CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

"Catalytic N_2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A."

Version 1.2

Date of Completion: 28/09/2011

A.2. Description of the 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.

General Introduction

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:

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

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

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

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):

$$2\,NO + O_2 \rightarrow 2\,NO_2 \qquad \text{(main reaction 2)} \qquad \mathbf{(4)}$$

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

$$3\,NO_2 + H_2O \rightarrow 2\,HNO_3 + NO \qquad \text{(main reaction 3)} \qquad \mathbf{(5)}$$

(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 (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:

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

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.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly 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
(*) 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.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Republic of Chile

A.4.1.2. Region/State/Province etc.:

2nd Region (Region of Antofagasta), Province of Antofagasta

A.4.1.3. City/Town/Community etc.:

Planta Prillex® America
City: Mejillones
Address: Avenida Costanera Norte N°300

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

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

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

A.4.2. Category(ies) of project activity:

Sectoral Scope: 5 Chemical Industry

A.4.3. Technology to be employed by the project activity:

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

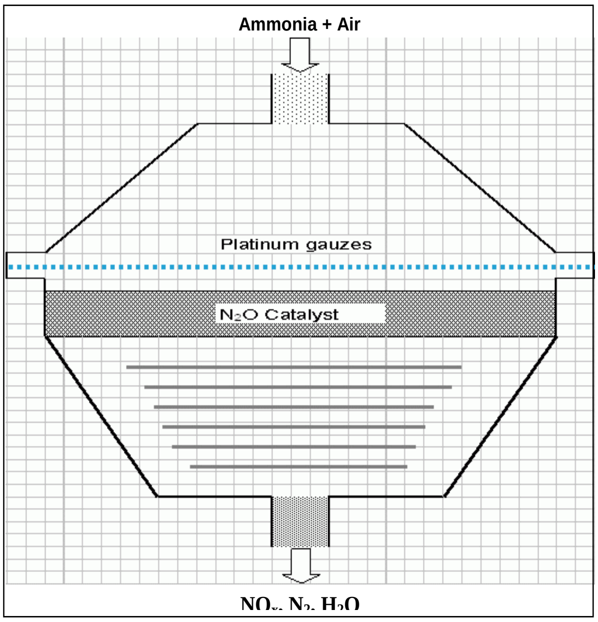

Figure 3: Location of a secondary catalyst inside the AOR reactor

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

The implementation of the project activity will result in an ex-ante estimation of GHG emission reductions conservatively calculated at about 2.7 million tCO_2e over ten years crediting period. Please note that estimations of GHG emission reductions are made for reference purposes only – actual emission reductions will be determined based on measurement results on ex-post basis. The global warming potential of N_2O is set at 310 according to the methodology.

As the project is planned to start on 01/12/2011 with a ten years crediting period, the emission reductions during the crediting period are estimated as shown in the table below.

Table: Summary of Emission Reductions 2011-2021

Years (First Crediting Period)	**Annual estimation of emission reductions in tonnes of CO_2e**
12/2011	31,011
2012	351,773
2013	331,413
2014	311,054
2015	300,875
2016	280,515
2017	260,156
2018	239,797
2019	229,617
2020	209,258

01-11/2021	191,820
Total estimated reductions (tonnes of CO_2e)	**2,737,289**
Total number of crediting years	**10 years**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**273,729**

A.4.5. Public funding of the project activity:

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

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

This Project Design Document is based on the approved consolidated baseline and monitoring methodology ACM0019 “N_2O abatement from nitric acid production” (Version 01.0.0) 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. Justification of the choice of the methodology and why it is applicable to the project activity:

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 is currently any secondary or tertiary abatement technology installed in the PANNA 4 nitric acid plant, 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 be 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).

B.3. Description of the sources and gases included in the project boundary:

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

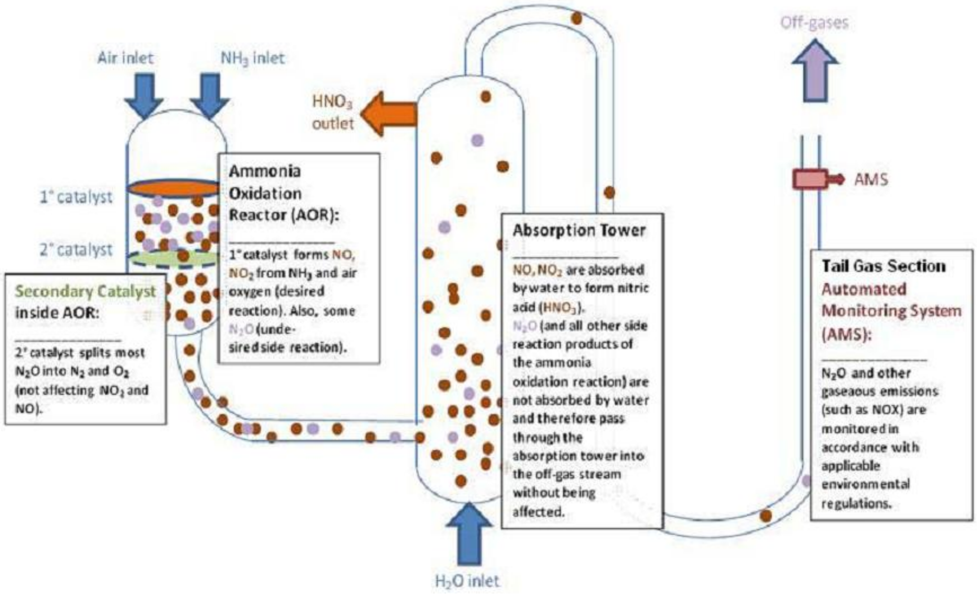
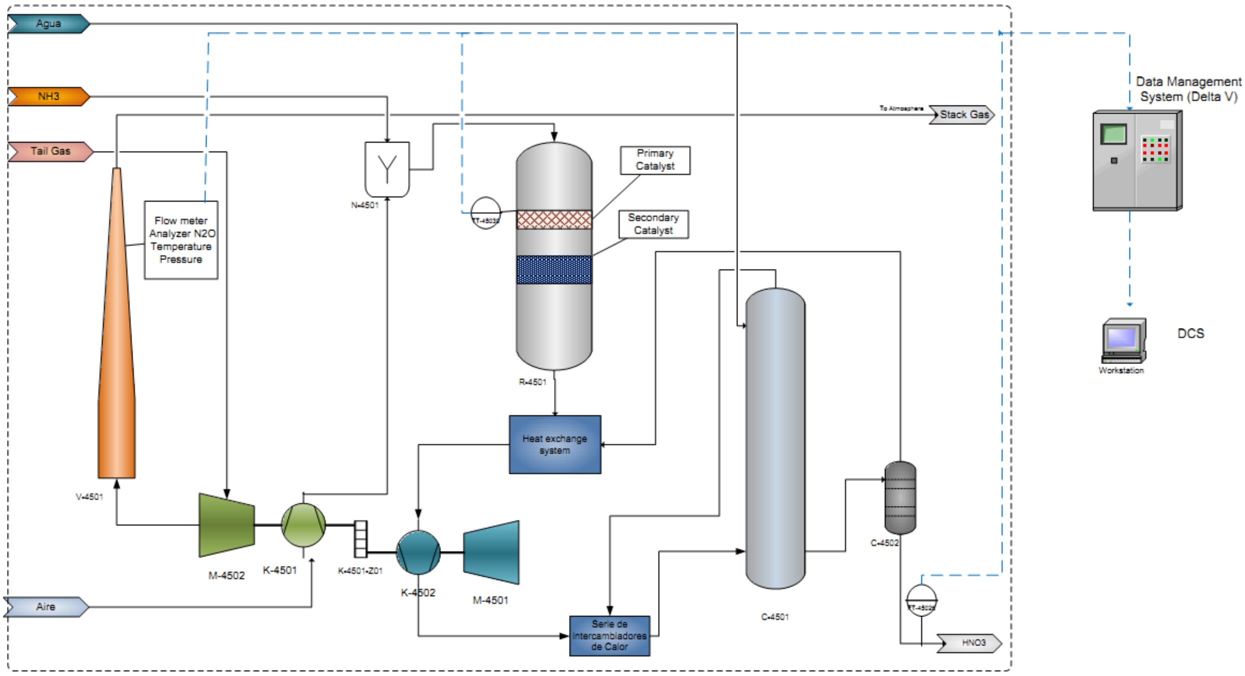


Figure 4: Project boundary if the Project Activity consists of the introduction of a secondary N_2O abatement measure (simplified standard nitric plant layout displaying the location of the N_2O abatement catalyst, process sources of N_2O and the sampling point location for the Automated Monitoring System (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. Description of how the baseline scenario is identified and description of the identified 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. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and 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:

BASELINE EMISSIONS

According to *Section II* of the approved consolidated baseline and monitoring methodology ACM0019 "N_2O abatement from nitric acid production" the baseline emissions are calculated as follows:

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

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

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:

$$EF_{BL,N2O,n} = EF_{default,y} \tag{8}$$

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:

$$PE_n = PE_{N2O,n} + PE_{CO2,tertiary,n} \quad \textbf{(9)}$$

Where:

PE_n	=	Project emissions in monitoring period n (tCO_2e)
$PE_{N2O,n}$	=	Project emissions of N_2O from the project plant in monitoring period n (tCO_2e)
$PE_{CO2,tertiary,n}$	=	Project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in monitoring period n (tCO_2)

<u>Project emissions of N_2O from the project plant ($PE_{N2O,n}$)</u>

The amount of N_2O emissions from the project activity includes two emission sources:

a) The N_2O contained in the tail gas stream of the plant which is released to the atmosphere; and
b) 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, $PE_{N2O,n}$ is determined as follows:

$$PE_{N2O,n} = (Q_{N2O,tailgas,n} + Q_{N2O,by-pass,n}) * GWP_{N2O} \quad \textbf{(10)}$$

Where:

$PE_{N2O,n}$	=	Project emissions of N_2O from the project plant in monitoring period n (tCO_2e)
$Q_{N2O,tail\ gas,n}$	=	Amount of N_2O released through the tail gas of the project plant to the atmosphere in monitoring period n (tN_2O)
$Q_{N2O,by-pass,n}$	=	Amount of N_2O released through the by-pass to a tertiary N_2O abatement system to the atmosphere in monitoring period n (tN_2O)
GWP_{N2O}	=	Global Warming Potential of N_2O valid for the commitment period

<u>Determination of $Q_{N2O,tail\ gas,n}$</u>

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;

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:

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

With

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

Where:

$F_{i,t}$ = Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h)

[3] $F_{i,t}$ corresponds to the parameter $F_{N2O,tail\ gas,h}$ of the methodology ACM0019.

$V_{t,db}$	=	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 be 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 be measured according to the prevailing methodology and tool as well as to relevant current norms and standards.

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

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

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

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

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

[4] Source: Mass balance

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 ($Q_{N2O,by-pass,n}$) is considered to be zero.

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

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 n ($PE_{CO2,tertiary,n}$) 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:

$$ER_n = BE_n - PE_n \quad \textbf{(14)}$$

Where:

ER_n	=	Emission reductions in monitoring period n (tCO_2e)
BE_n	=	Baseline emissions in monitoring period n (tCO_2e)
PE_n	=	Project emissions in monitoring period n (tCO_2e)

B.6.2. Data and parameters that are available at validation:

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

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
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

Data / Parameter:	GWP_{N2O}
Data unit:	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 applied:	310
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 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:	R_u
Data unit:	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 applied:	8,314
Justification of the choice of data or description of measurement methods and procedures actually applied:	Specified in the tool

Any comment:	NA

Data / Parameter:	MM_i
Data unit:	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 applied:	**Compound** / **Structure** / **Molecular mass (kg/kmol)** Nitrous oxide / N_2O / 44.02
Justification of the choice of data or description of measurement methods and procedures actually applied:	Specified in the tool
Any comment:	NA

Compound	**Structure**	**Molecular mass (kg/kmol)**
Nitrous oxide	N_2O	44.02

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 days[9], which leads to yearly operating hours of 8,520.

<u>BASELINE EMISSIONS</u>

Baseline emissions are calculated as below:

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

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[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: "2011 Production Plan" and "Operation manual Project Panna 4"

Year	BE_n	$PA_{NA,n}$	$EF_{BL,N2O,n}$	GWP_{N2O}
	tCO_2e	$tHNO_3$	kgN_2O / $tHNO_3$	
12/2011	34,780	27,365	4.10	310
2012	397,005	328,375	3.90	310
2013	376,646	328,375	3.70	310
2014	356,287	328,375	3.50	310
2015	346,107	328,375	3.40	310
2016	325,748	328,375	3.20	310
2017	305,389	328,375	3.00	310
2018	285,030	328,375	2.80	310
2019	274,850	328,375	2.70	310
2020	254,491	328,375	2.50	310
01-11/2021	233,283	301,010	2.50	310

PROJECT EMISSIONS

Project emissions are calculated as below:

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

Year	PE_n	$PE_{N2O,n}$	$PE_{CO2,tertiary,n}$
	tCO_2e	tCO_2e	tCO_2
12/2011	3,769	3,769	0
2012	45,233	45,233	0
2013	45,233	45,233	0
2014	45,233	45,233	0
2015	45,233	45,233	0
2016	45,233	45,233	0
2017	45,233	45,233	0
2018	45,233	45,233	0
2019	45,233	45,233	0
2020	45,233	45,233	0
01-11/2021	41,463	41,463	0

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

Year	$PE_{N2O,n}$	$Q_{N2O,tail\ gas,n}$	$Q_{N2O,by-pass,n}$	GWP_{N2O}
	tCO_2e	tN_2O	tN_2O	
12/2011	3,769	12.16	0	310
2012	45,233	145.91	0	310

2013	45,233	145.91	0	310
2014	45,233	145.91	0	310
2015	45,233	145.91	0	310
2016	45,233	145.91	0	310
2017	45,233	145.91	0	310
2018	45,233	145.91	0	310
2019	45,233	145.91	0	310
2020	45,233	145.91	0	310
01-11/2021	41,463	133.75	0	310

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

Year	**$Q_{N2O,tail\ gas,n}$**	**$F_{N2O,tail\ gas,h}$**	**h_n**
	tN_2O	**kgN_2O/h**	**h**
12/2011	12.16	17.13	710
2012	145.91	17.13	8,520
2013	145.91	17.13	8,520
2014	145.91	17.13	8,520
2015	145.91	17.13	8,520
2016	145.91	17.13	8,520
2017	145.91	17.13	8,520
2018	145.91	17.13	8,520
2019	145.91	17.13	8,520
2020	145.91	17.13	8,520
01-11/2021	133.75	17.13	7,810

According to currently available information $F_{N2O,tail\ gas,h}$[10] was determined to 17.13 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	**$F_{N2O,tail\ gas,h} = F_{i,t}$**	**$V_{t,db}$**	**$v_{i,t,db}$**	**$\rho_{i,t}$**

[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)”.

	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	17.13	181,899	7.20E-05	1.308
2012	17.13	181,899	7.20E-05	1.308
2013	17.13	181,899	7.20E-05	1.308
2014	17.13	181,899	7.20E-05	1.308
2015	17.13	181,899	7.20E-05	1.308
2016	17.13	181,899	7.20E-05	1.308
2017	17.13	181,899	7.20E-05	1.308
2018	17.13	181,899	7.20E-05	1.308
2019	17.13	181,899	7.20E-05	1.308
2020	17.13	181,899	7.20E-05	1.308
01-11/2021	17.13	181,899	7.20E-05	1.308

Year	$\rho_{i,t}$	P_t	MM_i	R_u	T_t
	kg gas i/m^3 gas i	Pa	kg/kmol	Pa.m^3/kmol.K	K
12/2011	1.308	105,000	44.02	8,314	425.15
2012	1.308	105,000	44.02	8,314	425.15
2013	1.308	105,000	44.02	8,314	425.15
2014	1.308	105,000	44.02	8,314	425.15
2015	1.308	105,000	44.02	8,314	425.15
2016	1.308	105,000	44.02	8,314	425.15
2017	1.308	105,000	44.02	8,314	425.15
2018	1.308	105,000	44.02	8,314	425.15
2019	1.308	105,000	44.02	8,314	425.15
2020	1.308	105,000	44.02	8,314	425.15
01-11/2021	1.308	105,000	44.02	8,314	425.15

LEAKAGE

Any leakage emissions sources are deemed to be negligible.

EMISSION REDUCTIONS

Project emissions are calculated as below:

$$ER_n = BE_n - PE_n$$

Year	ER_n	BE_n	PE_n
	tCO_2e	tCO_2e	tCO_2e

12/2011	31,011	34,780	3,769
2012	351,773	397,005	45,233
2013	331,413	376,646	45,233
2014	311,054	356,287	45,233
2015	300,875	346,107	45,233
2016	280,515	325,748	45,233
2017	260,156	305,389	45,233
2018	239,797	285,030	45,233
2019	229,617	274,850	45,233
2020	209,258	254,491	45,233
01-11/2021	191,820	233,283	41,463

B.6.4 Summary of the ex-ante estimation 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 starting date of the crediting period: 01/12/2011

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

Year	Estimation of Project Activity Emissions (tonnes of CO_2e)	Estimation of Baseline Emissions (tonnes of CO_2 e)	Estimation of Leakage (tonnes of CO2e)	Estimation of overall Emission Reductions (tonnes of CO_2 e)
12/2011	3,769	34,780	0	31,011
2012	45,233	397,005	0	351,773
2013	45,233	376,646	0	331,413
2014	45,233	356,287	0	311,054
2015	45,233	346,107	0	300,875
2016	45,233	325,748	0	280,515
2017	45,233	305,389	0	260,156
2018	45,233	285,030	0	239,797
2019	45,233	274,850	0	229,617
2020	45,233	254,491	0	209,258
01-11/2021	41,463	233,283	0	191,820
Total (tonnes of CO_2e)	**452,327**	**3,189,616**	**0**	**2,737,289**

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

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

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 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 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:	$V_{t,db}$
Data unit:	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 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:	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.
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.
Any comment:	Periodic calibration will be performed according to manufacturer´s recommendation.

Data / Parameter:	$v_{i,t,db}$
Data unit:	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 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:	Continuous gas analyser operating in dry-basis. Volumetric flow measurement refers to the actual pressure and temperature. Continuous monitoring.
QA/QC procedures to be applied:	According to European Norm 14181
Any comment:	NA

Data / Parameter:	$C_{H2O,t,db,n}$
Data unit:	mg H_2O/m³ 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 of data applied for the purpose of calculating expected emission reductions in section B.5	Discrete measurement procedure Calculated 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).
Description 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.
QA/QC procedures to be applied:	According to the USEPA CF42 method 4
Any comment:	Option A parameter for proving that the gaseous stream is dry.

Data / Parameter:	T_t
Data unit:	K
Description:	Temperature of the gaseous stream in time interval t
Source of data to be used:	Measured
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:	Instruments with recordable electronic signal
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.
Any comment:	Periodic calibration will be performed according to manufacturer´s recommendation.

Data / Parameter:	P_t
Data unit:	Pa
Description:	Pressure of the gaseous stream in time interval t
Source of data to be used:	Measured
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:	Instruments with recordable electronic signal
QA/QC procedures to	Periodic calibration against a primary device will be performed periodically and

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

B.7.2. Description of the 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 01.0.0) 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;

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

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

Date of completion of the application of the methodology to the project activity study: 28/09/2011

Persons/entities responsible for the application of the baseline and monitoring methodology to the project activity are shown below.

Persons/entities	***Project Participant Yes / No***
Carbon Climate Protection GmbH Am Südblick 5 A-3550 Langenlois Austria tel. +43 2734 322 70 fax. +43 2734 322 70 99 Gerald Dunkel Andreas Rammelmüller	***Yes***

Hans-Jürgen Salmhofer Sonja Haderer Email: dunkel@carbon-austria.com Email: rammelmueller@carbon-austria.com Email: salmhofer@carbon-austria.com Email: haderer@carbon-austria.com	

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the 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 the project activity:

25 years

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Expected starting date of first crediting period: 01/12/2011

C.2.2.2. Length:

10 years, 0 months

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary 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. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Not applicable, as no significant environmental impacts are considered.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

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:

Enaex

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,

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

Gerente General

COMUNICÁNDONOS *en confianza*

N°54-2011

Enaex

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 the 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:

Question Number	Answer		No Answer	Total
	Yes	No		
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 how due account was taken of any 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.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Enaex S.A.
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Represented by:	Ms. Ursula Bustamante
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Represented by:	Mr. Ferdinand Heilig
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Salutation:	
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Middle Name:	
First Name:	Ferdinand
Department:	
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Direct FAX:	+43 2734 322 70 99
Direct tel:	+43 2734 322 70 10
Personal E-Mail:	heilig@carbon-austria.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

Annex 3

BASELINE INFORMATION

No additional baseline information is to be mentioned.

Annex 4

MONITORING INFORMATION

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" 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 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. 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.

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