CDM Monitoring Report Nº2
Version 01
June 01, 2010

"Monomeros Nitrous Oxide Abatement Project" Colombia

UNFCCC Ref Nº 1428

Monitoring period
From: 25 March, 2009
To: 03 May, 2010

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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 March, 2009 to 03 May, 2010 (both days included)

Duration of the project activity period:
Registration date: 14 February, 2008
Crediting period: 14 February, 2008 to 13 February 2015 (Renewable)

Monómeros Colombo-Venezolanos S.A. has implemented a project activity aimed to reduce N_2O 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 N_2O inside the ammonia burner of nitric acid plants"

Approved monitoring methodology
AM0034 version 2 "Catalytic reduction of N_2O 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".
Report Nº 2007-1193- Revision Nº2
Date: 06 November, 2007

CDM Registration
"Monomeros Nitrous Oxide Abatement Project".Ref. Nº 1428.
Date of registration: 14 February, 2008.

CDM Monitoring Report Nº1 version 03
"Monomeros Nitrous Oxide Abatement Project".Ref. Nº 1428.
Date: 05 March, 2010.

3. Description of the Project Activity

The project activity involves the installation of a secondary catalyst to abate N_2O inside the ammonia burner once it is formed.

Nitrous Oxide (N_2O) 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 N_2O from nitric acid production is typically released into the atmosphere, as it does not have any economic value or toxicity at typical emission levels. N_2O 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 S.A. 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 100%.

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: Latitude 11º 10' N
Longitude 74º 50' W

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 N_2O contained in the waste stream exiting the stack at each site. The abatement of N_2O 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_2O	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_2O	Included	
	Leakage emissions from production, transport, operation and decommissioning of the catalyst.	CO_2	Excluded	No leakage emissions are expected.
		CH_4	Excluded	
		N_2O	Excluded	

Figure below shows project boundary.

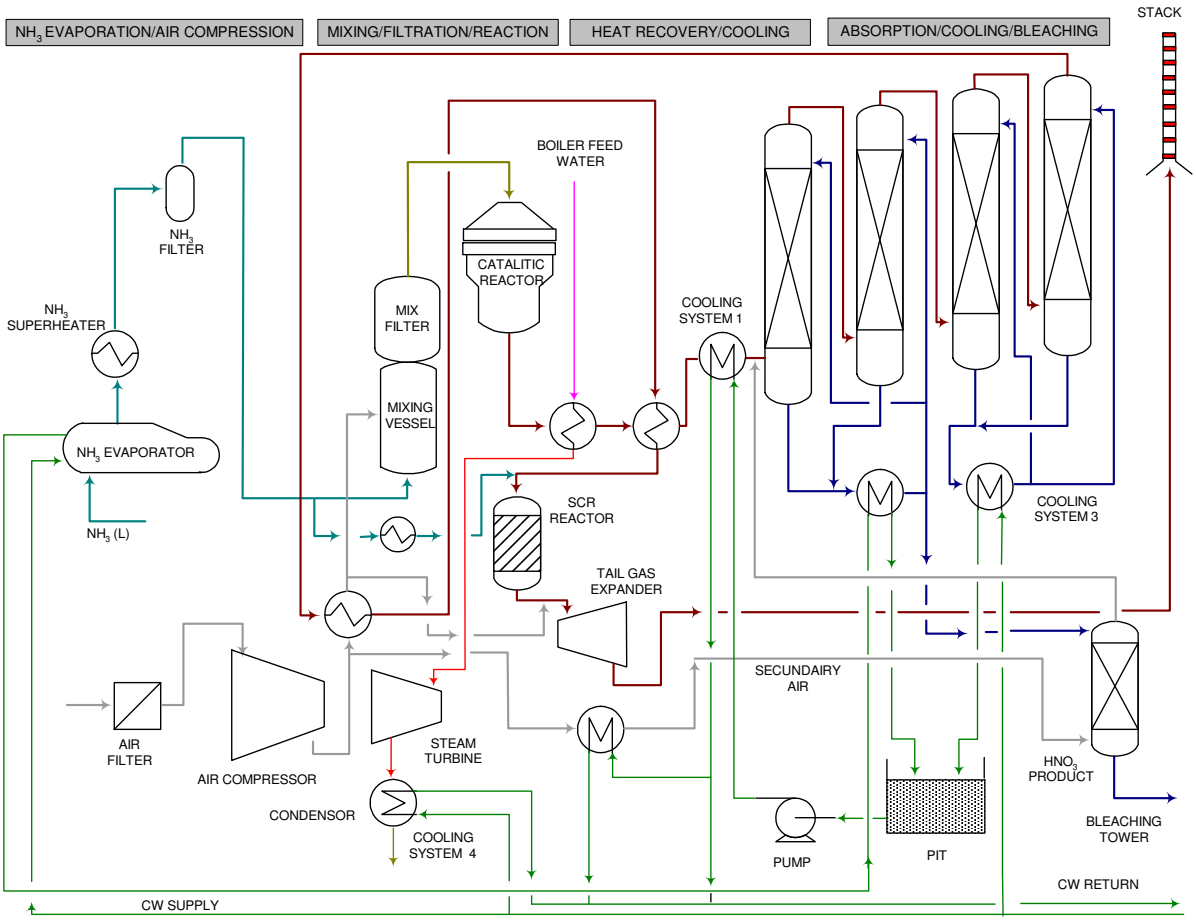

Figure 1. Project boundary for Monomeros Nitric Acid Plant

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	33,296 Nm^3 /h
Recording frequency	Every two seconds
Comments:	None

Data / Parameter:	**Baseline Temperature of the Stack Gas, TSG_{BC}**
Data unit:	ºC
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	117.8 ºC
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	2,219 mg N_2O/ 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 at MCV's plant
Value of data monitored	8,465 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	84,823, ton 100% HNO_3
Recording frequency	Daily
Comment:	Baseline campaign exceeded normal campaign length, which was 83,165 tonne 100% HNO_3 Then, the baseline emission factor was calculated accordingly, taking into account considerations of EB51 Repan_12.

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	0.00715 ton N_2O / ton 100% HNO_3.
Recording frequency	Calculated once at the end of the baseline campaign
Comments:	Baseline campaign length was 84,823 tonne 100% HNO_3, this production exceeds normal campaign length, 83,165 tonne 100% HNO_3, Hence for baseline emission factor calculation, values of $NCSG_{BC}$ previous to the day in which the plant exceeded the normal campaign length were used. (February 9th 2008).

Data / Parameter:	**Baseline Oxidation Temperature, OT_{BC}**
Data unit:	ºC
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	849.5 ºC
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	324,343 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	2,793 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	0.0602 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	84,823 ton 100% HNO_3
Recording frequency	Calculated at the end of the baseline campaign
Comments:	Baseline campaign exceeded normal campaign length, which was 83,165 tonne 100% HNO_3 Then, the baseline emission factor was calculated accordingly, taking into account considerations of EB51 Repan_12.

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 corresponding to Second project campaign.

Data / Parameter:	Project Volume Flow in the Stack Gas, $VSG_{project}$
Data unit:	Nm^3 / hour
Description:	MeanVolume 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	37,037 Nm^3 / hour
Recording frequency	Every two seconds
Comments:	None.

Data / Parameter:	**Project Temperature of the Stack Gas, $TSG_{project}$**
Data unit:	ºC
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	128.15 ºC
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	1.04 kg/cm^2
Recording frequency	Every two seconds
Comments:	Average value

Data / Parameter:	**Project N_2O Concentration in the Stack Gas, $NCSG_{project}$**
Data unit:	mg N_2O/ m^3 (converted from ppmv if necessary)
Description:	Mean N_2O 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	599 mg N_2O/ 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	9,370 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	84,335 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	0.00247 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	84,335 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_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.

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 N_2O analyzer (AO 2000- URAS 14 NDIR supplied by ABB GmbH) is suitable to perform the indicated analysis (N_2O 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 (Accredited according to EN ISO / IEC 17025). 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.

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 (Accredited according to EN ISO / IEC 17025) in May 2009. The AST report is available for DOE review. The report concludes the following: The QA/QC system complies with the requirements of EN 14181 QAL3; the analyzer passed the test on variance, suitability and linearity; the flow meter 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.

In order to guarantee the accomplishment of the monitoring plan, sometimes some Monomeros' employees could be replaced for others with the same skills, strengths, competences and authority level. For example, the Senior Manager Operations could be replaced by the General Manager. The Plant Manager could be replaced for the Operations' Manager. Other case could be the replacement of the Process Engineering in case of the Monitoring Engineering.

8. GHG emission reductions calculations

Baseline emissions

For baseline emission factor determination, N_2O concentration and gas volume flow at the plant were monitored throughout the baseline campaign. Hourly average readings for N_2O 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 N_2O generation have been set based

on plant historical operating conditions, appropriate technical literature 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)	ºC	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 N_2O 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.

a) Calculated the sample mean (x)
b) Calculated the sample standard deviation (s)
c) Calculated the 95% confidence interval (equal to 1.96 times the standard deviation)
d) Eliminated all data that lied outside the 95% confidence interval
e) 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

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

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

Where:

BE_{BC}	Total baseline emissions in the baseline measurement period, in, tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
OH_{BC}	Number of operating hours in the baseline measurement period, in h
EF_{BL}	Baseline emission factor, in tN_2O/ $tHNO_3$
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 value is:
83,165 tons HNO_3

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 N_2O values obtained beyond CL_n. (This data treatment was clearly detailed in Annex 12 of EB51)
Baseline campaign took place between February, 15th 2007 and February, 17th 2 008. The operating day was considered from 8:00 AM of the corresponding day to 7:00 AM of the following day. Following this criteria, baseline campaign took place between 8:00 AM of February, 15th 2007 and 7:00 AM of February, 18th 2 008.

For baseline emission factor calculation the following period was used in order to not exceed normal campaign length. From: February 15th 2007 to February 17th 2008. (See document "MCV BLEF calculation - ver 1.0".xls)

As second project campaign was longer than normal campaign length, we hadn't to re-calculate the baseline emission factor.

To follow all the calculations see the spreadsheet "MCV BLEF calculation -ver 1.0".xls)

Values obtained are:

$BE_{BC} = 33{,}296 * 8{,}465*10^{-9} * 2{,}219 = 625$ *tonnes* N_2O

$$EF_{BL} = \frac{625}{84{,}823} * (1-(2.94/100)) = 0.00715 \text{ tonnes } N_2O/\text{tonnes } HNO_3$$

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, 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 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 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 tN_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 *nth* campaign, in ton N_2O/ton HNO_3
NAP_n	Nitric acid production in the *nth* campaign, in ton 100% HNO_3

Project campaign took place between: March 25^h 2009 and May 3rd 2010. The operating day was considered from 8:00 AM of the corresponding day to 7:00 AM of the following day. Following this criteria, project campaign took place between 8:00 AM of March, 25th 2009 and 7:00 AM of May, 4rd 2010. The days March 25^h 2009 and March 26^h 2009 the Nitric Acid Plant was Shut down during 36 hours for planned maintenance and gauzes change for start Second Campaign.

Values obtained are:

PE_n = 37,037 * 9,370*10^{-9} * 599 = 207.9 *tonnes* N_2O

$$EF_n = \frac{207.9}{84,335} = 0.00247 \text{ tonnes } N_2O/\text{tonnes } HNO_3$$

Complete project emission factor calculation is in document "Monomeros second project campaign-ver 1.0"

Emission Reduction Calculation

As indicated, the present Monitoring Report involves the following period: From March 25th 2009 and May 3rd 2010.

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 *nth* campaign, tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/ tHNO_3$
EF_p	Project emission factor, applicable to the *nth* campaign, in $tN_2O/ tHNO_3$
NAP_n	Nitric acid production during the *nth* campaign of the project activity, in, $tHNO_3$
GWP_{N_2O}	global warming potential, of N_2O set as 310 tCO_2e/tN_2O for the 1st commitment period

Value obtained for the project is:

ER_n = (0.00715 – 0.00247) * 84,335 * 310 = 122,354 *tonnes* CO_{2e}

Complete emission reduction calculation is in the following document: "Monomeros Second project campaign-ver 1.0.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.

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Annex I

List of critical instrumentation:

Instrument	TAG	Brand/Model	Calibration frequency	Date of 2009 calibration	Date of latest calibration
N_2O Analyzer	AIT-11E02:	ABB- AO2000 and URAS 14	Monthly (depending on Shewhart chart results the frequency could be increased)	June 4 2009 (Weekly checking) May 6 2009 (Metrology department check)	May 19 2010 (Monthly checking) May 5 2010 (Metrology department check)
Stack gas flow meter.	FIT-11E02	Rosemount model 3095 MFA	Every gauze changes	January 27 2009	May 5 2010
Stack pressure meter.	PIT-11E02:	Rosemount model 3095 MFA	Every gauze changes	January 27 2009	May 5 2010
Stack temperature meter	TE-11E02	Rosemount model 3095 MFA	Every gauze changes	January 27 2009	May 5 2010
Gas pressure meter at R-1101 inlet	PIT-11A12:	Rosemount model 3051S2CD1	Every gauze changes	March 26 2009	April 5 2010
Gauzes temperature meter	TI-11A10:	LEEDS AND NORTHRUP Model THERMOCOUPLE TYPE K CHROMEL ALUMEL CAT. NO. 8784 K-1-5-36-1-3-1) SHEAT H 5/16 LENGHT 36" JUNTION TYPE CAST IRON WITH MOUNTIN G BUSHING FOR TEMPERATURE 2100 GF	Every gauze changes	March 26 2009	April 5 2010
Ammonia flow meter to ammonia/air mixer	FIT-11A04:	Rosemount model 1151DP5	Every gauze changes	March 26 2009	April 5 2010
Air flow meter to ammonia/air mixer	FIT-11A05:	Rosemount model 3051CD1	Every gauze changes	March 26 2009	April 5 2010
Nitric Acid flow meter.	FIS-11C02	Micro Motion model CMF200H	Every gauze changes	May 27 2009	May 5 2010
Nitric Acid flow meter.	FIS-12N09	Micro Motion model 2700R11ABUSZZZ	Every gauze changes	June 24 2009	May 5 2010

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Annex II

List of relevant events during Baseline 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 condenser 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

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List of relevant events during Second Project campaign.

Date	Event	Reference document
25/03/2009	Plant Shut down. Planned maintenance and gauzes change.	Nitric Acid Plant office log book. Monthly Production Report
03/04/2009	Shut Down during 3.33 hours. Failure in transformer TR-4.	Nitric Acid Plant office log book. Monthly Production Report
19/05/2009	Shut Down during 4 hours. Failure in supply of current to DCS.	Nitric Acid Plant office log book. Monthly Production Report
21/05/2009	Shut Down during 7.4 hours. Air compressor shut down.	Nitric Acid Plant office log book. Monthly Production Report
22/05/2009	Shut Down during 11.5 hours. Three way High Pressure steam valve.	Nitric Acid Plant office log book. Monthly Production Report
10/06/2009	Shut Down during 3 hours. High Pressure differential in air filters, F-1102	Nitric Acid Plant office log book. Monthly Production Report
27/09/2009	Shut Down during 28 hours. Escape steam boiler of Plant 0.	Nitric Acid Plant office log book. Monthly Production Report
01/10/2009	Shut Down during 3 hours. Failure in transformer TR-1-5.	Nitric Acid Plant office log book. Monthly Production Report
01/10/2009	Shut Down during 5.16 hours. Failure in transformer TR-1-5.	Nitric Acid Plant office log book. Monthly Production Report
21/10/2009	Shut Down during 2.16 hours. Failure in the positioner of valve FPV-11A03.	Nitric Acid Plant office log book. Monthly Production Report
06/11/2009	Shut Down during 11 hours. Failure of the pumps MP-1106A/B.	Nitric Acid Plant office log book. Monthly Production Report
12/11/2009	Shut Down during 8 hours. Relocation of vents of SV-11A01/02/03/07.	Nitric Acid Plant office log book. Monthly Production Report
23/11/2009	Shut Down during 5.25 hours. Damage the pump coupling TP-1104B.	Nitric Acid Plant office log book. Monthly Production Report
06/01/2010	Shut Down during 3.66 hours. Failure of turbine pump of the coolant water Tower 2.	Nitric Acid Plant office log book. Monthly Production Report
07/01/2010	Shut Down during 11 hours. Three way High Pressure steam valve.	Nitric Acid Plant office log book. Monthly Production Report

21/01/2010	Shut Down during 205 hours. Planned maintenance of CPL section.	Nitric Acid Plant office log book. Monthly Production Report
03/05/2010	Shut Down during 69 hours. Planned maintenance and gauzes change.	Nitric Acid Plant office log book. Monthly Production Report