

CDM Monitoring Report N°1
Version 01
June 9, 2009

**“Monomeros Nitrous Oxide Abatement Project”
Colombia**

UNFCCC Ref N° 1428

Monitoring period
From: 14 February, 2008
To: 24 March, 2009

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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: 9 March, 2008 to 24 March, 2009 (both days included)

Duration of the project activity period:

Registration date: 14 February, 2008

Crediting period: 14 February, 2008 to 13 February 2015 (Renewable)

Monomeros has implemented a project activity aimed to reduce N₂O emissions at it Nitric Acid plant located in Barranquilla, Colombia.

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

“Monomeros Nitrous Oxide Abatement Project”. Version 3, 20, September, 2007.

Validation Report

“Monomeros Nitrous Oxide Abatement Project in Colombia”.

DNV, Report N° 2007-1193- Revision N°2

Date: 06 November, 2007

CDM Registration

“Monomeros Nitrous Oxide Abatement Project”.Ref. N° 1428.

Date of registration: 14 February, 2008.

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 the nitric acid plant owned by Monomeros Colombo Venezolanos in Barranquilla.

4. Project participant

Name of Party involved	Project participant (as applicable)	Party involved considered as project participant
Switzerland	MGM Carbon Portfolio S.a.r.l	No
Colombia (host)	Monomeros Colombo Venezolanos S.A.	No

Monomeros Colombo Venezolanos S.A. is a Company established in Colombia to provide chemical products to the manufacture industry and fertilizers to the agri-business, its production volume become one of the most important petrochemical companies in the countries of the Andino Group.

In December 1967, the setting-up of Monomeros of Colombia as a limited-liability company was executed by deed, with the initial participation of the Industrial Promotion Institute (IFI), the Colombian Oil Company (ECOPETROL) and the Venezuelan Petrochemical Institute (IVP).

In 1968, the Dutch firm holding the license for the Stamicarbon process became a stockholder, in 2007 the Venezuelan Petrochemical S.A. Pequiven bought Monomeros and currently this is the main stakeholder with 86.21%.

Currently, Monomeros manufactures three types of products: compound fertilizers, tricalcium phosphates and industrial chemicals, among these, nitric acid, sulphuric acid and others.

5. Project Location

The project activity is located in the nitric acid plant owned by Monomeros at Barranquilla city, Atlántico State.

6. Project Boundary

The project boundary encompasses the physical, geographical site of the nitric acid plant 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.

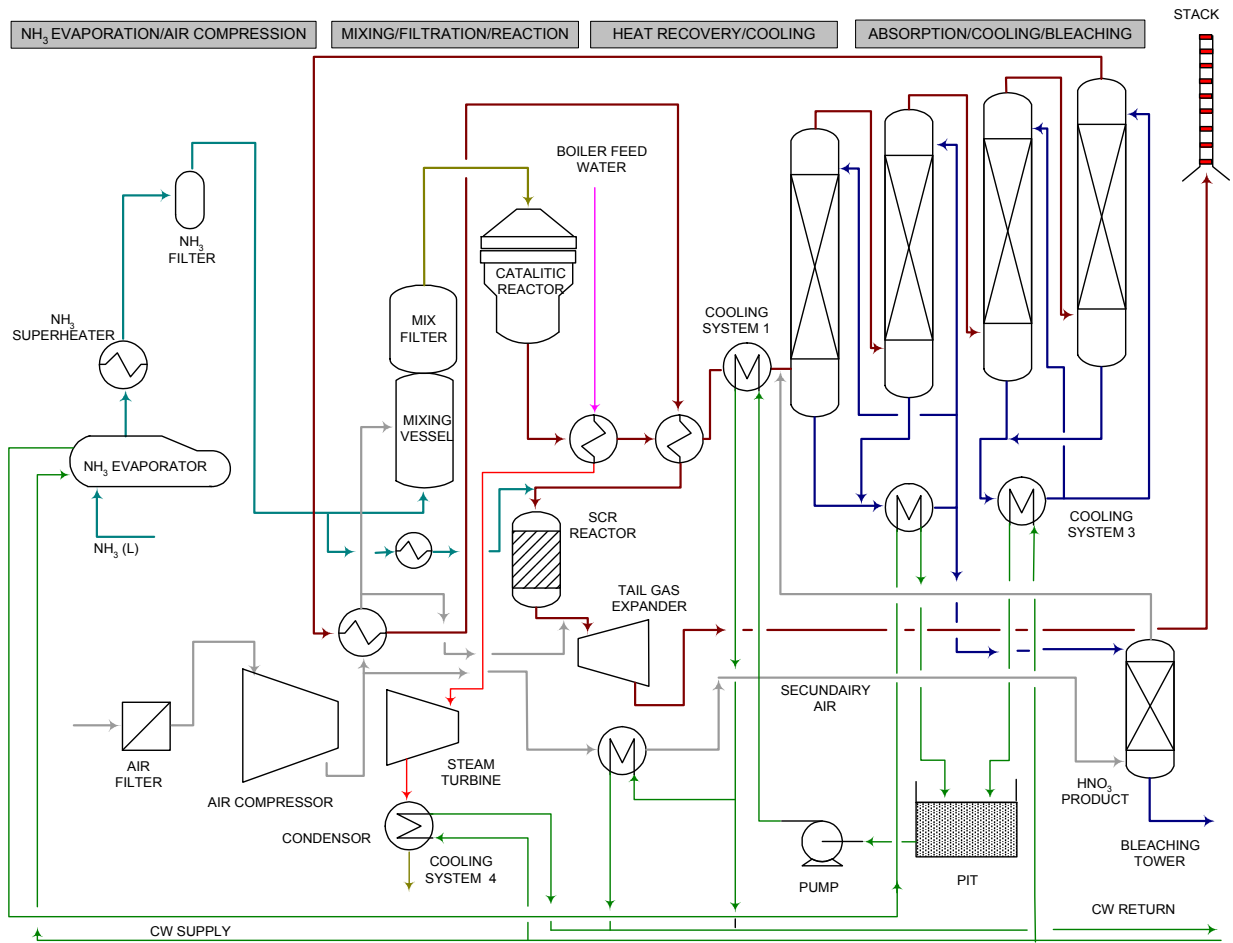


Figure 1. Project boundary for Monómeros Nitric Acid Plant

7. Monitoring methodology and Plan

Data monitored

The following tables show the parameters that have been monitored in order to calculate baseline emission factor.

Data / Parameter:	Baseline Volume Flow in the Stack Gas, VSG_{BC}
Data unit:	Nm^3 / hour
Description:	Mean gas volume flow rate in the stack gas during baseline campaign
Source of data to be used:	AMS (Flow meter) at MCV's plant.
Value of data monitored	33,439 Nm^3 /h
Recording frequency	Every two seconds
Comments:	None

Data / Parameter:	Baseline Temperature of the Stack Gas, TSG_{BC}
Data unit:	°C
Description:	Temperature of the gas in the stack gas during baseline campaign
Source of data to be used:	AMS (Flow meter).
Value of data monitored	115 °C
Recording frequency	Every two seconds
Comments	Average value

Data / Parameter:	Baseline Pressure of the Stack Gas, PSG_{BC}
Data unit:	kg/cm^2
Description:	Pressure in the stack gas during baseline campaign
Source of data to be used:	AMS (Flow meter).
Value of data monitored	1.05 kg/cm^2
Recording frequency	Every two seconds
Comments:	Average value

Data / Parameter:	Baseline N_2O Concentration in the Stack Gas, $NCSG_{BC}$
Data unit:	$mg\ N_2O/ m^3$ (converted from ppmv if necessary)
Description:	Mean concentration of N_2O in the stack gas for the baseline campaign
Source of data to be used:	AMS (Infrared gas analyzer) at MCV's plant.
Value of data monitored	2,113 $mg\ N_2O/ Nm^3$
Recording frequency	Every two seconds

Comments:	None
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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 at MCV's plant
Value of data monitored	7,421 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	2.94 %
Recording frequency	Calculated once
Comments:	Data obtained from QAL2 test carried out by SGS Environmental Services.

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 MCV's plant.
Value of data monitored	74,094, ton 100% HNO ₃
Recording frequency	Daily
Comment:	Baseline campaign length was 84,924 ton 100% HNO ₃ , which exceeds normal campaign length, 75,398 ton 100% HNO ₃ . Then for baseline emission factor calculation, the cumulative production previous to the day in which the plant exceeded normal campaign length was used (January 8 th 2008). The first project campaign resulted at 74, 250 ton 100% HNO ₃ , shorter than normal campaign length. Then baseline emission factor was recalculated considering data up to the cumulative production previous to the day in which the plant exceeded normal length. (January 3 rd , 2008).

Data / Parameter:	Baseline Emission Factor, EF_{BL}
Data unit:	ton N ₂ O / 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	0.00686 ton N ₂ O / 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:	°C
Description:	Oxidation temperature of the ammonia reactor for the baseline campaign
Source of data to be used:	Distributed Control System of MCV's plant.
Value of data monitored	849 °C
Recording frequency	Every hour
Comments:	Average value

Data / Parameter:	Baseline Oxidation Pressure, OP_{BC}
Data unit:	Pa
Description:	Oxidation pressure of the ammonia reactor for the baseline campaign
Source of data to be used:	Distributed Control System of MCV's plant.
Value of data monitored	322,962 Pa
Recording frequency	Every hour
Comments:	Average value

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:	Distributed Control System of MCV's plant.
Value of data monitored	2,783 kg NH ₃ /hour
Recording frequency	Continuously
Comments:	Average value

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:	Distributed Control System of MCV's plant.
Value of data monitored	0.061 kg NH ₃ /kg air
Recording frequency	Every hour
Comments:	Average value

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:	Distributed Control System of MCV's plant.
Value of data monitored	74, 094 ton 100% HNO_3
Recording frequency	Calculated at the end of the baseline campaign
Comments:	Baseline campaign length was 84,924 ton 100% HNO_3 , which exceeds normal campaign length, 75,398 ton 100% HNO_3 . Then for baseline emission factor calculation, the cumulative production previous to the day in which the plant exceeded normal campaign length was used (January 8 th 2008). The first project campaign resulted at 74, 250 ton 100% HNO_3 , shorter than normal campaign length. Then baseline emission factor was recalculated considering data up to the cumulative production previous to the day in which the plant exceeded normal length. (January 3 rd , 2008).

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 office of MCV's plant.
Value of data monitored	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	58.0 to 60.0 % Pt, 3.4 to 4.4 % Rh, 36.1 to 38.1 % Pd.
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:	Mean Volume flow rate in the stack gas for the project campaign
Source of data to be used:	AMS (Flow meter) at MCV's plant.
Value of data monitored	36,927 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)
Value of data monitored	113 °C
Recording frequency	Every two seconds
Comments:	Average value.

Data / Parameter:	Project Pressure of the Stack Gas, PSG_{project}
Data unit:	kg/cm ²
Description:	Pressure in the stack gas for the project campaign
Source of data to be used:	AMS (Flow meter).
Value of data monitored	1.02 kg/cm ²
Recording frequency	Every two seconds
Comments:	Average value

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:	Mean N ₂ O concentration in the stack gas for the project campaign
Source of data to be used:	AMS (Infrared gas analyzer) at MCV's plant.
Value of data monitored	495 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 at MCV's plant.
Value of data monitored	7,864 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 MCV's plant.
Value of data monitored	74,250 ton 100% HNO ₃

Recording frequency	Daily
Comments:	None

Data / Parameter:	Project Emission Factor, EF_n
Data unit:	ton N_2O / 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	0.00194 t N_2O / 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:	Production logs of MCV's plant.
Value of data monitored	74,250 ton 100% 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 MCV plant.
Value of data monitored	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 MCV plant.
Value of data monitored	58.0 to 60.0 % Pt, 3.4 to 4.4 % Rh, 36.1 to 38.1 % Pd.
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 ₂ O 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.

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 report was provided by the equipment manufacturer 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 the plant. The QAL1 report confirmed that the N₂O analyzer (AO 2000- URAS 14 NDIR supplied by ABB GmbH) is suitable to perform the indicated analysis (N₂O concentration). Report was audited during validation and is available at the site 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 May 2007, by SGS Environmental Services (ISO 17025 certified lab). The QAL2 report is available for DOE review. The report concludes the monitoring system complies with the standard.

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 plant (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 Monomeros plant and available for auditing purposes.

8. GHG emission reductions calculations

Baseline emissions

For baseline emission factor determination, N₂O concentration and gas volume flow at the 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 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 are:

Parameter	Data unit	Value applied
Normal Operating Temperature, OT_{normal} (range of temperature)	°C	832- 872
Normal Operating Pressure, OP_{normal} (range of pressure)	Pa	303,948- 384,890
Maximum Ammonia Flow Rate, AFR_{max}	kg NH ₃ /hour	3,282
Maximum Ammonia to Air Flow Rate, AIFR_{max}	kg NH ₃ /kg air	0.066

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:
75,398 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 greater 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.

Baseline campaign took place between February, 15th 2007 and February, 17th 2008.
For baseline emission factor calculation the following period was used in order to not exceed normal campaign length. From: February 15th 2007 to January 8th 2008. (See document “MCV baseline campaign calculation- April 2009”.xls)

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: February, 15th 2007 to January, 3rd 2008.

To follow all the calculations see the spreadsheet “MCV Baseline emission factor recalculation for First project campaign.xls”)

Values obtained are:

$$BE_{BC} = 33,439 \cdot 7,421 \cdot 10^{-9} \cdot 2,113 = 524.37 \text{ ton } N_2O$$

$$EF_{BL} = \frac{524.37}{74,094} \left(1 - \frac{2.94}{100}\right) = 0.00686 \text{ ton } N_2O / \text{tonHNO}_3$$

Baseline campaign was valid because more than 50% of the duration of the baseline, the plant was operated within normal operating conditions.

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 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 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 took place between: March 9th 2008 and March 24th 2009.

Values obtained are:

$$PE_n = 36,927 \cdot 495 \cdot 10^{-9} \cdot 7,834 = 143.71 \text{ ton } N_2O$$

$$EF_n = \frac{143.71}{74,250} = 0.00194 \text{ ton } N_2O / \text{ ton } HNO_3$$

Complete project emission factor calculation is in document “Monomeros first project campaign-2009”

Emission Reduction Calculation

As indicated, the present Monitoring Report involves the following period: From February 14th, 2008 to March 24th 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 <i>n</i> th campaign, tCO ₂ e
EF_{BL}	Baseline emission factor, in tN ₂ O/ tHNO ₃
EF_p	Project emission factor, applicable to the <i>n</i> th campaign, in tN ₂ O/ tHNO ₃
NAP_n	Nitric acid production during the <i>n</i> 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

Value obtained for the project is:

$$ER_n = (0.00686 - 0.00194) \cdot 74,250 \cdot 310 = 113,246 \text{ tonCO}_2\text{e}$$

Complete emission reduction calculation is in the following document: “Monomeros First project campaign-2009.xls”

Relevant information of instruments involved in the CDM project is included in Annex I.

Summary of important events occurred during the period analyzed can be found in Annex II.

Annex I

List of critical instrumentation:

Instrument	TAG	Brand/Model	Calibration frequency	Date of latest calibration
N ₂ O Analyzer	AIT-11E02:	ABB- AO2000 and URAS 14	Weekly (depending on Shewhart chart results the frequency could be increased)	June 4 2009 (Weekly checking) May 6 2009 (Metrology department check)
Stack gas flow meter.	FIT-11E02	Rosemount 3095 MFA model	Every gauze changes	January 27 2009
Stack pressure meter.	PIT-11E02:	Rosemount 3095 MFA model	Every gauze changes	January 27 2009
Stack temperature meter	TE-11E02	Rosemount 3095 MFA model	Every gauze changes	January 27 2009
Gas pressure meter at R-1101 inlet	DPIT-11A12:	Rosemount 3051S2CD1 model	Every gauze changes	March 26 2009
Gauzes temperature meter	TI-11A10:	LEEDS AND NORTHRUP Model THERMOCOUPLE TYPE K CHROMEL ALUMEL CAT. NO. 8784 K-1-5-36-1-3-1) SHEATH 5/16 LENGHT 36" JUNCTION TYPE CAST IRON WITH MOUNTING BUSHING FOR TEMPERATURE 2100 GF	Every gauze changes	March 26 2009
Ammonia flow meter to ammonia/air mixer	FIT-11A04:	Rosemount 1151DP5 model	Every gauze changes	March 26 2009
Air flow meter to ammonia/air mixer	FIT-11A05:	Rosemount 3051CD1 model	Every gauze changes	March 26 2009

Annex II

List of relevant events during Base Line campaign.

Date	Event	Reference document
19/02/2007	Shut Down during 12 hours. Failure in supply of natural gas to MCV.	Nitric Acid Plant office log book. Monthly Production Report
16/04/2007	Shut Down during 2 hours. Failure in supply of ammonia liquid to plant.	Nitric Acid Plant office log book. Monthly Production Report
03/07/2007	Shut Down during 72 hours. Adjustment in demand of Nitric Acid due to problem at Fertilizers plant.	Nitric Acid Plant office log book. Monthly Production Report
17/07/2007	Shut Down during 5 days. Interlocking in air compressor due to High vibrations	Nitric Acid Plant office log book. Monthly Production Report
25/07/2007	Shut down during 7 hours. Air compressor shut down	Nitric Acid Plant office log book. Monthly Production Report
26/07/2007	Shut down during 8 hours. Air compressor shut down	Nitric Acid Plant office log book. Monthly Production Report
13/09/2007	Shut Down during 42 hours. Cleaning in place to the driver air compressor.	Nitric Acid Plant office log book. Monthly Production Report
17/10/2007	Shut Down during 38 hours. Antisurge air compressor shut down.	Nitric Acid Plant office log book. Monthly Production Report
14/11/2007	Shut Down during 6 hours. Nitric acid leakage in cooler condensor E-1109.	Nitric Acid Plant office log book. Monthly Production Report
28/11/2007	Shut down during 2 hours. False signal interlocking for high temperature in control room.	Nitric Acid Plant office log book. Monthly Production Report
02/02/2008	Shut Down during 33 hours. Failure in supply of natural gas to MCV.	Nitric Acid Plant office log book. Monthly Production Report
17/02/2008	Shut down during 12 days. Over Haul K-1101 and gauzes change.	Nitric Acid Plant office log book. Monthly Production Report

List of relevant events during First Project campaign.

Date	Event	Reference document
13/03/2008	Shut Down during 5 hours. Nitric Acid Leak in level gauge, vessel V-1109	Nitric Acid Plant office log book. Monthly Production Report
03/05/2008	Shut Down during 19 hours. Nitric Acid Leak in Vessel V-1109	Nitric Acid Plant office log book. Monthly Production Report
22/06/2008	Shut Down during 2.2 hours. Cooling Tower out of service.	Nitric Acid Plant office log book. Monthly Production Report
27/06/2008	Shut Down during 6.7 hours. High Pressure differential in ammonia filters, S-1101	Nitric Acid Plant office log book. Monthly Production Report
27/06/2008	Shut Down during 6.7 hours. Three way High Pressure steam valve	Nitric Acid Plant office log book. Monthly Production Report
21/08/2008	Shut Down during 35.0 hours. Failure in tubes of cooler condensor E-1109.	Nitric Acid Plant office log book. Monthly Production Report
02/09/2008	Shut Down during 11.0 hours. High Pressure differential in air filters, F-1102	Nitric Acid Plant office log book. Monthly Production Report
02/09/2008	Shut Down during 4.6 hours. Air compressor shut down	Nitric Acid Plant office log book. Monthly Production Report
19/09/2008	Shut Down during 5.5 hours. High Pressure differential in ammonia filters, S-1101	Nitric Acid Plant office log book. Monthly Production Report
24/09/2008	Shut Down during 49.0 hours. Planned Maintenance in fertilizer plant.	Nitric Acid Plant office log book. Monthly Production Report
12/10/2008	Shut Down during 6.5 hours. High Pressure differential in ammonia filters, S-1101	Nitric Acid Plant office log book. Monthly Production Report
02/11/2008	Shut down during 7.7 hours. Antisurge control signal fail.	Nitric Acid Plant office log book. Monthly Production Report
08/11/2008	Shut Down 19.7 days. Temporarily Shut down due to Marked needs change.	Nitric Acid Plant office log book. Monthly Production Report
31/12/2008	Shut Down during 2.5 hours. High Pressure differential in ammonia filters, S-1101	Nitric Acid Plant office log book. Monthly Production Report

05/01/2009	Shut Down 22.7 days. Temporarily Shut down due to Marked needs change.	Nitric Acid Plant office log book. Monthly Production Report
21/02/2009	Production adjustment (Low load) due to by-pass in first catalyst.	Nitric Acid Plant office log book. Monthly Production Report
28/02/2009	Shut Down during 5.5 hours. High Pressure differential in ammonia filters, S-1101	Nitric Acid Plant office log book. Monthly Production Report
03/03/2009	Shut Down during 7.9 hours. Nitric Acid Leak in Vessel V-1111.	Nitric Acid Plant office log book. Monthly Production Report
06/03/2009	Plant Shut down during 7.2 hours. Interlocking air compressor.	Nitric Acid Plant office log book. Monthly Production Report
11/03/2009	Shut Down during 7.7 hours. High Pressure differential in ammonia filters, S-1101	Nitric Acid Plant office log book. Monthly Production Report
19/03/2009	Shut Down during 7.7 hours. High Pressure differential in ammonia filters, S-1101	Nitric Acid Plant office log book. Monthly Production Report
24/03/2009	Plant Shut down during 4.6 hours. Vibration test in air compressor.	Nitric Acid Plant office log book. Monthly Production Report
25/03/2009	Plant Shut down. Planned maintenance and gauzes change.	Nitric Acid Plant office log book. Monthly Production Report