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# Verification Report

**ENAEX S.A.**

Periodic Verification of the Registered CDM Project

"Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A."

UNFCCC 5393-CDMP

Monitoring period #01: 19-12-2011 to 31-01-2012

Report No. 600500885

**17 July 2012**

TÜV SÜD Industrie Service GmbH
Carbon Management Service
Westendstrasse 199 - 80686 Munich - GERMANY

| Report No. | Date of first issue | Version No.: | Revision date |
|---|---|---|---|
| 600500885 | 02-04-2012 | 02 | 17-07-2012 |
| **Subject:** | Periodic Verification #01 | | |
| **Executing Operational Unit:** | | | |
| TÜV SÜD Industrie Service GmbH, Carbon Management Service<br>Westendstrasse 199 - 80686 Munich, Federal Republic of Germany | | | |
| **Project Participant (client):** | | | |
| ENAEX S.A., Renato Sánchez F. #3859 Las Condes, Santiago, Chile | | | |
| **Registration number / Project Title** | Project 5393: "Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A." | | |
| **Monitoring period:** | 19-12-2011 to 31-01-2012 | | |
| **First Monitoring Report (version/date)** | Version 1 / 01-03-2012 | | |
| **Final Monitoring Report (version/date)** | Version 3 / 23-05-2012 | | |

**Summary:**

TÜV SÜD Industrie Service GmbH has performed the periodic verification #01 of the registered CDM project: "Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A.". The project consists of a secondary abatement technology installed below the primary catalyst (NH3 catalyst) in the ammonia oxidation reactor of the PANNA 4 nitric acid plant. The N2O catalyst largely results in decomposition of N2O to nitrogen (N2) and oxygen (O2) without any further energy, nor material inputs.

The management of Enaex S.A. is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions.

A document review, followed by a site visit and online interviews was conducted to verify the information submitted by the project participant regarding the present verification period. Based on the assessment carried out, the verifier confirms the following:

- the project has been implemented and operated in accordance with the description given in the registered PDD (version 1.2, 28-09-2011, registration date 30-11-2011).
- the project is completely implemented as described in the registered PDD.
- the emission reductions presented in the current monitoring report do not deviate significantly from the emission reductions as indicated in the registered PDD.
- the monitoring plan complies with the applied methodology (ACM0019, version 01.0.0) and the monitoring has been carried out in accordance with the monitoring plan.

Installed equipment essential for generating emission reductions run reliably and the meters are calibrated appropriately according to frequency specified in monitoring methodology and the monitoring plan. The project is generating emission reductions as a CDM project.

The verifier can confirm that the GHG emission reductions are calculated without material misstatements. Our opinion refers to the project's GHG emissions and resulting GHG emission reductions reported, both determined using the valid and registered project's baseline, its monitoring plan and its associated documents.

Based on the information we have seen and evaluated, we confirm that the implementation of the project resulted in 45,876 t $CO_{2e}$ of emission reductions during the verification period 19-12-2011 to 31-01-2012.

| | |
|---|---|
| **Assessment Team Leader:**<br>Hammer, Martin<br>**Assessment Team Members:**<br>Tollio Vanhaz, Dante Luis<br>Saldias Kiefer, Lester | **Technical Reviewer:**<br>Tausche, Konrad<br>**Certification Body responsible:**<br>Kleiser, Thomas |

# Abbreviations

| | |
|---|---|
| **AM** | Approved Methodology |
| **CAR** | Corrective Action Request |
| **CDM** | Clean Development Mechanism |
| **CDM-EB** | CDM Executive Board |
| **CER** | Certified Emission Reduction |
| **CMP** | Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol |
| **$CO_{2e}$** | Carbon dioxide equivalent |
| **CR / CL** | Clarification Request |
| **DNA** | Designated National Authority |
| **DOE** | Designated Operational Entity |
| **EF** | Emission Factor |
| **ER** | Emission Reduction |
| **FAR** | Forward Action Request |
| **GHG** | Greenhouse Gas(es) |
| **GWP** | Global Warming Potential |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **IRL** | Information Reference List |
| **KP** | Kyoto Protocol |
| **MP** | Monitoring Plan |
| **MR** | Monitoring Report |
| **PDD** | Project Design Document |
| **PP** | Project Participant |
| **TÜV SÜD** | TÜV SÜD Industrie Service GmbH |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **VVM** | Validation and Verification Manual |

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**Main Documents (referred to in this report)**

| | | |
|---|---|---|
| Methodology (name / version) | ACM0019 version 01.0.0 | |
| Scope | 5 | |
| Technical Area | 5.1 | |
| Registered PDD: | version 1.2, 28-09-2011;<br>Date of registration: 30-11-2011<br>Date of registration action: 24-02-2012 | |
| Revised Monitoring Plan: | - | |
| | Version | Date |
| Published Monitoring Report | 01 | 01-03-2012 |
| Final Monitoring Report | 03 | 23-05-2012 |
| Project documentation link: | http://cdm.unfccc.int/Projects/DB/RWTUV1320421146.84/view | |

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# 1 INTRODUCTION

## 1.1 Objective

Enaex S.A. has commissioned an independent verification by TÜV SÜD Industrie Service GmbH (TÜV SÜD) of its registered CDM project: “Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A.”.
The objective of the verification work is to comply with the requirements of paragraph 62 of the CDM Modalities and Procedures. According to this assessment TÜV SÜD shall:

- ensure that the project activity has been implemented and operated as per the registered PDD “Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A.” Version 1.2, 28-09-2011, and that all physical features (technology, project equipment, monitoring and metering equipment) of the project are in place,
- ensure that the published MR and other supporting documents provided are complete, verifiable and in accordance with applicable CDM requirements,
- ensure that the actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved methodology,
- evaluate the data recorded and stored as per the ACM0019 Version 01.0.0.

## 1.2 Scope

The verification scope encompasses an independent and objective review and ex-post determination of the monitored reductions in GHG emissions by the Designated Operational Entity. The verification is based on the submitted monitoring report, the validated project design documents including its monitoring plan and validation report, the applied monitoring methodology, relevant decisions, clarifications and guidance from the CMP and the EB and any other information and references relevant to the project activity’s resulting emission reductions. These documents are reviewed against the requirements of the Kyoto Protocol, the CDM Modalities and Procedures and related rules and guidance.

Based on the requirements in the VVM, TÜV SÜD has applied a rule-based approach for the verification of the project. The principles of accuracy, completeness, relevance, reliability and credibility were combined with a conservative approach to establish a traceable and transparent verification opinion.

The verification considers both quantitative and qualitative information on emission reductions.

The verification is not meant to provide any consultancy towards the client. However, stated requests for clarifications, corrective and/or forward actions may provide input for improvement of the monitoring activities.

## 1.3 GHG Project Description

| | |
|---|---|
| Project activity: | "Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A." |
| UNFCCC registration number: | 5393 |
| Project Participants: | Enaex S.A. / Carbon Climate Protection GmbH |
| Location of the project: | Barrio Industrial s/n; Mejillones, Antofagasta, Chile |
| Date of registration: | 30-11-2011 |
| Date of registration action: | 24-02-2012 |
| Starting date of the crediting period: | 19-12-2011 (Changed from: 01-12-2011) |

Under the project activity, a N2O catalyst was inserted below the primary catalyst (NH3 catalyst) in the ammonia oxidation reactor. The N2O catalyst largely results in decomposition of N2O to nitrogen (N2) and oxygen (O2) without any further energy, nor material inputs. Catalytic decomposition of N2O occurs when the N2O is split into its constituent elements by contact with a catalyst. A catalyst is a material which accelerates speed of the reaction without itself being transformed or consumed by the reaction.

# 2 METHODOLOGY

## 2.1 Verification Process

The verification process is based on the approach depicted in the Validation and Verification Manual.

Standard auditing techniques have been adopted for the verification process. The verification team performs first a desk review, followed by an on-site visit, which results in the formation of a protocol that includes all the findings. The next step involves the evaluation of the findings through direct communication with the PPs and then finally the preparation of the verification report. This verification report and other supporting documents then undergo an internal quality control by the CB "climate and energy" before submission to the CDM-EB.

## 2.2 Verification Team

The appointment of the verification team takes into account the technical area(s), sectoral scope(s) and relevant host country experience required amongst team members for verifying the ER achieved by the project activity in the relevant monitoring period for this verification.

The CB TÜV SÜD operates the following qualification levels for team members that are assigned by formal appointment rules:

- Assessment Team Leader (ATL);
- Verifier (V);
- Verifier Trainee (T);
- Technical Experts (TE).

The verification team consisted of the following members:

| Name | Qualification | Coverage of scope | Coverage of technical area | Coverage of financial aspect | Host country experience |
|---|---|---|---|---|---|
| **Hammer, Martin** | **ATL** | ☑ | ☑ | ☑ | **-** |
| Saldias Kiefer, Lester | V | - | - | - | ☑ |
| Tollio Vanhaz, Dante Luis | TE | ☑ | ☑ | - | ☑ |

Technical reviewer: Tausche, Konrad.

## 2.3 Review of Documents

The Monitoring Report version 01 submitted by the PP was made publicly available on the UNFCCC website before the verification activities started. The published MR was assessed based on all the relevant documents as listed above. The aim of the assessment in the desk review was to:

- verify the completeness of the data and the information presented in the MR,
- check the compliance of the MR with respect to the monitoring plan depicted in the registered PDD and verify that the applied methodology was carried out. Particular attention to the frequency of measurements, the quality of the metering equipment

including calibration requirements, and the quality assurance and quality control procedures was paid,

- evaluate the data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

A complete list of all documents reviewed is available in annex 2 of this report.

## 2.4 On-site Assessment and follow-up Interviews

From 20/03/2012 to 21/03/2012, TÜV SÜD performed a physical site inspection and on-site interviews with project stakeholders to:

- confirm the implementation and operation of the project,
- review the data flow for generating, aggregating and reporting the monitoring parameters,
- confirm the correct implementation of procedures for operations and data collection,
- cross-check the information provided in the MR documentation with other sources,
- check the monitoring equipment against the requirements of the PDD and the approved methodology, including calibrations, maintenance, etc.,
- review the calculations and assumptions used to obtain the GHG data and ER,
- identify if the quality control and quality assurance procedures are in place to prevent or correct errors or omissions in the reported parameters.

A list of the persons interviewed during this verification activity is included in annex 2.

## 2.5 Quality of Evidence to Determine Emission Reductions

Among several evidence items submitted, the following relevant and reliable evidence material have been used by the audit team during the verification process:

A detailed review of calculation spreadsheets (IRL 10a-d) including data transfer and manual recalculation had been carried out. Any key parameters had been focused with special awareness. Any automatic raw data entry and a proper use of correct default data from external data sources had been proved.

Any so called “Log-book” - such as facility shut downs or special situations which deviate from the standard production of Nitric Acid, standard destruction of nitrous oxide or usual data processing had been detected and analyzed with a special focus.

Several documents were assessed to verify reported external data such QAL2 report, technical descriptions and training documents from the supplier of the technical installations (e.g. analyser, metering equipment), Data collection and processing systems, calibration certificates, QAL 2 and AST report, nitric acid production cross check).

The CDM related activities including personnel training and calibration/maintenance have been performed as a part of the Integrated Management System. Applicable maintenance and calibration records including control charts as required by EN14181 were found without deficiency at the plant.

Sufficient evidence covering the full verification period in the required frequency is available to validate the figures stated in the final MR. The source of the evidence will be discussed in chapter 3 of this report. Specific cross-checks have been done in cases that further sources were available. The monitoring report’s figures were checked by the audit team against the raw data. The data collection system meets the requirements of the monitoring plan as per the methodology and applied methodological tool.

## 2.6 Resolution of Clarification and Corrective and Forward Action Requests

The objective of this phase of the verification process is to resolve any outstanding issues which require clarification for TÜV SÜD's positive conclusion of the achieved GHG emission reduction. The findings raised as Forward Action Requests (FARs) (if any) indicated in previous reports (validation/verification) were discussed during this phase and, issues raised in the FARs were resolved, during communications between the PP and TÜV SÜD.

Concerns rose in the desk review, the on-site audit assessments and the follow up interviews and the responses provided for the raised concerns are documented in Annex 1 (verification protocol) to guarantee the transparency of the verification process.

A Corrective Action Request is raised where TÜV SÜD identifies:

- non-conformities in monitoring and/or reporting with the monitoring plan and/or methodology;
- that the evidence provided is not sufficient to prove conformity;
- mistakes in assumptions, data or calculations that impair the ER;
- FARs stated during validation that are not solved until the on-site visit.

A Clarification Request is raised where TÜV SÜD does not have enough information or the information is not clear in order to confirm a statement or data.

A Forward Action Request is raised where TÜV SÜD identifies that monitoring and/or reporting require special attention or adjustments for the next verification period.

Information or clarifications provided as a response to a CAR, CR or FAR could also lead to a new CAR.

## 2.7 Internal Quality Control

As a final step of verification, the final documentation including the verification report and annexes have to undergo an internal quality control by the Certification Body (CB) "climate and energy", i.e. each report has to be finally approved either by the Head of the CB or the Deputy (a Veto person can be used). In case one of these two persons is part of the assessment team, the approval can only be given by the person who is not a part of the assessment team. If the documents have been satisfactorily approved, the Request for Issuance is submitted to the CDM-EB along with the relevant documents.

# 3 VERIFICATION RESULTS

In the following sections, the results of the verification are stated. The verification results relate to the project performance as documented and described in the final PDD and the final Monitoring Report. The verification findings for each verification subject are presented below:

## 3.1 FARs from Validation / Previous Verification

This is the 1st periodic verification hence no FAR has been presented any previous verification report. The following FAR has been presented in the Validation Report

| | |
|---|---|
| Outstanding Requests from Validation | During the first verification process, the verifier shall be checked that appropriate training has been carried out among the people involved in the project. |
| Summary of project owner response | Evidence of appropriate training of the people involved in the project was provided to the assessment team. |
| Audit team Conclusion and IRL | PPs provided the following documents:<br>Signed List of Participants for Gas Analyzer Training held by Daniel Rojas Gas Analyser Specialist from INECO S.A. (IRL 14a)<br>Signed List of Participants for Delta V Training held by Pablo Saez Delta V Specialist from INECO S.A. (IRL 14b)<br>Information on internal WebEx Trainings held by Carbon Climate Protection (IRL 14c).<br>The documents provided were reviewed by the verifier, hence it is concluded that appropriate trainings have been carried out among the people involved in the project. Moreover the audit team got the impression that the peoples involved are well qualified and trained.<br>☑<br>This Finding is closed.<br>IRL 14a<br>IRL 14b<br>IRL 14c |

## 3.2 Project Implementation in accordance with the registered Project Design Document

The project is fully implemented according to the description presented in the registered PDD. The verifier confirms, through the visual inspection that all physical features of the proposed CDM project activity including data collecting systems and storage have been implemented in accordance with the registered PDD. The project activity is completely operational and the same has been confirmed on-site.

The difference between the values of the data and/or variables presented in the MR and the stated data in the registered PDD is not significant. The difference in the values does not lead to a substantial increment of the ER in this period in relation to the estimates in the registered PDD.

Neither a notification nor approval of change from the project activity described in the registered PDD has been requested to the CDM Executive Board. For the monitoring period in consideration, no deviation applied or has been requested for approval to the CDM Executive Board.

## 3.3 Compliance of the Monitoring Plan with the Monitoring Methodology

The monitoring plan is in accordance with the approved methodology, ACM0019, Version 01.0.0 and "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) applied by the proposed CDM project activity.

Neither a revision nor a deviation to the monitoring plan has been requested to the CDM Executive Board.

## 3.4 Compliance of the Monitoring with the Monitoring Plan

The monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD. All parameters were monitored and determined as per the Monitoring Plan.

Data transfer from meters to the monitoring report is realized as follows:
The instruments transmitters convert the primary sensing signal (resistance, voltage, Infrared light, etc.) to a 4 - 20 mA analogue signal according to range and units configured. These signals are hardwired transmitted to I/O cards (analogue input cards) and collected by the DeltaV Processor. These digital values are made available in the fibre optics network to be processed, among others, in controller blocks, other variables calculations and DeltaV Continuous Historian Server (CHS). Modifications of the Delta V, which are protected by security levels by the supplier, are tracked by a Version Control Tool. The CHS is installed in the ProPlus station where the information of field process variables are stored. The hourly averages (.csv-files) were manually transferred to the Excel Calculation Tool followed by a quality procedure. A Macro for automatic data transfer is currently under preparation.
To calculate the Emission Reductions, two Excel Files are available.

- Step 1: Transfer to the Excel Tool. No manual recalculations applied.
- Step 2 Calculation based on the transferred data according to the applied methodology and tool and any manual recalculation.

The verification of the parameters required by the monitoring plan is provided as follows (more information is provided in Annex 1:

**Parameters not monitored**

| **Data / Parameter:** | $EF_{default,y}$ |
|---|---|
| Data unit: | kgN2O/tHNO3 |
| Description: | Default N2O baseline emissions factor in the calendar year y of the monitoring period n |
| Source of data used: | According to PDD and ACM0019 version 01.0.0. |
| Means of verification/Comments: | The applied emissions factors have been compared with the default value given in the PDD and applied methodology. The correct values are applied. |
| Cross-check | Not applicable |

| **Data / Parameter:** | $GWP_{N2O}$ |
|---|---|
| Data unit: | tCO2e/tN2O |
| Description: | Global warming potential of N2O valid for the commitment period |
| Source of data used: | According to PDD and ACM0019 version 01.0.0. |
| Means of verification/Comments: | The applied value has been compared with the default value given in the PDD and applied methodology. The correct value is applied. |
| Cross-check | Not applicable |

| **Data / Parameter:** | $R_u$ |
|---|---|
| Data unit: | $Pa.m^3/kmol.K$ |
| Description: | Universal ideal gases constant |
| Source of data used: | According to PDD and “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0) |
| Means of verification/Comments: | The applied value has been compared with the default value given in the PDD and applied methodology. The correct value is applied. |
| Cross-check | Not applicable |

| **Data / Parameter:** | $MM_i$ |
|---|---|
| Data unit: | kg/kmol |
| Description: | Molecular mass of N2O |
| Source of data used: | According to PDD and “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0) |
| Means of verification/Comments: | The applied value has been compared with the default value given in the PDD and applied methodology. The correct value is applied. |
| Cross-check | Not applicable |

**Parameters monitored**

| **Data / Parameter:** | $P_{NA,n}$ |
|---|---|
| Data unit: | $tHNO_3$ |
| Description: | Nitric acid produced in the monitoring period n |
| Source of data used: | The coriolis type mass flow meter and the integrated density measurement deliver values, which are used as basis for calculation of the concentration (taking into consideration the measured temperature of the nitric acid). The nitric acid at 100% is calculated by multiplying the mass flow with the concentration. Then nitric acid produced is automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br>The instruments are calibrated according to the manufacturer`s specification (IRL 6a, 6c). |
| Means of verification/Comments: | The calibration certificates were provided as evidence of the calibration work performed (IRL 7a, 7e). Hence it is confirmed that calibration was not delayed.<br>Data provided in the raw data sheet were traced by the verifier with the help of ProPlus graphs over the whole period. In case of peculiarities the graph was zoomed and checked with special awareness taking into consideration the specific operation of the facility as demonstrated by other related parameter to verify explanations given. The reported data found to be consistent with the ProPlus graphs.<br>DeltaV Monthly reports (.mdi-files) (IRL 9a) were used to verify correct transfer of raw data to the Excel Tool. |
| Cross-check | PPs provided daily production data for this monitoring period “Listado de Producciones Diarias Planta Prillex América” (IRL 12b) that includes data recorded manually once every day from Foxboro DCS . The verifier could crosscheck reported nitric acid production of the monitoring period in MR with this data source. The difference was found to be below 1% of the value reported in the MR. |

| **Data / Parameter:** | $h_n$ |
|---|---|
| Data unit: | - |
| Description: | Number of hours of operation in a monitoring period n |
| Source of data used: | The oxidation temperature is automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br>Type: digital (DCS)<br>The plant is considered to be in operation when the temperature is in a range from 850°C to 905°C. The range has been validated (IRL 1b). |
| Means of verification/Comments: | The calibration certificate was provided as evidence of the calibration work performed (IRL 7d). Hence it is confirmed that calibration was not delayed.<br>Data provided in the raw data sheet were traced by the verifier with the help of ProPlus graphs over the whole period. In case of peculiarities the graph was zoomed and checked with special awareness taking into consideration the specific operation of the facility as demonstrated by other related parameter to verify explanations given.<br>DeltaV Monthly reports (.mdi-files) (IRL 9a) were used to verify |

| | |
|---|---|
| | correct transfer of raw data to the Excel Tool. |
| Cross-check | To cross-check the data the values of the three thermocouples TT 45030A TT 45030B and TT 45030C were compared to each other. All values were found to be consistent over the period. |

| **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 used: | The total gas volume is continuously measured by a DURAG DFL 100 DS and automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br>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 are applied to both the N2O concentration and the volume flow of the tail gas.<br>The QAL2 parameters are applied to the calculated hourly averages as part of the calculation of project emissions in the Excel calculation tool (IRL 10). This is in accordance with the applied methodology. |
| Means of verification/Comments: | The QAL2 report (IRL 7b) was provided as evidence of the calibration work performed. Hence it is confirmed that calibration was not delayed.<br>Data provided in the raw data sheet were traced by the verifier with the help of ProPlus graphs over the whole period. In case of peculiarities the graph was zoomed and checked with special awareness taking into consideration the specific operation of the facility as demonstrated by other related parameter to verify explanations given.<br>DeltaV Monthly reports (.mdi-files) (IRL 9a) were used to verify correct transfer of raw data to the Excel Tool. |
| Cross-check | In order to ensure the integrity of the data, the verification team reviewed the series of hourly data in parallel with other parameters including to make graphs in the Excel file calculation sheets submitted, e.g. to see peculiarity in the graph shape, to check the similarity between nitric acid produced and tail gas flow, to see the overall integrity of oxidation temperature. The data were found to be plausible |

| **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 used: | The volumetric fraction of N2O is continuously measured by an non-dispersive infrared photometry for N2O and automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br><br>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 are applied to both the N2O concentration and the volume flow of the tail gas.<br>The QAL2 parameters are applied to the calculated hourly averages |

| | |
|---|---|
| | as part of the calculation of project emissions in the Excel calculation tool (IRL 10). This is in accordance with the applied methodology. |
| Means of verification/Comments: | The QAL2 report (IRL 7b) provided as evidence of the calibration work performed. Hence it is confirmed that calibration was not delayed.<br>Data provided in the raw data sheet were traced by the verifier with the help of ProPlus graphs over the whole period. In case of peculiarities the graph was zoomed and checked with special awareness taking into consideration the specific operation of the facility as demonstrated by other related parameter to verify explanations given.<br>DeltaV Monthly reports (.mdi-files) (IRL 9a) were used to verify correct transfer of raw data to the Excel Tool. |
| Cross-check | In order to ensure the integrity of the data, the verification team reviewed the series of hourly data in parallel with other parameters including to make graphs in the Excel file calculation sheets submitted, e.g. to see peculiarity in the graph shape, to check the similarity between nitric acid produced and tail gas flow and N2O concentration. The data were found to be plausible |

| **Data / Parameter:** | Tt |
|---|---|
| Data unit: | K |
| Description: | Temperature of the gaseous stream in time interval t |
| Source of data used: | The temperature of tail gas is continuously measured by a PT 100 resistance thermometer and automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files). |
| Means of verification/Comments: | The calibration certificate (IRL 7c) was provided as evidence of the calibration work performed. Hence it is confirmed that calibration was not delayed.<br>Data provided in the raw data sheet were traced by the verifier with the help of ProPlus graphs over the whole period. In case of peculiarities the graph was zoomed and checked with special awareness taking into consideration the specific operation of the facility as demonstrated by other related parameter to verify explanations given.<br>DeltaV Monthly reports (.mdi-files) (IRL 9a) were used to verify correct transfer of raw data to the Excel Tool. |
| Cross-check | In order to ensure the integrity of the data, the verification team reviewed the series of hourly data in parallel with other parameters including to make graphs in the Excel file calculation sheets submitted, e.g. to see peculiarity in the graph shape, to check the similarity between nitric acid produced and tail gas flow and N2O concentration. The data were found to be plausible |

| **Data / Parameter:** | Pt |
|---|---|
| Data unit: | Pa |
| Description: | Pressure of the gaseous stream in time interval t |
| Source of data used: | Static and atmospheric pressure data are continuously measured by Capacitive pressure transducers and data is automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files). |

| | |
|---|---|
| | DeltaV Monthly reports (.mdi-files) (IRL 9a) were used to verify correct transfer of raw data to the Excel Tool. |
| Means of verification/Comments: | The calibration certificates (IRL 7f, IRL 7g) were provided as evidence of the calibration work performed. Hence it is confirmed that calibration was not delayed.<br>Data provided in the raw data sheet were traced by the verifier with the help of ProPlus graphs over the whole period. In case of peculiarities the graph was zoomed and checked with special awareness taking into consideration the specific operation of the facility as demonstrated by other related parameter to verify explanations given.<br>DeltaV Monthly reports (.mdi-files) (IRL 9a) were used to verify correct transfer of raw data to the Excel Tool. |
| Cross-check | In order to ensure the integrity of the data, the verification team reviewed the series of hourly data in parallel with other parameters including to make graphs in the Excel file calculation sheets submitted, e.g. to see peculiarity in the graph shape, to check the similarity between nitric acid produced and tail gas flow and N2O concentration. The data were found to be plausible |

| **Data / Parameter:** | $C_{H2O,t,db,n}$ |
|---|---|
| Data unit: | mg H2O/m3 dry gas |
| Description: | Moisture content of the gaseous stream at normal conditions, in time interval t |
| Source of data used: | Measurements according to USEPA CF 42 method 4 – Gravimetric determination of water content (QAL2 Report). |
| Means of verification/Comments: | Option A of the tool can be applied, as the moisture content is less than 0.05 kg H2O/m³ dry gas. The highest measured value according to QAL2 report is 0.0024 kg H2O/m3 dry gas. |
| Cross-check | The validating DOE mentions (IRL 1b): *In the mass balance, the expected moisture con-tent given by the technology supplier at design operation conditions is far below 0.05 kgH2O/m3 dry gas. Although the mass balance is given for design operating conditions not considering the presence of the secondary catalyst, this value is deemed to be acceptable since the secondary catalyst only affects the composition of the gas in terms of N2O.*<br>The moisture content measured during QAL2 by third party is in compliance with the observations of validating DOE. |

## 3.5 Assessment of Data and Calculation of Greenhouse Gas Emission Reductions

All data has been available and all the parameters have been monitored in accordance with the registered monitoring plan.

The reported data have been cross-checked against other sources available as explained above in chapter 3.4.

The verifier confirms that the methods and formulae used to obtained the baseline, project and leakage emissions are appropriate. The same has been done in accordance with the methods and formulae described in the registered monitoring plan and applicable methodology.

The verifier confirms that the monitoring report includes all parameters and the monitored data at the intervals required by the methodology and PDD.

The verifier confirms that all the emission factors and default values (ex-ante values from PDD) have been correctly justified. All the emission factors and default values are explicitly mentioned in the monitoring report. No assumptions have been applied by the project participant.

# 4 SUMMARY OF FINDINGS

The verifier can confirm that the published MR and related documents are complete and verifiable in accordance with the CDM requirements. All the findings rose by the verification team, the responses by the PPs and the conclusion from the team are presented in Annex 1. The means of verification and resulting changes in the MR or related documents are identified in the following table:

| |
|---|
| **CAR 1:**<br>The serial number for TT 45050 reported in Monitoring Report (N0909.842183/VO336261) is not consistent with the calibration certificate dated on 30/11/2011 provided to the audit team and the serial number found during onsite visit(N0809.842183/VO336261). |
| **CAR 1, means of verification** |
| The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on the serial number of TT 45050. |
| **CAR 1, changes in the MR or related documents** |
| The serial number was found to be corrected. Hence it complies with the serial number stated in the calibration certificate (IRL 7e) and found onsite. |

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| **CAR 2:**<br>The MR template requires to report about the calculation method of any monitoring parameter. PPs are requested to report about the method used to calculate 100% nitric acid and to calculate the absolute pressure of the gaseous stream which is determined by the sum of the static pressure inside the stack and the barometric pressure |
| **CAR 2, means of verification** |
| The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on the calculation method of 100% nitric acid (parameter PNA,n) and pressure of the gaseous stream (Pt). |
| **CAR 2, changes in the MR or related documents** |
| The calculation method is correctly reported. |

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| **CAR 3:**<br>The reported date of last calibration of N2O gas analyser (AT 45094) in the Monitoring Report is not found to be consistent with the date of test reported in the QAL2 report. |
| **CAR 3, means of verification** |
| The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on the calibration date of N2O gas analyser (AT 45094). |
| **CAR 3, changes in the MR or related documents** |
| The date was found to be revised. Hence it is consistent with the end date of comparative measurements performed from 14/12/2011 to 16/12/2011 reported in the QAL2 report (IRL 7b). |

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| **CAR 4:**<br>Zero check during QAL3 of the N2O analyser was out of allowed Shewhart Control Chart limit two times during this monitoring period. PPs added the measured deviation to the recorded hourly value in order to correct the value. However, PPs do not correct the measured values, but correct the QAL2 adjusted values. Furthermore the period of correction shall be clarified. |
| **CAR 4, means of verification** |
| The audit team reviewed the revised Excel Calculation Tool (IRL 10c,d) with special focus on the QAL3 corrections and DCS print screens (IRL 11c) for the days that were corrected because of QAL3 was out of allowed Shewhart Control Chart to confirm the period of |

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| correction. |
| **CAR 4, changes in the MR or related documents** |
| The deviation was found to be added to the measured value (in formula included in spreadsheet 03 Monitoring Parameters, column “Q”) |

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| **CAR 5:**<br>In the Monitoring Report the reported date of last determination of moisture content of the gaseous stream at normal conditions is not correctly reported as a different date was found in the QAL2 report. |
| **CAR 5, means of verification** |
| The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on the date of moisture measurement (parameter CH2O,t,db,n). |
| **CAR 5, changes in the MR or related documents** |
| The date of last determination of moisture content has been corrected to be consistent with QAL2 report (IRL 7b). |

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| **CAR 6:**<br>Values obtained during the time period between two QAL 3 have been corrected in case QAL 3 exceeded the limit.<br>However PPs excluded these corrected values from the calculation of the maximum value, which serves as a default value in case emission values are not available.<br>This is not according to the methodology and must be corrected. |
| **CAR 6, means of verification** |
| The audit team reviewed the revised Excel Calculation Tool (IRL 10c,d) with special focus on the calculation of maximum values. |
| **CAR 6, changes in the MR or related documents** |
| The corrected values were not found to be excluded. |

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| **CAR 7:**<br>With the intention to establish a conservative approach, PPs manually changed the status of operation for 4 hours during this monitoring period. I.e. operating hours (AOR temperature within the range of 850 – 905°C) were changed to shut down hours.<br>PPs are requested to follow the definition in the registered Monitoring Plan when determining operating hours (i.e. AOR temperature within the range of 850 – 905°C) or submit a request for deviation to EB. |
| **CAR 7, means of verification** |
| The verifier has reviewed revised Excel Calculation Tool (IRL 10d) with special focus to the operating hours. |
| **CAR 7, changes in the MR or related documents** |
| The determination of the operating hours were found in compliance with the PDD (i.e. plant is in operation when AOR temperature within the range of 850 – 905°C). No manual change is applied anymore. |

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| **CAR 8:**<br>Chapter A.7. of the MR should be updated as the start of crediting period has been changed. |
| **CAR 8, means of verification** |
| The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on Chapter A.7. |
| **CAR 8, changes in the MR or related documents** |
| The start date of the crediting period was found to be corrected. Hence it is consistent with the information provided at UNFCCC project site (IRL 2a). |

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| **CAR 9:**<br>In the Monitoring Report Figure 3 “Line diagram showing all relevant monitoring points” is not readable and not complete. It shall be improved. |
| **CAR 9, means of verification** |
| The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on Figure 3 “Line diagram showing all relevant monitoring points”. |
| **CAR 9, changes in the MR or related documents** |
| Figure 3 was found to be completed and in proper quality. |

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| **CR 1:**<br>The transfer from raw data (.csv-files) to the Excel calculation tool has been done manually. To ensure correct transfer PPs did the transfer two times and crosschecked these two data sets. To verify the crosscheck conducted by PPs to ensure correct transfer of raw data (.csv-file) to Excel calculation tool, the two different data sets shall be provided. Moreover the verifier requests the monthly reports from DeltaV (.mdi-file) as additional crosscheck source. |
| **CR 1, means of verification** |
| The files have been submitted (IRL 9a and IRL 12f). The verifier used DeltaV (.mdi-file) (IRL 9a) to confirm correct transfer of raw data to the Excel Tool. |
| **CR 1, changes in the MR or related documents** |
| N/A |

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| **CR 2:**<br>The methodology applied requires to set default values in case data for either the N2O 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. PPs shall clarify the method of calculating the hourly averages that is automatically done in the Delta V system and explicitly clarify if any elimination of data is done during the data processing in Delta V. Appropriate evidences shall be provided. |
| **CR 2, means of verification** |
| PPs provided a statement from INECO (IRL 6f) which is the official representative of EMERSON (Delta V- provider) in Chile dated on May 2012. The statement confirms that the Delta V system records data every second. All data (3600 values per hour) are used by the Excel Add-in to calculate the hourly average. |
| **CR 2, changes in the MR or related documents** |
| N/A |

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| **CR 3:**<br>The applied methodology requires that 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 N2O concentration and the volume or mass flow of the tail gas. The project measures N2O concentration and volume of the tail gas flow according to the methodology.<br>Clarification is requested if the calibration standard (like EN14181 including QAL2 correction factors) is used to calibrate also tail gas temperature and tail gas pressure.<br>Moreover evidences on the requirements on calibration frequency from manufacturer shall be provided for tail gas temperature and tail gas pressure instruments. |
| **CR 3, means of verification** |
| PPs submitted a statement from INECO (IRL 6g) regarding recommended calibration frequency of pressure model 2051C and temperature model 3144P transmitters. The recommended calibration frequency is 2 years. The verifier reviewed the response from PP. Hence the PPs clarified transparently that calibration frequency of pressure transmitter is defined by methodology and its underlying tool in this regard, “Tool to determine the mass flow of a |

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| greenhouse gas in a gaseous stream" (Version 02.0.0) which is requiring a monthly calibration frequency of  for pressure transducers. The compliance with this requirement has been verified by calibration certificate presenting 13/01/2012  as calibration date for (IRL 7f). |
| **CR 3, changes in the MR or related documents** |
| N/A |

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| **CR 4:**<br>Different colours are used in the Excel file to indicate different types of data (transferred data from csv-file, calculated values, etc). However the colour code is missing in the Excel File. |
| **CR 4, means of verification** |
| The audit team reviewed the revised Excel Calculation Tool (IRL 10c) with special focus on the colour code. |
| **CR 4, changes in the MR or related documents** |
| A colour code has been included in spreadsheet "03 Monitoring Parameters" which allow a transparent understanding of the coloured cells. |

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| **CR 5:**<br>PPs informed about an error in the programming of automatic QAL3 procedure (insufficient time of span gas supply to analyser) and that they switched to manual QAL 3 during that monitoring period. Evidence is required that the failure in automatic QAL3 did not result in an invalid analyser adjustment. |
| **CR 5, means of verification** |
| During 25-26/12/2011, 30/12/2011, 01/01/2012, 08/01/2012, 14/01/2012, 28/01/2012 automatic QAL3 has been started, but due to the error in programming (insufficient time of span gas supply to analyser) the QAL3 was not completed, i.e. the deviation (measured value vs. reference value) was too high so the analyser did not adjust automatically).<br>This situation could be verified by following documents that were provided by the PPs.<br>1. According to the Software manual (IRL 11e) the analyzer performs a zero or span adjustment only if this deviation between the standard gas and the actual measurement at calibration is less than a percentage of range. The default values for these parameters are:<br>End of range value: 200 ppm<br>Max zero calibration deviation: 30% (default value)<br>Max span calibration deviation: 20% (default value)<br>So, the max span calibration deviation is 40 ppm. This means that for every deviation in span less than 40 ppm the analyzer made a valid span adjustment and in other cases the span adjustment is not performed.<br>2. Additionally the print screens from DCS for those days (IRL 11d) focused on the QAL3 event were reviewed and no adjustment found, as the N2O concentration was on the exactly same level before and after the QAL3 event.<br>Thus in opinion of verifier enough evidences were provided to proof that the error in the automatic QAL 3 program did not result in a invalid adjustment of the analyser.<br><br>However the automatic QAL3 process has not been re-implemented in this monitoring period hence FAR 1 has been raised to pay special attention to proper function of automatic QAL3 process in the next verification. |
| **CR 5, changes in the MR or related documents** |
| N/A |

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| **CR 6:**<br>The applied tool to calculate the mass flow of N2O requires a monthly calibration frequency for pressure transducers (either capacitive or resistive). Hence it is required to clarify the type of |

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| transducers used and appropriate evidences shall be submitted. The type of transducers used shall be mentioned in the Monitoring Report.<br>Moreover, clarify if the pressure transducer has been calibration against a primary device and provide appropriate including the calibration certificate of the primary device used. |
| **CR 6, means of verification** |
| The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on parameter Pt. Additionally the verifier reviewed an extract of the Rosemount 2051 Reference Manual (IRL 6h) submitted by PPs as evidence. Hence correct information has been included in the MR and the type of pressure transducer is explicitly mentioned in the Monitoring Report. Furthermore the verifier reviewed the calibration certificates of primary devices used to calibrate PT-45091 and PT-45095 on 13/01/2012 submitted by PPs. |
| **CR 6, changes in the MR or related documents** |
| N/A |

Industrie Service

# 5 VERIFICATION STATEMENT

TÜV SÜD Industrie Service GmbH has performed the periodic verification #01 of the CDM project: “Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A.”. The verification is based on the currently valid documentation of the UN Framework Convention on Climate Change (UNFCCC). The management of Enaex S.A. is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions on the basis set out within the project’s Monitoring Plan indicated in the registered PDD version 1.2, dated 28-09-2011, the applied methodology ACM0019, Version 01.0.0 and Tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0) and reported in the final Monitoring Report (version 3, dated on 23-05-2012). The registration date of the project was 30-11-2011 and the crediting period is from 19-12-2011 to 18-12-2021 (fixed).

The verifier can confirm that:

- the development and maintenance of records and reporting procedures are in accordance with the registered monitoring plan;
- the project is operated as planned and described in the project design document approved by the EB;
- the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately;
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements;
- the monitoring plan in the Monitoring Report is as per the PDD and the monitoring plan approved by the EB;
- the monitoring plan in the approved PDD is as per the applied methodology.

Our opinion is based on the project’s GHG emissions and resulting GHG emission reductions reported, which have been both determined through the valid and registered project’s baseline, its monitoring plan and its associated documents. Based on the information we have seen and evaluated, we confirm the following statement:

Reporting period: From 19-12-2011 to 31-01-2012

Verified emissions in the above reporting period:

| | | |
|---|---|---|
| Baseline emissions: | 50,852 | t $CO_{2e}$ |
| Project emissions: | 4,976 | t $CO_{2e}$ |
| Leakage emission: | 0 | t $CO_{2e}$ |
| Emission reductions: | 45,876 | t $CO_{2e}$ |

Munich, 17-07-2012

Thomas Kleiser
Certification Body “climate and energy”
TÜV SÜD Industrie Service GmbH

Munich, 17-07-2012

Martin Hammer
Assessment Team Leader

Industrie Service

# Annex 1

# Verification Protocol

# Verification Protocol

Project Title: Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A.

Date of Completion: 17/07/2012

Industrie Service

## Table of Contents

Industrie Service

# 1. Project Activity Implementation

## 1.1. Technology

| Project Location | | | |
|---|---|---|---|
| | PDD Description | Verification Findings(or Results?) | Conclusion and IRL |
| Site Description / Address: | The project site is the Panna 4 nitric acid plant at ENAEXs Prillex América ammonia nitrate complex in Mejillones in Northern Chile (Province of Antofagasta, 2nd Region). Mejillones is located 65 km to the north of Antofagasta, the region's capital city and 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.<br><br>ENAEX Prillex América Plant<br>Barrio Industrial s/n<br>Mejillones | The location is correctly stated in the PDD. The address is correct as confirmed during onsite visit. | ☑<br>IRL 3 |
| GSP coordinates: | Latitude: 23°05'50.64'' S<br>Longitude: 70°25'48.55'' W | Latitude: 23°05'50.64'' S<br>Longitude: 70°25'48.55'' W<br><br>In decimal format:<br>Latitude: -23.097400°<br>Longitude: -70.430153° | ☑<br>IRL 3 |
| Technical Equipment – Main Components | | | |

| | PDD Description | Verification Findings(or Results?) | Conclusion and IRL |
|---|---|---|---|
| Plant Description | The new nitric acid plant, designed for a capacity of 925 metric tonnes of HNO3 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 N2O destruction) will be implemented in the PANNA 4 nitric acid plant. | 925 metric tonnes of HNO3 per day is consistent with the information stated in the secondary installation report (IRL4e).<br>The start of operation is confirmed by a Test run Protocol (IRL4a).<br>For verification of the design temperature and pressure PPs provided the AOR data sheet (IRL 4b). | ☑<br>IRL 4a<br>IRL 4b<br>IRL 4e |
| Component :<br>Technical Features:<br>Secondary Catalyst | Under the project activity, a N2O catalyst will be inserted below the primary catalyst (NH3 catalyst) in the ammonia oxidation reactor. The N2O catalyst will largely result in decomposition of N2O to nitrogen (N2) and oxygen (O2) without any further energy, nor material inputs. | A secondary catalyst from Hereaus has been installed in the AOR of Panna4 nitric acid plant. An installation report dated on 30/11/2011 has been provided to the audit team. | ☑<br>IRL 4e |
| Operation Status during verification | | | |
| | Verification Findings | | Conclusion and IRL |

| | | |
|---|---|---|
| Approvals / Licenses | Operating Permit of Panna4 Nitric Acid Plant issued by CONAMA has been provided for verification (IRL 4c) | ☑ IRL 4c |
| Actual Operation Status | Start date of operation: A secondary catalyst has been installed in the AOR of Panna4 nitric acid plant. An installation report dated on 30/11/2011 has been provided to the audit team.<br>Under construction ☐<br>In operation ☒<br>Out of operation ☐<br><br>Evidence that the nitric acid plant was in operation during onsite visit (e.g. print screen of control monitor) | ☑ IRL 4e IRL 4h |
| | The verifier confirms during the periodic verification using different documents provided by ENAEX S.A. and/or visits in the on-site verifications that the project is implemented as planned and as described in the validated and registered PDD. Installed equipment essential for generating emissions reductions runs reliably. The monitoring system is in place and is calibrated appropriately and the project is generating emission reduction as a CDM project. | ☑ |
| Remarks on Special Operational Circumstances During the Verification Period | Phased implementation: not applicable<br>Special cases: not applicable | |

## 1.2. Organization

| Project Participant (s) | | |
|---|---|---|
| | Verification Findings | Conclusion and IRL |
| Entity / Responsible person: | There are following project participants: | ☑ |

| | | |
|---|---|---|
| | • Enaex S.A.<br>• Carbon Climate Protection GmbH<br>The project participants Enaex S.A. and Carbon Climate Protection GmbH are consistent with the information given in the PDD. | IRL 2a |
| CDM Project management: | The overall responsibility of the project is with ENAEX S.A.. (IRL 5b)<br>Carbon Climate Protection supervises and approves the documents submitted to UNFCCC. (IRL 3)<br>The responsibilities of all persons dealing with information and data required to prepare the monitoring report are clearly indicated and ruled by the internal quality management system. (IRL 5b) | ☑<br>IRL 3<br>IRL 5b |

### 1.3. Quality Management System

| General aspects of the Quality Management System | | |
|---|---|---|
| | Verification Findings | Conclusion and IRL |
| Quality Management Manual: | The Prillex America production facility of Enaex has received the following certification:<br>• NCh ISO 9001. Of. 2001<br>• ANSI/ASQ Q9001:2000<br>• BS EN ISO 9001:2000<br><br>Procedures:<br>ISO 9001 Certificate for Planta Prillex America Mejillones Enaex S.A. valid until 29/10/2012<br>Procedure DM-MR-CD-027 “Instrumentalist Work procedure“, version 1, 03/09/2007<br>Procedure DM-MR-CD-080 “Thermocouple Temperature revision“, version 1, | ☑<br>IRL 5c-g |

| | | |
|---|---|---|
| | 03/08/2007<br>Procedure "Analyzer N2O Concentration Calibration" (Not included in ISO)<br>Procedure "Gauge pressure Transmitter Calibration" (Not included in ISO) | |
| Responsibilities: | According to the Monitoring Plan it is the responsibility of the Project Developer and Project Operator to organize and implement a quality management system that ensures the integrity of the data.<br>As described above ENAEX S.A. as project developer and project operator has implemented a quality management system for the CDM project.<br>This is in line with the Monitoring Plan. | ☑<br>IRL 5b |
| Qualification and Training: | According to the internal procedures and training records shown during the periodic verifications the TÜV SÜD assessment team confirms that the work has been done by people with the appropriate competences and qualifications. | ☑<br>IRL 14 |
| Implementation of QM-system | The verifier confirms the accessibility of documents of the QM-system and the proper implementation of the procedures. | ☑<br>IRL 3 |

## 1.4. Outstanding FARs from previous Verifications (or forwarded issues from the validation report)

| **Outstanding Requests from Validation** | Summary of project owner response | Audit team Conclusion and IRL |
|---|---|---|
| During the first verification process, the verifier shall be checked that appropriate training has been carried out among the people involved in the project. | Evidence of appropriate training of the people involved in the project was provided to the assessment team. | PPs provided the following documents:<br>Signed List of Participants for Gas Analyzer Training held by Daniel Rojas Gas Analyser Specialist from INECO S.A. (IRL 14a)<br>Signed List of Participants for Delta V Training held by Pablo Saez Delta V Specialist from INECO S.A. (IRL 14b)<br>Information on internal WebEx Trainings held |

| **Outstanding Requests from Validation** | Summary of project owner response | Audit team Conclusion and IRL |
|---|---|---|
| | | by Carbon Climate Protection (IRL 14c)<br>The documents provided were reviewed by the verifier, hence it is concluded that appropriate trainings have been carried out among the people involved in the project. Moreover the audit team got the impression that the peoples involved are well qualified and trained.<br>☑<br>This Finding is closed.<br>IRL 14a<br>IRL 14b<br>IRL 14c |

## 2. Monitoring Plan Implementation

### 2.1. Parameters

| Parameters | | | | | |
|---|---|---|---|---|---|
| Meth/tool | PDD | MR | Included in table | Compliance | Conclusion and IRL |
| $P_{NA,n}$ | $P_{NA,n}$ | $P_{NA,n}$ | Section 2.2 Table 1 | Compliant | ☑ |
| $h_n$ | $h_n$ | $h_n$ | Section 2.2 Table 2 | Compliant | ☑ |
| $V_{t,db}$ | $V_{t,db}$ | $V_{t,db}$ | Section 2.2 Table 3 | Compliant | ☑ |
| $v_{i,t,db}$ | $v_{i,t,db}$ | $v_{i,t,db}$ | Section 2.2 Table 4 | Compliant | ☑ |
| $C_{H2O,t,db,n}$ | $C_{H2O,t,db,n}$ | $C_{H2O,t,db,n}$ | Section 2.4 Table 1 | Compliant | ☑ |
| $T_t$ | $T_t$ | $T_t$ | Section 2.2 Table 5 | Compliant | ☑ |
| $P_t$ | $P_t$ | $P_t$ | Section 2.2 Table 6 | Compliant | ☑ |
| $EF_{default,y}$ | $EF_{default,y}$ | $EF_{default,y}$ | Section 3 under default parameters | Compliant | ☑ |
| $GWP_{N2O}$ | $GWP_{N2O}$ | $GWP_{N2O}$ | Section 3 under default parameters | Compliant | ☑ |
| $R_u$ | $R_u$ | $R_u$ | Section 3 under default parameters | Compliant | ☑ |
| $MM_i$ | $MM_i$ | $MM_i$ | Section 3 under default parameters | Compliant | ☑ |

## 2.2. Parameters measured directly with instruments in the field

**Table 1**

| Parameter and instrumentation Information | | | | | |
|---|---|---|---|---|---|
| | PDD | Meth/Tool | MR | Verification Findings | Conclusion and IRL |
| Parameter title | Nitric acid produced in the monitoring period n | Nitric acid produced in the monitoring period n | Nitric acid produced in the monitoring period n | Consistent | ☑ |
| Parameter ID (if available) | $P_{NA,n}$ | $P_{NA,n}$ | $P_{NA,n}$ | Consistent | ☑ |
| Data Unit | tHNO3 | t HNO3 | tHNO3 | Consistent | ☑ |
| Monitoring frequency (reading) | - | - | 1(s) | Consistent | ☑ |
| Monitoring frequency (recording) | Every monitoring period | Every monitoring period | Hourly | Consistent<br>The recording frequency is even much higher than required. | ☑ |
| Calibration requirements | Periodic calibration will be performed according to supplier´s recommendations. | QA/QC supplier recommendations. | Periodic calibration is performed according to manufacturer's recommendation.<br><br>Coriolis flow and density transmitter<br>Calibration frequency: 2 years | Consistent<br><br>Latest calibrations:<br>Coriolis flow and density transmitter<br>June 2010 (Calibration)<br>09/11/2011 | ☑<br>IRL 7a<br>IRL 6a<br>IRL 7e<br>IRL 6c |

| | | | | | |
|---|---|---|---|---|---|
| | | | Temperature transmitter<br>Calibration frequency: 2 years | Temperature transmitter<br>30/11/2011 | |
| Uncertainty level | - | Low | FT 45026 :<br>Accuracy class: 0.15% of instrument range<br>TT 45050:<br>Accuracy class: 0.1% of range | Consistent | ☑<br>IRL 7e |
| Measurement Principle (if applicable) | The nitric acid flow is measured with a “coriolis” type mass flow meter. The coriolis can also measure the fluid density. | - | The coriolis type mass flow meter and the integrated density measurement deliver values, which are used as basis for calculation of the concentration (taking into consideration the measured temperature of the nitric acid). The nitric acid at 100% is calculated by multiplying the mass flow with the concentration. | Consistent | ☑ |
| | Technical aspects | | | | Conclusion and IRL |

| | | |
|---|---|---|
| Instrument Type: | Coriolis flow and density transmitter TAG ID: FT 45026<br>Temperature Transmitter TAG ID: TT 45050 | ☑ |
| Serial Number: | Coriolis flow and density transmitter serial number: EB024716000<br>Temperature Transmitter serial number: N0909.842183/VO336261<br><br>**Corrective Action Request No. 1:**<br>The serial number for TT 45050 reported in Monitoring Report (N0909.842183/VO336261) is not consistent with the calibration certificate dated on 30/11/2011 provided to the audit team and the serial number found during onsite visit(N0809.842183/VO336261). | ☑<br>IRL 3<br>IRL 7a<br>IRL 7e<br>CAR |
| Manufacturer Model Nr.: | Flow and density Sensor PROMASS PROMASS 80F<br>Temperature: Inor; Model: Meso-H | ☑ |
| Specific Location: | After the absorption column | ☑ |
| Measurement Range: | 0-36t/h<br>0-100°C | ☑<br>IRL 7a |
| Gaps in operating time of instrument : | Period: 11/01/2012 16:00 – 20:00 (4 hours) | ☑ |
| | Default value used: 34.82 | ☑<br>IRL 10 |
| | Justification: Default value used is the minimum of hourly value during monitoring period. Normal operation of nitric acid plant could be verified as no unusual increase or decrease of ammonia input (IRL 11a) was found during those hours and also ammonia oxidation temperature as reported in the Calculation Tool (IRL 10) was found to be in normal range. An underestimated nitric acid production results in underestimated baseline emissions. Hence emission reduction from such hours are conservatively determined. | ☑<br>IRL 11a<br>IRL 10 |
| | QA/QC aspects | Conclusion and IRL |

| | | |
|---|---|---|
| Source of data | The coriolis type mass flow meter and the integrated density measurement deliver values, which are used as basis for calculation of the concentration (taking into consideration the measured temperature of the nitric acid). The nitric acid at 100% is calculated by multiplying the mass flow with the concentration. Then nitric acid produced is automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br><br>**<u>Corrective Action Request No. 2:</u>**<br>The MR template requires to report about the calculation method of any monitoring parameter. PPs are requested to report about the method used to calculate 100% nitric acid and to calculate the absolute pressure of the gaseous stream which is determined by the sum of the static pressure inside the stack and the barometric pressure | ☑<br>CAR |
| | Procedures:<br>ISO 9001 Certificate for Planta Prillex America Mejillones Enaex S.A. valid until 29/10/2012<br>Procedure DM-MR-CD-027 “Instrumentalist Work procedure“, version 1, 03/09/2007<br>Procedure DM-MR-CD-080 “Thermocouple Temperature revision“, version 1, 03/08/2007<br>Procedure “Analyzer N2O Concentration Calibration“ (Not included in ISO)<br>Procedure “Gauge pressure Transmitter Calibration“ (Not included in ISO) | ☑<br>IRL 5c-g |
| | Implementation of procedure: The procedures developed are well implemented as could be seen during the on-site visit | ☑<br>IRL 3 |
| | Responsibility: ENAEX S.A. CDM Project Team | ☑<br>IRL 5b |
| Archiving of raw data and protection measures | The data-report hardware of DeltaV consists in two PCs. The first, called Pro Plus, is where the reports are generated daily. These data are transported to the second PC, called Backup, where is possible extract the necessary files to calculate the ER. This PC is also the backing up of information. | ☑<br>IRL 3 |

| | | |
|---|---|---|
| Data transfer and protection of input data for calculations | **Clarification Request No.1:**<br>The transfer from raw data (.csv-files) to the Excel calculation tool has been done manually. To ensure correct transfer PPs did the transfer two times and crosschecked these two data sets.<br>To verifiy the crosscheck conducted by PPs to ensure correct transfer of raw data (.csv-file) to Excel calculation tool, the two different data sets shall be provided. Moreover the verifier requests the monthly reports from DeltaV (.mdi-file) as additional crosscheck source.<br>The whole system is password protected and accessible only to authorized personnel. | CR<br>IRL 3 |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | Delta –V Data were reviewed which show complete and credible data. Any deviation is described above in section “Gaps in operating time of instrument”.<br>files) to the verifi-cation team. | ☑ |
| Data verification | Consistency of raw data with calculation tool:<br>See CL 1 | ☑<br>CL |
| | Consistency of calculation tool with monitoring report: The verifier compared the values from Excel spreadsheet and the reported value in the Monitoring Report. Hence it was found that values of calculation tool and Monitoring Report are consistent. | ☑<br>IRL 1e<br>IRL 10 |
| Crosscheck (if available) | PPs provided daily production data for this monitoring period “Listado de Producciones Diarias Planta Prillex América” (IRL 12b) that includes data recorded manually once every day from Foxboro DCS .<br>The verifier could crosscheck reported nitric acid production of the monitoring period in MR with this data source. The difference was found to be below 1% of the value re-ported in the MR. | ☑<br>IRL 12b |

**Table 2**

| Parameter and instrumentation Information | | | | | |
|---|---|---|---|---|---|
| | PDD | Meth/Tool | MR | Verification Findings | Conclusion and IRL |
| Parameter title | Number of hours of operation in a monitoring period n | Number of hours of operation in a monitoring period n | Number of hours of operation in a monitoring period n | Consistent | ☑ |
| Parameter ID (if available) | $h_n$ | $h_n$ | $h_n$ | Consistent | ☑ |
| Data Unit | - | - | - | Consistent | ☑ |
| Monitoring frequency (reading) | - | - | 1(s) | Consistent | ☑ |
| Monitoring frequency (recording) | Every monitoring period | Every monitoring period | Hourly | Consistent<br>The recording frequency is even much higher than required. | ☑ |
| Calibration requirements | Periodic calibration will be performed according to manufacturer´s recommendation. | - | Every two years<br>Periodic calibration is performed according to manufacturer's recommendation. | Consistent<br>Last calibration date: 13/09/2010<br><br>Recommendation letter from manufacturer states that the frequency of calibration (e.g. 2 years) depends on the customer application and the environmental condi- | ☑<br><br>IRL 7d<br>IRL 6b |

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| | | | | tions. | |
| Uncertainty level | - | - | Accuracy class: 0.4% of range | Consistent<br>Class 1 of EN 60584 (most accurate) | ☑<br>IRL 7d |
| Measurement Principle (if applicable) | - | - | 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, B and C) measuring the temperature at the same time. The value of the instrument with the tag number TT 45030A was selected as main signal for monitoring the operation temperature; TT | Consistent | ☑ |

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|---|---|---|---|---|---|
| | | | 45030B and TT 45030C are used as backup signals in case TT 45030A is not fully functional | | |
| | Technical aspects | | | | Conclusion and IRL |
| Instrument Type: | TT-45030A: Thermocouple WIKA TC10 Sensor: K-Type (NiCr-Ni) | | | | ☑ IRL 7d |
| Serial Number: | 3F0AF4X | | | | ☑ |
| Manufacturer Model Nr.: | Thermocouple WIKA TC10 Sensor: K-Type (NiCr-Ni) | | | | ☑ |
| Specific Location: | Ammonia Oxidation Reactor | | | | ☑ |
| Measurement Range: | 0-1000°C | | | | ☑ IRL 4d |
| Gaps in operating time of instrument : | Period: No. | | | | ☑ |
| | Default value used: not applicable | | | | ☑ |
| | Justification: not applicable | | | | ☑ |
| | QA/QC aspects | | | | Conclusion and IRL |
| Source of data | The oxidation temperature is automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br>Type: digital (DCS)<br>The plant is considered to be in operation when the temperature is in a range from 850°C to 905°C. The range has been validated (IRL 1b). | | | | ☑ IRL 1b |
| | Procedures: | | | | ☑ |

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| | ISO 9001 Certificate for Planta Prillex America Mejillones Enaex S.A. valid until 29/10/2012<br>Procedure DM-MR-CD-027 “Instrumentalist Work procedure“, version 1, 03/09/2007<br>Procedure DM-MR-CD-080 “Thermocouple Temperature revision“, version 1, 03/08/2007<br>Procedure “Analyzer N2O Concentration Calibration“ (Not included in ISO)<br>Procedure “Gauge pressure Transmitter Calibration“ (Not included in ISO) | IRL 5c-g |
| | Implementation of procedure: The procedures developed are well implemented as could be seen during the on-site visit | ☑<br>IRL 3 |
| | Responsibility: ENAEX S.A. CDM Project Team | ☑<br>IRL 5b |
| Archiving of raw data and protection measures | The data-report hardware of DeltaV consists in two PCs. The first, called Pro Plus, is where the reports are generated daily. These data are transported to the second PC, called Backup, where is possible extract the necessary files to calculate the ER. This PC is also the backing up of information. | ☑<br>IRL 3 |
| Data transfer and protection of input data for calculations | The transfer from raw data (.csv-files) to the Excel calculation tool has been done manually. In order to ensure correct transfer PPs have done the transfer twice and crosschecked both transferred data sets. As informed during onsite audit a Macro Excel for automatic transfer of .csv data to the Excel tool is currently developed.<br><br>See Findings in Table 1 Chapter 2.2. | ☑ |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | Delta –V Data were reviewed which show complete and credible data. Any deviation is described above in section “Gaps in operating time of instrument”. | ☑ |
| Data verification | Consistency of raw data with calculation tool: | ☑ |

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| | See Findings in Table 1 Chapter 2.2. | |
| | Consistency of calculation tool with monitoring report: The verifier compared the values from Excel spreadsheet and the reported value in the Monitoring Report. Hence it was found that values of calculation tool and Monitoring Report are consistent. | ☑<br>IRL 1e<br>IRL 10 |
| Crosscheck (if available) | To cross-check the data the values of the three thermocouples TT 45030A TT 45030B and TT 45030C were compared to each other.<br>All values were found to be consistent over the period. | ☑<br>IRL 10 |

**Table 3**

| Parameter and instrumentation Information | | | | | |
|---|---|---|---|---|---|
| | PDD | Meth/Tool | MR | Verification Findings | Conclusion and IRL |
| Parameter title | Volumetric flow of the gaseous stream in time interval t on a dry basis | Volumetric flow of the gaseous stream in time interval t on a dry basis | Volumetric flow of the gaseous stream in time interval t on a dry basis | Consistent | ☑ |
| Parameter ID (if available) | $V_{t,db}$ | $V_{t,db}$ | $V_{t,db}$ | Consistent | ☑ |
| Data Unit | $m^3$ dry gas/h | $m^3$ dry gas/h | $m^3$ dry gas/h | Consistent | ☑ |
| Monitoring frequency (reading) | Continuously<br>2 seconds (or shorter) interval | Continuously<br>2 seconds (or shorter) interval | Continuously<br>1 second | Consistent | ☑ |
| Monitoring frequency (recording) | hourly | hourly | hourly | Consistent | ☑ |
| Calibration requirements | Periodic calibration against a primary device provided by | Periodic calibration against a primary device provided by | Every two years<br>Periodic calibration | Consistent<br>Last QAL2: | ☑<br>IRL 7b |

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| | an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer´s specifications.<br>Periodic calibration will be performed according to manufacturer´s recommendation. | an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer´s specifications | (QAL2) against a primary device by an independent accredited laboratory.<br>Periodic calibration is performed according to manufacturer's recommendation. | 14.12.-16.12.2011<br><br>**Clarification Request No.3:**<br>The applied methodology requires that 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 N2O concentration and the volume or mass flow of the tail gas. The project measures N2O concentration and volume of the tail gas flow according to the methodology.<br>Clarification is requested if the calibration standard (like EN14181 including QAL2 correction factors) is used to calibrate | |

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| | | | | also tail gas temperature and tail gas pressure.<br>Moreover evidences on the requirements on calibration frequency from | |
| Uncertainty level | - | - | Accuracy class: 2% of range<br>Uncertainty: 1.83% according to QAL2 report | Consistent | ☑ |
| Measurement Principle (if applicable) | 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). | Volumetric flow measurement should always refer to the actual pressure and temperature. Calculated based on the wet basis flow measurement plus water concentration measurement | Option A is applied hence volumetric flow measurement refer to the actual pressure and temperature.<br>Result of moisture determination during QAL2 :<br>The measured moisture content in the stack gas is less than 0,05 kg/m³dry gas. The stack gas is dry (definition "Tool to determinate the mass flow of a green house gas in a gaseous stream"). | Consistent | ☑ |

| | Technical aspects | Conclusion and IRL |
|---|---|---|
| Instrument Type: | Difference-pressure technology TAG ID FT 45092 | ☑ IRL 7b |
| Serial Number: | Probe: 1221484<br>Transmitter: 265DS6600071043 | ☑ IRL 7b |
| Manufacturer Model Nr.: | Probe: DURAG DFL 100 DS -2S 300 NE<br>Transmitter: ABB 265 DS | ☑ IRL 7b |
| Specific Location: | stack in a height of 37,2 m | ☑ IRL 7b |
| Measurement Range: | 0 - 3 mbar (difference pressure)<br>0 – 286.000 $m^3$/h (working condition) | ☑ IRL 7b |
| Gaps in operating time of instrument : | Period:<br>13/01/2012 14:00 - 19:00 (1)<br>19/12/2012 16:00 - 17:00 (2) | ☑ |
| | Default value used:<br>22.20 kgN2O/h (1)<br>209,419 $m^3$drygas/h (2) | ☑ |
| | Justification: If data for either the N2O 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 N2O concentration or volume or mass flow of the tail gas observed during the monitoring period. If data for neither the N2O 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 N2O 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 | ☑ |

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| | Ad(1)<br>Because there is a gap in data of pressure and temperature measurements of tail gas required to calculate the density of PPs applying the downtime procedure required in the methodology in case no concentration and volume flow data are available. | |
| | QA/QC aspects | Conclusion and IRL |
| Source of data | The total gas volume is automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br>Type: digital (DCS)<br>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 are applied to both the N2O concentration and the volume flow of the tail gas.<br>The QAL2 parameters are applied to the calculated hourly averages as part of the calculation of project emissions in the Excel calculation tool (IRL 10). This is in accordance with the applied methodology. | ☑<br>IRL 10 |
| | Procedures:<br>ISO 9001 Certificate for Planta Prillex America Mejillones Enaex S.A. valid until 29/10/2012<br>Procedure DM-MR-CD-027 “Instrumentalist Work procedure“, version 1, 03/09/2007<br>Procedure DM-MR-CD-080 “Thermocouple Temperature revision“, version 1, 03/08/2007<br>Procedure “Analyzer N2O Concentration Calibration“ (Not included in ISO)<br>Procedure “Gauge pressure Transmitter Calibration“ (Not included in ISO) | ☑<br>IRL 5c-g |
| | Implementation of procedure: The procedures developed are well implemented as could be seen during the on-site visit | ☑<br>IRL 3 |
| | Responsibility: ENAEX S.A. CDM Project Team | ☑<br>IRL 5b |

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| Archiving of raw data and protection measures | The data-report hardware of DeltaV consists in two PCs. The first, called Pro Plus, is where the reports are generated daily. These data are transported to the second PC, called Backup, where is possible extract the necessary files to calculate the ER. This PC is also the backing up of information. | ☑ IRL 3 |
| Data transfer and protection of input data for calculations | The transfer from raw data (.csv-files) to the Excel calculation tool has been done manually. In order to ensure correct transfer PPs have done the transfer twice and crosschecked both transferred data sets. As informed during onsite audit a Macro Excel for automatic transfer of .csv data to the Excel tool is currently developed.<br><br>See Findings in Table 1 Chapter 2.2. | CR |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | Delta –V Data were reviewed which show complete and credible data. Any deviation is described above in section “Gaps in operating time of instrument”. | ☑ |
| Data verification | Consistency of raw data with calculation tool:<br><br>See Findings in Table 1 Chapter 2.2. | CR |
| | Consistency of calculation tool with monitoring report: The verifier compared the values from Excel spreadsheet and the reported value in the Monitoring Report. Hence it was found that values of calculation tool and Monitoring Report are consistent. | ☑ IRL 1e IRL 10 |
| Crosscheck (if available) | In order to ensure the integrity of the data, the verification team reviewed the series of hourly data in parallel with other parameters including to make graphs in the Excel file calculation sheets submitted, e.g. to see peculiarity in the graph shape, to check the similarity between nitric acid produced and tail gas flow, to see the overall integrity of oxidation temperature.<br>Except those date mentioned in the findings above under “Gaps in operating time of instrument:” the data were found to be plausible. | ☑ |

**Table 4**

| Parameter and instrumentation Information | | | | | |
|---|---|---|---|---|---|
| | PDD | Meth/Tool | MR | Verification Findings | Conclusion and IRL |
| Parameter title | Volumetric fraction of greenhouse gas i in a time interval t on a dry basis | Volumetric fraction of greenhouse gas i in a time interval t on a dry basis | Volumetric fraction of greenhouse gas i in a time interval t on a dry basis | Consistent | ☑ |
| Parameter ID (if available) | $v_{i,t,db}$ | $v_{i,t,db}$ | $v_{i,t,db}$ | Consistent | ☑ |
| Data Unit | $m^3$ gas i/$m^3$ dry gas | $m^3$ gas i/$m^3$ dry gas | $m^3$ gas i/$m^3$ dry gas | Consistent | ☑ |
| Monitoring frequency (reading) | Continuously<br>2 seconds (or shorter) interval | Continuously<br>2 seconds (or shorter) interval | Continuously<br>1 second | Consistent | ☑ |
| Monitoring frequency (recording) | hourly | hourly | hourly | Consistent | ☑ |
| Calibration requirements | According to Euro-pean Norm 14181. | Calibration should include zero verifi-cation with an inert gas (e.g. N2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period | According to EN14181 | Consistent<br>Last QAL2:<br>14.12.-16.12.2011<br><br>**<u>Corrective Action Request No. 3:</u>**<br>The reported date of last calibration of N2O gas analyser (AT 45094) in the Monitoring Report is not found to be consistent with the date of test reported | ☑<br>IRL 7b<br>IRL 5a<br>CAR |

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| | | | | in the QAL2 report. | |
| Uncertainty level | - | - | Accuracy class: 1% of range<br>Uncertainty: 0,25% according to QAL2 report | Consistent | ☑<br>IRL 7b |
| Measurement Principle (if applicable) | Continuous gas analyser operating in dry-basis.<br>Non-dispersive in-frared photometry for N2O | Continuous gas analyser operating in dry-basis. | Non-dispersive in-frared photometry (NDIR) for N2O (Gas analyzer<br>equipment) | Consistent | ☑ |
| | Technical aspects | | | | Conclusion and IRL |
| Instrument Type: | Non-dispersive infrared photometry for N2O TAG AT 45094 | | | | ☑<br>IRL 7b |
| Serial Number: | 3709103038248 | | | | ☑<br>IRL 7b |
| Manufacturer Model Nr.: | NGA 2000 MLT2 IRIR PO2 | | | | ☑<br>IRL 7b |
| Specific Location: | The Analyzer is installed in an air conditioned container<br>Sampling is done in the horizontal duct behind expander turbine. In about 36,8m height over bottom. | | | | ☑<br>IRL 7b |
| Measurement Range: | Range 1: 0-200ppm<br>Range 2: 0-2000 ppm | | | | ☑<br>IRL 7b |
| Gaps in operating time of instrument : | Period: No gaps in operation of the instrument<br>Invalid QAL3: | | | | ☑ |

| | | |
|---|---|---|
| | (1) 25/12/2011 10:00 – 26/12/2011 16:00 (1)<br>(2) 29/12/2011 10:00 – 18:00 | |
| | Default value used:<br><br>**<u>Corrective Action Request No. 4:</u>**<br>Zero adjustment during QAL3 was out of allowed limit two times during this monitoring period. PPs added the measured deviation to the recorded hourly value in order to correct the value. However, PPs do not correct the measured values, but correct the QAL2 adjusted values. Furthermore the period of correction shall be clarified.<br><br>**<u>Clarification Request No.5:</u>**<br>PPs informed about an error in the programming of automatic QAL3 procedure (insufficient time of span gas supply to analyser). Hence evidence of correct span adjustment during the monitoring period is required. | CAR<br>CR<br>FAR |
| | Justification:<br>(1) Measured value + 33.27 ppm<br>(2) Measured value + 44.43 ppm | ☑ |
| | QA/QC aspects | Conclusion and IRL |
| Source of data | The volumetric fraction of N2O is automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br><br>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 are applied to both the N2O concentration and the volume flow of the tail gas.<br>The QAL2 parameters are applied to the calculated hourly averages as part of the calculation of project emissions in the Excel calculation tool (IRL 10). This is in accordance | ☑<br>IRL 10 |

| | | |
|---|---|---|
| | with the applied methodology.<br><br>Type: digital (DCS)Type: digital (DCS) | |
| | Procedures:<br>ISO 9001 Certificate for Planta Prillex America Mejillones Enaex S.A. valid until 29/10/2012<br>Procedure DM-MR-CD-027 “Instrumentalist Work procedure“, version 1, 03/09/2007<br>Procedure DM-MR-CD-080 “Thermocouple Temperature revision“, version 1, 03/08/2007<br>Procedure “Analyzer N2O Concentration Calibration“ (Not included in ISO)<br>Procedure “Gauge pressure Transmitter Calibration“ (Not included in ISO) | ☑<br>IRL 5c-g |
| | Implementation of procedure: The procedures developed are well implemented as could be seen during the on-site visit | ☑<br>IRL 3 |
| | Responsibility: ENAEX S.A. CDM Project Team | ☑<br>IRL 5b |
| Archiving of raw data and protection measures | The data-report hardware of DeltaV consists in two PCs. The first, called Pro Plus, is where the reports are generated daily. These data are transported to the second PC, called Backup, where is possible extract the necessary files to calculate the ER. This PC is also the backing up of information. | ☑<br>IRL 3 |
| Data transfer and protection of input data for calculations | The transfer from raw data (.csv-files) to the Excel calculation tool has been done manually. In order to ensure correct transfer PPs have done the transfer twice and crosschecked both transferred data sets. As informed during onsite audit a Macro Excel for automatic transfer of .csv data to the Excel tool is currently developed.<br><br>See Findings in Table 1 Chapter 2.2. | CR |
| | Quality of evidence | Conclusion and IRL |

| | | |
|---|---|---|
| Completeness of data | Delta –V Data were reviewed which show complete and credible data. Any deviation is described above in section “Gaps in operating time of instrument”. | ☑ |
| Data verification | Consistency of raw data with calculation tool:<br><br>See Findings in Table 1 Chapter 2.2. | ☑ |
| | Consistency of calculation tool with monitoring report: The verifier compared the values from Excel spreadsheet and the reported value in the Monitoring Report. Hence it was found that values of calculation tool and Monitoring Report are consistent. | ☑<br>IRL 1e<br>IRL 10 |
| Crosscheck (if available) | In order to ensure the integrity of the data, the verification team reviewed the series of hourly data in parallel with other parameters including to make graphs in the Excel file calculation sheets submitted, e.g. to see peculiarity in the graph shape, to check the similarity between nitric acid produced and tail gas flow and N2O concentration. | ☑ |

**Table 5**

| Parameter and instrumentation Information | | | | | |
|---|---|---|---|---|---|
| | PDD | Meth/Tool | MR | Verification Findings | Conclusion and IRL |
| Parameter title | Temperature of the gaseous stream in time interval t | Temperature of the gaseous stream in time interval t | Temperature of the gaseous stream in time interval t | Consistent | ☑ |
| Parameter ID (if available) | Tt | Tt | Tt | Consistent | ☑ |
| Data Unit | K | K | K | Consistent | ☑ |
| Monitoring frequency (reading) | Continuously<br>2 seconds (or | Continuously<br>2 seconds (or | Continuously<br>1 second | Consistent | ☑ |

| | | | | | |
|---|---|---|---|---|---|
| | shorter) interval | shorter) interval | | | |
| Monitoring frequency (recording) | hourly | hourly | hourly | Consistent<br>Daily Values are presented in UNFCCC Summary Excel Sheet | ☑ |
| Calibration requirements | Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer´s specifications. | Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer´s specifications. | 2 Years<br>Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer´s specifications. | Refer to CL in Chapter 2.2 Table 3 | ☑<br>IRL6d |
| Uncertainty level | - | - | Accuracy class: 0.4°C<br>Uncertainty: 0,55% according to QAL2 report | Consistent | ☑<br>IRL 7b |
| Measurement Principle (if applicable) | Instruments with recordable electronic signal | Instruments with recordable electronic signal (analogical or digital) are required.<br>Examples include thermocouples, thermo resistance, | Measuring: Continuously<br>Reading: 1(s)<br>Recording: Hourly | Consistent<br>Platinum RTD Sensor is installed. | ☑<br>IRL 7b |

| | | | | | |
|---|---|---|---|---|---|
| | | etc. | | | |
| | Technical aspects | | | | Conclusion and IRL |
| Instrument Type: | TT 45093: PT 100 resistance thermometer (Platinum RTD Sensor from Rosemount including transmitter) | | | | ☑ IRL 7b |
| Serial Number: | Model Number Sensor: 0078N21C30A250F10AXA<br>Serial Number Transmitter: 0706088 | | | | ☑ IRL 7b |
| Manufacturer Model Nr.: | Model Number Sensor: 0078N21C30A250F10AXA<br>Model Number Transmitter: 3144PD1A1NAM5F5A1C4Q4XA | | | | ☑ IRL 7b |
| Specific Location: | Horizontal duct behind expander turbine<br>Height over bottom ≈ 37,2 m | | | | ☑ IRL 7b |
| Measurement Range: | 0-200°C | | | | ☑ IRL 7b |
| Gaps in operating time of instrument : | Period:<br>13/01/2012 14:00<br>13/01/2012 15:00<br>13/01/2012 16:00<br>13/01/2012 17:00<br>13/01/2012 18:00 | | | | ☑ |
| | Default value used: 22.20 kgN2O/h | | | | ☑ |
| | Justification: According to ACM0019 the maximum value of mass flow of N2O calculated during the monitoring period shall be applied to any hour where the N2O 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. 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. | | | | ☑ |

| | | |
|---|---|---|
| | Because there is a gap in data of pressure and temperature measurements of tail gas required to calculate the density of PPs applying the downtime procedure required in the methodology in case no concentration and volume flow data are available. | |
| | QA/QC aspects | Conclusion and IRL |
| Source of data | The temperature of tail gas is automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br>Type: digital (DCS) | ☑ |
| | Procedures:<br>ISO 9001 Certificate for Planta Prillex America Mejillones Enaex S.A. valid until 29/10/2012<br>Procedure DM-MR-CD-027 “Instrumentalist Work procedure“, version 1, 03/09/2007<br>Procedure DM-MR-CD-080 “Thermocouple Temperature revision“, version 1, 03/08/2007<br>Procedure “Analyzer N2O Concentration Calibration“ (Not included in ISO)<br>Procedure “Gauge pressure Transmitter Calibration“ (Not included in ISO) | ☑<br>IRL 5c-g |
| | Implementation of procedure: The procedures developed are well implemented as could be seen during the on-site visit | ☑<br>IRL 3 |
| | Responsibility: ENAEX S.A. CDM Project Team | ☑<br>IRL 5b |
| Archiving of raw data and protection measures | The data-report hardware of DeltaV consists in two PCs. The first, called Pro Plus, is where the reports are generated daily. These data are transported to the second PC, called Backup, where is possible extract the necessary files to calculate the ER. This PC is also the backing up of information. | ☑<br>IRL 3 |
| Data transfer and protection of input data for calculations | The transfer from raw data (.csv-files) to the Excel calculation tool has been done manually. In order to ensure correct transfer PPs have done the transfer twice and | CR |

| | | |
|---|---|---|
| | crosschecked both transferred data sets. As informed during onsite audit a Macro Excel for automatic transfer of .csv data to the Excel tool is currently developed.<br><br>See Findings in Table 1 Chapter 2.2. | |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | Delta –V Data were reviewed which show complete and credible data. Any deviation is described above in section “Gaps in operating time of instrument”. | ☑ |
| Data verification | Consistency of raw data with calculation tool:<br><br>See Findings in Table 1 Chapter 2.2. | CR |
| | Consistency of calculation tool with monitoring report: The verifier compared the values from Excel spreadsheet and the reported value in the Monitoring Report. Hence it was found that values of calculation tool and Monitoring Report are consistent. | ☑<br>IRL 1e<br>IRL 10 |
| Crosscheck (if available) | In order to ensure the integrity of the data, the verification team reviewed the series of hourly data in parallel with other parameters including to make graphs in the Excel file calculation sheets submitted, e.g. to see peculiarity in the graph shape, to check the similarity between nitric acid produced and tail gas flow and N2O concentration. | ☑ |

**Table 6**

| Parameter and instrumentation Information | | | | | |
|---|---|---|---|---|---|
| | PDD | Meth/Tool | MR | Verification Findings | Conclusion and IRL |
| Parameter title | Pressure of the gaseous stream in time interval t | Pressure of the gaseous stream in time interval t | Pressure of the gaseous stream in time interval t | Consistent | ☑ |

| | | | | | |
|---|---|---|---|---|---|
| Parameter ID (if available) | Pt | Pt | Pt | Consistent | ☑ |
| Data Unit | Pa | Pa | Pa | Consistent | ☑ |
| Monitoring frequency (reading) | Continuously<br>2 seconds (or shorter) interval | Continuously<br>2 seconds (or shorter) interval | Continuously<br>1 second | Consistent | ☑ |
| Monitoring frequency (recording) | hourly | hourly | hourly | Consistent | ☑ |
| Calibration requirements | 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). | Periodic calibration against a primary device must be performed periodically and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) must be calibrated monthly. | Monthly<br>Calibration and Maintenance Program is nominally scheduled on yearly basis for each single instrument, however, the exact date is subject to the Programmed Plant Shutdowns for Change of Gauzes. This criterion fulfills the requirements of every instrument's manufacturer. | Refer to CL in Chapter 2.2 Table 3<br><br>PT 45091:<br>Date of factory calibration: 17/11/2011<br><br>Date of Commissioning: 15/12/2011<br>Date of last calibration: 13/01/2012<br><br>PT 45095<br>Date of factory calibration: 17/11/2011<br>Date of Commissioning: 15/12/2011<br>Date of last calibration: 13/01/2012<br><br>The manufacturer indicates a 2 year | ☑<br>IRL6d<br>IRL 7f<br>IRL 7g |

| | | | | | |
|---|---|---|---|---|---|
| | | | | validity of calibration. This confirms valid calibration for the time of commissioning. After commissioning the calibration frequency is monthly according to the applied tool to calculate the mass flow. | |
| Uncertainty level | - | - | PT 45091:<br>Accuracy class: 0.1% of range<br>Uncertainty: 1.31% according to QAL2 report<br><br>PT 45095<br>Accuracy class: 0.1% of range<br>Uncertainty: 0.46% according to QAL2 report | Consistent | ☑ |
| Measurement Principle (if applicable) | Instruments with recordable electronic signal | Instruments with recordable electronic signal (analogical or digital) are required.<br>Examples include pressure transduc- | Measuring: Continuously<br>Reading: 1(s)<br>Recording: Hourly | Consistent<br>Pressure transmitter | ☑ |

| | | | | | |
|---|---|---|---|---|---|
| | | ers, etc | | | |
| | Technical aspects | | | | Conclusion and IRL |
| Instrument Type: | PT 45091: Capacitive pressure sensor<br>PT 45095: Capacitive pressure sensor<br><br>**Clarification Request No.6:**<br>The applied tool to calculate the mass flow of N2O requires a monthly calibration frequency for pressure transducers (either capacitive or resistive). Hence it is required to clarify the type of transducers used and appropriate evidences shall be submitted. The type of transducers used shall be mentioned in the Monitoring Report.<br>Moreover, clarify if the pressure transducer has been calibration against a primary device and provide appropriate including the calibration certificate of the primary device used. | | | | ☑<br>IRL 7b |
| Serial Number: | PT 45091: 0058154<br>PT 45095: 0058157 | | | | ☑<br>IRL 7b |
| Manufacturer Model Nr.: | PT 45091: Rosemount Inc / Type 2051T / Model Number: 2051TA1A2B21AS5B4M5Q4<br>PT 45095: Rosemount Inc / Type 2051T / Model Number: 2051TA1A2B21AS5B4M5Q4 | | | | ☑<br>IRL 7b |
| Specific Location: | Horizontal duct behind expander turbine<br>Height over bottom ≈ 37,2 m. | | | | ☑<br>IRL 7b |
| Measurement Range: | PT 45091: -10 - 10 hPa<br>PT 45095: 900 - 1100 hPa | | | | ☑<br>IRL 7b |
| Gaps in operating time of instrument : | Period:<br>13/01/2012 14:00<br>13/01/2012 15:00<br>13/01/2012 16:00<br>13/01/2012 17:00 | | | | ☑ |

| | | |
|---|---|---|
| | 13/01/2012 18:00 | |
| | Default value used: 22.20 kgN2O/h | ☑ |
| | Justification: According to ACM0019 the maximum value of mass flow of N2O calculated during the monitoring period shall be applied to any hour where the N2O 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. 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.<br><br>Because there is a gap in data of pressure and temperature measurements of tail gas required to calculate the density of PPs applying the downtime procedure required in the methodology in case no concentration and volume flow data are available. | ☑ |
| | QA/QC aspects | Conclusion and IRL |
| Source of data | Static and atmospheric pressure data are automatically recorded in the Delta V system and provided as hourly averages in Excel sheet which is derived from Delta V system (csv.files).<br>Type: digital (DCS) | ☑ |
| | Procedures:<br>ISO 9001 Certificate for Planta Prillex America Mejillones Enaex S.A. valid until 29/10/2012<br>Procedure DM-MR-CD-027 “Instrumentalist Work procedure“, version 1, 03/09/2007<br>Procedure DM-MR-CD-080 “Thermocouple Temperature revision“, version 1, 03/08/2007<br>Procedure “Analyzer N2O Concentration Calibration“ (Not included in ISO)<br>Procedure “Gauge pressure Transmitter Calibration“ (Not included in ISO) | ☑<br>IRL 5c-g |
| | Implementation of procedure: The procedures developed are well implemented as could be seen during the on-site visit | ☑ |

| | | |
|---|---|---|
| | | IRL 3 |
| | Responsibility: ENAEX S.A. CDM Project Team | ☑<br>IRL 5b |
| Archiving of raw data and protection measures | The data-report hardware of DeltaV consists in two PCs. The first, called Pro Plus, is where the reports are generated daily. These data are transported to the second PC, called Backup, where is possible extract the necessary files to calculate the ER. This PC is also the backing up of information. | ☑<br>IRL 3 |
| Data transfer and protection of input data for calculations | The transfer from raw data (.csv-files) to the Excel calculation tool has been done manually. In order to ensure correct transfer PPs have done the transfer twice and crosschecked both transferred data sets. As informed during onsite audit a Macro Excel for automatic transfer of .csv data to the Excel tool is currently developed.<br><br>See Findings in Table 1 Chapter 2.2. | CR |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | Delta –V Data were reviewed which show complete and credible data. Any deviation is described above in section “Gaps in operating time of instrument”. | ☑ |
| Data verification | Consistency of raw data with calculation tool:<br>See Findings in Table 1 Chapter 2.2. | CR |
| | Consistency of calculation tool with monitoring report: The verifier compared the values from Excel spreadsheet and the reported value in the Monitoring Report. Hence it was found that values of calculation tool and Monitoring Report are consistent. | ☑<br>IRL 1e<br>IRL 10 |
| Crosscheck (if available) | In order to ensure the integrity of the data, the verification team reviewed the series of hourly data in parallel with other parameters including to make graphs in the Excel file calculation sheets submitted, e.g. to see peculiarity in the graph shape, to check the similarity between nitric acid produced and tail gas flow and N2O concentration. | ☑ |

### 2.3. Parameters measured through sampling

Not applicable as not parameter sampled

### 2.4. Parameters obtained through external sources and accounting data

| External sources and accounting information use a separate table for each single parameter | | | | | |
|---|---|---|---|---|---|
| | PDD | Meth/Tool | MR | Verified | Conclusion and IRL |
| Parameter title | Moisture content of the gaseous stream at normal conditions, in time interval t | Moisture content of the gaseous stream at normal conditions, in time interval t | Moisture content of the gaseous stream at normal conditions, in time interval t | Consistent | ☑ |
| Parameter ID (if available) | $C_{H2O,t,db,n}$ | $C_{H2O,t,db,n}$ | $C_{H2O,t,db,n}$ | Consistent | ☑ |
| Data Unit | mg H2O/m3 dry gas | mg H2O/m³ dry gas | mg H2O/m³ dry gas | Consistent | ☑ |
| | Technical aspects | | | | Conclusion and IRL |
| Description of Data / Data Refers to: | Moisture content of the gaseous stream at normal conditions, in time interval t | | | | ☑ |
| Date of Data: | Date of last determination:<br>**Corrective Action Request No. 5:**<br>In the Monitoring Report the reported date of last determination of moisture content of the gaseous stream at normal conditions is not correctly reported as a different date was found in the QAL2 report. | | | | ☑<br>CAR |
| Gaps in data | Period: Not applicable | | | | ☑ |
| | Default value used: Not applicable | | | | ☑ |

| | | |
|---|---|---|
| | Justification: Not applicable | ☑ |
| | QA/QC aspects | Conclusion and IRL |
| Source of data | Measurements according to USEPA CF 42 method 4 – Gravimetric determination of water content (QAL2 Report) | ☑ IRL 7b |
| | Responsibility: ENAEX S.A. CDM Team | ☑ |
| | Representativeness: not applicable | ☑ |
| Reliability of Data Source: | Measurement of third party AIRTEC. | ☑ |
| Is the Data up-to-date? | Yes. Requirement: the moisture content must be monitored to coincide with calibration of the flow meter, or the time of the Annual Surveillance Test associated with the EN 14181 | ☑ |
| Archiving of raw data and protection measures | Not applicable | ☑ |
| Data transfer and protection of input data for calculations | Not applicable | ☑ |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | Not applicable | ☑ |
| Data verification | Option A of the tool can be applied, as the moisture content is less than 0.05 kg H2O/m³ dry gas. The highest measured value according to QAL2 report is 0.0024 kg H2O/m3 dry gas. | ☑ IRL 7b |
| | Consistency of calculation tool with monitoring report: Yes | ☑ |
| Crosscheck (if available) | The validating DOE mentions (IRL 1b): *In the mass balance, the expected moisture content given by the technology supplier at design operation conditions is far below 0.05 kgH2O/m3 dry gas. Although the mass balance is given for design operating conditions not considering the presence of the secondary catalyst, this value is deemed to be ac-* | ☑ IRL 7b IRL 1b |

| | | |
|---|---|---|
| | *ceptable since the secondary catalyst only affects the composition of the gas in terms of N2O.*<br>The moisture content measured during QAL2 by third party is in compliance with the observations of validating DOE. | |

### 2.5. Other parameters not included in the methodology/tool but included in the PDD

Not applicable as no other parameter included in the PDD

## 3. Data Processing and ER calculation

| Description of data processing from transferred data to final results in the calculation tool | | |
|---|---|---|
| Step | Description | Conclusion and IRL |
| Consistency | All abbreviations and units are consistent with the PDD and Methodology and traceable to the raw data.<br>**Clarification Request No.4:**<br>Different colours are used in the Excel file to indicate different types of data (transferred data from csv-file, calculated values, etc). However the colour code is missing in the Excel File. | ☑<br>CL |
| Calculation Tool description | The calculation tool basically consists (two) Excel files. The Excel files contains the raw data derived from the Monitoring system which provides data in csv format and calculation without any manual recalculation. In the next Excel file manual recalculation are included (e.g. QAL3) .<br>The whole calculation tool is clearly and transparently described in a data handling protocol and it includes issuing date and version number. | ☑<br>IRL 10 |
| Elimination of not plausible data (if applicable) | **Clarification Request No.2:**<br>The methodology applied requires to set default values in case data for either the N2O 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. PPs shall clarify the method of calculating the hourly averages that is automatically done in the Delta V system and explicitly clarify if any elimination of data is done during the data processing in Delta V. Appropriate evidences shall be provided. | CR |
| Transformation from useable data to input data for further calculation (if applicalbe) | Measurement instrument data is derived from Delta V (Continuous Historian Server CHS) which stores continually the information of field process variables. It's from the CHS database where the Excel Macros get the data.<br>The Delta V system provides hourly average values which are the basis for CER calculation (CERs are calculated in the calculation tool on hourly basis). | ☑ |
| Ex-ante data | Following ex-ante data are used in the CER calculation are in compliance with the PDD: | ☑ |

<table>
<tr><td></td><td>Operating conditions oxidation burner T-45030A 850– 905 °C</td><td>IRL 1a</td></tr>
<tr><td>Default parameter</td><td>Following default parameters are used in the CER calculation that are in compliance with the PDD:
<table>
<tr><td>$GWP_{N2O}$</td><td>Global Warmin Potential</td><td>310</td></tr>
<tr><td>$R_u$</td><td>Universal ideal gases constant</td><td>8,314 Pa.m³/kmol.K</td></tr>
<tr><td>$MM_i$</td><td>Molecular mass of N2O</td><td>44.02</td></tr>
<tr><td>$PE_{CO2,tertiary,n}$</td><td>Project emissions of CO2 from the operation of the tertiary N2O abatement facility in monitoring period n</td><td>0 tCO2</td></tr>
<tr><td>$EF_{default,y}$</td><td>Default N2O baseline emissions factor in the calendar year y of the monitoring period n</td><td>
<table>
<tr><th>Year</th><th>Emission factor ($kgN_2O/HNO_3$)</th></tr>
<tr><td>2011</td><td>4.10</td></tr>
<tr><td>2012</td><td>3.90</td></tr>
<tr><td>2013</td><td>3.70</td></tr>
<tr><td>2014</td><td>3.50</td></tr>
<tr><td>2015</td><td>3.40</td></tr>
<tr><td>2016</td><td>3.20</td></tr>
<tr><td>2017</td><td>3.00</td></tr>
<tr><td>2018</td><td>2.80</td></tr>
<tr><td>2019</td><td>2.70</td></tr>
<tr><td>2020</td><td>2.50</td></tr>
<tr><td>2021</td><td>2.50</td></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>Year n</td><td>2.50</td></tr>
</table>
</td></tr>
<tr><td>$Q_{N2O,by\text{-}pass,n}$</td><td>Amount of N2O released through the by-pass to a tertiary N2O abatement<br>system to the atmosphere in monitoring period n (t N2O)</td><td>0 tN2O</td></tr>
</table>
</td><td>☑<br>IRL 1a</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>Formulae check</td><td>All formula included in the calculation tool are in compliance with the PDD, methodology or tool.<br><br>
<table>
<tr><th>Methodology / Tool</th><th>PDD</th><th>MR</th><th>Excel</th><th>Comment</th></tr>
<tr><td>$ER_n = BE_n - PE_n$</td><td>☑</td><td>☑</td><td>☑</td><td>Emission Reduction</td></tr>
<tr><td>$BE_n = P_{NA,n} \times EF_{BL,N2O,n} \times GWP_{N2O} \times 10^{-3}$</td><td>☑</td><td>☑</td><td>☑</td><td>Baseline Emissions</td></tr>
<tr><td>$EF_{BL,N2O,n} = EF_{default,y}$</td><td>☑</td><td>☑</td><td>☑</td><td>Baseline Emissions</td></tr>
<tr><td>$PE_n = PE_{N2O,n} + PE_{CO2,tertiary,n}$</td><td>☑</td><td>☑</td><td>☑</td><td>Project Emissions</td></tr>
<tr><td>$PE_{N2O} = (Q_{N2O,tail\ gas,n} + Q_{N2O,by\text{-}pass,n}) \times GWP_{N2O}$</td><td>☑</td><td>☑</td><td>☑</td><td>Project Emissions</td></tr>
<tr><td>$Q_{N2O,tail\ gas,n} = \sum_{h=1}^{h=h_n} F_{N2O,tail\ gas,h} \cdot 10^{-3}$</td><td>☑</td><td>☑</td><td>☑</td><td>Project Emissions</td></tr>
<tr><td>$F_{i,t} = V_{t,db} \times v_{i,t,db} \times \rho_{i,t}$</td><td>☑</td><td>☑</td><td>☑</td><td>Project Emissions</td></tr>
<tr><td>$\rho_{i,t} = P_t \times MM_i / (R_u \times T_t)$</td><td>☑</td><td>☑</td><td>☑</td><td>Project Emissions</td></tr>
</table>
<br>Operating hours ($h_n$) are determined via the oxidation burner temperature ($T_1$). The plant is operation if the temperature is in a range of 850-905 °C. For hours outside of this range the N2O mass flow (project emissions) and nitric acid production (baseline emissions) are set to zero.</td><td>☑</td></tr>
<tr><td>Rounding functions</td><td>Rounding function at emission reductions (ERn) is conservatively applied</td><td>☑</td></tr>
<tr><td>Calculation tool changes and protection measures</td><td>The whole monitoring system at ENAEX is password protected. Changes in the calculation tool are only done by authorised personal. The Delta V System, the Excel files are equipped with Revision Numbers and documented revision history.<br>Current revision numbers Delta V: 11</td><td>☑<br>IRL6e</td></tr>
<tr><td>Reported data</td><td>The figures of the MR are consistent with the figures of the calculation tool.</td><td>☑</td></tr>
</table>

## 4. Additional assessment

### 4.1. Internal Review

| Description and performance of internal review | | |
|---|---|---|
| | Description | Conclusion and IRL |
| Procedure | The personnel of Enaex develop periodic meetings in order to check the consistency of the data provided in the Monitoring Report. The result of these meetings are official mails generated by means all the personnel involved in the project is aware of the latest information. | ☑ |
| Documentation | Email correspondence (IRL 12c) regarding an consistency check within ENAEX S.A. team was submitted to the audit team. | ☑ IRL 12c |
| Responsibilities | ENAEX S.A. CDM Project Team | ☑ |

### 4.2. Peculiarities

| Description of Peculiarities and unexpected Daily Events during the verification period | | |
|---|---|---|
| | Description | Conclusion and IRL |
| Performance | **Table 1:** Shutdown periods of Nitric Acid plant | ☑ IRL 10 IRL 12d IRL 1a CAR |

| Start | | End | | Description |
|---|---|---|---|---|
| Date | Time | Date | Time | |
| 24/12/2011 | 15:00 | 25/12/2011 | 07:00 | Nitric acid plant shutdown (17 hours) |
| 26/12/2011 | 23:00 | 28/12/2011 | 02:00 | Nitric acid plant shutdown (28 hours) |
| 07/01/2012 | 06:00 | 07/01/2012 | 21:00 | Nitric acid plant shutdown (16 hours) |

| | | |
|---|---|---|
| | As defined in validated PDD the nitric acid plant is in operation when the temperature of the AOR is in a range of 850°C – 905°C.<br>The reported shutdown events were crosschecked with logbook notes (IRL 12d) and found to be consistent. PPs do not consider any (even very small) nitric acid production for such events. This is conservative and hence accepted by the verifier.<br><br>**Corrective Action Request No. 6:**<br>Values obtained during the time period between two QAL 3 have been corrected in case QAL 3 exceeded the limit.<br>However PPs excluded these corrected values form the calculation of the maximum value, which serves as a default value in case emission values are not available.<br>This is not according to the methodology and must be corrected.<br>**Corrective Action Request No. 7:**<br>With the intention to establish a conservative approach, PPs manually changed the status of operation for 4 hours during this monitoring period. I.e. operating hours (AOR temperature within the range of 850 – 905°C) were changed to shut down hours.<br>PPs are requested to follow the definition in the registered Monitoring Plan when determining operating hours (i.e. AOR temperature within the range of 850 – 905°C) or submit a request for deviation to EB.<br>The other events reported in Chapter B.1. of the Monitoring Report are already included in tables above. | |
| Documentation | All peculiarities are well documented in a logbook and summarized in MR. Comments are given in the calculation tool in the relevant hours. | ☑<br>IRL 8e<br>IRL 11 |
| Measures | - | ☑ |

### 4.3. Further additional requirements

| Description of additional requirements to be checked | | |
|---|---|---|
| | Description | Conclusion and IRL |
| | Not applicable | ☑ |

### 4.4. Data Reporting

| Description of the Monitoring Report | | |
|---|---|---|
| | Comments and Results | Conclusion and IRL |
| Compliance with UNFCCC regulations | The published Monitoring Report was assessed based on the registered PDD and the applied methodology. The final Monitoring Report is in compliance with the UNFCCC regulations.<br>The verification period is correctly stated in the Monitoring Report.<br>**Corrective Action Request No. 8:**<br>Chapter A.7. or the MR should be updated as the start of crediting period has been changed.<br>**Corrective Action Request No. 9:**<br>In the Monitoring Report Figure 3 “Line diagram showing all relevant monitoring points” is not readable and not complete. It shall be improved. | ☑ |
| Completeness and Transparency | The assessment verified the completeness and transparency of the data and the information presented in the monitoring report.<br>All other data and information is found to be transparent and complete. | CAR |
| Correctness | Values from the assessed calculation tool and other relevant sources were correctly transferred to the final Monitoring Report. | ☑ |

## 5. Compilation and Resolutions of CARs, CRs and FARs

| Corrective Action Requests by audit team | | | |
|---|---|---|---|
| | Comments and Results | Ref | Conclusion and IRL |
| Issue | **Corrective Action Request No. 1:**<br>The serial number for TT 45050 reported in Monitoring Report (N0909.842183/VO336261) is not consistent with the calibration certificate dated on 30/11/2011 provided to the audit team and the serial number found during onsite visit(N0809.842183/VO336261). | Chapter 2.2 Table 1 | ☑<br>This Finding is closed<br>IRL 1f<br>IRL 7e |
| Response | The MR was corrected with the consistent serial N°. The revised MR was provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on the serial number of TT 45050. The serial number was found to be corrected. Hence it complies with the serial number stated in the calibration certificate (IRL 7e) and found onsite. | | |
| Issue | **Corrective Action Request No. 2:**<br>The MR template requires to report about the calculation method of any monitoring parameter. PPs are requested to report about the method used to calculate 100% nitric acid and to calculate the absolute pressure of the gaseous stream which is determined by the sum of the static pressure inside the stack and the barometric pressure | Chapter 2.2 Table 1 | ☑<br>This Finding is closed<br>IRL 1f |
| Response | A report about the method used to calculate 100% nitric acid and absolute pressure of the gaseous stream was included in the MR. The revised MR was provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on the calculation method of 100% nitric acid (parameter $P_{NA,n}$) and pressure of the gaseous stream ($P_t$). The calculation method is correctly reported. | | |

| | | | |
|---|---|---|---|
| Issue | **Corrective Action Request No. 3:**<br>The reported date of last calibration of N2O gas analyser (AT 45094) in the Monitoring Report is not found to be consistent with the date of test reported in the QAL2 report. | Chapter 2.2 Table 4 | ☑<br>This Finding is closed<br>IRL 1f<br>IRL 7b |
| Response | The MR was corrected with the consistent date reported in the QAL2 report. The revised MR was provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on the calibration date of N2O gas analyser (AT 45094). The date was found to be revised. Hence it is consistent with the end date of comparative measurements performed from 14/12/2011 to 16/12/2011 reported in the QAL2 report (IRL 7b). | | |

| | | | |
|---|---|---|---|
| Issue | **Corrective Action Request No. 4:**<br>Zero check during QAL3 of the N2O analyser was out of allowed Shewhart Control Chart limit two times during this monitoring period. PPs added the measured deviation to the recorded hourly value in order to correct the value. However, PPs do not correct the measured values, but correct the QAL2 adjusted values. Furthermore the period of correction shall be clarified. | Chapter 2.2 Table 4 | ☑<br>This Finding is closed<br>IRL 10c<br>IRL 1f<br>IRL 11c |
| Response | The measured values were corrected at calculation excel book. The revised calculation sheet an MR were provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Excel Calculation Tool (IRL 10c) with special focus on the QAL3 corrections. The deviation was found to be added to the measured value (in formula included in spreadsheet 03 Monitoring Parameters, column “Q”)<br>The defined period of correction shall be clarified. | | |
| Response | The defined period of correction has been clarified. The first period lasted for 30 hours, the second period lasted for 8 hours. Supporting documentation has been provided to the assessment team. | | |
| Assessment | PPs submitted DCS print screens (IRL 11c) for the days that were corrected because of QAL3 was out of allowed Shewhart Control Chart. The hours corrected in the Excel calculation tool (25/12/2011, 10:00 to 26/12/2011, 15:00 and 29/12/2011, 10:00 to 29/12/2011, | | |

| | | | |
|---|---|---|---|
| | 17:00) complies with the periods of sudden decreased N2O concentration shown by the DCS graph. Hence the periods that were corrected are found to be correct. | | |

| | | | |
|---|---|---|---|
| Issue | **Corrective Action Request No. 5:**<br>In the Monitoring Report the reported date of last determination of moisture content of the gaseous stream at normal conditions is not correctly reported as a different date was found in the QAL2 report. | Chapter 2.4 Table 1 | ☑<br>This Finding is closed<br>IRL 1f<br>IRL 7b |
| Response | The MR was corrected with the consistent date reported in the QAL2 report. The revised MR was provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on the date of moisture measurement (parameter $C_{H2O,t,db,n}$). The date of last determination of moisture content has been corrected to be consistent with QAL2 report (IRL 7b) which reports 3 humidity measurements performed from 14-15/12/2011. | | |

| | | | |
|---|---|---|---|
| Issue | **Corrective Action Request No. 6:**<br>Values obtained during the time period between two QAL 3 have been corrected in case QAL 3 exceeded the limit.<br>However PPs excluded these corrected values from the calculation of the maximum value, which serves as a default value in case emission values are not available.<br>This is not according to the methodology and must be corrected. | Chapter 4.2 | ☑<br>This Finding is closed<br>IRL 10c |
| Response | The calculation excel sheet was corrected in order to include the QAL3 corrected values in calculation of maximum values. The revised calculation sheet an MR were provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Excel Calculation Tool (IRL 10c) with special focus on the calculation of maximum values. The corrected values were not found to be excluded. | | |

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| Issue | **Corrective Action Request No. 7:**<br>With the intention to establish a conservative approach, PPs manually changed the status of operation for 4 hours during this monitoring period. I.e. operating hours (AOR temperature within the range of 850 – 905°C) were changed to shut down hours.<br>PPs are requested to follow the definition in the registered Monitoring Plan when determining operating hours (i.e. AOR temperature within the range of 850 – 905°C) or submit a request for deviation to EB. | Chapter 4.2 | ☑<br>This Finding is closed<br>IRL 10d |
| Response | - | | |
| Assessment | No response has been provided by PPs. | | |
| Response | The definitions in the registered Monitoring Plan have been followed and the calculation corrected accordingly. The revised documentation has been provided to the verification team. | | |
| Assessment | The verifier has reviewed revised Excel Calculation Tool (IRL 10d) with special focus to the operating hours. The determination of the operating hours were found to be in compliance with the PDD (i.e. plant is in operation when AOR temperature within the range of 850 – 905°C) | | |

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| Issue | **Corrective Action Request No. 8:**<br>Chapter A.7. of the MR should be updated as the start of crediting period has been changed. | Chapter 4.4 | ☑<br>This Finding is closed<br>IRL 1f |
| Response | The MR was corrected accordingly. The revised MR was provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on Chapter A.7. The start date of the crediting period was found to be corrected. Hence it is consistent with the information provided at UNFCCC project site (IRL 2a). | | |

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| Issue | **Corrective Action Request No. 9:**<br>In the Monitoring Report Figure 3 “Line diagram showing all relevant monitoring points” is not readable and not complete. It shall be improved. | Chapter 4.4 | ☑<br>This Finding is closed<br>IRL 1f |
| Response | The Figure 3 was corrected accordingly. The revised MR was provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on Figure 3 “Line diagram showing all relevant monitoring points”. Figure 3 was found to be completed and in proper quality. | | |

| Clarification Requests by audit team | | | |
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| | Comments and Results | Ref | Conclusion and IRL |

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| Issue | **Clarification Request No.1:**<br>The transfer from raw data (.csv-files) to the Excel calculation tool has been done manually. To ensure correct transfer PPs did the transfer two times and crosschecked these two data sets.<br>To verify the crosscheck conducted by PPs to ensure correct transfer of raw data (.csv-file) to Excel calculation tool, the two different data sets shall be provided. Moreover the verifier requests the monthly reports from DeltaV (.mdi-file) as additional crosscheck source. | Chapter 2.2 Table 1 | ☑<br>This Finding is closed<br>IRL 9a<br>IRL 12f |
| Response | The relevant data sets and documents were provided to the assessment team. | | |
| Assessment | The files have been submitted (IRL 9a and IRL 12f). The verifier used DeltaV (.mdi-file) (IRL 9a) to confirm correct transfer of raw data to the Excel Tool. | | |

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| Issue | **Clarification Request No.2:**<br>The methodology applied requires to set default values in case data for either the N2O 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. PPs shall clarify the method of calculating the hourly averages that is automatically done in the Delta V system and explicitly clarify if any elimination of data is done during the data processing in Delta V. Appropriate evidences shall be provided. | Chapter 3 | ☑<br>This Finding is closed<br>IRL 6f |
| Response | Evidence of no elimination of data and method of calculation of hourly averages were provided to the assessment team. | | |
| Assessment | PPs provided a statement from INECO (IRL 6f) which is the official representative of EMERSON (Delta V- provider) in Chile dated on May 2012. The statement confirms that the Delta V system records data every second. All data (3600 values per hour) are used by the Excel Add-in to calculate the hourly average. | | |

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| Issue | **Clarification Request No.3:**<br>The applied methodology requires that 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 N2O concentration and the volume or mass flow of the tail gas. The project measures N2O concentration and volume of the tail gas flow according to the methodology.<br>Clarification is requested if the calibration standard (like EN14181 including QAL2 correction factors) is used to calibrate also tail gas temperature and tail gas pressure.<br>Moreover evidences on the requirements on calibration frequency from manufacturer shall be provided for tail gas temperature and tail gas pressure instruments. | Chapter 2.2 Table 3 | ☑<br>This Finding is closed<br>IRL 6g<br>IRL 7f |
| Response | Tail gas temperature and tail gas pressure calibration used is physical calibration according to manufacturer recommendation. Evidence of frequency of calibration were provided to the assessment team. | | |
| Assessment | PPs submitted a statement from INECO (IRL 6g) regarding recommended calibration frequency of pressure model 2051C and temperature model 3144P transmitters. The recom- | | |

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| | mended calibration frequency is 2 years.<br>PPs clarified *"Tail gas temperature and tail gas pressure calibration used is physical calibration according to manufacturer recommendation."*<br>This clarification shall be further explained especially in regard to the calibration requirements for the instrument measuring tail gas pressure included in the applied methodology and its underlying tool ("Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) | | |
| Response | It should be emphasized that the tail gas temperature and tail gas pressure instruments are calibrated following the registered project documentation, the methodology and its underlying tool in this regard, "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0).<br>For the pressure transmitters a monthly calibration cycle according to the respective tool is applied (thereby by far exceeding manufacturer requirements). For the temperature transmitter a 2 year cycle according to manufacturer recommendation is applied.<br>Summarizing, all provisions whether coming from the registered project documentation, the methodology and its underlying tool or manufacturer recommendations are fully implemented and carried out accordingly. | | |
| Assessment | The verifier reviewed the response from PP. Hence the PPs clarified transparently that calibration frequency of pressure transmitter is defined by methodology and its underlying tool in this regard, "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) which is requiring a monthly calibration frequency of for pressure transducers. The compliance with this requirement has been verified by calibration certificate presenting 13/01/2012 as calibration date for (IRL 7f). | | |

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| Issue | **<u>Clarification Request No. 4:</u>**<br>Different colours are used in the Excel file to indicate different types of data (transferred data from csv-file, calculated values, etc). However the colour code is missing in the Excel File. | Chapter 2.2 Table 4 | ☑<br>This Finding is closed<br>IRL 10c |
| Response | The calculation excel book was corrected accordingly. The revised excel file was provided to the assessment team. | | |

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| Assessment | The audit team reviewed the revised Excel Calculation Tool (IRL 10c) with special focus on the colour code.<br>A colour code has been included in spreadsheet “03 Monitoring Parameters” which allow a transparent understanding of the coloured cells. | | |

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| Issue | **Clarification Request No.5:**<br>PPs informed about an error in the programming of automatic QAL3 procedure (insufficient time of span gas supply to analyser) and that they switched to manual QAL 3 during that monitoring period. Evidence is required that the failure in automatic QAL3 did not result in an invalid analyser adjustment.. | Chapter 2.2 Table 4 | IRL 11d<br>IRL 11e<br>FAR 1 has been raised |
| Response | Evidence of correct span adjustment during the monitoring period was provided to the assessment team. | | |
| Assessment | The verifier reviewed the supporting documents provided. However, a clear and transparent evidence of correct span adjustment during the monitoring period is required. | | |
| Response | Additional clear and transparent evidence of correct span adjustment during the monitoring period has been provided. | | |
| Assessment | PPs provided additional document including print screens from DCS “Process history View” for the days 25-26/12/2011, 30/12/2011, 01/01/2012, 08/01/2012, 14/01/2012, 28/01/2012. During those days automatic QAL3 has been started, but due to the error in programming (insufficient time of span gas supply to analyser) the QAL3 was not completed (i.e. the deviation (measured value vs. reference value) was too high so the analyser did not adjust automatically).<br>This could be verified by following documents that were provided by the PPs.<br>1. According to the Software manual (IRL 11e) the analyzer performs a zero or span adjustment only if this deviation between the standard gas and the actual measurement at calibration is less than a percentage of range. The default values for these parameters are:<br>End of range value: 200 ppm<br>Max zero calibration deviation: 30% (default value) | | |

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| | Max span calibration deviation: 20% (default value)<br>So, the max span calibration deviation is 40 ppm. This means that for every deviation in span less than 40 ppm the analyzer made a valid span adjustment and in other cases the span adjustment is not performed.<br>2. Additionally the print screens from DCS for those days (IRL 11d) focused on the QAL3 event were reviewed and no adjustment found, as the N2O concentration was on the exactly same level before and after the QAL3 event.<br>Thus in opinion of verifier enough evidences were provided to proof that the error in the automatic QAL 3 program did not result in a invalid adjustment of the analyser.<br><br>However the automatic QAL3 process has not been re-implemented in this monitoring period hence FAR 1 has been raised to pay special attention to proper function of automatic QAL3 process in the next verification. | | |

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| Issue | **Clarification Request No.6:**<br>The applied tool to calculate the mass flow of N2O requires a monthly calibration frequency for pressure transducers (either capacitive or resistive). Hence it is required to clarify the type of transducers used and appropriate evidences shall be submitted. The type of transducers used shall be mentioned in the Monitoring Report.<br>Moreover, clarify if the pressure transducer has been calibration against a primary device and provide appropriate including the calibration certificate of the primary device used. | Chapter 2.2 Table 6 | ☑<br>This Finding is closed<br>IRL 1f<br>IRL 6h<br>IRL 7h |
| Response | The pressure transducer are capacitive, MR was corrected accordingly. The revised MR and evidence of primary devices used was provided to the assessment team. | | |
| Assessment | The audit team reviewed the revised Monitoring Report (IRL 1f) with special focus on parameter Pt. Additionally the verifier reviewed an extract of the Rosemount 2051 Reference Manual (IRL 6h) submitted by PPs as evidence. Hence correct information has been included in the MR and the type of pressure transducer is explicitly mentioned in the Monitoring Report.<br>Furthermore the verifier reviewed the calibration certificates of primary devices used to calibrate PT-45091 and PT-45095 on 13/01/2012 submitted by PPs. | | |

| Forward Action Requests by audit team | | | |
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| | Comments and Results | Ref | Conclusion and IRL |
| Issue | **Forward Action Request No.1:**<br>After identification of a problem in the programming of automatic QAL3 procedure, PPs switched to manual QAL3 mode in the first monitoring period. When switching back to automatic QAL3 mode, sufficient evidences on the proper functioning of automatic QAL 3 shall be provided. | CR 5 | |
| Response | *required during next verification* | | |
| Assessment | *required during next verification* | | |

Industrie Service

# Annex 2:

# Information Reference List

| Ref. No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date | Additional Information (Relevance in CDM context) |
|---|---|---|---|---|
| 1 | ENAEX S.A.<br>TÜV SÜD<br>TÜV NORD | **Monitoring Report, Project Design Documents, Previous Verification Reports**<br>a. PDD of the CDM Project "Catalytic N2O destruction project at the new nitric acid plant PANNA 4 of Enaex S.A." (CDM Registration N° 5393), version 1.2, dated on September 28th, 2011.<br>b. Validation Report for CDM project "CATALYTIC N2O DESTRUCTION PROJECT AT THE NEW NITRIC ACID PLANT PANNA 4 OF ENAEX S.A." (Report No: 8000398029 – 11/370) issued by TÜV Nord, dated on 29/11/2011<br>e. Monitoring Report version 1 dated on 01/03/2012 (GSP version)<br>f. Monitoring Report version 2 dated on 03/05/2012<br>g. Monitoring Report version 3 dated on 23/05/2012 (final version) | Various<br>See the left column. | PDD,<br>Validation Report,<br>Monitoring Reports,<br>Verification Reports |
| 2 | UNFCCC<br>IPCC | **References and requirements at UNFCCC**<br>a. UNFCCC homepage http://www.unfccc.int including the CDM section http://cdm.unfccc.int/index.html.<br>b. Approved consolidated baseline and monitoring methodology ACM0019 - N2O abatement from nitric acid production, version 01.0.0 http://cdm.unfccc.int/UserManagement/FileStorage/CDM_ACMHXKPX0GBQMNS4MA745SZQ2NX6OE672<br>c. Guidelines for completing the monitoring report form, version 01 (Annex 34, EB54) http://cdm.unfccc.int/Reference/Guidclarif/iss/iss_guid06_v01.pdf<br>d. Guidelines of completeness check of requests for issuance, version 01,(Annex 68, EB48) | Various<br>See the left column. | UNFCCC Regulative |

| Ref. No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date | Additional Information (Relevance in CDM context) |
|---|---|---|---|---|
| | | report http://cdm.unfccc.int/EB/048/eb48_repan68.pdf<br>e. Guidelines for assessing compliance with the Calibration Frequency Requirements, version 01 (Annex 60, EB52) http://cdm.unfccc.int/EB/052/eb52_repan60.pdf<br>f. Guidelines on assessment of different types of changes from the project activity described in the registered PDD, version 01 (Annex 67, EB48) http://cdm.unfccc.int/Reference/Guidclarif/iss/iss_guid03.pdf<br>g. Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 02.0.0 (Annex 11, EB61) http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v1.pdf/history_view<br>h. CDM Glossary version 05 (EB47) http://cdm.unfccc.int/Reference/glossary.html<br>i. CDM Validation and Verification Manual, version 01.1(EB51) http://cdm.unfccc.int/Reference/Manuals/accr_man01.pdf | | |
| 3 | TÜV SÜD | **Audit participants**<br>On-site and on-line interviews conducted from 20-03-2012 to 21-03-2012 TÜV SÜD and signed list of participants<br>Verification team:<br>Martin Hammer — ATL — TÜV SÜD — web conference<br>Lester Saldías — GHG Verifier — TÜV SÜD — onsite<br>Dante Tollio — Technical Expert — TÜV SÜD — onsite<br>Interviewed persons:<br>Claudia Bravo — Process Engineer — ENAEX S.A.. | See the left column. | Onsite and online audit |

| Ref. No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date | Additional Information (Relevance in CDM context) |
|---|---|---|---|---|
| | | Carlos Araneda — Process Engineer — ENAEX S.A.<br>Silvana Cardenas C. — Process Engineer — ENAEX S.A.<br>Maria Josefina Diaz — CDM Project Engineer — ENAEX S.A.<br>Ricardo Camus R. — Operator Engineer — ENAEX S.A.<br>Hans-Jürgen Salmhofer — CDM Project Engineer — Carbon Climate Protection — web conference<br>Gerald Dunkel — CDM Project Director — Carbon Climate Protection — web conference<br>Sonja Haderer — CDM Project Engineer — Carbon Climate Protection — web conference | | |
| 4 | COREMA,<br>CONAMA,<br>ENAEX S.A. | **Project Implementation, Licenses**<br>a. Test run Protocol for Panna4 Nitric Acid Plant signed by ENAEX and Tecnicas Reunidas Espindesa 05/11/2011<br>b. Process Data Sheet of R4501 Ammonia Oxidation Reactor of Panna4 Nitric Acid Plant issued by Tecnicas Reunidas, 01 Process Data and 02 Materials rev. 01 dated on 22/09/2006<br>c. Resolución Exenta Nº 0121/2006 – permit for the whole complex dated on 29/05/2006 issued by CONAMA<br>d. Data Sheet of AOR Thermocouple TT-45030 A.B.C dated on 27/01/2012<br>e. Secondary Catalyst installation report issued by Heraus dated on 30/11/2011<br>f. Screenshots of the control panel from FoxView (AOR temperature range) | Various<br>See the left column. | |

| Ref. No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date | Additional Information (Relevance in CDM context) |
|---|---|---|---|---|
| | | g. Commissioning Certificates for TAG's Meters: AT45094 A, AT45094 B, AT45094 C, FT45092, PT45091, PT45095, PT45097, TT45093, TT45096, dated on 13/12/2011<br>h. Printscreen of main monitor dated 20/05/2011.. | | |
| 5 | ENAEX S.A. | **Procedures and standards**<br>a. European Standard EN14181 Stationary source emissions - Quality assurance of automated measuring systems dated on July 2004<br>b. "Responsibilities & Operational Project Structure.pdf" version 1.0 issued by ENAEX dated on February 2012<br>c. ISO 9001 Certificate for Planta Prillex America Mejillones Enaex S.A. valid until 29/10/2012<br>d. Procedure DM-MR-CD-027 "Instrumentalist Work procedure", version 1, 03/09/2007<br>e. Procedure DM-MR-CD-080 "Thermocouple Temperature revision", version 1, 03/08/2007<br>f. Procedure "Analyzer N2O Concentration Calibration" (Not included in ISO)<br>g. Procedure "Gauge pressure Transmitter Calibration" (Not included in ISO) | Various<br>See the left column. | QA/QC Procedures |
| 6 | Endress +Hauser<br>WIKA<br>INOR<br>INECO | **Monitoring Equipment**<br>a. Email from Elliot Sanchez Product Manager Flow & EMS Endress +Hauser Chile Ltda regarding recommendations of calibration frequency<br>b. Manufacturer´s declaration, Document number 5006501 regarding Model TC10 issued by WIKA Alexander Wiegeland SE & Co. KG<br>c. Statement from INOR – signed by a Service and Calibration Engineer - regarding stability of Meso-H / Meso HX applications<br>d. Email from Anibal Gonzales from INECO S.A. regarding recommendations of calibration frequency of PT-45091, TT-45093 and PT-45095. | Various<br>See the left column. | Calibration Requirements Manufacturer |

| Ref. No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date | Additional Information (Relevance in CDM context) |
|---|---|---|---|---|
| | | e. Delta V Print Screen – Version number<br>f. Statement from INECO dated on May 2012 regarding the hourly average calculation in the Delta-V system<br>g. Statement from INECO dated on May 2012 regarding recommended calibration frequency of pressure model 2051C and temperature model 3144P transmitters<br>h. Rosemount 2051 Reference Manual 00809-0100-4101, Rev AA dated on July 2008 | | |
| 7 | Various<br>See the right column. | **Calibration**<br>a. FT 45026 and AT45026 Coriolis Flow and density calibration certificate issued by Endress+Hauser Flowtec dated on 09/11/2011<br>b. AT45094 and FT 45092 : QAL2 report issued by AIRTEC Date of test 14.12-16.12.2011. Measured objects: FT 45092 (tail gas volume), AT 45094 (N2O concentration), Moisture content, TT 45093 (Tail gas temperature), PT 45091 (Static pressure), PT 45095 (Atmospheric pressure)<br>c. TT 45093: Serial number 706088 Temperature Transmitter Calibration Certificate issued by CIDE USACH dated on 16/11/2011<br>d. TT-45030A: Acceptance Test Certificate 3.1 according to EN10204 for TC10 Serial number 3F0AF4X dated on 13/09/2010<br>e. TT-45050 - Certificate issued by ENAEX for HNO3 Temperature Transmitter (Manufacturer: Inor; Model: Meso-H) Serial Number N0809.842183/VO336261dated on 30/11/2011<br>f. PT-45091 Calibration Certificate for serial No. 58154, issued by CIDE S.A., dated on 17/11/2011, and 13/01/2012, issued by CESMEC S.A.<br>g. PT-45095 Calibration Certificate for serial No. 58157, issued by Emerson GmbH., dated on | Various<br>See the left column. | Calibration evidences |

| Ref. No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date | Additional Information (Relevance in CDM context) |
|---|---|---|---|---|
| | | 16/09/2011, and 13/01/2012, issued by CESMEC S.A.<br>h. Calibration Certificate issued for primary devices used to calibrate PT-45091 and PT-45095. Calibration certificate number 2011-0861 dated on 17/02/2011 and calibration certificate Nr. 2011-0874 both issued by Desarrollo de Tecnologias y sistemas (DTS) | | |
| 8 | ENAEX S.A.<br>AIRTEC<br>EMERSON | **Other Regular Maintenance other than Calibration**<br>a. Shewhart Control Chart, excel file with graphs of span and zero calibration values oN2O analyser for this monitoring period.<br>b. AT45094: QAL1 certificate MLT1 MLT2 of NGA Series issued by TÜV Rheinland Group dated on 16/02/1999 | Various<br>See the left column. | |
| 9 | ENAEX S.A. | **Data Measured and Recorded**<br>a. Delta V csv and mdi files (daily and monthly) for the monitoiring period. | 20/03/2012 | |
| 10 | ENAEX S.A. | **Calculation Spreadsheet and Tool**<br>a. MP 1_PANNA 4 (5393)_UNFCCC SUMMARY_v1<br>b. MP 1_PANNA 4 (5393)_UNFCCC SUMMARY_v1 RAW DATA<br>c. MP 1_PANNA 4 (5393)_UNFCCC SUMMARY_03-05-12<br>d. MP 1_PANNA 4 (5393)_UNFCCC SUMMARY_23-05-12 | 20/03/2012 | |
| 11 | ENAEX S.A. | **Special Events**<br>a. Alarm and Event List for December 2011 and January 2012.<br>b. Logbooks from December 2011 and January 2012, showing the main events that affected the | 21/03/2012 | |

| Ref. No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date | Additional Information (Relevance in CDM context) |
|---|---|---|---|---|
| | | monitoring period.<br>c. Print screens from DCS "Process history View" for the days 25-26/12/2011 and 29/12/2012<br>d. Print screens from DCS "Process history View" for the days 25-26/12/2011, 30/12/2012, 01/01/2012, 08/01/2012, 14/01/2012, 28/01/2012<br>e. Extract from Software Manual MLT Analyzer NGA 2000, Chapter 5.1.1 Calibration Parameters Tolerances | | |
| 12 | ENAEX S.A | **Cross-Checking LogBooks Checklists**<br>a. Weekly Checklist of Panna4 CDM Project instruments for this monitoring period.<br>b. Production Data "Listado de Producciones Diarias Planta Prillex América"<br>c. Email Correspondence from 01/03/2012<br>d. Daily LogBook for this monitoring period.<br>e. Real Time measurements and charts, taken on-site.<br>f. Raw data Check performed by ENAEX (PANNA4_UNFCCC SUMMARY_Verification Check 21_03_12) | Various<br>See the left column. | |
| 13 | Praxair | **Primary Gauzes, Other External Data**<br>a. Analyzer test gas certificates (zero gas, span gas used in this monitoring period) issued by Praxair S.A.<br>**Cyl No** / **Composition** / **Filled** / **Expired**<br>CC312768 / N2O 168ppm / 30/11/2011 / 30/11/2013<br>CC330059 / N2 99.999% / 21/12/2010 / -- | Various<br>See the left column. | |

| Ref. No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date | Additional Information (Relevance in CDM context) |
|---|---|---|---|---|
| 14 | ENAEX S.A.<br>Carbon Climate Protection | **Trainings**<br>a. Signed List of Participants for Gas Analyzer Training (12/01/2012) held by Daniel Rojas Gas Analyser Specialist from INECO S.A.<br>b. Signed List of Participants for Delta V Training (12-13/01/2012) held by Pablo Saez Delta V Specialist from INECO S.A.<br>c. Information on internal WebEx Trainings held by Carbon Climate Protection | Various<br>See the left column. | Personnel trainings |

Industrie Service

# Annex 3
# Appointment Certificates

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

# CERTIFICATE OF APPOINTMENT

TÜV SÜD Industrie Service

Mr Hammer, Martin, fulfills the requirements of the Certification Body "climate and energy" of TÜV SÜD Industrie Service GmbH to participate in audits.

| Qualification applicable to | | | | | | |
|---|---|---|---|---|---|---|
| **Standard** | CDM | JI | GS | VCS | VER | Other |
| **Date** | 23.03.11 | | | | | |

| Qualification as | | | | | | |
|---|---|---|---|---|---|---|
| **Status** | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| **Date** | | 23.03.11 | 23.03.11 | 23.03.11 | | |

| Other qualification | | | | | |
|---|---|---|---|---|---|
| **Country Expertise** | | | | | |
| **Region** | 1 | 2 | 3 | 4 | 5 |
| **Date** | 23.03.11 | | | | |
| **Financial Expertise** | | | | | |
| **Date** | 23.03.11 | | | | |

| Qualification in technical areas | |
|---|---|
| **Technical Area** | **Date** |
| 1.2_Energy generation from renewable energy source | 23.03.11 |
| 5.1_4.9_11.1_12.1_Chemical process industries | 23.03.11 |
| | |
| | |
| | |
| | |

This appointment is valid for 1 year from its date of signature below and is bound by internal requirements of the Management System of the Certification Body "climate and energy" of TÜV SÜD Industrie Service GmbH.
In case of loss of validity of this certificate as per result of an assessment according internal procedures or due to any other reason, it will be properly communicated to you.
Your Certificate has the internal reference No. CMS-Z-0005/02.

| Date | Signature |
|---|---|
| 23.03.12 Extension of Validity | |
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ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

# CERTIFICATE OF APPOINTMENT

TÜV SÜD Industrie Service

Mr Saldías Kiefer, Lester, fulfills the requirements of the Certification Body "climate and energy" of TÜV SÜD Industrie Service GmbH to participate in audits.

| Qualification applicable to | | | | | | |
|---|---|---|---|---|---|---|
| **Standard** | CDM | JI | GS | VCS | VER | Other |
| **Date** | 07.04.11 | | | | | |

| Qualification as | | | | | | |
|---|---|---|---|---|---|---|
| **Status** | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| **Date** | | 07.04.11 | 07.04.11 | | | |

| Other qualification | | | | | |
|---|---|---|---|---|---|
| **Country Expertise** | | | | | |
| **Region** | 1 | 2 | 3 | 4 | 5 |
| **Date** | 07.04.11 | 07.04.11 | | | |
| **Financial Expertise** | | | | | |
| **Date** | | | | | |

| Qualification in technical areas | |
|---|---|
| **Technical Area** | **Date** |
| 1.2_Energy generation from renewable energy source | 07.04.11 |
| 13.1_Waste handling and disposal | 07.04.11 |
| | |
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| | |
| | |

This appointment is valid for 1 year from its date of signature below and is bound by internal requirements of the Management System of the Certification Body "climate and energy" of TÜV SÜD Industrie Service GmbH.
In case of loss of validity of this certificate as per result of an assessment according internal procedures or due to any other reason, it will be properly communicated to you.
Your Certificate has the internal reference No. CMS-Z-0039/03.

| Date | Signature |
|---|---|
| 07.04.12 Extension of Validity | |
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ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

# CERTIFICATE OF APPOINTMENT

TÜV SÜD Industrie Service

Mr Tollio Vanhaz, Dante Luis, fulfills the requirements of the Certification Body "climate and energy" of TÜV SÜD Industrie Service GmbH to participate in audits.

| Qualification applicable to | | | | | | |
|---|---|---|---|---|---|---|
| **Standard** | CDM | JI | GS | VCS | VER | Other |
| **Date** | 23.03.11 | | | | | |

| Qualification as | | | | | | |
|---|---|---|---|---|---|---|
| **Status** | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| **Date** | | | | | | 23.03.11 |

| Other qualification | | | | | |
|---|---|---|---|---|---|
| **Country Expertise** | | | | | |
| **Region** | 1 | 2 | 3 | 4 | 5 |
| **Date** | | 23.03.11 | | | |
| **Financial Expertise** | | | | | |
| **Date** | | | | | |

| Qualification in technical areas | |
|---|---|
| **Technical Area** | **Date** |
| 5.1_4.9_11.1_12.1_Chemical process industries | 23.03.11 |
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This appointment is valid for 1 year from its date of signature below and is bound by internal requirements of the Management System of the Certification Body "climate and energy" of TÜV SÜD Industrie Service GmbH.
In case of loss of validity of this certificate as per result of an assessment according internal procedures or due to any other reason, it will be properly communicated to you.
Your Certificate has the internal reference No. CMS-Z-0018/02.

| Date | Signature |
|---|---|
| 23.03.12 Extension of Validity | |
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ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

# CERTIFICATE OF APPOINTMENT

Industrie Service

Mr Tausche, Konrad, fulfills the requirements of the Certification Body "climate and energy" of TÜV SÜD Industrie Service GmbH to participate in audits.

| Qualification applicable to | | | | | | |
|---|---|---|---|---|---|---|
| **Standard** | CDM | JI | GS | VCS | VER | Other |
| **Date** | 30.03.11 | | | | | |

| Qualification as | | | | | | |
|---|---|---|---|---|---|---|
| **Status** | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| **Date** | | 30.03.11 | 30.03.11 | 30.03.11 | 30.03.11 | |

| Other qualification | | | | | |
|---|---|---|---|---|---|
| **Country Expertise** | | | | | |
| **Region** | 1 | 2 | 3 | 4 | 5 |
| **Date** | 30.03.11 | | | | |
| **Financial Expertise** | | | | | |
| **Date** | 30.03.11 | | | | |

| Qualification in technical areas | |
|---|---|
| **Technical Area** | **Date** |
| 1.1_4.10_Thermal energy generation... | 30.03.11 |
| 5.1_4.9_11.1_12.1_Chemical process industries | 30.03.11 |
| 13.1_Waste handling and disposal | 30.03.11 |
| | |
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In case of loss of validity of this certificate as per result of an assessment according internal procedures or due to any other reason, it will be properly communicated to you.
Your Certificate has the internal reference No. CMS-Z-0035/02.

| Date | Signature |
|---|---|
| 30.03.12 Extension of Validity | Thomas Klein |
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