

CDM Monitoring Report N°1

“Sasol Nitrous Oxide Abatement Project”
South Africa

UNFCCC Ref N° 0961

Monitoring period
From: 25 May, 2007
To: 1 October, 2007

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1- Introduction

The purpose of this monitoring report is to inform GHG emission reduction achieved due to the project activity.

This monitoring report involves project activity from: 25 May, 2007 to 1 October, 2007 (both days included)

Duration of the project activity period:

Registration date: 25 May, 2007

Crediting period: 25 May, 2007 to 25 May 2014 (Renewable)

Sasol Nitro has implemented a project activity aimed to reduce N₂O emissions at its Nitric Acid plants, Sasolburg and Secunda.

The project activity is under the category large scale, sectoral scope 5 “Chemical Industry”

2- Reference

Approved baseline methodology

AM0034 version 2 “Catalytic reduction of N₂O inside the ammonia burner of nitric acid plants”

Approved monitoring methodology

AM0034 version 2 “Catalytic reduction of N₂O inside the ammonia burner of nitric acid plants”

Project Design Document

“Sasol Nitrous Oxide Abatement Project”. Version 5, 31 January, 2007.

Validation Report

“Sasol Nitrous Oxide Abatement Project” in South Africa.

Report N° 2007-0195

Date: 7 February, 2007

CDM Registration

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

Date of registration: 25 May, 2007.

3- Description of the Project Activity

The project activity 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 fed Ammonia 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.

The current project activity takes place at two nitric acid plants owned by Sasol Nitro, Sasolburg and Secunda respectively.

4- Project participant

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

Sasol Nitro (hereinafter called “Sasol”) is a division of Sasol Chemical Industries Limited, a private company incorporated under the laws of the Republic of South Africa. Sasol Chemical Industries Limited is part of the Sasol group of companies (the Sasol Group) whose activities are coordinated by the holding company Sasol Limited, founded in 1950. The Sasol Group is an integrated oil and gas entity with substantial chemical interests. It is based in South Africa with its head office in Johannesburg, but also has manufacturing and marketing facilities elsewhere in Africa, Europe, Asia and the Americas. Sasol is listed on the Johannesburg Securities Exchange (JSE), symbol SOL, and the New York Stock Exchange (NYSE), symbol SSL. Sasol

Chemical Industries Limited represents the Sasol Group’s chemicals businesses with its portfolio including polymers, solvents, olefins, surfactants, waxes, phenolics and nitrogenous products. Sasol Nitro, a division of Sasol Chemical Industries Limited, represents the nitrogenous products and related goods; it manufactures and markets ammonia, nitric acid, fertilizers, phosphoric acid, a phosphoric detergent, commercial explosives and specialized blasting accessories. The division also markets ammonia, sulfur and specialty gases produced by other Sasol divisions. Sasol Nitro operates two nitric acid plants. The smaller 557 ton 100% nitric acid per day unit in Sasolburg is linked to a downstream ammonium nitrate plant. The ammonium nitrate is processed in Sasolburg to produce low-density ammonium nitrate for use in the production of commercial explosives. The larger 860 ton per day unit in Secunda supplies a downstream ammonium nitrate plant linked to a 500,000 ton per annum fertilizer granulation facility that produces limestone ammonium nitrate (LAN) and various other fertilizer grades containing nitrogen, phosphorus and potassium. Ammonium nitrate for industrial use is sourced from both sites.

5- Project Location

The project activity is located at two nitric acid plants owned by Sasol. Sasolburg plant is located at Sasolburg city, Free State; and Secunda plant is located at Secunda city, Mpumalanga

6- Project Boundary

The project boundary encompasses the physical, geographical site of Sasolburg and Secunda nitric acid plants and equipment for the complete nitric acid production process from the inlet to the ammonia burner to the stack.

The only GHG emission relevant to the project activity is N₂O contained in the waste stream exiting the stack at each site. The abatement of N₂O is the only GHG emission under control of the project participant.

	Source	Gas	Included?	Justification / Explanation
Baseline	Nitric Acid Plant (Burner Inlet to Stack)	CO ₂	Excluded	The project does not lead to any change in CO ₂ or CH ₄ emissions, and, therefore, these are not included.
		CH ₄	Excluded	
		N ₂ O	Included	
Project Activity	Nitric Acid Plant (Burner Inlet to Stack)	CO ₂	Excluded	The project does not lead to any change in CO ₂ or CH ₄ emissions
		CH ₄	Excluded	
		N ₂ O	Included	
	Leakage emissions from production, transport, operation and decommissioning of the catalyst.	CO ₂	Excluded	No leakage emissions are expected.
		CH ₄	Excluded	
		N ₂ O	Excluded	

Figures below show project boundary for Sasolburg and Secunda plants.

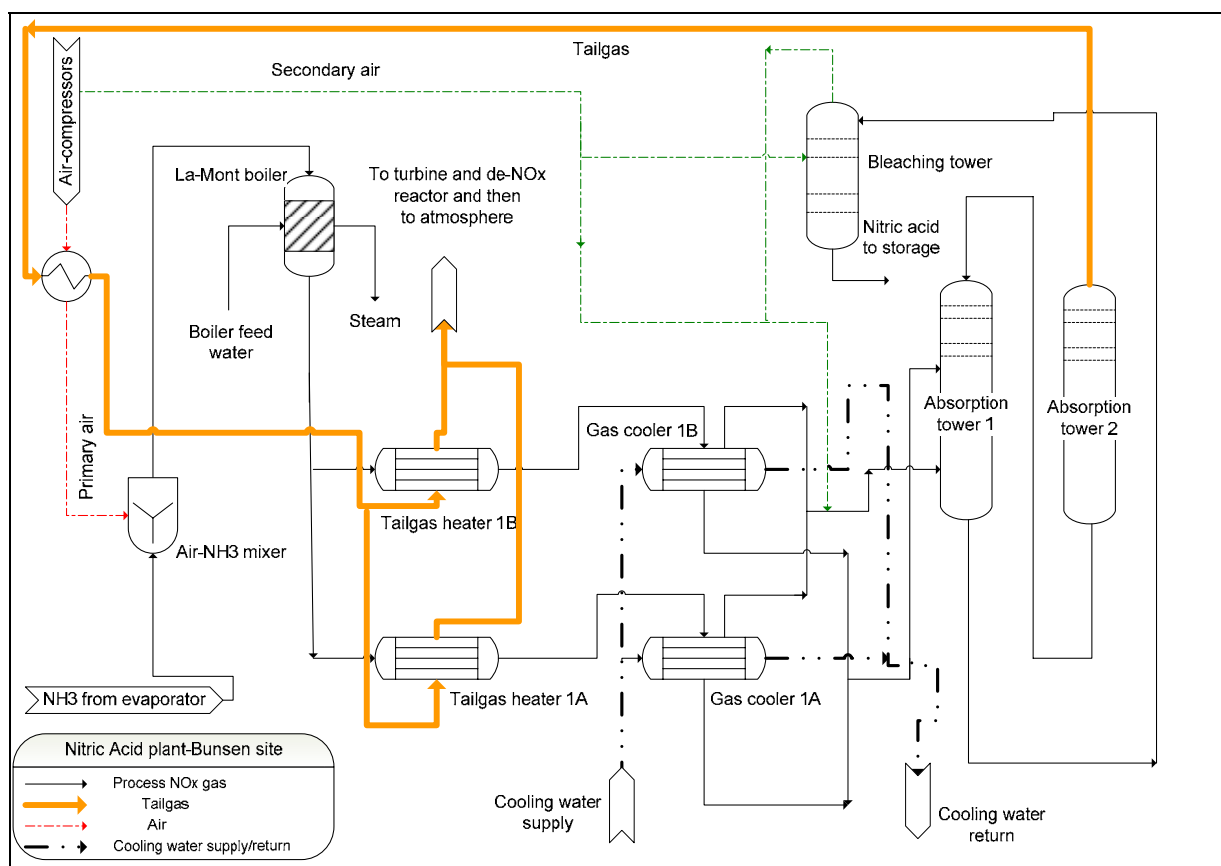


Figure 1. Project boundary for Sasolburg Nitric Acid Plant

Description:	Temperature of the gas in the stack gas during baseline campaign
Source of data to be used:	AMS (Flow meter) at Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 210.9°C Secunda: 97.5 °C
Recording frequency	Every two seconds
Comments	None.

Data / Parameter:	Baseline Pressure of the Stack Gas, PSG_{BC}
Data unit:	bar
Description:	Pressure in the stack gas during baseline campaign
Source of data to be used:	AMS (Flow meter) at Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 0.8 bar Secunda: 1.0 bar
Recording frequency	Every two seconds
Comments:	None.

Data / Parameter:	Baseline N₂O Concentration in the Stack Gas, NCSG_{BC}
Data unit:	mg N ₂ O/ m ³ (converted from ppmv if necessary)
Description:	Mean concentration of N ₂ O in the stack gas for the baseline campaign
Source of data to be used:	AMS (Infrared gas analyzer) of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 3,003 mg N ₂ O/ Nm ³ Secunda: 1,702 mg N ₂ O/ Nm ³
Recording frequency	Every two seconds
Comments:	None

Data / Parameter:	Baseline Operating Hours, OH_{BC}
Data unit:	Hours
Description:	Total operating hours for the baseline campaign
Source of data to be used:	Process control system of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 4,996 hours Secunda: 4,809 hours
Recording frequency	Once a day
Comments:	None

Data / Parameter:	Uncertainty of the monitoring system, UNC
Data unit:	%
Description:	Overall uncertainty of the monitoring system, calculated as the combined uncertainty of the applied monitoring equipment.
Source of data to be used:	Measured by QAL2 test.
Value of data monitored	For Sasolbrg: 3.89% For Secunda: 4.14%
Recording frequency	Calculated once
Comments:	Data obtained from QAL2 test carried out by SGS.

Data / Parameter:	Nitric Acid Production, NAP_{BC}
Data unit:	ton 100% HNO_3
Description:	Total nitric acid production for the baseline campaign.
Source of data to be used:	Production logs of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 110,072 ton 100% HNO_3 Secunda: 173,346 ton 100% HNO_3
Recording frequency	Daily
Comment:	At Sasolburg plant baseline campaign length was 130,657 ton 100% HNO_3 , this production exceeds normal campaign length, 114,727 ton 100% HNO_3 . Then the cumulative production previous to the day in which the plant exceeded normal campaign length. (February 2 nd 2007) was used for baseline emission factor calculation. The first project campaign was 110,174 ton 100% HNO_3 , shorter than normal campaign length. Then we recalculated the baseline emission factor using the cumulative production previous to the day in which the plant exceeded that production.

Data / Parameter:	Baseline Emission Factor, EF_{BL}
Data unit:	ton N_2O / ton 100% HNO_3
Description:	Baseline emission factor is calculated from monitored data for the baseline campaign
Source of data to be used:	Calculated from monitored data.
Value of data monitored	Sasolburg: 0.00938 ton N_2O / ton 100% HNO_3 . Secunda: 0.00526 ton N_2O / ton 100% HNO_3 .
Recording frequency	Calculated once at the end of the baseline campaign
Comments:	None

Data / Parameter:	Baseline Oxidation Temperature, OT_{BC}
Data unit:	$^{\circ}C$
Description:	Oxidation temperature of the ammonia reactor for the baseline campaign
Source of data to be used:	Process control system of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 878 $^{\circ}C$ Secunda: 870 $^{\circ}C$
Recording frequency	Every hour
Comments:	None

Data / Parameter:	Baseline Oxidation Pressure, OP_{BC}
Data unit:	Bar
Description:	Oxidation pressure of the ammonia reactor for the baseline campaign
Source of data to be used:	Process control system of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 4.0 bar Secunda: 4.7 bar
Recording frequency	Every hour
Comments:	None

Data / Parameter:	Baseline Ammonia Flow Rate, AFR_{BC}
Data unit:	Kg NH ₃ /hour
Description:	Ammonia flow rate to the ammonia oxidation reactor for the baseline campaign.
Source of data to be used:	Process control system of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 7,671 kg NH ₃ /hour Secunda: 9,281 kg NH ₃ /hour
Recording frequency	Continuously
Comments:	None.

Data / Parameter:	Baseline Ammonia to Air Flow Rate, AIFR_{BC}
Data unit:	kg NH ₃ /kg air
Description:	Ammonia to air flow rate to the ammonia oxidation reactor for the baseline campaign.
Source of data to be used:	Process control system of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 0.060 kg NH ₃ /kg air Secunda: 0.061 kg NH ₃ /kg air
Recording frequency	Every hour
Comments:	None.

Data / Parameter:	Baseline Campaign Length, CL_{BL}
Data unit:	ton 100% HNO ₃
Description:	Campaign length is defined as the total number of metric tonnes of nitric acid at 100% concentration produced with one set of gauzes. (see baseline nitric acid production, NAP _{BC})
Source of data to be used:	Plant production log book
Value of data monitored	For Sasolburg: 110,072 ton 100% HNO ₃ For Secunda: 173,346 ton 100% HNO ₃
Recording frequency	Calculated at the end of the baseline campaign
Comments:	At Sasolburg plant baseline campaign length was 130,657 ton 100% HNO ₃ , this production exceeds normal campaign length, 114,727 ton 100% HNO ₃ . Then the cumulative production previous to the day in which the plant exceeded normal campaign length (February 2 nd 2007) was used for baseline emission factor calculation. The first project campaign was 110,174 ton 100% HNO ₃ , shorter than normal campaign length. Then we recalculated the baseline emission factor using the cumulative production previous to the day in which the plant exceeded that production.

Data / Parameter:	Baseline Gauze Supplier GS_{BC}
Data unit:	Company name
Description:	Gauze supplier for the baseline campaign
Source of data to be used:	Procurement offices of Sasolburg and Secunda Plants
Value of data	Sasolburg: W.C. Heraeus

monitored	Secunda: W.C. Heraeus
Recording frequency	Once
Comments:	None.

Data / Parameter:	Baseline Gauze Composition, GC_{BC}
Data unit:	%(Pt, Rh, Pd)
Description:	Gauze composition for the baseline campaign
Source of data to be used:	Nitric plant procurement office and gauze Supplier technical service department
Value of data monitored	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 %
Recording frequency	Once
Comments:	None.

The following tables show the parameters monitored in order to calculate project emissions.

Data / Parameter:	Project Volume Flow in the Stack Gas, VSG_{project}
Data unit:	Nm ³ / hour
Description:	Volume flow rate in the stack gas for the project campaign
Source of data to be used:	AMS (Flow meter) at Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 72,028 Nm ³ / hour Secunda: 117,794 Nm ³ / hour
Recording frequency	Every two seconds
Comments:	None.

Data / Parameter:	Project Temperature of the Stack Gas, TSG_{project}
Data unit:	°C
Description:	Temperature of the gas in the stack gas during project campaign
Source of data to be used:	AMS (Flow meter) at Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 225 °C Secunda: 94 °C
Recording frequency	Every two seconds
Comments:	None.

Data / Parameter:	Project Pressure of the Stack Gas, PSG_{project}
Data unit:	bar
Description:	Pressure in the stack gas for the project campaign
Source of data to be used:	AMS (Flow meter) at Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 0.85 bar Secunda: 1.0 bar
Recording frequency	Every two seconds
Comments:	None.

Data / Parameter:	Project N₂O Concentration in the Stack Gas, NCSG_{project}
Data unit:	mg N ₂ O/ m ³ (converted from ppmv if necessary)
Description:	N ₂ O concentration in the stack gas for the project campaign
Source of data to be used:	AMS (Infrared gas analyzer) at Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 371 mg N ₂ O/ m ³ Secunda: 663 mg N ₂ O/ m ³
Recording frequency	Every two seconds
Comments:	None.

Data / Parameter:	Project Operating Hours, OH_{project}
Data unit:	Hours
Description:	Total operating hours for the project campaign
Source of data to be used:	Process control system of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 4,874 hours Secunda: 6,051 hours
Recording frequency	Daily
Comments:	None.

Data / Parameter:	Project Nitric Acid Production, NAP_{project}
Data unit:	ton 100% HNO ₃
Description:	Total nitric acid production for the project campaign
Source of data to be used:	Production logs of Sasolburg and Secunda plants.
Value of data monitored	Sasolburg: 68,878 ton 100% HNO ₃ Secunda: 108,962 ton 100% HNO ₃
Recording frequency	Daily
Comments:	Nitric acid productions during the first project campaign were: Sasolburg: 110,174 ton HNO ₃ Secunda: 215,875 ton HNO ₃ Productions for the monitoring period were: Sasolburg: 68,878 ton 100% HNO ₃ . Secunda: 108,962 ton 100% HNO ₃

Data / Parameter:	Project Emission Factor, EF_n
Data unit:	ton N ₂ O / ton 100% HNO ₃
Description:	Project emission factor calculated from monitored data for the project campaign
Source of data to be used:	Calculated from monitoring data.
Value of data monitored	Sasolburg: 0.00118 ton N ₂ O / ton 100% HNO ₃ . Secunda: 0.00219 ton N ₂ O / ton 100% HNO ₃ .
Recording frequency	Calculated once after ending the project campaign
Comments:	None.

Data / Parameter:	Project Campaign Length, CL_n
Data unit:	Ton 100% HNO_3
Description:	The project campaign length for the nth campaign (CL_n) is defined as the nitric acid produced during the nth campaign (see project Nitric Acid Production)
Source of data to be used:	Sasolburg and Secunda production log books.
Value of data monitored	Sasolburg: 110,174 ton 100% HNO_3 Secunda: 215,875 ton HNO_3
Recording frequency	Calculated at the end of the project campaign
Comments:	None.

Data / Parameter:	Project Gauze Supplier, GS_n
Data unit:	Company name
Description:	Gauze supplier for the project campaign
Source of data to be used:	Procurement offices of Sasolburg and Secunda Plants
Value of data monitored	Sasolburg: W.C. Heraeus Secunda: W.C. Heraeus
Recording frequency	Once
Comments:	None.

Data / Parameter:	Project Gauze Composition, GC_n
Data unit:	%
Description:	Gauze concentration for the project campaign
Source of data to be used:	Procurement offices of Sasolburg and Secunda Plants
Value of data monitored	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 %
Recording frequency	Once
Comments:	None.

Data / Parameter:	Emission Factor set by regulation, EF_{reg}
Data unit:	kg N_2O / ton HNO_3
Description:	Local and national regulations on N_2O and NO_x emissions
Source of data to be used:	Local and National Regulations
Value of data monitored	No local or national regulation has been introducing during project period.
Recording frequency	
Comments:	At date of introducing or change of regulation.

At each plant process data and data from the AMS are acquired by the DSC system. MGM receives all the information given by the plants and elaborates the emission factors and emission reduction calculations.

7.2 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 levels of Quality Assurance Levels (QAL):

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 (such as the German TÜV) and the specific installation characteristics and site conditions at each plant. The QAL1 reports confirmed the N₂O analyzers (in both cases an AO 2000- URAS 14 NDIR supplied by ABB GmbH) are suitable to perform the indicated analysis (N₂O concentration). Reports were audited during validation and 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 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 on February 2007, at both plants by SGS Environmental Services (ISO 17025 certified lab). The QAL2 reports are available for DOE review. The reports conclude 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 (un-manipulated data), the corrective formulae (calibration functions) were applied during data processing (with the aid of spreadsheets), meaning 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 check 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.

8 GHG emission reductions calculations

8.1 Baseline emissions

For baseline emission factor determination, N₂O concentration and gas volume flow for each plant were monitored throughout the baseline campaign. Hourly average readings for N₂O concentration and gas flow volume (calculated from every 2 second monitored data) were

performed. Error readings (e.g. downtime or malfunction) and extreme values were eliminated from the output data series.

Normal operating conditions 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 based on plant historical operating conditions and plant design data. 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.

Normal operating conditions determined for Sasolburg and Secunda plants are:

Parameter	Data unit	Value applied
Normal Operating Temperature, OT_{normal} (range of temperature)	°C	For Sasolburg: 703- 884 For Secunda: 860-920
Normal Operating Pressure, OP_{normal} (range of pressure)	bar	For Sasolburg: 3.7 – 4.5 For Secunda: 2.5 – 5.0
Maximum Ammonia Flow Rate, AFR_{max}	Kg NH ₃ /hour	For Sasolburg: 6,771 For Secunda: 10,630
Maximum Ammonia to Air Flow Rate, AIFR_{max}	Kg NH ₃ /kg air	For Sasolburg: 0.084 For Secunda: 0.063

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 (x)
- Calculated the sample standard deviation (s)
- Calculated the 95% confidence interval (equal to 1.96 times the standard deviation)
- Eliminated all data that lied outside the 95% confidence interval
- Calculated the new sample mean from the remaining values (volume of stack gas (VSG) and N₂O 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 (CL_n) length values are:

Sasolburg: 114,727 tons HNO₃

Secunda: 183,602 tons HNO₃

According to AM0034 baseline campaign length must be lower than or equal to CL_n .

In case of project campaign, campaign length must be longer than or equal to CL_n . If project campaign length is shorter than CL_n the baseline emission factor must be recalculated eliminating all data obtained during the production of tonnes of nitric acid beyond CL_n .

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

For baseline emission factor calculation the following period was used in order to not exceed normal campaign length. From June, 12th 2006 to February, 2nd 2007.

As it has been explained, the first project campaign was shorter than normal campaign length, then, we had to re-calculate the baseline emission factor, using in the calculation all the values monitored before the day in which the plant exceeded the production of the project campaign. The following period was included in the calculation: From: June, 12th 2006 to January, 24th 2007.

To follow all the calculations see the spreadsheet "Sasolburg Baseline Emission Factor Recalculation 10 Jan 08.xls")

At Secunda plant baseline campaign took place between August, 27th 2006 and March, 24th 2007. Since baseline campaign length did not exceed normal campaign length, the whole period was used for baseline emission factor calculation.

Baseline emission factor calculation and data monitored used in the calculation are compiled in the spreadsheet named "Secunda Baseline Emission Factor Calculation 10 Jan 08.xls"

Values obtained for Secunda plant are:

$$BE_{BC} = 116,416 \cdot 1,702 \cdot 10^{-9} \cdot 4,809 = 953 \text{ ton } N_2O$$

$$EF_{BL} = \frac{953}{173,346} \left(1 - \frac{4.14}{100}\right) = 0.00526 \text{ ton } N_2O / \text{ ton } HNO_3$$

Values obtained for Sasolburg plant are:

$$BE_{BC} = 71,636 \cdot 3,003 \cdot 10^{-9} \cdot 4,996 = 1,075 \text{ ton } N_2O$$

$$EF_{BL} = \frac{1,075}{110,072} \left(1 - \frac{3.89}{100}\right) = 0.00938 \text{ ton } N_2O / \text{ ton } HNO_3$$

At both plants baseline campaign were valid because more than 50% of the duration of the baseline, the plant was operated within normal operating conditions. In case of Sasolburg, the plant operated 74.7 % of campaign's duration within normal operating conditions; for Secunda this factor reached 94 %.

In case of Sasolburg plant normal operating temperature was calculated based on plant historical data; then, a statistical analysis was performed in order to demonstrate that the average temperature obtained during the baseline campaign was equal to the average temperature obtained in the normal temperature calculation. The excel spreadsheet containing that statistical analysis is attached to this monitoring report and demonstrate with 95% confidence level that averages temperatures are equal.

8.2- Project emissions

For project emission factor determination, N₂O concentration and gas volume flow for each plant were monitored throughout the project campaign. Hourly average readings for N₂O concentration and gas volume flow (calculated from every 2 second monitored data) were performed. 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 N₂O concentration and total flow rate 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 tN ₂ O
VSG_n	Mean stack gas volume flow rate for the nth project campaign, in Nm ³ /h
$NCSG_n$	Mean concentration of N ₂ O in the stack gas for the project campaign, in mg N ₂ O/Nm ³
OH_n	Number of operating hours in the project campaign, in h
EF_n	Emission factor calculated for the nth campaign, in ton N ₂ O/ton HNO ₃
NAP_n	Nitric acid production in the nth campaign, in ton 100% HNO ₃

Project campaign at Sasolburg plant took place between: March 7th 2007 and October 1st 2007. At Secunda plant the first project campaign took place between: April 18th 2007 and December 9th 2007.

As the project was registered on May 25th Sasol is requesting for CERs issuance for the following period: May 25th 2007 to October 1st 2007.

Values obtained for both plants are:

Sasolburg:

$$PE_n = 72,028 \cdot 371 \cdot 10^{-9} \cdot 4,872 = 130.15 \text{ ton } N_2O$$

$$EF_n = \frac{130.15}{110,174} = 0.00118 \text{ ton } N_2O / \text{ton } HNO_3$$

Secunda:

$$PE_n = 117,794 \cdot 663 \cdot 10^{-9} \cdot 6,051 = 472,6 \text{ ton } N_2O$$

$$EF_n = \frac{472.6}{215,875} = 0.00219 \text{ ton } N_2O / \text{ton } HNO_3$$

Complete project emission factor calculations are in the following documents: “Sasolburg First Project Campaign 10 Jan 08.xls” and “Secunda First Project Campaign 10 Jan 08.xls”.

8.3- Emission Reduction Calculation

As indicated, the present Monitoring Report involves the following period: From May 25th, 2007 to October 1st 2007.

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:

For Sasolburg plant

$$ER_n = (0.00938 - 0.00118) \cdot 68,878 \cdot 310 = 175,087 \text{ tonCO}_2\text{e}$$

For Secunda plant

$$ER_n = (0.00526 - 0.00219) \cdot 108,962 \cdot 310 = 103,700 \text{ tonCO}_2\text{e}$$

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

$$ER = 175,087 + 103,700 = \text{tonCO}_2\text{e}$$

Complete emission reduction calculations are in the following documents: “Sasolburg First Project Campaign 10 Jan 08.xls” and “Secunda First Project Campaign 10 Jan 08.xls”.