made using the values of each parameter informed by the plants, with all their significant figures.

Values of EF_{BL} and CERs were truncated and values of EF_n were rounded in order to obtain more conservative figures.

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

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO₂e)	Sasolburg plant: 515,837 Secunda plant: 444,485	Sasolburg plant: 456,908 Secunda plant: 32,731

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

The abovementioned amount of CERs was generated during the monitoring period, from August 10, 2008 to August 3, 2009.

The actual number of CERs generated during the monitoring period is lower than the number estimated in the PDD.

The reason for the difference is the following:

In the case of Sasolburg plant the actual abatement efficiency obtained was 75% during the third project campaign and 85% during the fourth project campaign. The amount of CERs in the PDD was estimated considering an abatement efficiency of the secondary catalyst of 90%.

This is the reason for the difference observed between the actual number of CERs and the estimated value.

The difference observed between the CERs estimated and actually obtained at Secunda plant is due to two reasons:

On the one hand, the annual production used in the ex-ante estimations was 290,000 ton HNO₃, which was greater than the amount actually produced during the monitoring period (210,899 ton HNO₃); on the other hand, the plant experienced some problems with the secondary catalyst which led to an abatement efficiency that was lower than expected.

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