PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Catalytic N_2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A.
Version number of the PDD	Version 1.~~2~~3~~4~~
Completion date of the PDD	~~28/09/2011~~~~26/06/2014~~17/09/2014
Project participant(s)	Enaex S.A. Carbon Climate Protection GmbH Mitsubishi Corporation
Host Party(ies)	Republic of Chile
Sectoral scope and selected methodology(ies)	05 Chemical Industry
Estimated amount of annual average GHG emission reductions	~~273,729~~243,437

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The sole purpose of the proposed project activity is to significantly reduce expected levels of N_2O emissions from the production of nitric acid at the PANNA 4 plant of Enaex S.A., Chile. The PANNA 4 nitric acid plant was erected in 2010 as part of the Enaex S.A. chemical complex site, Prillex®[1] América, at Mejillones. The new nitric acid plant, designed for a capacity of 925 metric tonnes of HNO_3 per day (100% of weight), has been commercially operational since November 5th, 2010 and produces nitric acid as an intermediate product for the ammonium nitrate plant within the complex. The plant was designed to operate with a dual pressure process, where the ammonia oxidation reactor is operated at a design pressure of 4.5 bar (medium pressure combustion plant) and the absorption tower at a pressure of 10.2 bar. The reactor is operated at a design temperature in zone 1 of 220°C, in zone 2 of 480°C, in zone 3 of 910°C and in zone 4 of 520°C. The proposed project activity (secondary N_2O destruction) will be implemented in the PANNA 4 nitric acid plant.

<u>*General Introduction*</u>

Nitrous oxide (N_2O) is an unwanted, invisible and previously neglected by-product of the manufacture of nitric acid. It is formed alongside the main, desired product nitric oxide (NO) during the catalytic oxidation of ammonia in air over noble metal gauzes. N_2O is a potent greenhouse gas with a Global Warming Potential (GWP) of 310. This value is valid for the current commitment period and was used for the ex-ante calculation of the emission reduction (also after 2012). The production of nitric acid takes place in three main process steps as indicated by the following reactions:

1. Ammonia (NH_3) combustion to form nitric oxide (NO):

   Ammonia is reacted with air on noble metal catalyst in the oxidation section of nitric acid plants. Nitric oxide and water are formed in this process according to the following equation:

   $$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O \quad \text{(main reaction 1)} \quad \textbf{(1)}$$

   Simultaneously, nitrous oxide (N_2O), nitrogen (N) and water (H_2O) are formed as well, in accordance with the following equations:

   $$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O \quad \text{(side reaction 1)} \quad \textbf{(2)}$$

   $$4NH_3 + 4O_2 \rightarrow 2N_2O + 6H_2O \quad \text{(side reaction 2)} \quad \textbf{(3)}$$

   NO yield depends mainly on pressure and temperature in the ammonia oxidation process and usually is in a range of 95% to 97%.

2. NO is oxidised to nitrogen dioxide (NO_2):

   $$2NO + O_2 \rightarrow 2NO_2 \quad \text{(main reaction 2)} \quad \textbf{(4)}$$

3. (According to the technical process) Absorption of NO_2 in water to form nitric acid (HNO_3):

   $$3NO_2 + H_2O \rightarrow 2HNO_3 + NO \quad \text{(main reaction 3)} \quad \textbf{(5)}$$

   (NO is oxidised to NO_2 according to main reaction 2)

Nitric acid plants are, in the vast majority of cases, part of a chemical complex and are built and operated to supply acid for consumption in downstream process units. The most common use for nitric acid is for fertilisers, with smaller quantities going into the manufacture of organic compounds and mining explosives. In the case of PANNA 4, nitric acid is employed as a feed stock to produce ammonium nitrate

[1] Prillex® is a registered brand of Enaex S.A.

(NH_4NO_3), which is used as a raw material for mining and civil explosives, which are used in the mining and construction industries. The nitric acid is also used as raw material for other explosives (PETN and Nitro-glycerine), which are also used as civil and mining explosives.
Enaex has an internal policy not to sell ammonium nitrate for explosives that can be used for military purposes, however there are special corps inside the Military Forces in Chile that perform civil works as demolition, construction of secondary paths and also destruction of anti-personal mines in the north of the country.
On leaving the ammonia oxidation reactor, there is no relevant loss of N_2O in the tail gas section unless a N_2O destruction facility is installed. N_2O that leaves the ammonia oxidation reactor is thus discharged to atmosphere in the tail gas, and has no economic value.

Description of catalytic decomposition process
Under the project activity, a N_2O catalyst will be inserted below the primary catalyst (NH_3 catalyst) in the ammonia oxidation reactor. The N_2O catalyst will largely result in decomposition of N_2O to nitrogen (N_2) and oxygen (O_2) without any further energy, nor material inputs.
Catalytic decomposition of N_2O occurs when the N_2O is split into its constituent elements by contact with a catalyst. A catalyst is a material which accelerates the speed of the reaction without itself being transformed or consumed by the reaction.

Overall reaction:

$$2N_2O \rightarrow 2N_2 + O_2 \qquad \textbf{(6)}$$

Products of N_2O decomposition are the substances that result from decomposition reaction (N_2 and O_2).

The project's aim will be to reduce N_2O emissions at the nitric acid plant PANNA 4. The project activity won´t result in any revenues except the income from the sale of CERs. The catalytic N_2O destruction project activity is expected to reduce more than 94 % of the N_2O emissions that would be emitted without the project activity.

A.2. Location of project activity
A.2.1. Host Party(ies)
>>
Republic of Chile

A.2.2. Region/State/Province etc.
>>
2nd Region (Region of Antofagasta), Province of Antofagasta

A.2.3. City/Town/Community etc.
>>
Planta Prillex® America
City: Mejillones
Address: Avenida Costanera Norte N°300

A.2.4. Physical/Geographical location
>>
The new PANNA 4 nitric acid plant is part of Enaex S.A.'s Prillex® América ammonia nitrate complex, located in Mejillones, Northern Chile (Province of Antofagasta, 2nd Region). Mejillones is located 65 km north of Antofagasta, the region's capital city and it is surrounded by the Pacific Ocean to the west and by one of the most arid deserts in the world (Desierto de Atacama) to the east. Since the past two centuries, the port of Antofagasta has been playing an important role for the export of raw materials extracted in the area, shifting from guano and sodium nitrate (saltpetre) to potassium nitrate and copper over the years. In

this field, the port of Mejillones has also playing an important role. Currently, the population of Mejillones is more than 8,500 and main economic activities are linked to the mining industry.

Figure 1: Location of the project

Enaex Prillex® América Plant
Avenida Costanera Norte N°300
Mejillones

Latitude: 23° 5' 50.64''S
Longitude: 70° 25' 48.55''W

Formatiert: Spanisch (Chile)

Figure 2: Location of the project within the Prillex® América Plant (green arrow)

A.3. Technologies and/or measures

>>

The employed technology will be a secondary N_2O abatement technology. N_2O, once formed, is removed by a catalyst inside the ammonia oxidation reactor. The preferred position of choice for secondary methods is directly after the gauzes.

The new PANNA 4 nitric acid plant was designed to produce nitric acid as an intermediate product for the ammonium nitrate production plant in this complex with a designed capacity of 925 metric tonnes of HNO_3 per day (100% of weight). The plant is designed to operate as a dual pressure nitric acid plant, whereas the ammonia oxidation reactor is operated at a design pressure of about 4.5 bar (medium pressure combustion plant) and the absorption tower at a design pressure of 10.2 bar. The reactor is operated at a design temperature in zone 1 of 220°C, in zone 2 of 480°C, in zone 3 of 910°C and in zone 4 of 520°C.

The PANNA 4 nitric acid plant will be equipped with a secondary N_2O abatement, by installing baskets inside the ammonia oxidation reactor and equipping them with the N_2O decomposition catalyst right below the platinum gauze in the high temperature zone of the reactor.

The measurement devices for the monitoring of N_2O concentration and tail gas flow will be located directly in the stack.

A secondary approach offers a number of advantages:

- Reduction >94 % can be achieved
- No influence on NO_x yield
- Works with all Pt-gauzes
- Drop in solution with moderate investment costs
- Low operation cost

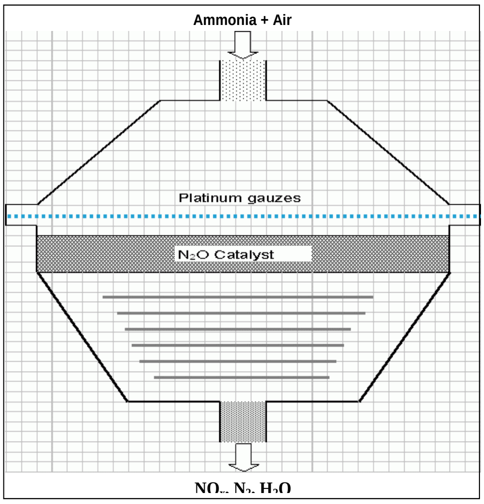


Figure 3: Location of a secondary catalyst inside the AOR reactor

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Chile (Host)	Enaex S.A.	No
Republic of Austria	Carbon Climate Protection GmbH	No
Japan	Mitsubishi Corporation	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Host country is the **Republic of Chile**. Chile ratified the Kyoto Protocol on August 26, 2002.

Project applicant, sponsor and operator is Enaex S.A. (herein after called Enaex), a private owned entity registered under the laws of the Republic of Chile and an incorporated company listed on the Santiago stock exchange, major shareholder is Sigdo Koppers S.A. Enaex is a leading producer of ammonium nitrate to produce explosive that will be used in the mining industry. Based in Chile, the company´s major customer is Enaex Servicios – an associated company of Enaex S.A. Other customers are the most important mining companies of South America, such as CODELCO, BHP Billiton, Anglo American, Antofagasta Minerals, Southern Perú Copper, Phelps Dodge and Placer Dome.

Enaex has well established people, management principles and practices that enable an integral development of its employees. Given the nature of its manufacturing and service operations, Enaex has a strict and high standard of selecting its workers throughout the organisation, which allows to have highly qualified personnel in all of its areas. Enaex's comprehensive people programs include performance management, health, well-being, training and development.

Some of the programs in place:

- Quality Assurance
- Continuous Education and Training
- Consulting on Drug and Alcohol addiction
- Health Plans
- Housing Plans
- Social Technical advising benefits
- Bonus and Equity participation systems
- Creativity Award
- Internal communications
- Sports, Recreation and integration of the family

In 2002, the company received "The Carlos Vial Espantoso Award" for best people management practices. The Prillex® América production facility of Enaex, of which PANNA 4 is one, is certified according to ISO 9001:2008 NCh 9001. Of 2009.

The proposed project activity will be installed in the PANNA 4 nitric acid plant and it is Enaex´ intention to include the PANNA 4 nitric acid plant as well as all CDM monitoring equipment in the quality management system.

Project participant, Carbon Climate Protection GmbH (herein after called CARBON), is a limited liability company located and registered in Austria under Austrian law. CARBON is responsible for the project development. The company is an experienced financing and investment company, focussing on the development and implementation of Greenhouse Gas reduction projects according to Article 6 of the Kyoto Protocol (Joint Implementation) and Article 12 of the Kyoto Protocol (Clean Development Mechanism). CARBON has experience with CDM project development in Africa, Latin America and Asia and is specialised in the catalytic N_2O destruction in the tail gas of nitric acid plants. It has developed the methodology for destruction of N_2O in the tail gas of nitric acid plants (AM0028) and has implemented the first N_2O destruction CDM project at nitric acid plants at Abu Qir Fertilizer Company in Egypt as well as similar CDM project at three nitric acid plants at Hu-Chems Fine Chemicals Corporation in Korea and Enaex S.A. in Chile.

Project participant, Mitsubishi Corporation (herein after called MITSUBISHI), has been involved as a possible buyer of Certified Emissions Reductions of the project. MITSUBISHI is a global integrated business enterprise that develops and operates businesses across virtually every industry including industrial finance, energy, metals, machinery, chemicals, foods, and environmental business. MITSUBISHI's current activities are expanding far beyond its traditional trading operations as its diverse business ranges from natural resources development to investment in retail business, infrastructure, financial products and manufacturing of industrial goods. With over 200 offices & subsidiaries in approximately 90 countries worldwide and a network of over 600 group companies, MITSUBISHI employs a multinational workforce of over 65,000 people.

A.5. Public funding of project activity

>>

No public funds are available for the financing of the project activity.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

>>

This Project Design Document is based on the approved consolidated baseline and monitoring methodology ACM0019 “N_2O abatement from nitric acid production” (Version 012.0.0) and according to the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0).

The applied methodology also stipulates that the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” is to be used when determining emissions from fossil fuel use in a tertiary abatement facility. Due to the fact, that no fossil fuels are used for the operation of the N_2O abatement facility in the project activity, this tool is not applicable to the project activity.

B.2. Applicability of methodology

>>

The proposed project activity destroys N_2O emissions by the catalytic reduction of N_2O by equipping already existing baskets inside the ammonia oxidation reactor with the N_2O decomposition catalyst right below the platinum gauze in the high temperature zone of the reactor of the new nitric acid plant PANNA 4 (secondary N_2O abatement).

The applicability criteria of the chosen methodology are met by the proposed project activity. These are:

- The PANNA 4 nitric acid plant started its commercial operation in November 5th, 2010. Neither No is currently any secondary or tertiary abatement technology was installed in the PANNA 4 nitric acid plant before the implementation of the CDM project activity, nor has this been the case at any time since the commercial start of operation.

- Continuous real-time measurements of the N_2O concentration and the total gas volume flow can be carried out in the tail gas stream after the abatement of N_2O emissions throughout the crediting period of the project activity. A dedicated Automated Monitoring System (AMS) will bewas installed in the plant prior to the beginning of the crediting period of the project activity in line with the requirements of the monitoring methodology.

- Currently, no laws or regulations exist, which mandate the complete or partial destruction of N_2O from nitric acid plants in the host country, the Republic of Chile.[2] In the absence of regulations on N_2O emissions in Chile it is obvious that there is no incentive for the plant operator to install N_2O abatement technologies in its nitric acid plant. This is due to the fact, that N_2O destruction facilities generate no financial or economic benefits (other than CDM related incomes).

From 19/03/2013 onwards methodology ACM0019 v02.0 is applicable.

B.3. Project boundary

[2] This was attested by a letter of the Ambient Evaluation Service of Chile sent to Enaex.

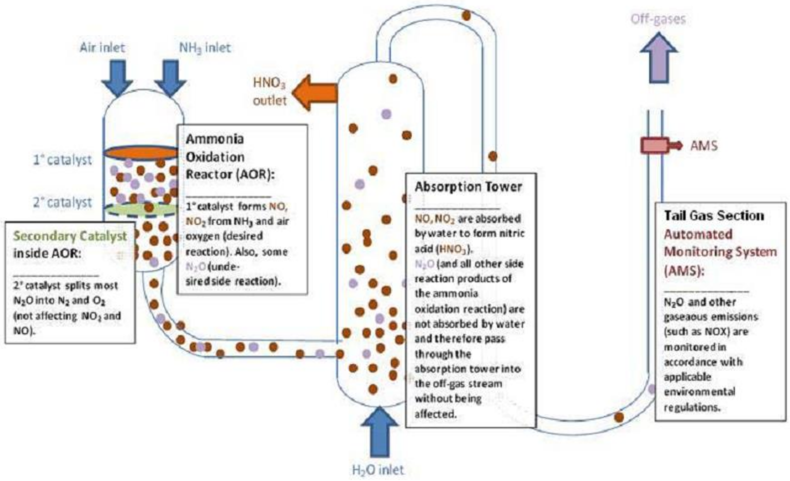
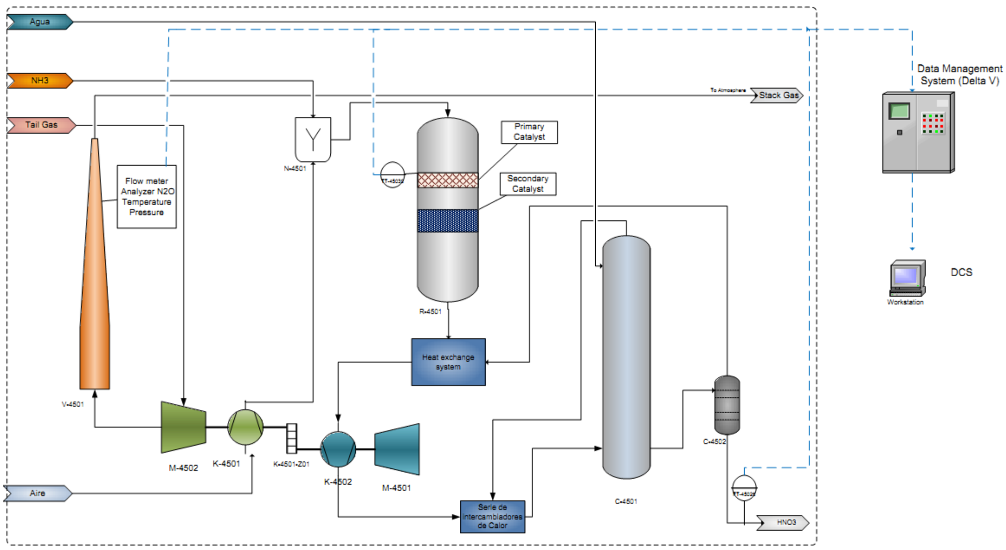


Figure 4: Project boundary if the Project Activity consists of the introduction of a secondary N_2O abatement measure (simplified standard nitric plant layout displaying the location of the N_2O abatement catalyst, process sources of N_2O and the sampling point location for the Automated Monitoring System (AMS))



INSTRUMENT TAG	INSTRUMENT DESCRIPTION	TAG EQUIPO	EQUIPMENT DESCRIPTION	Enaex	Enaex S.A.
TT-45030	Temperature Oxidation	V-4501	Stack Panna 4		
FT-45026	Nitric Acid Flow	M-4502	Expander	Project	Bonos de Carbono Panna 4
TAG EQUIPO	EQUIPMENT DESCRIPTION	K-4501	Air Compressor		
C-4502	Bleaching Tower	N-4501	Amoniac/Air Mixer		
K-4501-Z01	Compressor gearbox	R-4501	Oxidation reactor	Version	1
K-4502	Process Gas Compressor	C-4501	Absorption Tower		
M-4501	Steam Turbine				

Figure 5: Panna 4 Generic Diagram: Equipment and instruments involved in the project

The spatial extent of the project boundary encompasses the facility and equipment for the nitric acid production process from the inlet of the ammonia burner to the outlet of the tail gas section.

Since the project activity introduces only secondary and no tertiary N_2O abatement, the only gas to be included as project emissions is the N_2O, which is not destroyed and still present in the tail gas stream of

the plant (see Figure 4 above). The following table illustrates in detail, which emissions sources are included and which are excluded from the project boundary for determination of both baseline and project emissions.

Table: GHG included in or excluded from the project boundary:

Source		Gas	Included?	Justification / Explanation
Baseline	NH_3 oxidation at primary catalyst gauze	CO_2	No	The project activity has no influence on these types of emissions, if present
		CH_4	No	
		N_2O	Yes	Included, main emission source
Project activity	NH_3 oxidation at primary catalyst gauze	CO_2	No	The project activity has no influence on these types of emissions, if present
		CH_4	No	
		N_2O	Yes	Included, main emission source
	Operation of a tertiary N_2O Abatement facility	CO_2	Yes	In some cases, fossil fuels are used as reducing agent and/or for decomposing the tail gas as part of a tertiary N_2O abatement facility. In this case the fossil fuels are mainly converted to CO_2. CO_2 emissions arising from the production of ammonia are assumed to be small and **not** taken into account
		CH_4	No	
		N_2O	Yes	Included

GHG emissions from the operation of a tertiary N_2O abatement facility are not included, since the proposed CDM project activity does not comprise the installation of a tertiary N_2O abatement technology.

B.4. Establishment and description of baseline scenario

>>

In the following section the approved consolidated baseline and monitoring methodology ACM0019 “N_2O abatement from nitric acid production” is applied to the “Catalytic N_2O destruction project at the nitric acid plant PANNA 4 of Enaex S.A.” in order to identify the baseline scenario:

There are no direct Chilean regulations applicable to NO_x emissions at new nitric acid plants. The actual voluntary commitment of Enaex is based on the Swiss regulation (reference: Swiss Confederation Federal Law, October 7, 1983). According to resolution Number 102/2006 (Antofagasta, 26th May 2006, Comisión Regional del Medio Ambiente – COREMA) the NO_x emission limit for Enaex’ Prillex® América nitric acid plants is 100 ppm and covers the new PANNA 4 nitric acid plant also.

Currently, no laws or regulations exist, which mandate the complete or partial destruction of N_2O from nitric acid plants in the host country, the Republic of Chile. This was attested by a letter of the Ambient Evaluation Service of Chile, which can be reviewed during validation. Therefore in accordance with the approved consolidated baseline and monitoring methodology ACM0019 “N_2O abatement from nitric acid production”, Enaex has no economic incentives to take any N_2O abatement measures in its nitric acid plants in the absence of regulations requiring such measures, as this would entail capital and operating costs, but no financial benefits. Consequently, the proposed CDM project “Catalytic N_2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A.” is considered additional and the baseline scenario is the N_2O emitted to the atmosphere with no N_2O abatement measure implemented.

B.5. Demonstration of additionality

>>

According to the applied methodology ACM0019 the CDM project activity is considered additional in case of the absence of regulations requiring the abatement of N_2O emissions, as the operator of the nitric acid plant has no economic incentives to take any N_2O abatement measures.

Since it was clearly demonstrated in section B.4 above that in Chile no regulations exist, which require the abatement of N_2O emissions in nitric acid plants, the proposed project activity "Catalytic N_2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A." is considered additional.

It was not necessary to submit a prior consideration form for this project activity, since it was already submitted with the application for the new methodology NM340 in April 2010.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

>>

Since the proposed project activity didn´t use AM0028 or AM0034 in the first crediting period, "Case 2: For other nitric acid plants" applies for the emission reduction calculation and "Case 1: For nitric acid plants that have used AM0028 or AM0034 in the first crediting period" has not to be considered.

BASELINE EMISSIONS

According to ~~*Section II* of~~ the approved consolidated baseline and monitoring methodology ACM0019 "N_2O abatement from nitric acid production" (Version 02.0), case 2 the baseline emissions are calculated as follows:

$$BE_y = P_{production,y} * EF_{new,y} * \frac{(h_y - h_{r,y})}{h_y} * GWP_{N2O} * 10^{-3}$$

~~$BE_n = P_{NA,n} * EF_{BL,N2O,n} * GWP_{N2O} * 10^{-3}$~~ **(7)**

Where:

~~BE_n~~	~~=~~	~~Baseline emissions in monitoring period n (tCO_2e)~~
~~$P_{NA,n}$~~	~~=~~	~~Nitric acid produced in the monitoring period n ($tHNO_3$)~~
~~$EF_{BL,N2O,n}$~~	~~=~~	~~Baseline N_2O emission factor for nitric acid production in the monitoring period n (kgN_2O / $tHNO_3$)~~
~~GWP_{N2O}~~	~~=~~	~~Global Warming Potential of N_2O valid for the commitment period~~
BE_y		Baseline emissions in year y (t CO_2e)
$P_{production,y}$		Production of nitric acid in year y (t HNO_3)
$EF_{new,y}$		Baseline N_2O emission factor for nitric acid production in year y (kg N_2O/t HNO_3)
GWP_{N2O}		Global Warming Potential of N_2O valid for the commitment period
h_y		Number of hours in year y during which the plant was in operation (h)
$h_{r,y}$		Number of hours (h) in year y where: (a) For secondary N_2O abatement. Abatement system was not installed, underperforming or failed; (b) For tertiary N_2O abatement. The abatement system is by-passed, underperforming or failed

Calculation of $h_{r,y}$

An abatement system is deemed to be bypassed, not working, underperform or failed in the hour h in year y if:

$$F_{N2O,tail\ gas,h} > EF_{new,y} * P_{NA,h} \quad (8)$$

Where:

$P_{NA,h}$	Nitric acid produced in the hour h (t HNO_3)
$EF_{new,y}$	Baseline N_2O emission factor for nitric acid production in year y (kg N_2O/t HNO_3)
$F_{N2O,tail\ gas,h}$	Mass flow of N_2O in the gaseous stream of the tail gas in the hour h (kg N_2O/h)

Determination of the baseline N_2O emission factor ($EF_{BL,N2O,n}$)

The baseline N_2O emission factor in the monitoring period n ($EF_{BL,N2O,n}$) shall be determined as a default emission factor $EF_{default,y}$ given for each calendar year y for which BE_n is calculated (see monitoring tables for $EF_{default,y}$), as follows:

$$EF_{BL,N2O,n} = EF_{default,y} \quad (8)$$

Where:

$EF_{BL,N2O,n}$	=	Baseline N_2O emission factor for nitric acid production in the monitoring period n (kgN_2O / tHNO_3)
$EF_{default,y}$	=	Default N_2O baseline emissions factor in the calendar year y of the monitoring period n (kgN_2O / tHNO_3)

The default emission factors $EF_{default,y}$ for each calendar year are given in the following table:

Year	Emission factor (kgN_2O/HNO_3)
2005	5.10
2006	4.90
2007	4.70
2008	4.60
2009	4.40
2010	4.20
2011	4.10
2012	3.90
2013	3.70
2014	3.50
2015	3.40
2016	3.20
2017	3.00
2018	2.80
2019	2.70
2020	2.50
2021	2.50
2022	2.50
2023	2.50
…	…
Year n	2.50

~~If the monitoring period n spans across two (or more) calendar years, the baseline emissions (BE_n) shall be calculated separately for each calendar year, first establishing $EF_{BL,N2O,n}$ and then applying this to the nitric acid production of that calendar year.~~

PROJECT EMISSIONS

Project emissions include N_2O emissions, which have not been destroyed by the project activity and, in case of the installation of a tertiary N_2O abatement facility, CO_2 emissions resulting from the operation of the N_2O abatement facility. As the proposed CDM project activity does not comprise the installation of a tertiary N_2O abatement technology, no CO_2 emissions from the operation of such a facility need to be considered or monitored.

Project emissions are calculated as follows:

$$PE_y = PE_{N2O,y} + PE_{CO2,tertiary,y} \quad \text{~~}PE_n = PE_{N2O,n} + PE_{CO2,tertiary,n}\text{~~} \qquad \textbf{(9)}$$

Where:

PE_{ny}	=	Project emissions in ~~monitoring period n~~year y (t CO$_2$e)
$PE_{N2O,yn}$	=	Project emissions of N_2O from the project plant in year y ~~monitoring period n~~ (t CO$_2$e)
$PE_{CO2,tertiary,yn}$	=	Project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in year y ~~monitoring period n~~ (t CO$_2$)

Project emissions of N_2O from the project plant ($PE_{N2O,ny}$)

The amount of N_2O emissions from the project activity are the emissions from the N_2O contained in the tail gas stream of the plant which is released to the atmosphere. ~~includes two emission sources:~~
~~The N_2O contained in the tail gas stream of the plant which is released to the atmosphere; and~~
~~In the case of a tertiary N_2O abatement, the N_2O contained in any by-pass streams to the tertiary N_2O abatement facility. As the proposed CDM project activity does not comprise the installation of a tertiary N_2O abatement technology, no emissions need to be considered or monitored.~~

Accordingly, $PE_{N2O,ny}$ is determined as follows:

$$PE_{N2O} = \sum_1^{h_y - h_{r,y}} F_{N2O,tail\,gas,h} * GWP_{N2O} * 10^{-3}$$
$$\text{~~}PE_{N2O,n} = (Q_{N2O,tailgas,n} + Q_{N2O,by-pass,n}) * GWP_{N2O}\text{~~} \qquad \textbf{(10)}$$

Where:

$PE_{N2O,yn}$	=	Project emissions of N_2O from the project plant in ~~monitoring period n~~year y (t CO$_2$e)
~~$Q_{N2O,tail\,gas,n}$~~	~~=~~	~~Amount of N_2O released through the tail gas of the project plant to the atmosphere in monitoring period n (tN$_2$O)~~
~~$Q_{N2O,by\,pass,n}$~~	~~=~~	~~Amount of N_2O released through the by pass to a tertiary N_2O abatement system to the atmosphere in monitoring period n (tN$_2$O)~~
GWP_{N2O}	=	Global Warming Potential of N_2O valid for the commitment period
$F_{N2O,tail\,gas,h}$		Mass flow of N_2O in the gaseous stream of the tail gas in the hour h (kg N_2O/h)
h_y		Number of hours in year y during which the plant was in operation (h)
$h_{r,y}$		Number of hours (h) in year y where:

(a) For secondary N_2O abatement. Abatement system was not installed, underperforming or failed;
(b) For tertiary N_2O abatement. The abatement system is by-passed, underperforming or failed

Determination of FQ$_{N2O,tail\ gas,nh}$

The amount of N_2O emissions from the tail gas stream of the project plant shall be determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". In applying the tool, the following provisions apply:

- Throughout the crediting periods of the project activity, the N_2O concentration and volume or mass flow of the tail gas are to be monitored continuously. The monitoring system is to be installed and maintained throughout the crediting period based on the European Norm 14181 (2004), or any more recent update of that standard;
- The monitoring system should provide separate hourly average values for the N_2O concentration and the volume or mass flow of the tail gas based on 2 seconds (or shorter) interval readings that are recorded and stored electronically. These N_2O data sets shall be identified by means of a unique time / date key indicating when exactly the values were observed;
- The correction factors derived from the calibration curve of the QAL2 audit for the monitoring components as determined during the QAL2-test in accordance with EN14181 must be applied to both the N_2O concentration and the volume or mass flow of the tail gas. This can either be applied automatically to the raw data recorded by the data storage system at the plant or it can be applied to the calculated hourly averages as part of the calculation of project emissions;
- If data for either the N_2O concentration or the volume or mass flow of the tail gas are not available for more than 1/3 of any hour while the plant was in operation, the value for that hour shall be replaced with the maximum value of N_2O concentration or volume or mass flow of the tail gas observed during the monitoring period. If data for neither the N_2O concentration nor the volume or mass flow of the tail gas are available for more than 1/3 of any hour while the plant was in operation, the maximum value of mass flow of N_2O calculated during the monitoring period shall be applied to any such hour. Values observed during five operating hours before and after a plant start-up and shut-down shall not be used for the determination of the maximum values;
- In the case that the N_2O concentration and the volume or mass flow of the tail gas and by-pass are automatically converted to normal conditions by the AMS during the monitoring process, the parameters P_t and T_t do not need to be monitored except, if applicable, for the purpose of determining the moisture content in the gaseous stream.

According to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) the mass flow of greenhouse gas i in the gaseous stream in time interval t ($F_{i,t}$) is calculated based on measurements of (a) the total volume flow or mass flow of the gas stream, (b) the volumetric fraction of the gas in the gaseous stream and (c) the gas composition and water content. The flow and volumetric fraction may be measured on a dry basis or wet basis. The tool covers the possible measurement combinations, providing six different calculation options to determine the mass flow of a particular greenhouse gas (Option A to F).

Based on the currently available information Option A of the tool will be applied (measurement options for option A: volume flow of gaseous stream on dry basis, volumetric fraction on dry or wet basis), which states two ways how to demonstrate that the gaseous stream is dry. These are:

a) Measure the moisture content of the gaseous stream ($C_{H2O,t,db,n}$) and demonstrate that this is less or equal to 0.05 kg H_2O/m^3 dry gas; or

b) Demonstrate that the temperature of the gaseous stream (T_t) is less than 60°C (333.15 K) at the flow measurement point.

The mass flow of greenhouse gas i ($F_{i,t}$)[3] is determined as follows:

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t} \qquad (11)$$

With

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \qquad (12)$$

Where:

$F_{i,t}$	=	Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h)
$V_{t,db}$	=	Volumetric flow of the gaseous stream in time interval t on a dry basis (m³ dry gas/h)
$v_{i,t,db}$	=	Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m³ gas i/m³ dry gas)
$\rho_{i,t}$	=	Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i/m³ gas i)
P_t	=	Absolute pressure of the gaseous stream in time interval t (Pa)
MM_i	=	Molecular mass of greenhouse gas i (kg/kmol)
R_u	=	Universal ideal gases constant (Pa.m³/kmol.K)
T_t	=	Temperature of the gaseous stream in time interval t (K)

Option A of the tool can be applied since currently available information shows that the moisture content of the gaseous stream ($C_{H2O,t,db,n}$) will beis less than 0.05 kg H_2O/m³ dry gas and therefore the gas is considered to be dry. The moisture content of the gaseous stream will bewas lately measured according to "USEPA CF 42 method 4 – Gravimetric determination of water content"the prevailing methodology and tool as well as to relevant current norms and standards .:

- in September 2012 during AST (highest measured value: 0.0036 kg H_2O/m³ dry gas) and
- in October 2013 during QAL2 (highest measured value: 0.0028 kg H_2O/m³ dry gas).

Ex-ante determination of moisture content at stack:[4]

Mass flow of tail gas	153,705	kg/h
H_2O content of tail gas	316	kg H_2O/h
Density of tail gas	0.845	kg/m³

$$C_{H20,t,db,n} = \frac{H_2Ocontent}{VolumeFlow(drybasis)} = \frac{316kgH_2O/h}{\frac{(153{,}705kg/h - 316kgH_2O/h)}{0.845kg/m^3}} = 0.00174kgH_2O/m^3drygas$$

The hourly values are then aggregated for the duration of the monitoring period n, as follows:

$$Q_{N2O,tailgas,n} = \sum_{h=1}^{h=h_n} F_{N2O,tailgas,h} * 10^{-3} \qquad (13)$$

[3] $F_{i,t}$ corresponds to the parameter $F_{N2O,tail\ gas,h}$ of the methodology ACM0019 v02.0.
[4] Source: Mass balance

Where:

$Q_{N2O,tail\ gas,n}$	=	Amount of N_2O released through the tail gas of the project plant to the atmosphere in monitoring period n (tN_2O)
$F_{N2O,tail\ gas,h}$	=	Mass flow of N_2O in the gaseous stream of the tail gas in the hour h (kgN_2O/h)
h_n	=	Number of hours in monitoring period n during which the plant was in operation

During any periods in which a tertiary abatement system is by-passed, $F_{N2O,tail\ gas,h}$ is set to zero in order to avoid double counting of project emissions. Since the project activity applies only a secondary N_2O abatement facility this needs not to be considered according to the methodology.

Determination of $Q_{N2O,by\text{-}pass,n}$

This emission source only needs to be estimated if a tertiary N_2O abatement facility is installed under the project activity. Since the project activity applies only a secondary N_2O abatement facility the amount of N_2O released through the by-pass to a tertiary N_2O abatement system to the atmosphere in monitoring period n ($Q_{N2O,by\text{-}pass,n}$) is considered to be zero.

Project emissions from the operation of the tertiary N_2O abatement facility ($PE_{CO2,tertiary,ny}$)

This emission source only needs to be estimated if a tertiary N_2O abatement facility is installed under the project activity and if fossil fuels are used to operate the facility or re-heat the gas after the facility.

Since the project activity applies only a secondary N_2O abatement facility the project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in monitoring period nyear y ($PE_{CO2,tertiary,ny}$) are considered to be zero.

LEAKAGE

According to the methodology any leakage emissions sources are deemed to be negligible.

EMISSION REDUCTION

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad ER_n = BE_n - PE_n \qquad (13)$$

Feldfunktion geändert

Where:

ER_{ny}	=	Emission reductions in year y monitoring period n (t CO_2e)
BE_{ny}	=	Baseline emissions in year y monitoring period n (t CO_2e)
PE_{ny}	=	Project emissions in year y monitoring period n (t CO_2e)

B.6.2. Data and parameters fixed ex ante

Data / Parameter:	$EF_{default,y}$
Data unit:	$kgN_2O/tHNO_3$
Description:	Default N_2O baseline emissions factor in the calendar year y of the monitoring period n
Source of data used:	The default N_2O baseline emission factor will vary every year. In year 2005 the

	emission factor will be 5.1 and then it will decrease every year until it reaches a final value of 2.5 in the year 2020. The value of 2.5 will remain constant after 2020.
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied:	Specified in the methodology
Any comment:	The decrease in the value for the baseline emission factor over time is to reflect the technological development

Year	Emission factor (kgN_2O/HNO_3)
2011	4.10
2012	3.90
2013	3.70
2014	3.50
2015	3.40
2016	3.20
2017	3.00
2018	2.80
2019	2.70
2020	2.50
2021	2.50
…	…
Year n	2.50

Data / Parameter table 1.

Data / Parameter	$EF_{new,y}$
Unit	kg N_2O/t HNO_3
Description	Baseline N_2O emission factor for nitric acid production in year y (related to 100 per cent pure acid)

Source of data	The baseline N_2O emission factor for nitric acid production will vary every year. In year 2005 the emission factor will be 5.1 and then it will decrease every year until it reaches a final value of 2.5 in the year 2020. The value of 2.5 will remain constant after 2020, as provided in the following table: Year | Emission factor (kg N_2O/t HNO_3) 2005 | 5.10 2006 | 4.90 2007 | 4.70 2008 | 4.60 2009 | 4.40 2010 | 4.20 2011 | 4.10 2012 | 3.90 2013 | 3.70 2014 | 3.50 2015 | 3.40 2016 | 3.20 2017 | 3.00 2018 | 2.80 2019 | 2.70 2020 | 2.50 2021 | 2.50 2022 | 2.50 2023 | 2.50 … | … Year n | 2.50
Value(s) applied	Year | Emission factor (kg N_2O/t HNO_3) 2011 | 4.10 2012 | 3.90 2013 | 3.70 2014 | 3.50 2015 | 3.40 2016 | 3.20 2017 | 3.00 2018 | 2.80 2019 | 2.70 2020 | 2.50 2021 | 2.50
Choice of data or Measurement methods and procedures	None
Purpose of data	Calculation of baseline emissions
Additional comment	The decrease in the value for the baseline emission factor over time is to reflect the technological development

Formatiert: Portugiesisch (Brasilien)

Formatiert: Portugiesisch (Brasilien)

Data / Parameter table 2.

Data / Parameter:	GWP_{N2O}
Data uUnit:	tCO_2e/tN_2O
Description:	Global warming potential of N_2O valid for the commitment period
Source of data used:	Relevant decisions by the CMP
Value(s) applied:	310298
Choice of data or Measurement methods and procedures	None
Purpose of data	Calculation of baseline and project emissions
Justification of the choice of data or description of measurement methods and procedures actually applied:	Decision 2/CP.3 Methodological issues related to the Kyoto protocol (FCCC/CP/1997/7/Add.1)
Any dditional comment:	Not applicable (NA)

Parameters from the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)

Data / Parameter table 3.

Data / Parameter:	R_u
Data uUnit:	Pa.m³/kmol.K
Description:	Universal ideal gases constant
Source of data used:	"Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)
Value(s) applied:	8,314
Choice of data or Measurement methods and procedures Justification of the choice of data or description of measurement methods and procedures actually applied:	Specified in the tool
Purpose of data	Calculation of project emissions
Anydditional comment:	NA

Data / Parameter table 4.

Data / Parameter:	MM_i
Data uUnit:	kg/kmol
Description:	Molecular mass of greenhouse gas i
Source of data used:	"Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)
Value(s) applied:	Compound: Nitrous oxide; Structure: N_2O; Molecular mass (kg/kmol): 44.02
Choice of data or	Specified in the tool

Measurement methods and procedures ~~**Justification of the choice of data or description of measurement methods and procedures actually applied:**~~	
Purpose of data	Calculation of project emissions
A~~ny~~dditional comment~~:~~	NA

B.6.3. Ex ante calculation of emission reductions

>>

Ex-ante estimation of emission reduction is made by projecting nitric acid output, N_2O formation and efficiency of the catalytic N_2O destruction process. Estimation is for reference purposes only, actual project and baseline emissions will be determined on measurement results on an ex-post basis.

The following data are applied for the ex-ante calculation of emission reduction:

- Nitric acid production of 925 $tHNO_3$/d (100% of weight)[5];
- Tail gas mass flow rate of 153,705 kg/h (actual conditions)[6];
- Concentration of N_2O prior to the N_2O abatement catalyst of about 1,200 ppmv[7];
- Removal rate of 94 %[8] of N_2O emissions, resulting in an outlet concentration of about 72 ppmv;
- Yearly operation is assumed to be ~~355~~ 350 days[9], which leads to yearly operating hours of 8,~~520~~400.

Since the proposed project activity didn´t use AM0028 or AM0034 in the first crediting period, "Case 2: For other nitric acid plants" applies for the emission reduction calculation and "Case 1: For nitric acid plants that have used AM0028 or AM0034 in the first crediting period" has not to be considered.

Please note: Ex-ante estimation of emission reductions was done for the period from 19/03/2013 onwards only, since from then onwards methodology ACM0019 v02.0 was applied. Values of emission reductions before that date are real emission reductions (already generated, verified and issued during Monitoring Periods # 1 – 4 of the CDM project). All data are based on continuous real-time measurements.

BASELINE EMISSIONS

Baseline emissions are calculated as below:

$$BE_y = P_{production,y} * EF_{new,y} * \frac{(h_y - h_{r,y})}{h_y} * GWP_{N2O} * 10^{-3}$$

~~$BE_n = P_{NA,n} * EF_{BL,N2O,n} * GWP_{N2O} * 10^{-3}$~~

Year	BE_y	$P_{production,y}$	$EF_{new,y}$	h_y	$h_{r,y}$	GWP_{N2O}

5 Source: "Operation manual Project Panna 4" of TR-ESPINDESA

6 Source: Mass balance
Tail gas volume flow rate (actual conditions): 181,899 m³ dry gas/h; parameter is considered to be dry.

7 Source: "Operation manual Project Panna 4" of TR-ESPINDESA

8 Source: "Technical details for HERAEUS secondary catalyst system" of contract between HERAEUS and Enaex

9 Source: "201~~1~~4 Production Plan" and "Operation manual Project Panna 4"

	t CO_2e	t HNO_3	kg N_2O/t HNO_3	h	h	t CO_2e/t N_2O
12/2011	13,932	10,961	NA	267	NA	310
2012	404,173	334,304	NA	7,938	NA	310
2013	345,162	313,043	NA / 3.7	8,281	NA / 0	298
2014	337,671	323,750	3.5	8,400	0	298
2015	328,024	323,750	3.4	8,400	0	298
2016	308,728	323,750	3.2	8,400	0	298
2017	289,433	323,750	3.0	8,400	0	298
2018	270,137	323,750	2.8	8,400	0	298
2019	260,489	323,750	2.7	8,400	0	298
2020	241,194	323,750	2.5	8,400	0	298
01-11/2021	221,094	296,771	2.5	8,101	0	298

The operating hours (h_y) from 19/03/2013 onwards were calculated on the basis of 35~~5~~0 operating days per full year of operation: (1 h x 24 h / day x 35~~5~~0 days (number of intervals) = 8,~~52~~400 h / year)

PROJECT EMISSIONS

Project emissions are calculated as below:

$$PE_y = PE_{N2O,y} + PE_{CO2,tertiary,y}$$

~~$PE_n = PE_{N2O,n} + PE_{CO2,tertiary,n}$~~

Year	PE_y	PE_{N2O}	$PE_{CO2,tertiary,y}$
	t CO_2e	t CO_2e	t CO_2
12/2011	1,242	1,242	0
2012	161,931	161,931	0
2013	66,312	66,312	0
2014	44,721	44,721	0
2015	44,721	44,721	0
2016	44,721	44,721	0
2017	44,721	44,721	0
2018	44,721	44,721	0
2019	44,721	44,721	0
2020	44,721	44,721	0
01-11/2021	43,128	43,128	0

$$PE_{N2O} = \sum_{1}^{h_y - h_{r,y}} F_{N2O,tail\ gas,h} * GWP_{N2O} * 10^{-3}$$

~~$PE_{N2O,n} = (Q_{N2O,tailgas,n} + Q_{N2O,by-pass,n}) * GWP_{N2O}$~~

Year	PE_{N2O}	$F_{N2O,tail\ gas,h}$	h_y	$h_{r,y}$	GWP_{N2O}
	t CO_2e	kg N_2O/h	h	h	t CO_2e/t N_2O
12/2011	1,242	15.01	267	NA	310
2012	161,931	65.80	7,938	NA	310
2013	66,312	40.42	8,281	NA / 0	298
2014	44,721	17.87	8,400	0	298
2015	44,721	17.87	8,400	0	298
2016	44,721	17.87	8,400	0	298
2017	44,721	17.87	8,400	0	298

2018	44,721	17.87	8,400	0	298
2019	44,721	17.87	8,400	0	298
2020	44,721	17.87	8,400	0	298
01-11/2021	43,128	17.87	8,101	0	298

According to currently available information $F_{N2O,tail\ gas,h}$[10] was determined to ~~17.13~~17.87 kgN_2O/h and was used for ex-ante determination.

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t}$$

With

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t}$$

Year	$F_{N2O,tail\ gas,h} = F_{i,t}$	$V_{t,db}$	$v_{i,t,db}$	$\rho_{i,t}$
	kgN_2O/h	m^3 dry gas/h	m^3 gas i/ m^3 dry gas	kg gas i/m^3 gas i
12/2011	15.01~~17.13~~	179,813~~181,899~~	5.11E-05~~7.20E-05~~	1.404~~1.308~~
2012	65.80~~17.13~~	169,319~~181,899~~	2.43E-04~~7.20E-05~~	1.400~~1.308~~
2013	40.42~~17.13~~	~~181,899~~174,336	1.48~~7.20~~E-04~~5~~	1.3~~0~~86
2014	17.87~~17.13~~	181,899	7.20E-05	1.364~~1.308~~
2015	17.87~~17.13~~	181,899	7.20E-05	1.364~~1.308~~
2016	17.87~~17.13~~	181,899	7.20E-05	1.364~~1.308~~
2017	17.87~~17.13~~	181,899	7.20E-05	1.364~~1.308~~
2018	17.87~~17.13~~	181,899	7.20E-05	1.364~~1.308~~
2019	17.87~~17.13~~	181,899	7.20E-05	1.364~~1.308~~
2020	17.87~~17.13~~	181,899	7.20E-05	1.364~~1.308~~
01-11/2021	17.87~~17.13~~	181,899	7.20E-05	1.364~~1.308~~

Formatiert: Portugiesisch (Brasilien)

LEAKAGE

Any leakage emissions sources are deemed to be negligible.

EMISSION REDUCTIONS

Project emissions are calculated as below:

$$ER_y = BE_y - PE_y$$ ~~$ER_n = BE_n - PE_n$~~

Year	**ER_y**	**BE_y**	**PE_y**
	t CO_2e	**t CO_2e**	**t CO_2e**

[10] $F_{N2O,tail\ gas,h}$ corresponds to the parameter $F_{i,t}$ of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)".

12/2011	12,690	13,932	1,242
2012	242,242	404,173	161,931
2013	278,850	345,162	66,312
2014	292,950	337,671	44,721
2015	283,302	328,024	44,721
2016	264,007	308,728	44,721
2017	244,711	289,433	44,721
2018	225,416	270,137	44,721
2019	215,768	260,489	44,721
2020	196,473	241,194	44,721
01-11/2021	177,966	221,094	43,128

B.6.4. Summary of ex ante estimates of emission reductions

The anthropogenic emissions of the proposed project activity within the project boundary consist of the emissions of non-destroyed N_2O only. Estimation is for reference purposes only, actual project and baseline emissions will be determined on measurement results on an ex-post basis.

~~Expected s~~Starting date of the crediting period: ~~0~~19/12/2011

The table below summarizes the project's emissions by sources.

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
12/2011	13,932	1,242	0	12,690
2012	404,173	161,931	0	242,242
2013	345,162	66,312	0	278,850
2014	337,671	44,721	0	292,950
2015	328,024	44,721	0	283,302
2016	308,728	44,721	0	264,007
2017	289,433	44,721	0	244,711
2018	270,137	44,721	0	225,416
2019	260,489	44,721	0	215,768
2020	241,194	44,721	0	196,473
01-11/2021	221,094	43,128	0	177,966
Total	**3,020,036**	**585,663**	**0**	**2,434,373**
Total number of crediting years	10 years			
Annual average over the crediting period	**302,004**	**58,566**	**0**	**243,437**

~~Over the crediting period, the project activity is expected to generate 2,737,289 tCO_2e of emission reductions.~~

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter table 5.

Data / Parameter	**$P_{production,y}$**
Unit	t HNO_3
Description	Production of nitric acid in year y
Source of data	Production log
Value(s) applied	The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.
Measurement methods and procedures	The nitric acid flow is measured with a “coriolis” type mass flow meter. The coriolis can also measure the fluid density. These two parameters are sent to the DCS (control room), where the concentration with tabulated values is calculated. Finally, the nitric acid at 100% is calculated by multiplying the mass flow with the concentration. Automatically monitored.
Monitoring frequency	Every monitoring period
QA/QC procedures	Periodic calibration will be performed according to supplier´s recommendations.
Purpose of data	Calculation of baseline emissions
Additional comment	The parameter $P_{NA,h}$ (Nitric acid produced in the hour h) represents the hourly value of $P_{production,y}$ and is used for determining $h_{r,y}$ as described in section 5.3.3 of the applied methodology (Equation 5).

Data / Parameter table 6.

Data / Parameter	**h_y**
Unit	h
Description	Number of hours of operation in year y
Source of data	Measured
Value(s) applied	The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.
Measurement methods and procedures	The operation temperature of the oxidation burner ranges from 850 – 905°C (as defined by the technology supplier) and this range corresponds to the real operation hours of the reactor. The temperature is reported automatically by three independent measurement points (TAG numbers TT45030 A – C) measuring the temperature at the same time. The value of the instrument with the TAG number TT45030 A was selected as main signal for monitoring the operation temperature; TT45030 B and TT45030 C are used as back-up signals in case TT45030 A is not fully functional. The information will be stored in electronic records and paper during whole project´s lifetime.
Monitoring frequency	Every monitoring period
QA/QC procedures	Periodic calibration will be performed according to manufacturer´s recommendation.
Purpose of data	Calculation of baseline and project emissions
Additional comment	Records to be maintained during project´s lifetime

Data / Parameter table 7.

Data / Parameter	$h_{r,y}$
Unit	h
Description	Number of hours (h) in year y where for secondary N_2O abatement: Abatement system was not installed, underperforming or failed
Source of data	Measured
Value(s) applied	The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.
Measurement methods and procedures	Since the proposed project activity didn´t use AM0028 or AM0034 in the first crediting period, "Case 2: For other nitric acid plants" applies for the emission reduction calculation. Accordingly the abatement system is deemed to be not installed, underperforming or failed in the hour h in year y if: $F_{N2O,tail\ gas,h} > EF_{new,y} * P_{NA,h}$ The parameters mentioned above will be determined and monitored as explained in the respective sections of this PDD ($P_{NA,h}$ → Parameter table 5; $F_{N2O,tail\ gas,h}$ → Parameter table 8 – 12; $EF_{new,y}$ → Parameter table 1 (need not to be monitored).
Monitoring frequency	Every monitoring period
QA/QC procedures	Periodic calibration will be performed according to manufacturer´s recommendation.
Purpose of data	Calculation of baseline and project emissions
Additional comment	Records to be maintained during project´s lifetime

~~**Data / Parameter:**~~	~~$P_{NA,n}$~~
~~Data unit:~~	~~$tHNO_3$~~
~~Description:~~	~~Nitric acid produced in the monitoring period n~~
~~Source of data to be used:~~	~~Production log~~
~~Value of data applied for the purpose of calculating expected emission reductions in section B.5~~	~~No measurements available at this stage of the project.~~ ~~The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.~~
~~Description of measurement methods and procedures to be applied:~~	~~The nitric acid flow is measured with a "coriolis" type mass flow meter. The coriolis can also measure the fluid density. These two parameters are sent to the DCS (control room), where the concentration with tabulated values is calculated. Finally, the nitric acid at 100% is calculated by multiplying the mass flow with the concentration.~~ ~~Automatically monitored.~~
~~QA/QC procedures to be applied:~~	~~Periodic calibration will be performed according to supplier´s recommendations.~~
~~Any comment:~~	~~NA~~

~~**Data / Parameter:**~~	~~h_n~~
~~Data unit:~~	~~NA~~
~~Description:~~	~~Number of hours of operation in a monitoring period n~~
~~Source of data to be used:~~	~~Measured~~
~~Value of data applied~~	~~No measurements available at this stage of the project.~~

for the purpose of calculating expected emission reductions in section B.5	The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.
Description of measurement methods and procedures to be applied:	The operation temperature of the oxidation burner ranges from 850 – 905°C (as defined by the technology supplier) and this range corresponds to the real operation hours of the reactor. The temperature is reported automatically by three independent measurement points (TAG numbers TT45030 A – C) measuring the temperature at the same time. The value of the instrument with the TAG number TT45030 A was selected as main signal for monitoring the operation temperature; TT45030 B and TT45030 C are used as back-up signals in case TT45030 A is not fully functional. The information will be stored in electronic records and paper during whole project´s lifetime.
QA/QC procedures to be applied:	Periodic calibration will be performed according to manufacturer´s recommendation.
Any comment:	Records to be maintained during project´s lifetime

Parameters from the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)

Data / Parameter table 8.

Data / Parameter:	$V_{t,db}$
Data Uunit:	m³ dry gas/h
Description:	Volumetric flow of the gaseous stream in time interval t on a dry basis
Source of data to be used:	Measured
Value(s) appliedValue of data applied for the purpose of calculating expected emission reductions in section B.5	No measurements available at this stage of the project. The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.
Measurement methods and proceduresDescription of measurement methods and procedures to be applied:	Volumetric flow measurement will refer to the actual pressure and temperature. Calculated based on the dry basis flow measurement plus water concentration measurement (according to Option A of the tool). Continuous monitoring.
Monitoring frequency	Continuous monitoring
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer´s specifications.
Purpose of data	Calculation of project emissions
Any comment:	Periodic calibration will be performed according to manufacturer´s recommendation.

Data / Parameter table 9.

Data / Parameter:	$v_{i,t,db}$
Data uUnit:	m³ gas i/m³ dry gas
Description:	Volumetric fraction of greenhouse gas i in a time interval t on a dry basis

Source of data to be used:	Measured
Value(s) appliedValue of data applied for the purpose of calculating expected emission reductions in section B.5	No measurements available at this stage of the project. The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.
Measurement methods and proceduresDescription of measurement methods and procedures to be applied:	Continuous gas analyser operating in dry-basis. Volumetric flow measurement refers to the actual pressure and temperature. Continuous monitoring.
Monitoring frequency	Continuous monitoring
QA/QC procedures to be applied:	According to European Norm 14181
Purpose of data	Calculation of project emissions
Any comment:	NA

Data / Parameter table 10.

Data / Parameter:	$C_{H2O,t,db,n}$
Data uUnit:	mg H_2O/m^3 dry gas
Description:	Moisture content of the gaseous stream at normal conditions, in time interval t
Source of data to be used:	Measurements according to the USEPA CF42 method 4 – Gravimetric determination of water content
Value(s) appliedValue of data applied for the purpose of calculating expected emission reductions in section B.5	Discrete measurement procedure Latest measurements: • 0.0028 kg H_2O/m^3 dry gas (highest measured value in October 2013 during QAL2 • 0.0036 kg H_2O/m^3 dry gas (highest measured value in September 2012 during ASTCalculated value for ex-ante determination of emission reductions is 1,740 mg H_2O/m^3 dry gas (= 0.00174 kg H_2O/m^3 dry gas).
Measurement methods and proceduresDescription of measurement methods and procedures to be applied:	The mean value among three consecutive measurements performed in the same day (at least 2 hours each) will be considered. Measurements will coincide with the Annual Surveillance Test (associated with requirements of the EN 14181 standard) or the calibration of the flow meter for the gaseous stream.
Monitoring frequency	Measurements will coincide with the Annual Surveillance Test (associated with requirements of the EN 14181 standard) or the calibration of the flow meter for the gaseous stream.
QA/QC procedures to be applied:	According to the USEPA CF42 method 4
Purpose of data	Calculation of project emissions
Any comment:	Option A parameter for proving that the gaseous stream is dry.

Data / Parameter table 11.

Data / Parameter:	T_t

Data uUnit:	K
Description:	Temperature of the gaseous stream in time interval t
Source of data to be used:	Measured
Value(s) appliedValue of data applied for the purpose of calculating expected emission reductions in section B.5	No measurements available at this stage of the project. The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.
Measurement methods and proceduresDescription of measurement methods and procedures to be applied:	Instruments with recordable electronic signal
Monitoring frequency	Continuous monitoring
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer´s specifications.
Purpose of data	Calculation of project emissions
Any comment:	Periodic calibration will be performed according to manufacturer´s recommendation.

Data / Parameter table 12.

Data / Parameter:	P_t
Data uUnit:	Pa
Description:	Pressure of the gaseous stream in time interval t
Source of data to be used:	Measured
Value(s) appliedValue of data applied for the purpose of calculating expected emission reductions in section B.5	No measurements available at this stage of the project. The assumptions for Emission Reductions calculations can be found in respective section B.6.1 and B.6.3.
Measurement methods and proceduresDescription of measurement methods and procedures to be applied:	Instruments with recordable electronic signal
Monitoring frequency	Continuous monitoring
QA/QC procedures to be applied:	Periodic calibration against a primary device will be performed periodically and records of calibration procedures will be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) will be calibrated monthly using digital communication between transducer and control or monitoring system (e.g. via Highway Addressable Remote Transducer Protocol).
Purpose of data	Calculation of project emissions

Any comment:	Periodic calibration will be performed according to manufacturer´s recommendation.

B.7.2. Sampling plan

>>

Not applicable for the project activity.

B.7.3. Other elements of monitoring plan

>>

The emission reductions achieved by the project activity will be monitored using the requirements of the approved consolidated baseline and monitoring methodology ACM0019 "N_2O abatement from nitric acid production" (Version 0102.0.0) and of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0).

Enaex has been operating chemical complex' incl. nitric acid plants since the commissioning of the plants 1-3 and has sufficient and well-experienced staffs. Enaex has been in production of the nitric acid for more than 90 years and measurement of various production parameters including operation of analysers, which are managed by the production team.

Measurement of the N_2O concentration and the total gas volume flow

The project will employ the latest state of the art monitoring and control equipment that measures, records and reports all key parameters to determine the GHG emission reductions. The plant will be equipped with an Automated Monitoring System (AMS) in order to allow continuous real-time measurements of the N_2O concentration and the total gas volume flow, which is required by the methodology.

The amount of N_2O emissions from the tail gas stream of the project plant shall be determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". In applying the tool, the following provisions apply:

- Throughout the crediting periods of the project activity, the N_2O concentration and volume or mass flow of the tail gas are to be monitored continuously. The monitoring system is to be installed and maintained throughout the crediting period based on the European Norm 14181 (2004), or any more recent update of that standard;
- The monitoring system should provide separate hourly average values for the N_2O concentration and the volume or mass flow of the tail gas based on 2 seconds (or shorter) interval readings that are recorded and stored electronically. These N_2O data sets shall be identified by means of a unique time / date key indicating when exactly the values were observed;
- The correction factors derived from the calibration curve of the QAL2 audit for the monitoring components as determined during the QAL2-test in accordance with EN14181 must be applied to both the N_2O concentration and the volume or mass flow of the tail gas. This can either be applied automatically to the raw data recorded by the data storage system at the plant or it can be applied to the calculated hourly averages as part of the calculation of project emissions;
- If data for either the N_2O concentration or the volume or mass flow of the tail gas are not available for more than 1/3 of any hour while the plant was in operation, the value for that hour shall be replaced with the maximum value of N_2O concentration or volume or mass flow of the tail gas observed during the monitoring period. If data for neither the N_2O concentration nor the volume or mass flow of the tail gas are available for more than 1/3 of any hour while the plant was in operation, the maximum value of mass flow of N_2O calculated during the monitoring period shall be applied to any such hour. Values observed during five operating hours before and after a plant start-up and shut-down shall not be used for the determination of the maximum values;

- In the case that the N_2O concentration and the volume or mass flow of the tail gas and by-pass are automatically converted to normal conditions by the AMS during the monitoring process, the parameters P_t and T_t do not need to be monitored except, if applicable, for the purpose of determining the moisture content in the gaseous stream.

The European Norm EN 14181 stipulates three levels of quality assurance tests and one annual functional test for AMS, which are recommended to be used as guidance regarding the selection, installation and operation of the AMS under the applied monitoring methodology. The three quality assurance levels (QAL) are as follows:

1. Quality assurance of tested AMS. AMS will have performance certificate with calculation of uncertainty before installation. The specific performance characteristics of the monitoring system chosen by the project will be listed in the Monitoring Reports.
2. Quality assurance of installation and calibration of the Automated Measuring System according to the Standard Reference Measurement Method (SRM) for concentration measurements, determination of the measurement uncertainty/variability of the AMS and inspection of the compliance with the prescribed measurement uncertainties. Such tests will be carried out by organisations that have an accredited quality assurance system.
3. Continuous quality assurance through the local operator/manager (drift and accuracy of the AMS, verification management and documentation).
    a) Permanent quality assurance during the plant operation by the operating staff;
    b) Assurance of reliable and correct operation of the monitoring equipment (maintenance evidence);
    c) Regular controls as scheduled by the manufacturer (maintenance intervals);

In addition, annual functionality tests including SRM measurements to check for uncertainties in the data measured by the AMS are planned. Such tests will be carried out by organisations that have an accredited quality assurance system.

Quality Management
The monitoring procedures will be integrated in Enaex quality management system. All monitoring equipment will be serviced, calibrated and maintained according to the manufacturers' instructions and international standards. Parameters to be monitored are described above.

It is the responsibility of the Project Operator to ensure that experienced staff is available and that the operational staff is able to operate the monitoring system properly. It is also the responsibility of the Project Operator to organize and implement a quality management system that ensures the integrity of the data.

Operation and maintenance
The data measured by the installed monitoring system is sent directly to the Delta V System. This system has a historian that will archive the data without the need of human intervention. This will ensure data integrity. Malfunction of system components will be indicated on the operator console in the control room as an alarm. The occurrence of such an alarm requires the operator to immediately take measures to remedy the problem. This is normally done by informing the instrument department, which then decides whether the problem can be fixed immediately by themselves, or whether external support from manufacturer is required. In such a case it is important to act immediately in order to avoid loss of valuable data.

Enaex will perform a visual inspection of system on a regular basis by the operating staff. Such an inspection can give indications on oncoming problems and allow to be prepared for them. Internal review of project performance and calculation of emission reductions will be executed by Enaex and CARBON on a regular basis.

The operation and maintenance of the N_2O monitoring system will be incorporated to the ISO 9001:2008 quality management system. The production team will be appointed to be responsible for the operation of the N_2O monitoring system. The production team will follow the monitoring plan and report the data on regular intervals to the management team and Plant Manager in ascending order.

Find below the responsibilities and corresponding tasks for the CDM Project.

Responsibility	Tasks	Company
CDM Project Management	Needs to report to the ENAEX Board and communicates with the UNFCCC to achieve project goals	Enaex
Project Administration	Ensures that the project proceeds according to the schedule and budget	Enaex
Project Communication DOE	Provides the DOE with all required information for the validation and verification process	Enaex
Project Operation	Ensures that the on-site operative activities of the project runs according the project plan	Enaex
Project Maintenance	Provides support to the Project Operation and ensures that all quality procedures are accomplished	Enaex
Project Construction	Ensures that the project will be implemented technically according to the design and all relevant laws, prevailing methodology and tools	Enaex
Project Review: Monitoring Reports	Review and approval of monitoring reports before they are sent to DOE/UNFCCC	Carbon
Project Monitoring (data collection)	Collects all relevant parameters required for monitoring the project	Enaex

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

Starting date of the project activity: 07/07/2011

This date is the date, when INECO was assigned with the monitoring system.

C.1.2. Expected operational lifetime of project activity

>>

25 years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>

Fixed crediting period

C.2.2. Start date of crediting period

>>

~~Expected s~~Starting date of first crediting period: ~~0~~19/12/2011

C.2.3. Length of crediting period

10 years, 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

The catalytic N_2O destruction project at the PANNA 4 Nitric Acid Plant is a sustainable project that contributes to the environmental, economic and social benefits in the Republic of Chile.

Environmental Impacts

The ex-ante GHG emission reduction is estimated to be about 2.7 million tonnes of CO_2e over the ten year crediting period.

No transboundary impacts are expected.

Since the CDM project won´t cause any environmental impact, it was not necessary to carry out an Environmental Impact Study. This was officially approved by authority COREMA with the letter No. 221/2006.

D.2. Environmental impact assessment

>>

Not applicable, as no significant environmental impacts are considered.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

A local stakeholder consultation was carried out by Enaex S.A. in the Antofagasta region on July 14th, 2011. The stakeholder conference took place in the auditorium of the "Mutual de Seguridad C.Ch.C" in Antofagasta city and its purpose was to inform local stakeholders about the CDM project of catalytic reduction of N_2O at the nitric acid plant PANNA 4 in Mejillones, Chile.

More than 180 invitations were prepared and sent to different stakeholders. Internally, a letter to the General Managers and e-mails were sent to the staff of the entire company:

LANZAMIENTO PROYECTO
BONOS DE CARBONO-ENAEX S.A.

Juan Andrés Errázuriz Domínguez, Gerente General de Enaex S.A., invita cordialmente a Ud. a la presentación del proyecto "Bonos de Carbono PANNA 4" desarrollado en la Planta Prillex América de Mejillones.

La conferencia abordará el fenómeno del cambio climático, las medidas que se están implementando a nivel mundial, las consecuencias para Chile y los proyectos que la Empresa desarrolla actualmente como parte de su compromiso con la comunidad y el cuidado del medio ambiente.

El evento se realizará el jueves 14 de julio a las 10 hrs., en el Auditorio de la Mutual de Seguridad C.Ch.C. ubicado en Washington 2701, tercer piso, Antofagasta.

Para la comunidad de Mejillones se dispondrá de movilización especial. La salida será desde el Municipio de la ciudad a las 08:30 hrs y el regreso una vez finalizado el cóctel.

Atentamente,

Gerente General

R.S.V.P
jdiaz@enaex.cl o al teléfono (562) 8377648

COMUNICÁNDONOS
En confianza

N°54-2011

**LANZAMIENTO PROYECTO
BONOS DE CARBONO-ENAEX S.A.**

Comunicamos que el **jueves 14 de julio** se realizará en la ciudad de Antofagasta el Lanzamiento del proyecto **"Bonos de Carbono PANNA 4"** desarrollado en la Planta Prillex® América de Mejillones.

Para Enaex este es un proyecto trascendente, ya que a través de su implementación se podrá reducir más de 300,000 TM CO2 eq. al año que sumado a las 800.000 TM reducidas en PANNA 3, transforma a Enaex en uno de los complejos de producción de Ácido Nítrico más eficientes a nivel global en la lucha contra el cambio climático.

El programa será el siguiente:

El evento comienza a las 10:00 hrs., en el Auditorio de la Mutual de Seguridad C.Ch.C, ubicado en calle Jorge Washington 2701, tercer piso. Para los trabajadores de la planta Prillex se dispondrá de bus para el regreso una vez finalizada la actividad.

Moderador: Sr. Jorge Saffie

Horario	Presenta	Tema
10:00 - 10:15	**Sr. Marcelino Carvajal** **Alcalde de Mejillones**	**Bienvenida**
10:15 - 10:45	**Sr. Alex Illge** Gerente Planta Prillex	Enaex S.A. - Planta Prillex América: 90 años de Crecimiento y Comprometidos con el Futuro
10:45 - 11:15	**Sr. Rafael Visedo** Gerente RSE Enaex S.A.	Responsabilidad Social Empresarial Un Compromiso de Todos
11:15 - 11:45	**Srta. Úrsula Bustamante** Ingeniero de Proyectos	Huella de Carbono Enaex S.A. Proyecto Bonos de Carbono en Panna 4
11:45- 12:15	**Sr. Jorge Saffie** Subgerente Innovación	Cambio Climático: Perspectivas a Futuro
cóctel		

Cordialmente,

Juan Andrés Errázuriz Domínguez

07 de Julio de 2011

In addition, an announcement was published in the regional newspaper in Antofagasta, El Mercurio (http://edicionimpresa.soychile.cl/antofagasta/?c).

The meeting covered three main subjects:

1. Enaex and its role with Social Responsibility

2. Global Warming with its current and future impacts and
3. PANNA4 CDM Project with an insight on the carbon market and the future perspectives of the Kyoto Protocol

A total of 86 people from different sectors attended the meeting. A variety of sectors were represented among the attendants, as shown on the following table:

Organization/Company	Number
General Public	40
Local Companies	19
Enaex S.A.	16
Goverment	7
Comunication Media	3
Army	1
Total	**86**

E.2. Summary of comments received
>>
A questionnaire containing the following 10 questions was handed out to the attendees:

1. Has the presentation improved your understanding of Global Warming?
2. Has the presentation improved your understanding of this CDM Project?
3. Do you have a positive attitude to this CDM Project?
4. Do you believe that this CDM Project has environmental benefits for the local surrounding?
5. Do you believe that this CDM Project has environmental benefits for the global climate?
6. Do you believe that local people will benefit from this CDM Project (i.e. job opportunities, air quality improvement etc.)?
7. Do you believe that the image of the region will benefit from this environmental friendly CDM Project?
8. Do you believe that this CDM Project contributes to sustainable development in the region?
9. Do you believe that this CDM Project has economic benefits for the local surrounding?
10. Do you believe that the Government of Chile should support this CDM Project?

A total of 71 attendees answered the questionnaire with the following results:

	Answer			
Question Number	Yes	No	No Answer	Total
1	64	6	1	**71**
2	68	2	1	**71**
3	69	2		**71**
4	67	4		**71**
5	68	3		**71**
6	59	12		**71**
7	64	7		**71**
8	65	6		**71**
9	59	12		**71**
10	67	4		**71**

E.3. Report on consideration of comments received
>>
The survey shows that the project has strong support amongst local people. According to the response received from questionnaires, almost all local stakeholders support the CDM Project Activity and believe

that the Government of Chile should support the CDM Project. Therefore there has been no need to modify the plans due to comments received.

Nevertheless, the project participants will consider potential input which could arise during the national approval process, besides following CDM Rules & Procedures. No direct action is necessary according to the comments received. However, in order to further address additional questions from local stakeholders, the project participants intend to provide a reasonable level on transparency on the CDM Project Activity development.

SECTION F. Approval and authorization

>>

The Letters of Approval of the following Parties are available at the time of submitting the PDD to the DOE:

- Chile (Host)
- Austria
- Japan.

- - - - -

Appendix 1: Contact information of project participants

Organization name	Enaex S.A.
Street/P.O. Box	Renato Sánchez # 3859, Las Condes
Building	
City	Santiago
State/Region	Región Metropolitana
Postcode	7550282
Country	Chile
Telephone	+56-2-8377600
Fax	+56-2-2066752
E-mail	
Website	www.enaex.cl
Contact person	Ms. ~~Ursula Bustamante~~Josefina Diaz Fresno
Title	Project Manager
Salutation	
Last name	Diaz Fresno~~Bustamante~~
Middle name	
First name	Josefina~~Ursula~~
Department	
Mobile	+56-9-~~6-1935900~~93465064
Direct fax	+56-2-2066752
Direct tel.	+56-2-837766~~64~~48
Personal e-mail	josefina.diaz@enaex.com~~ubustamante@enaex.cl~~

Organization name	Carbon Climate Protection GmbH
Street/P.O. Box	Am Südblick 5/2
Building	
City	Langenlois
State/Region	
Postcode	A-3550
Country	Austria
Telephone	+43 2734 322 70
Fax	+43 2734 322 70 99
E-mail	office@carbon-austria.com
Website	www.carbon-austria.com
Contact person	Mr. Ferdinand Heilig
Title	Managing Director
Salutation	
Last name	Heilig
Middle name	
First name	Ferdinand
Department	
Mobile	

Direct fax	+43 2734 322 70 99
Direct tel.	+43 2734 322 70 10
Personal e-mail	heilig@carbon-austria.com

Organization name	Mitsubishi Corporation
Street/P.O. Box	3-1 Marunouchi 2-Chome, Chiyoda-Ku
Building	
City	Tokyo
State/Region	Tokyo
Postcode	100-8086
Country	Japan
Telephone	+81-3-3210-8759
Fax	
E-mail	mc-focal-point@mitsubishicorp.com
Website	www.mitsubishi.com
Contact person	Yousuke Kuroda
Title	Project Team North & Latin Americas
Salutation	Mr.
Last name	Kuroda
Middle name	
First name	Yousuke
Department	
Mobile	
Direct fax	
Direct tel.	+81-3-3210-6361
Personal e-mail	yousuke.kuroda@mitsubishicorp.com

Appendix 2: Affirmation regarding public funding

No public funds are available for the financing of the project activity.

Appendix 3: Applicability of selected methodology

No additional information on the applicability of the methodology is to be mentioned.

Appendix 4: Further background information on ex ante calculation of emission reductions

No additional information on the ex-ante calculation of emission reductions is to be mentioned.

Appendix 5: Further background information on monitoring plan

The project activity will apply an Automated Monitoring System (AMS), which is in line with the requirements of the approved consolidated baseline and monitoring methodology ACM0019 "N_2O abatement from nitric acid production" (Version 02.0) and of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) to monitor the N_2O concentration as well as the tail gas flow volume. Therefore continuous real-time measurements of the N_2O concentration and the total gas volume flow will be carried out in the tail gas stream after the abatement of N_2O emissions throughout the crediting period of the project activity.

The Monitoring Plan describes the procedures for data collection, storage and reporting required for the project in order to determine and verify the emission reductions achieved by the project activity. All required data are automatically transferred to the digital process control system, where they are displayed, evaluated and stored.

The monitoring procedures for the project activity will be fully in compliance with the applied approved monitoring methodology ACM0019 version 02.0 and of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) and will be fully integrated in Enaex quality management system. All monitoring equipment will be serviced, calibrated and maintained according to the prevailing methodology and tools as well as to manufacturers' instructions and international standards.

Monitoring equipment

In order to be able to calculate the greenhouse gas emission reductions a direct measurement of the quantity of tail gas flowing through the tail gas stack is necessary. A differential pressure bar will be installed in the vertical section of the tail gas stack according to the standard EN 15259. The measuring system operates according to the differential pressure principle. The probe has two separate chambers, between which the flow builds up a differential pressure.

The analyser is located in an instrument container located at the floor near the stack. The concentration of N_2O is measured at using non-dispersive infrared photometry. Measured data is stored and evaluated in a digital process control system. Data storage is redundant and manipulation-proof.

The measurement site was selected according to EN 14181:2004 and EN 15259. All sample points will be in the same sample plane at the measurement site. All instruments and standard reference method (SRM) openings are located at 0.5 m between them.

The gas sample extracted at the sample point is delivered to the conditioning system via an electrical tracing line that maintains the sample in gas phase. The sample line is electrically heated and insulated with fiberglass. The conditioning system is located in the instrument container. The sample, before being fed to the analyser, is conditioned.

In the tail gas, the concentration of nitrogen dioxide (N_2O) is analysed continuously (range 0 – 500 ppm). Analysis is done by using non-dispersive infrared photometry for N_2O. The analyser will take readings continuously. These readings will be stored and based on the raw data´s average value hourly figures will be calculated, reported and stored at the data storage system. Sample handling includes provisions for pressure reduction, separation of residual solids, sample flow adjustment, and supply with test gases. The analysers are, as far as technically possible, corrected for any applicable cross sensitivity.

The actual nitric acid production is measured with a coriolis flow meter. The instrument signals will be recorded in the control room.

The operation temperature of the oxidation burner ranges from 850 – 905°C and this range corresponds to the actual operation hours of the reactor. The temperature is reported automatically by three independent measurement points measuring the temperature at the same time.

The actual temperature of the ammonia oxidation reactor is monitored using the existing instruments. The instrument signals will be recorded in the control room and used to determine whether the nitric acid plant is in operation or not.

Data acquisition and storage

The measured values are transferred to a digital process control system, where they are displayed, evaluated and stored. Data storage for raw data as well as for evaluated data is done automatically on a computer network, which is directly connected to the process control system. The software for data storage is designed in a way that falsification of data is excluded. Time stamps are generated by a GPS clock.

The instrument containers include the analyser, parts of the sample handling system, and the controllers of the DCS. Data logging is carried out with redundant storage on two computers and operating data will be selected from the nitric acid plant as required by the relevant CDM methodology ACM0019 (Version 02.0). These are the operating parameters of the ammonia oxidation burners and nitric acid production.

The mass flow of N_2O in the gaseous stream needs to be calculated according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0). The tool provides six different calculation options to determine the mass flow of a particular greenhouse gas (Option A to F). Option A can be applied for the catalytic N_2O destruction project at the PANNA 4 Nitric Acid Plant. If Enaex S.A. is forced by unforeseen circumstances to change parameters of the catalytic N_2O destruction project at the PANNA 4 Nitric Acid Plant it might be required to apply a different option of the tool.

Operation of the monitoring system

The system is designed for automatic operation so that activities by operation personnel are not required during normal operation. However, it is required to observe the system for possible failures, and to perform required maintenance activities on a regular basis.

It is Enaex responsibility to ensure that required and experienced capacity is available and that their operational staffs are able to operate the monitoring system properly. It is also Enaex responsibility to organize and implement a quality management system that ensures the integrity of the data.

Malfunction of system components is indicated on the operator console in the control room as an alarm. The occurrence of such an alarm requires the operator to take measures to remedy the problem. This is normally done by informing the instrument department, which then decides whether the problem can be fixed immediately by them or if the manufacturer´s support is required. In such a case it is important to act immediately in order to avoid loss of valuable data.

The analysers need a calibration on a regular basis. This calibration procedure is done automatically and can be triggered manually from the operating console or automatically on a time basis. Since calibration is done with test gases, it is essential that availability of test gases is ensured. Enaex instrument technicians are responsible for the availability of test gas. Stock of test gases will be controlled regularly, and spare supply is made available in proper time.

Enaex will perform a visual inspection of system on a regular basis by the operating staff (e.g. once every week). Such an inspection can give indications on oncoming problems and allow to be prepared for them.

Data export from the data storage is to be done manually upon operational requests, but at least once a month. Detailed instructions are given by the manufacturer. Internal review of project performance and calculation of emission reductions will be executed by Enaex with the support of CARBON on a regular basis.

Appendix 6: Summary of post registration changes

Following the response of the Meth Panel to the Request for Clarification AM-CLA_0255 an updated PDD including a Post Registration Change (Permanent Change) was elaborated. The Meth Panel clarified in its response that the project participants can use a later version of the methodology as per § 89 of the "Procedure for development, revision and clarification of baseline and monitoring methodologies and methodological tools". '…If the project participants or coordinating/managing entity wish to use a later version of the methodology or methodological tool for the purpose of monitoring of emission reductions or removals after the registration of the project activity or PoA, or a DOE, when performing a verification, determines that permanent changes to the monitoring plan as described in the registered PDD or PoA-DD, generic CPA-DD, or the monitoring methodology have occurred or expected to occur, the DOE shall submit a request for approval by the Board prior to the submission of the request for issuance in accordance with the relevant provisions of the "Clean development mechanism project cycle procedure" (EB 70, annex 36).

The adaptions of the PDD, which arouse from the change of methodology ACM0019 version 01.0 to version 02.0, can be summarized as follows:

- Change of methodology version throughout the whole document
- Section B.6.1 equations have been updated
- Section B.6.2 and B.7.1 parameter tables have been updated
- Section B.6.3 and B.6.4 ex-ante calculation of the emission reductions have been updated for the years 2013 until 2021 based on current input data verified during last 4 Monitoring Periods (Ex-ante estimation of emission reductions was done for the period from 19/03/2013 onwards only, since from then onwards methodology ACM0019 v02.0 was applied. Values of ER before that date are real emission reductions, which are already generated, verified and issued during Monitoring Periods # 1 – 4 of CDM project.)
- Information about project participants and starting date of crediting period has been updated
- Editorial and other changes were done due to the PDD being upgraded to PDD form version 04.1

- - - - -

History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03	EB 25, Annex 15 26 July 2006	
02	EB 14, Annex 06b 14 June 2004	
01	EB 05, Paragraph 12 03 August 2002	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		