CDM Monitoring Report No. 10:

"Catalytic N_2O destruction project in the tail gas of the Nitric Acid Plant of Abu Qir Fertilizer Co”

UNFCCC 0490

Monitoring Period:
From: 10/03/2009
To: 30/06/2009

Version 1
July 5th 2009

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Table of Contents:

Tables:

Figures:

1 Introduction

The purpose of this monitoring report is to calculate and clarify GHG emission reduction quantity achieved by this project activity for periodic verification.

This monitoring report covers the activity from **10/03/2009 to 30/06/2009** as the 10th monitoring period.

Duration of the project activity period:

The starting date of the project activity is the:	09/10/2004
The project was registered at UNFCCC on:	07/10/2006 with number 0490
The starting date of the crediting period is:	15/09/2006

Carbon Egypt has implemented a project for GHG emission reduction by catalytic N_2O destruction in Abu Qir, Egypt. The project is categorized as large scale project under sectoral scope 5: "Chemical Industry". The Host Party for the project activity is the Republic of Egypt.

2 Reference

Approved Baseline methodology:
AM0028 Version 1: "Catalytic N_2O destruction in the tail gas of Nitric Acid Plants"; submitted by Carbon Projektentwicklung GmbH.

Approved Monitoring methodology:
AM0028 Version 1: "Catalytic N_2O destruction in the tail gas of Nitric Acid Plants"; submitted by Carbon Projektentwicklung GmbH.

Project Design Document:
"Catalytic N_2O destruction project in the tail gas of the Nitric Acid Plant of Abu Qir Fertilizer Co"
Version: 2 (b)
Date of Completion: June 20th 2006

Validation Report:
Validation of the CDM Project: "Catalytic N_2O Destruction project in the tail gas of the Nitric Acid Plant of Abu Qir Fertilizer Co."
REPORT NO. 611173
July 03rd 2006 by TÜV SÜD Industry Service GmbH

CDM Registration:
"Catalytic N_2O destruction project in the tail gas of the Nitric Acid Plant of Abu Qir Fertilizer Co" – UNFCCC ref. Number 0490
Date of registration: October 07th 2006

3 Definition

- y **:** Monitoring period (in this report, **March 10th 2009** to **June 30th 2009**)
- **PDD** : Project Design Document of this project "Catalytic N_2O destruction project in the tail gas of the Nitric Acid Plant of Abu Qir Fertilizer Co" Version 2 (b) on June 20th 2006.

4 General Description of Project

4.1 Project Activity

The Project Activity includes development, design, engineering, procurement, finance, construction, operation and maintenance of a system for catalytic reduction of N_2O. The EnviNOx® process used in the Abu Qir II nitric acid plant is based on the catalytic reduction of NO_x (NO and NO_2) with ammonia (NH_3) and of nitrous oxide (N_2O) with a hydrocarbon. The hydrocarbon used is natural gas of which the main constituent is methane (CH_4). The reactions take place over two iron zeolite catalyst beds.

General Introduction:
Nitrous oxide (N_2O) is an unwanted, invisible and previously neglected by-product of the manufacture of nitric acid. It is formed alongside the main, desired product nitric oxide (NO) during the catalytic oxidation of ammonia in air over noble metal gauzes. The production of nitric acid takes place in three main process steps as indicated by the following reactions:

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

   $4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$ (main reaction 1) **(1)**

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

   $4\ NH_3 + 3\ O_2 \rightarrow 2\ N_2 + 6\ H_2O$ (side reaction 1) **(2)**
   $4\ NH_3 + 4\ O_2 \rightarrow 2\ N_2O + 6\ H_2O$ (side reaction 2) **(3)**

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

[1] Ammonia is reacted with air on noble metal catalyst in the oxidation section of nitric acid plants. Nitric oxide and water are formed in this process according to the above mentioned main equation.

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

   $2\ NO + O_2 \rightarrow 2\ NO_2$ (main reaction 2) **(4)**

3. (According to the technical process) Absorption of NO_2 in water to form nitric acid (HNO_3):
   $3\ NO_2 + H_2O \rightarrow 2\ HNO_3 + NO$ (main reaction 3) **(5)**
   (NO is oxidised to NO_2 according to main reaction 2)

Description of catalytic reduction process:
Although the term catalytic reduction nowadays has a more general definition in terms of the transfer of electrons, the following definition is sufficient for present purposes: catalytic reduction of N_2O occurs when reactions take place between N_2O and other substances in contact with a catalyst, such that the oxygen is removed from the N_2O molecule and forms one or more compounds with other species. The substance or substances that react with N_2O to remove oxygen are termed reducing agent. A general reaction equation for the catalytic reduction of N_2O can be given as:

$$n\ N_2O + x\ RA \rightarrow n\ N_2 + y_1\ P(1)O_A + y_2\ P(2)O_B + \ldots + z_1\ Q(1) + z_2\ Q(2) + \ldots \quad \textbf{(6)}$$

where RA is a molecule of the reducing agent, $P(1)O_A$, $P(2)O_B$ are the compound formed by reaction with the oxygen of the N_2O and Q(1), Q(2) represent further products of the oxidation reaction, n, x, y_1, y_2, z_1, z_2 are the appropriate stoichiometric coefficients.

Project Specific description:

Principles of the EnviNOx® process
The reactions take place over two iron zeolite catalyst beds. The first bed contains an iron zeolite that is especially effective in catalysing the reduction of NO_x with ammonia according to such reactions as:

$$6\ NO_2 + 8\ NH_3 \rightarrow 7\ N_2 + 12\ H_2O \quad \textbf{(7)}$$
$$6\ NO + 4\ NH_3 \rightarrow 5\ N_2 + 6\ H_2O \quad \textbf{(8)}$$
$$NO + NO_2 + 2\ NH_3 \rightarrow 2\ N_2 + 3\ H_2O \quad \textbf{(9)}$$
$$4\ NO + O_2 + 4\ NH_3 \rightarrow 4\ N_2 + 6\ H_2O \quad \textbf{(10)}$$

Effectively all the NO_x is removed. Furthermore some destruction of N_2O occurs.

Equations showing reduction N_2O with methane:
The second and main bed contains an iron zeolite that is particularly efficient in catalysing the reduction of nitrous oxide with methane.

$$CH_4 + 3\ N_2O \rightarrow CO + 2\ H_2O + 3\ N_2 \quad \textbf{(11)}$$
$$CH_4 + 4\ N_2O \rightarrow CO_2 + 2\ H_2O + 4\ N_2 \quad \textbf{(12)}$$

Technology employed by the project activity:
In this project, CARBON Egypt installed the EnviNOx® system for catalytic reduction of NO_x and N_2O additionally to the equipment at the nitric acid manufacturing plant. The project activity reduces the GHG emissions, which would otherwise be released to the atmosphere, if the project was not implemented. The implementation of the N_2O destruction project at AFC involves that natural gas, a mixture of hydrocarbons of which the main constituent is methane (CH_4), is employed as a reducing agent for N_2O removal.

The EnviNOx® system was installed in September 2006 and the catalytic reduction process of N_2O started in the end of September 2006.

Location of the project activity:
The EnviNOx® system was installed at the nitric acid plant on site of Abu Qir Fertilizer Co. S.A.E., furthermore called “AFC”.

Location of the EnviNOx®-System:
The EnviNOx®-Reactor (21R004) is located between tail gas heater IV (21E013) and the tail gas turbine (21MT022) which is the position with the highest tail gas temperature in the nitric acid production process at AFC.

4.2 Project Participants

Name of Party involved	Project participants (as applicable)	Party involved considered as project participant
Arab Republic of Egypt (Host)	CARBON Egypt Ltd.	No
Republic of Austria	KOMMUNALKREDIT PUBLIC CONSULTING GmbH	No
	Energie AG Oberösterreich	No
Federal Republic Germany	RWE Power AG	No

Host Country is the Arab Republic of Egypt. The Arab Republic of Egypt ratified the Kyoto Protocol in January 2005. The other Party involved in the Project at the time of registration is the Republic of Austria. Subsequent to the registration of the Project, Federal Republic Germany has been added as a Party involved in the Project.

Focal point:
The project participants agreed that CARBON Projektentwicklung GmbH, Austria serves as focal point of communication with the Executive Board and the UNFCCC Secretariat.

Project applicant, developer and sponsor is **CARBON Egypt Ltd.** (furthermore called “CARBON”). CARBON Egypt Ltd. is registered under the laws of the Arab Republic of Egypt. The company is a 100% subsidiary of CARBON Projektentwicklung GmbH, Austria.

CARBON Projektentwicklung GmbH was founded as a limited liability company located and registered in Austria under Austrian law in order to develop, finance and operate high quality JI/CDM Projects. CARBON Projektentwicklung GmbH has vast experience with CDM-Project development in Africa, Latin America and Asia and is specialized on the catalytic N_2O destruction in the tail gas of nitric acid plants.

Kommunalkredit Public Consulting (KPC) was appointed for the Programme Management on behalf of the Austrian Ministry of Agriculture and Forestry, Environment & Water Management. The Programme is operational since August 2003.

Energie AG Oberösterreich (Energie AG) is the leading infrastructure group in the region of Upper Austria. Energie AG with its subsidiary companies works in the fields of energy, water and disposal, both in Austria and abroad.

The RWE Group is one of Europe's leading integrated electricity and gas companies. **RWE Power AG** is the continental power generation company within the RWE Group and Germany's biggest power producer. RWE Power has a diverse generation portfolio including lignite, hard coal, nuclear energy, gas and renewable sources such as hydro, wind and biomass. RWE invests and participates actively in projects under the Clean Development Mechanism and Joint Implementation. The RWE team combines a track record in global commodities and emissions trading as well as risk management with broad experience and a deep understanding of specific risks inherent in CDM and JI projects.

Project Operator is **Abu Qir Fertilizer Co. S.A.E**. (furthermore called "AFC"), the biggest Fertilizer Company in Africa. AFC was founded as a joint stock company located and registered in the Alexandria Province under Egyptian law in 1976 and is the market leader with a market share of close to 70% of the local Egyptian fertilizer market. With closely to 3000 employees AFC is among the major job providers in Alexandria area. The company is ISO 9001/2000 and ISO 14001 certified and one of the most important companies of the Egyptian industry. Owners of AFC are Egyptian banks, petroleum corporations, other industrial shareholders, insurance companies and the labour union as well as individual shareholders.
In the light of huge reserves of natural gas in Egypt, the recent major agricultural projects (irrigation) and the increasing over-population in Egypt, the fertilizer industry is considered to be one of the most important industries in Egypt, both today and in the future.
The nitric acid plant ABU QIR II was constructed by UHDE GmbH, Germany in July 1991. With a capacity of 1,830 t of nitric acid per day, ABU QIR II is one of the largest nitric acid plants in the world.

Project Technology Provider is UHDE GmbH (furthermore called "UHDE"), a 100% subsidiary of ThyssenKrupp. UHDE is world market leader in the field of fertilizer technology engineering and construction. Consequently, UHDE has constructed numerous modern fertilizer plants including nitric acid plants. Among these plants is AFC's nitric acid plant. In response to increasing concerns surrounding climate change and the destruction of the ozone layer, UHDE has developed catalyst-based processes for removing N_2O from nitric acid tail gas streams.

5 Baseline Methodology

The approved Baseline Methodology AM0028 Version 1 "Catalytic N_2O destruction in the tail gas of Nitric Acid Plants"; submitted by Carbon Projektentwicklung GmbH is applied to this project activity.

The use of the methodology is justified because the following statements are true:

- The methodology is applied to the existing production capacity installed no later than 31 December 2005.
- The Abu Qir II nitric acid plant has *not* installed any N_2O destruction or abatement technology prior to the start of the project activity. The project activity will not result in any shut down of an existing N_2O destruction or abatement facility at Abu Qir II.
- The project activity does not cause a nitric acid production increase.
- The project activity results in NO_x emission reductions that are at least as effective as the $DeNO_x$-unit installed prior to the start of the project activity.
- The $DeNO_x$-unit installed prior to the start of the project activity at Abu Qir II was a SCR $DeNO_x$-unit.
- The N_2O concentrations are measured in real time at the inlet and the outlet of the N_2O destruction facility.

Project boundary

For the purpose of determining project activity emissions, the following emission sources are included:

- N_2O concentration in the flow stream of the tail gas;
- Hydrocarbons as a reducing agent to enhance the efficiency of a N_2O catalytic reduction facility.

For the purpose of determining baseline emissions, the following emission sources are included:

- N_2O concentration in the flow stream of the tail gas.

The following table illustrates, which emission sources are included and which are excluded from the project boundary for determination of both, baseline and project emissions.

Table 1: Overview on emission sources included or excluded from the project boundary

Baseline Emissions:

Source	***Gas***		***Justification/Explanation***
Emissions of N_2O as a result of side reaction to the nitric acid Production process	N_2O	Included	Main emission source, taking national N_2O emission regulations into account.

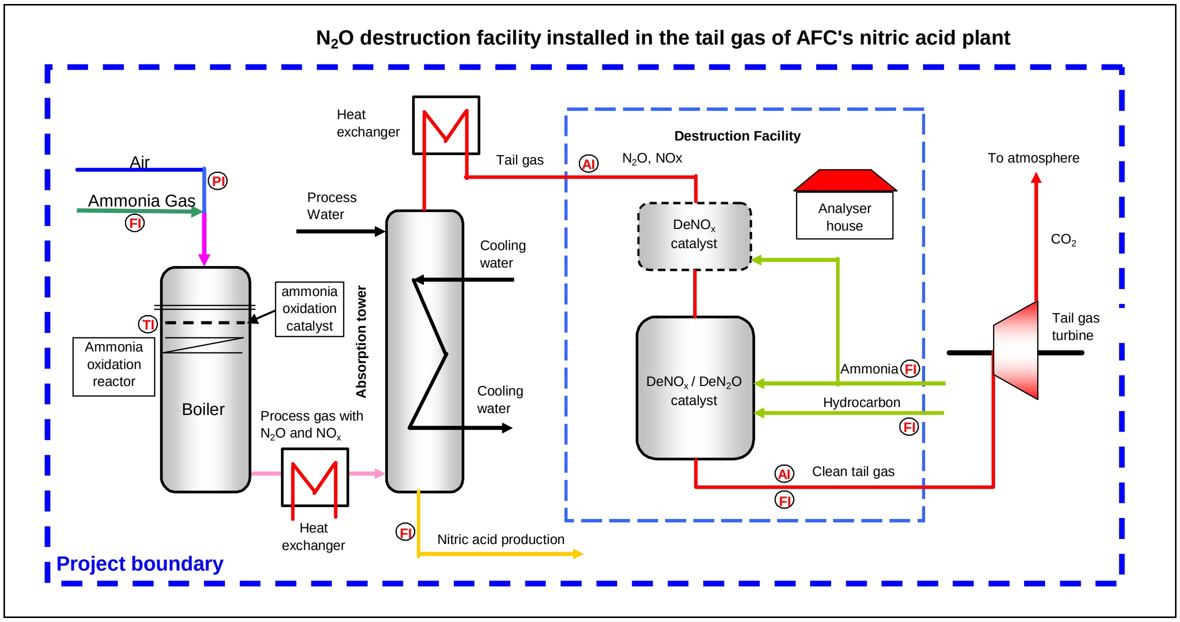
Emissions related to the production of ammonia used for NO_x reduction	CO_2 CH_4 N_2O	Excluded according to AM0028	In case of Abu Qir II a SCR $DeNO_x$ unit was already installed prior to the project start: ammonia input for SCR is considered to be of the same magnitude to project related ammonia input for NO_x reduction. Baseline emissions and project emissions are similar and therefore not considered for calculation.
N_2O emissions from SCR $DeNO_x$ unit	N_2O	Excluded according to AM0028	The presence of a SCR $DeNO_x$ unit tends to increase the N_2O emissions. Therefore the ex-post measurement of the baseline emissions at the inlet of the N_2O destruction facility represents a conservative determination of the baseline N_2O emissions.

Project Emissions:

Source	***Gas***		***Justification/Explanation***
Emissions of N_2O as a result of side reaction to the nitric acid production process	N_2O	Included	Main emission source that remains in the tail gas after the N_2O destruction facility
Emissions related to the production of ammonia input used for NO_x reduction	CO_2 CH_4 N_2O	Excluded according to AM0028	In case of Abu Qir II a SCR $DeNO_x$ unit was already installed prior to the project start: ammonia input for SCR is considered of the same order as project related ammonia input for NO_x-reduction. Baseline emissions and project emissions are similar and therefore not considered for calculation.
In case of N_2O reduction process installed: Emissions at the project site resulting from hydrocarbons used as reducing agent	CH_4 and/or CO_2	Included	At Abu Qir II a N_2O reduction process was installed and natural gas is used as reducing agent. Natural gas is used to enhance the efficiency of a N_2O catalytic reduction facility. Hydrocarbons are mainly converted to CO_2, while some hydrocarbons may remain intact. Fractions of unconverted methane are measured (monitored online). All other hydrocarbons are assumed to be completely converted to CO_2.
Emissions from electricity demand	CO_2 CH_4 N_2O	Excluded	GHG emissions related to the electricity consumption are insignificant (< 0.005%) and are excluded as monitoring would lead to unreasonable costs.
Emissions related to the production of the hydrocarbons	CO_2 CH_4 N_2O	Excluded	GHG emissions related to the production of hydrocarbons used as reducing agent represent less than 0.001% of expected emission reductions and will not be taken into account due to unreasonable costs for monitoring.

The following figure shows the spatial extend of the project boundary.

Figure 1: Project boundary Abu Qir II



At Abu Qir II nitric acid plant, the EnviNOx®-Systems is installed between the tail gas heaters and the tail gas turbine. The $DeNO_x$-unit was removed.

6 Monitoring Methodology and Plan

The approved Monitoring Methodology AM0028 Version 1 “Catalytic N_2O destruction in the tail gas of Nitric Acid Plants”; submitted by Carbon Projektentwicklung GmbH is applied to this project activity.

This approved Monitoring Methodology is applicable to project activities that destroy N_2O emissions either by catalytic decomposition or catalytic reduction of N_2O in the tail gas of nitric acid plants (i.e. tertiary destruction) This approved Monitoring Methodology was valid from March 3rd 2006 to October 5th 2006 (request for registration until November 30th 2006). The present project activity, which has been registered on October 7th 2006, satisfies these applicability conditions.

Furthermore the use of the methodology is justified because the following statements are true:

- The methodology is applied to the existing production capacity installed no later than 31 December 2005.
- The Abu Qir II nitric acid plant has not installed any N_2O destruction or abatement technology prior to the starting data of the project activity.
- The project activity did not cause a nitric acid production increase.
- A $DeNO_x$-unit was already installed at Abu Qir II nitric acid plant prior to the starting date of the project activity. The project activity results in NO_x emission reductions that are at least as effective as the existing $DeNO_x$-unit.
- The $DeNO_x$-unit installed at Abu Qir II nitric acid plant was a SCR $DeNO_x$-unit.
- The N_2O concentrations are measured in real time at the inlet and the outlet of the N_2O destruction facility.
- Relevant historical data and manufacturer information were available.
- The monitoring methodology is used in conjunction with the “Baseline Methodology for Catalytic N_2O destruction in the tail gas of Nitric Acid Plants”.

The data being collected in order to monitor GHG emissions from the project activity are described below and detailed in Annex 1 of the Monitoring Report.

ID number	Data Variable	Source of data	Data unit	Recording frequency
P1	PE_y Project emissions	Monitoring system	tCO_2e	Annual
P2	PE_ND,y Project emissions from N_2O not destroyed	Monitoring system	tCO_2e	Annual

P3	PE_DF,y Project emissions from destruction facility	Monitoring system	tCO_2e	Annual
P4	PE_N2O,y N_2O not destroyed by facility	Monitoring system	tN_2O	Daily
P5	F_TG,i Volume flow tail gas at N_2O destruction facility	Flow meter	m^3/h	Daily
P6	CO_N2O,i N_2O concentration at destruction facility outlet	Monitoring system, measuring device	tN_2O/ Nm^3	Daily
P7	M_i Measuring Interval	Measuring device, data management system	H	Daily
P8	PE_HC,y Emissions from hydrocarbon use in destruction facility	Monitoring system	tCO_2e	Annual
P9	HCE_C,y Converted hydrocarbon emissions	Monitoring system	tCO_2e	Annual
P10	HCE_NC,y Non-converted hydrocarbon emissions	Monitoring system	tCO_2e	Annual
P11	Q_HC,y Hydrocarbon input (reducing agent)	Measuring device	m^3	Daily
P12	ρ_HC Hydrocarbon density	Hydrocarbon supplier or default value	t/m^3	Annual

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P13	EF_HC Hydrocarbon CO_2 emission factor	IPCC	tCO_2/t	Once
P14	OXID_HC Hydrocarbon oxidation factor	Measuring device	%	Daily
P15	Type_HC Type of hydrocarbon	Hydrocarbon supplier	-	Once

The data being collected in order to monitor baseline emissions are described below and detailed in Annex 1 of the Monitoring Report.

ID number	**Data Variable**	**Source of data**	**Data unit**	**Recording Frequency**
B1	P_HNO3,y Plant output of HNO_3	Production reports	$tHNO_3$	Daily
B2	QI_N2O,y Quantity of N_2O at inlet of destruction facility	Monitoring system	tN_2O	Daily
B3	CI_N2O,I N_2O concentration at N_2O destruction facility inlet	Monitoring system, measuring device	tN_2O/Nm^3	Daily
B4	QR_N2O,y Regulation I: annual quantity N_2O limited	National legislation	tN_2O	Date of regulation
B5	RSE_N2O,y Regulation II: N_2O emissions per unit of nitric acid	National legislation	$tN_2O/t\ HNO_3$	Date of regulation

B6	CR_N2O Regulation III: N_2O concentration in tail gas limited	National legislation	tN_2O/m^3	Date of regulation
B7	P_HNO3,hist Design capacity	Manufacturer's specifications / production reports	T	Once
B8	T_g,hist Historical operating temperature range of the ammonia oxidation reactor	Production reports / manufacturer's specification	^oC	Once
B9	P_g,hist Historical operating pressure range of the ammonia oxidation reactor	Production reports / manufacturer's specifications	Barg	Once
B10	T_g Actual operating temperature ammonia oxidation reactor	Measuring device	^oC	Continuous
B11	P_g Actual operating pressure ammonia oxidation reactor	Measuring device	Barg	Continuous
B12	Reg_NOx National regulation on NO_x emissions	National regulations, Ministry of Environment	tNO_x/m^3	Date of regulation
B13	G_sup Supplier of the ammonia oxidation catalyst	Supplier's information	-	Date of changing gauze composition
B14	G_com Composition of the ammonia oxidation catalyst	Annual reports, supplier's information	%	Date of changing gauze composition
B15	G_sup,hist Historical supplier of ammonia oxidation catalyst	Annual reports, supplier's information	-	Once

B16	G_com,hist Historical composition of the ammonia oxidation catalyst	Supplier's information	%	Date of start of usage of catalyst
B17	SE_N2O N_2O emission rate per ton of nitric acid	Monitoring reports	$tN_2O/tHNO_3$	Yearly
B18	A_OR,hist Max. historical ammonia flow rate to the ammonia oxidation reactor	Production reports / manufacturer's specifications / literature	tNH_3/day	Once
B19	A_OR,d Actual ammonia flow rate to the ammonia oxidation reactor	Measuring device	tNH_3/day	Continuous

7 Quality Control (QC) and Quality Assurance (QA)

7.1 Quality Management System

Project Operator is Abu Qir Fertilizer Co. S.A.E. ("AFC"), the biggest Fertilizer Company in Africa with closely to 3000 employees. AFC is ISO 9001:2000 and ISO 14001:2004 certified.
The EnviNOx® system is incorporated into AFC's ISO 9001:2000 and ISO 14001:2004 standards.

The operating personnel of the EnviNOx® system has been trained by the technology provider UHDE and the supplier of the digital process control system (Delta V, M/s. process management).
Carbon Egypt is responsible for monitoring and reporting of data under the CDM Project.

7.2 Quality Control and Quality assurance procedures

The quality assurance and quality control procedures, in terms of equipment operations and maintenance, have been defined based on applicable international standards, as well as standards provided by technology provider. AFC is certified under the ISO 9001:2000 and ISO 14001:2004 and applies appropriate QA & QC procedures.

The QC and QA procedures are set and implemented in order to:

1. secure a good consistency through planning to implementation of the CDM project, and
2. stipulate the responsibilities for operation and monitoring, and
3. avoid any misunderstanding between people and organizations involved.

7.2.1 Back Up Plans for measuring systems / Periodically observation of the automated monitoring system

<u>EnviNOx – automatic DCS system:</u>
The EnviNOx® system is designed for automatic operation, so that activities by the operation personnel are not required for during normal operation. However, all alarms and any action taken by the operating personnel (events) are automatically logged at the engineering and the operation station (Alarm & Event List) of the DCS system. All log sheets for **Alarm & Events** are exported and therefore digital available (Excel Files) and can easily be analysed and evaluated.
Malfunction of system components is indicated on the operator (AFC) console in the control room as an alarm. Occurrence of such an alarm requires the operator to immediately take measures to remedy the problem. This is done by informing AFC instrument department and Carbon Egypt. It is then decided whether the problem can be fixed immediately by AFC or Carbon Egypt, or whether external support from ENTRAG/EMERSON/UHDE is required.

Back Up – EnviNOx support:

In addition to the quality control and quality assurance procedures according to AFC quality management system and in order to avoid possible failures of the automated monitoring system several procedures are implemented for the project activity.

Carbon Egypt has contracted the Egyptian ENTRAG Group – the Agent for EMERSON Process Management in Egypt - to execute monthly on-site **Health Checks.** EMERSON Germany has been contracted to execute quarterly on-site **Inspection Visits**. Furthermore a **24 hours emergency service** and the **Delta V Guardian Support** are covered by the contract.

The monthly health checks and the quarterly inspection visits are to conduct observation of the EnviNOx® system, the monitoring equipment required for the CDM project and the automated monitoring system. The system components, measurement devices, calibration works and the automated monitoring system required for the monitoring of the CDM project are covered by the contracts. Health check reports and inspection visit reports are available.

The responsible project managers of Carbon Egypt are carrying out **on-site inspections** on a daily basis and AFC is carrying out a site check of the EnviNOx system once per shift.

Furthermore AFC maintenance department is performing **weekly inspection** including an on-site check of the EnviNOx® system.

Supervision is done based on the daily reports by the technology provider UHDE and EMERSON.

Back Up – Spare Parts on Stock On-site:

As a further important part of the back up plan to deal with events like measuring equipment out of service Carbon Egypt stocks a comprehensive range of spare part devices on-site. The spare part stock consists basically of 6-month consumables and for two year operation as recommended by the supplier. It includes inter alia filter elements, valves and pressure controllers for the sample handling system and filter elements, analysis cells (crucial part for analyzers), flow sensors and several electrical parts for the analyzers. The stock of spare parts is updated on a quarterly basis and the amount of spare parts to reorder is recommended by the supplier as well.

Back Up – Certified test gases

Pressure levels of test gases used for the regular, automatic calibration of the inlet and outlet analysers are constantly monitored during the regular inspection by AFC. Spare bottles of test gases are purchased in proper time. Specifications of test gases are available and submitted to the DOE for verification.

Back Up – Procedures:

In addition to the quality control and quality assurance procedures according to AFC quality management system and in order to avoid possible failures of the automated monitoring system several procedures are implemented for the project activity. The approach by Carbon Egypt was to ensure immediate response to such alarms/malfunctions respectively in the system.

The following table summarizes the periodically observations of the AMS.

Table 2: AMS observation overview

Organization	Action	Frequency	Output
Delta V	Events & Alarm List	Continuously	Txt-files, Excel files
AFC	Shift inspection	3 times a day	Plant Check
CARBON Egypt	Inspection	Daily	EnviNOx Journal
AFC	Inspection	Weekly	AFC Report
ENTRAG	Health check, System diagnostic	Monthly	Health Check Report on AMS and EnviNOx
EMERSON Germany	Inspection visit	Quarterly	Inspection Report on AMS and EnviNOx
EMERSON Germany	Remote diagnosis	Continuously	Diagnosis Check
UHDE	Supervision	Continuously	Plausibility Check

All resulting documents are analysed and evaluated by Carbon Egypt. In case of any upcoming problem or failure of the EnviNOx® system and/or the automated monitoring system Carbon Egypt immediately take measure to remedy the problem. The provider of the automated monitoring system is available 24 hours a day via Hotline. Furthermore ENTRAG is committed to be onsite within 24 hours.

7.2.2 Systematic measures for QA for monitoring data during analyzer down times

- Back Up Plans (cf. 7.2.1)

- Check against operating parameters

  In order to ensure the quality of the monitored data during analyzer downtimes Carbon Egypt contracted EMERSON Germany and ENTRAG for regular maintenance & calibration services and applied the CDM/QA procedure according to the Project Design Document of "Catalytic N_2O Destruction Project in the Tail Gas of the Nitric Acid Plant of Abu Qir Fertilizer Co."

  The procedure how to proceed in cases of analyzer down times is a five-step approach:

  (1) Nitric Acid plant in normal operation:
  If there is a down time of concentration measurements Carbon Egypt provides suitable operating parameters to demonstrate that the nitric acid plant is operating under normal conditions.

  (2) EnviNOx® system in normal operation:
  Carbon Egypt provides suitable operating parameters to demonstrate that the EnviNOx® system is operating under normal conditions and has reached normal efficiency.

(3) Correlation check:
The estimation of emission reductions is based on correlation methods, applying the parameter with the highest historical correlation to the missing parameter.

(4) Recalculation:
In order to ensure a conservative determination of emission reductions for hours with analyzer downtimes recalculation is based on parameters with applicable historical correlation to the missing parameter (e.g. minimum historical efficiency of the EnviNOx® system; the flow of N_2O reducing agent to the reactor; the tail gas volume flow;) and consequently guarantees a conservative determination of emission reductions.
Conservativeness is ensured inter alia by using minimum efficiency of the system or in terms of correlation parameters taking into consideration an additional deduction of inlet N_2O concentrations of 2%.

(5) Check parameters before and after analyzer down time:
Operating parameters are compared with values prior and after the analyzer was out of operation or out for maintenance to ensure that those values are within the same range.

7.3 Calibration and maintenance

All measuring and analytical instruments are being calibrated as defined in the approved CDM Project Design Document: “Catalytic N_2O destruction project in the tail gas of the Nitric Acid Plant of Abu Qir Fertilizers Co.”, version 2 (b), 20 June 2006.

The plant operator AFC has a Quality Management System (ISO 9001) where maintenance methods are incorporated. The analyzers need a calibration on a regular basis. This adjustment procedure is done automatically, and can be triggered manually from the operating console or automatically on a time basis. All relevant instruments like project relevant AOR instruments and EnviNOx® instruments have been calibrated accordingly.

As Carbon Egypt works on improvements in terms of reliability, availability and maintainability of the EnviNOx® system together with its technology and service providers continuously, a general check of the systems was ordered and finally performed during the scheduled shutdown of the Abu Qir Nitric Acid plant (01-03-2009 – 08-03-2009).
The maintenance activities included inter alia a comprehensive check of the analyzer system by EMERSON Germany and the exchange of the field instruments of the EnviNOx® system also carried out by EMERSON Germany.

Table 3: Significant calibration and maintenance 2009 (AOR instruments)

TAG	Instrument Description		Date	Description work
AOR Instruments				
PT-21353	Pressure transmitter	Primary air pressure	05-03-2009	Calibration
FT-21401	Differential pressure transmitter	Ammonia gas	05-03-2009	Calibration
FQ-21411	Flowmeter	Nitric Acid flow	05-03-2009	Calibration
FQ-21401	Flowmeter	Ammonia flow	05-03-2009	Calibration
PT-21201	Pressure transmitter	Ammonia gas pressure	02-03-2009	Calibration
TE-21001	Temperature transmitter	Ammonia gas temperature	02-03-2009	Calibration
TE-21014	Temperature transmitter	Ammonia burner 1 temperature	03-03-2009	Calibration
TE-21015	Temperature transmitter	Ammonia burner 1 temperature	03-03-2009	Calibration
TE-21020	Temperature transmitter	Ammonia burner 2 temperature	03-03-2009	Calibration
TE-21021	Temperature transmitter	Ammonia burner 2 temperature	03-03-2009	Calibration

Table 4: Significant calibration and maintenance 2009 (EnviNOx® instruments)

EnviNOx® Instruments				
AT-218001	Inlet Analyzer (NDIR)	N_2O, NO_X concentration	20-06-2009	Service by Emerson Germany
AT-218002	Outlet Analyzer (NDIR)	N_2O, NO_X, CH_4 concentration	18-06-2009	Service by Emerson Germany
TE-218001	Temperature transmitter	Tail gas inlet temperature	05-03-2009	Replacement with new instruments
TE-218003	Temperature transmitter	Ammonia Vapor	05-03-2009	Replacement with new instruments
TE-218004	Temperature transmitter	Natural gas temperature	05-03-2009	Replacement with new instruments
TE-218005A	Temperature transmitter	Tail gas downstream temperature	05-03-2009	Replacement with new instruments
TE-218005B	Temperature transmitter	Tail gas downstream temperature	05-03-2009	Replacement with new instruments
FT-218001	Variable area flowmeter	Ammonia flow	05-03-2009	Replacement with new instruments
FT-218002	Variable area flowmeter	Natural gas flow	05-03-2009	Replacement with new instruments
FT-218003A	Differential pressure transmitter	Tail gas flow	05-03-2009	Replacement with new instruments
FT-218003B	Differential pressure transmitter	Tail gas flow	05-03-2009	Replacement with new instruments
PDT-218001	Differential pressure transmitter	Tail gas differential pressure	05-03-2009	Replacement with new instruments
PT-218006A	Pressure transmitter	Tail gas pressure	05-03-2009	Replacement with new instruments
PT-218006B	Pressure transmitter	Tail gas pressure	05-03-2009	Replacement with new instruments
PT-218002	Pressure transmitter	Ammonia pressure	05-03-2009	Replacement with new instruments
PT-218004	Pressure transmitter	Natural gas pressure	05-03-2009	Replacement with new instruments

All relevant service reports and calibration certificates issued by EMERSON Germany and AFC and manufacturer's certificates for the newly installed instruments are submitted for verification.

7.4 Environmental Impacts

According to the national Environment Law number 4 of Egypt (year 1994) the NO_x emissions at nitric acid plants are limited to 3000 mg/m³ for existing nitric acid plants (AFC). Continuous measurement of the NO_x concentration at the outlet of the EnviNOx® system reports a concentration of 1.7 ppm.

The above shows that the CDM Project operation is in compliance of the environmental standards.

7.5 Social Fund

As described in the PDD a Social Fund was established by the project developer and the project operator. This fund will contribute to the social and environmental benefit of the people living in the area of the project activity by financing projects. The contribution to the Social Fund and the activities are monitored and reported on an annual basis.

The environmental surveillance equipment, which was identified as the first Social Fund project out of this CDM project, was already ordered by AFC.

The contribution to the Social Fund in 2008 was 292,690 Euro. AFC and the local DNA (EEAA) are currently in discussion about the allocation of the amount.

The proposed projects from AFC side are the following:

- Dust surveillance monitoring system.
- Road network improvements in the surrounding area of AFC.
- Establishing of a medical center in the surrounding area of AFC.
- Establishing a medical survey for early detection of breast cancer.
- Establishing an environmental study of one of the ditches on the area surrounding AFC.
- Establishing a study to remove ammoniated water in cooperation with the Faculty of Science of Alexandria University.

The decision which project(s) will be chosen will be made on mutual agreements between EEAA and AFC in order to guarantee responsibly allocation of the fund.

All relevant documents and correspondence between AFC and EEAA are submitted for verification.

8 Observations during Monitoring Period 10

Please note the following Shutdown Periods for the nitric acid plant and observations for the EnviNOx® system. Relevant hours of Nitric Acid plant shutdown periods have not been considered in overall calculations of Emission Reductions (if applicable).

Table 5: Shutdown periods of Nitric Acid plant

Date	Remarks
-	No shutdowns during Monitoring Period

Table 6: Observations at EnviNOx® system

Date	Remarks
10-03-2009 – 18-03-2009	Blockage in the outlet sample line
18-06-2009 – 20-06-2009	Quarterly Inspection Check by EMERSON Germany

8.1 Observations at EnviNOx® system

8.1.1 Blockage in the outlet sample line (10-03-2009 – 18-03-2009)

From the 10th March 2009 to 18th March 2009 after completing the revamp activities ***(For AFC II and the EnviNOx® unit),*** there was a blockage in the outlet sample line due to some contaminations in the sample line which may was formed during the start up of the Nitric acid plant and later on at the EnviNOx® system.
This incident occurred completely unexpected the first time after a start-up procedure and shall not be considered as repeated failure.

An analyzer flow alarm at the control room appeared on the 10th of March 2009. In order resolve the issue ENTRAG was immediately contacted and furthermore on-site after 24 hours of ordering the emergency visit (11th of March 2009). ENTRAG checked the outlet analyzer flow and pressure parameters and changed filters as the problem seemed to be temporary. The following days the alarm appeared again, so finally EMERSON Germany was ordered to be on-site for an emergency visit. EMERSON Germany cleaned the complete outlet sample line by distilled water, checked the analyzer physics, and exchanged the filters. Due to our *"Back Up Plan – Spare Parts on Stock On-site"* the needed spare parts were available on-site. The alarm at the control room disappeared afterwards and EMERSON Germany recommended to observe the flow parameters (*which is already a part of Carbon Egypt procedures)* in order to detect such a blockage at the earliest stage possible.

The emergency service reports issued by ENTRAG and EMERSON Germany are submitted for verification.

8.1.2 Preventive Maintenance (Quarterly Inspection Check) at analyzers (18-06-2009 – 20-06-2009)

The calibration/maintenance activities (quarterly Inspection Visit) were carried out on-site by EMERSON Germany and had included (but not limited to) check and clean the filter, check the pressure regulator, check the sample handling system, check the solenoid valve, check the analyzer with internal diagnostic menus, leak test at sample system, clean sample lines with distilled water and manual calibration of the analyzer.
The phase of analyzer out of operation for maintenance lasted about 10 hours per day during preventive maintenance.

Furthermore a check of correct function of analyser sampling system by applying test gas at the beginning of the sample lines is applied on a yearly basis by EMERSON Germany (most recently performed at 08 March 2009).

The service reports issued by EMERSON Germany are submitted for verification.

8.1.3 Evidence on destruction facility operational at normal efficiency

The following applied approach is fully in compliance with AM0028 vers1 and the registered Monitoring Plan for the project activity.

The destruction facility itself was operational at normal efficiency on 10th March to 18th March 2009, and 18th June to 20th June 2009, due to following conditions:

(1) Nitric Acid plant was in normal operation for the relevant periods. This was demonstrated by the following parameters:
   - (1a) AOR temperature: → no relevant variations
   - (1b) AOR pressure: → no relevant variations
   - (1c) Ammonia Input: → no relevant variations
   - (1d) Nitric acid production: → no relevant variations

(2) The EnviNOx® system was in normal operation for the relevant periods and achieves normal efficiency. This was demonstrated and documented by the following parameters:

   (2a) No significant variations in the EnviNOx® parameters (a) tail gas flow rate, (b) N_2O concentration, (c) NO_X concentration.
   (2b) Ammonia input required for NO_X reduction: The EnviNOx® system was supplied with the required amount of ammonia for the whole period.

(2c) Natural gas input required for high efficient N_2O reduction: The EnviNOx® system was supplied with the required amount of natural gas for high efficient N_2O emission reductions for the whole period.
(2d) Temperature increase over the EnviNOx® reactor: As the N_2O reduction taking place in the EnviNOx® reactor is exothermic and causes a temperature rise, this temperature increase over the EnviNOx® reactor provided evidence that the reactions have taken place and the EnviNOx® system has reached normal performance.

(3) Correlation Check: Based on the documents described above it was clearly demonstrated by correlation to the missing parameter that the nitric acid plant and the EnviNOx® system have been operated under normal conditions and have reached normal efficiency. The applied approach is fully in compliance with AM0028 vers1 and the registered Monitoring Plan for the project activity.

Supporting documents and numerous additional clarifying tables and charts to underline above mentioned demonstrations were prepared and submitted for verification.

(4) In order to ensure a conservative determination of emission reductions for these days recalculation is based on correlation and minimum historical efficiency of the EnviNOx® system and guarantees a conservative determination of project emissions (underestimation of emission reductions).

(5) The check of operating parameters before and after analyzer down time compared with values prior and after the analyzer was out of operation or out for maintenance clearly showed that those values are within the same range.

Corrected details sheet including above mentioned recalculations were prepared and submitted for verification.

Note: The efficiency of the EnviNOx® system has reached again the “normal” level of about 99.3% after the calibration/maintenance activities performed by Emerson Germany, the regular calibration/maintenance activities were finished (identical performance as prior to the inspection check) and the blockage at the outlet sample line issue was resolved. This provides evidence that the EnviNOx® system was working at “normal” efficiency during the period of quarterly maintenance activities and blockage at the outlet sample line, as the EnviNOx® system is characterized by the stability of the catalyst performance. The manufacturer confirmed that after initial activation of the catalyst any change – if it takes place – occurs slowly and monotonically.

Supporting document by the manufacturer is submitted for verification.

8.2 Clarifications and measures undertaken for a reliable system

The blockage at the outlet sample line (flow problem) at the beginning of the Monitoring Period (10th - 18th March 2009) was subject to detailed investigation by Carbon Egypt and its technology and service providers. After emergency visits by ENTRAG and another by EMERSON Germany the issue was resolved.
After consultation with the technology provider it turned out that the contamination in the sample line, which lead to the sample flow problems, may was formed due to a singular high ammonia injection to the reactor during the start up phase after the gauze change at the beginning of March 2009 (please refer also to Monitoring Report No 9).

In order to minimize risks in connection with the start-up of the EnviNOx® system Carbon Egypt together with the manufacturer and technology provider is currently in discussion on how to improve the start-up procedure in order to avoid any formation of contaminations in the sample lines in future.

The quarterly Inspection Visits carried out by EMERSON Germany should not be considered as a failure of the analyzer system but a measure to ensure highest possible quality of the monitoring data through regular calibration/maintenance checks.

Emergency service reports by ENTRAG and EMERSON Germany as well as inspection visit reports by EMERSON Germany are submitted for verification.

CARBON

9 GHG Calculation

In terms of the Approved Methodology (AM0028 / Version 1), the emission reduction (ER_y) by the project activity during a given period *y* is the difference between the baseline emissions (BE_y) and project emissions (PE_y), as follows:

ER_y = BE_y – PE_y – LE_y . **(13)**

where:

ER_y	emissions reductions of the project activity during the year *y* (tCO_2e)
BE_y	baseline emissions during the year y (tCO_2e)
PE_y	project emissions during the year y (tCO_2e)
LE_y	leakage emissions in year y (tCO_2e)

Project Emissions:

The emissions due to the project activity are composed of (a) the emissions of not destroyed N_2O and (b) emissions from auxiliary hydrocarbons input resulting from the operation of the EnviNOx® system. N_2O emissions not destroyed by the project activity are calculated based on the continuous measurement of the N_2O concentration in the tail gas of the EnviNOx® system and the volume flow rate of the tail gas stream. The emissions related to the operation of the N_2O destruction facility are given by on-site emissions due to the hydrocarbons used as input to the EnviNOx® system.

PE_y = PE_ND,y + PE_DF,y = [3,215 + 557 = 3,772 tCO_2e]

= PE_N2O,y x GWP_N2O + PE_HC,y =

= $\sum_i^n F\_TG,i$ x CO_N2O,i x M_i x GWP_N2O + HCE_C,y =

= $\sum_i^n F\_TG,i$ x CO_N2O,i x M_i x GWP_N2O + ρ_HC x Q_HC,y x EF_HC x OXID_HC/100 =

= 3,772 tCO_2e

Project emissions are limited to the design capacity of the nitric acid plant. According to AM0028 the design capacity is measured in tons of nitric acid per year. The actual nitric acid production in the covered monitoring period does not exceed the design capacity.

Baseline Emissions:

It has been checked that there are no Egyptian regulation in place that would limit the quantity of N_2O that can be taken into account for the calculation of baseline emissions.
Baseline emissions of the project activity are determined based on the quantity of N_2O emitted in the baseline scenario, taking national regulations, production levels and operating conditions into consideration. The quantity of N_2O is determined based on the measurement of the N_2O at the inlet of the EnviNOx®-System, which results in a conservative estimation of baseline emissions.

BE_y = BE_N2O,y x GWP_N2O = [1,433.35 x 310 = 444,339 tCO2e]

$$= \sum_i^n F\_TG,i \text{ x CI\_N2O,i x M\_i x GWP\_N2O} =$$

= 444,339 tCO_2e

Baseline emissions are limited to the design capacity of the nitric acid plant. According to AM0028 the design capacity is measured in tons of nitric acid per year. The actual nitric acid production in the covered monitoring period does not exceed the design capacity.

Leakage Emissions:

As described the project activity does not result in any relevant leakage emission, therefore:

LE_y = 0

Emission Reduction:

The total emission reduction achieved by this project activity during the first monitoring period is therefore:

ER_y = BE_y – PE_y – LE_y . **(14)**
= 444,339 – 3,772 – 0 =

= 440,567 tCO_2e

The above emission reductions cover the monitoring period from March 10^{th} 2009 to June 30^{th} 2009.

Comparison of the actual emission reductions with the estimate in the registered PDD

The emissions reductions in this Monitoring Period are 440,567 tonnes of CO_2 equivalents in the period from 10 March 2009 to 30 June 2009 (i.e. 113 days). The yearly expected emissions reductions according to the registered PDD is 1,065,881 tonnes of CO_2 equivalents. This corresponds to emissions reductions of 329,985 tonnes of CO_2 equivalents in 113 days and hence the observed emissions reduction is higher than expected.

The reasons are:

- An observed higher inlet N_2O concentration, approx. 2.32E-06 tN_2O/Nm^3 (average) in this Monitoring Period compared to the value of 1.88E-06 tN_2O/Nm^3 used for calculation of ex-ante emission reductions in the PDD.
- Higher conversion efficiency of N_2O (99.26% compared to 94% as conservatively assumed in the registered PDD).
- No shutdown periods of Nitric Acid plant of any kind during the Monitoring Period.

It should be noted that the ex-ante estimation of emissions reductions was generally based on conservative assumptions.

10 Check against baseline requirements

In order to avoid that the operation of the nitric acid production plant is manipulated in a way to increase the N_2O generation, thereby increasing the CERs, actual operating conditions have been checked against the baseline requirements.

Operating temperature:
The temperature in both ammonia oxidation reactors (AOR) are monitored by two thermocouples. The operating temperatures in the AORs are automatically collected by AFC´s distributed control system (DCS) and then automatically transferred to the Delta-V distributed control system (Delta-V system) serving the CDM project. Based on these two thermocouples, the Delta-V system automatically calculates and reports the average temperature. Subsequently, the Delta-V system generates daily reports including the daily average AOR temperatures.
The data from the daily reports generated by the Delta-V system are transferred to an excel sheet in order to present all parameters as required by AM0028 in an overall format. This file also includes the daily average values of the ammonia oxidation temperatures and an automatic check of each daily average value in order to see if the operation has been within the permitted operating range. The excel sheet containing values and automatic checks is attached as *Annex 2* to this Monitoring Report.

The actual average daily operating temperature in both AORs is within the permitted range for all operating days covered by this monitoring report.

Operating pressure:
The operating pressure representing the pressure in the ammonia oxidation reactors (AOR) is measured by a pressure transmitter in the air compressor discharge line. The operating pressure is automatically collected by the AFC´s distributed control system (DCS) and then automatically transferred to the Delta-V distributed control system (Delta-V system), serving the CDM project. Subsequently, the Delta-V system generates daily reports including the daily average AOR pressures.
The data from the daily reports generated by the Delta-V system are transferred to an excel sheet in order to present all parameters as required by AM0028 in an overall format. This file also includes the daily average values of the ammonia oxidation pressure and an automatic check of each daily average value in order to see if the operation has been within the permitted operating range. The excel sheet containing values and automatic checks is attached as *Annex 2* to this Monitoring Report.

The actual average daily operating pressure in the AORs is within the permitted ranges for all days covered by this monitoring report.

Composition of the ammonia oxidation catalyst:
The composition of the ammonia oxidation catalyst is the same kind of catalyst composition already in operation prior to the start of the project activity.

The following table summarizes the campaign information:

Table 7: Summary of Campaign Gauzes

Installation Date	Closure Date	Gauze Type	Gauze Specification
08th March 2009	-	Heraeus	90% Platinum 10% Rhodium

Ammonia flow rate to the ammonia oxidation reactor:

The cumulated ammonia flow rate to both ammonia oxidation reactors is derived from AFC recordings which are prepared in accordance with AFC´s quality management system ISO 9001:2000.

The cumulative volume in Nm^3 is recorded each hour by AFC in sheet no. 409/1/2/3 F3. Daily consumption is recorded in sheet no. 409/1/2/3 F1 and the converted value in tNH_3/day is also recorded in the same sheet.

The CDM relevant data on daily ammonia flow rate to the ammonia oxidation reactors is derived from AFC´s sheet no. 409/1/2/3 F1 and transferred to an excel sheet in order to present all parameters as required by AM0028 in an overall format. This file also includes the total daily ammonia inlet flow and an automatic check of each daily value in order to see if the operation has been within the permitted operating range. The excel sheet containing values and automatic checks is attached as *Annex 2* to this Monitoring Report.

The daily ammonia input to the AORs is within the permitted ranges for all days covered by this Monitoring Period.

HNO_3 production:

The HNO_3 production data are derived from AFC recordings which are prepared in accordance with AFC´s quality management system ISO 9001:2000.

The cumulative volume in m^3 is recorded in each shift by the operator in Abu Qir's EnviNOx®-System unit reading sheet no. 409/1/2/3A/F1 and log sheet no. 409/1/2/3 F5. The concentration of the nitric acid is analysed two times per shift and logged in reporting sheet 410/3/3/F1. The daily HNO_3 production and the daily average concentration are recorded in sheet no. 409/1/2/3 F1.

The CDM relevant data on daily HNO_3 production is derived from AFC´s sheet no. 409/1/2/3 F1 prepared in accordance with AFC´s quality management system ISO 9001:2000 and transferred to an excel sheet in order to present all parameters as required by AM0028 in an overall format. This file also includes the total daily HNO_3 production. The excel sheet containing values and automatic checks will attached as *Annex 2* to this Monitoring Report.

In order to prove plausibility of HNO_3 production a check on a regular basis was performed and showed plausible data for all days covered by this Monitoring Period.

The document has been submitted for Verification and clearly shows plausible data.

The accumulated nitric acid production from the beginning of the year 2008 is 669,373 $tHNO_3$.
The accumulated nitric acid production from the beginning of the year 2009 is 314,221 $tHNO_3$.
It is clearly shown that both values are lower than the limit established in the PDD: 700,800 $tHNO_3$.

Details can be seen in the following tables:

Table 8: Summary of Nitric Acid Production 2008

Data / Parameter:	**P_HNO3 $_{2008}$**
Data unit:	$tHNO_3$
Description:	Plant output of HNO_3
Source of data to be used:	Production reports
Total Nitric Acid produced 2008	**669,373 $tHNO_3$** (verified)
Limit of Nitric Acid Production according to PDD	**700,800 $tHNO_3$**

Table 9: Summary of Nitric Acid Production 2009 (till 30th June)

Data / Parameter:	**P_HNO3 $_{2009}$**
Data unit:	$tHNO_3$
Description:	Plant output of HNO_3
Source of data to be used:	Production reports
Total Nitric Acid produced 2009	**314,221 $tHNO_3$**
Limit of Nitric Acid Production according to PDD	**700,800 $tHNO_3$**

A table for a comprehensive overview of HNO_3 production (on a calendar year basis) is attached as part of the Excel Sheet mentioned in *Annex 2* (*MR_10_AFC_UNFCCC_FINAL.xls).*

Annex 1

Data and parameter monitored:

Data / Parameter:	**F_TG**
Data unit:	Nm³/h
Description:	Volume flow tail gas at N_2O destruction facility interval i
Source of data to be used:	Venturi tube, designed and manufactured in accordance with ISO 5167-4:2003 Standard Normal Conditions: 1,013.25 hPa, 273.15 K)
Description of measurement methods and procedures to be applied:	Flow metering system automatically records volume flow adjusted to standard temperature and pressure.
Value monitoring period:	**228,191 Nm³/h** **(618,855,320 Nm³)**

Data / Parameter:	**CO_N2O**
Data unit:	tN_2O/ Nm³
Description:	N_2O concentration at destruction facility outlet
Source of data to be used:	Non-dispersive infrared photometry for N_2O
Description of measurement methods and procedures to be applied:	In the effluent of the EnviNOx®- system, the concentration of nitrous oxide (N_2O) is analysed continuously. Analysis is done by using non-dispersive infrared photometry for N_2O.
Value monitoring period:	**1.67E-08 tN_2O/Nm³**

Data / Parameter:	**P_HNO3**
Data unit:	$tHNO_3$
Description:	Plant output of HNO_3
Source of data to be used:	Production reports
Description of measurement methods and procedures to be	The actual nitric acid production is measured according to the installed instruments. The instrument signals will be recorded in control rooms and used to determine whether the nitric acid production is within the historical designed

applied:	capacity.
Value monitoring period:	**203,923 $tHNO_3$**

Data / Parameter:	**SE_N2O**
Data unit:	$tN_2O/tHNO_3$
Description:	N_2O emission rate per ton of nitric acid
Source of data to be used:	Production reports
Description of measurement methods and procedures to be applied:	The quantity of N_2O at the inlet of the destruction facility is calculated based on the concentration at the inlet and the volume flow. The actual nitric acid production is measured according to the installed instruments.
Value monitoring period:	**7.03E-03 $tN_2O/tHNO_3$**

Data / Parameter:	**CI_N2O**
Data unit:	tN_2O/Nm^3
Description:	N_2O concentration at destruction facility inlet
Source of data to be used:	Non-dispersive infrared photometry for N_2O
Description of measurement methods and procedures to be applied:	In the feed of the EnviNOx®- system, the concentrations of nitrous oxide (N_2O), is analysed continuously. Analysis is done by using non-dispersive infrared photometry in a combined analyzer device.
Value monitoring period:	**2.32E-06 tN_2O/Nm^3**

Data / Parameter:	**T_g**
Data unit:	°C
Description:	Actual operating temperature ammonia oxidation reactor
Source of data to be used:	Thermocouple
Description of measurement methods and procedures to be applied:	The actual temperature at the ammonia oxidation catalyst is measured with the exchanged measuring devices. Actual daily temperatures are reported in the Delta V Daily reports.
Value monitoring period:	Burner 1: **875 °C**

	Burner 2: **894 °C**

Data / Parameter:	P_g
Data unit:	Barg
Description:	Actual operating pressure ammonia oxidation reactor
Source of data to be used:	Pressure transmitter
Description of measurement methods and procedures to be applied:	The actual pressure at the ammonia oxidation catalyst is measured with the installed measuring devices.
Value monitoring period:	**3.67 barg**

Data / Parameter:	G_sup
Data unit:	-
Description:	Supplier of the ammonia oxidation catalyst
Source of data to be used:	Ammonia oxidation catalyst supplier
Description of measurement methods and procedures to be applied:	Commercial Invoice
Value monitoring period:	**Heraeus**

Data / Parameter:	G_com
Data unit:	%
Description:	Composition of the ammonia oxidation catalyst
Source of data to be used:	Ammonia oxidation catalyst supplier
Description of measurement methods and procedures to be applied:	Certificate catalyst supplier
Value monitoring period:	**90% Pt** **10% Rh**

Data / Parameter:	**A_OR,d**
Data unit:	tNH_3/d
Description:	Actual ammonia flow rate to the ammonia oxidation reactor
Source of data to be used:	Flow meter
Description of measurement methods and procedures to be applied:	The actual ammonia flow to the ammonia oxidation reactor is measured with the already installed measuring devices. Actual daily ammonia flow is reported in the Delta V Daily reports.
Value monitoring period:	**507 tNH_3/d** **(57,241 tNH_3)**

Data / Parameter:	**Q_HC**
Data unit:	Nm^3
Description:	Hydrocarbon input (natural gas as reducing agent)
Source of data to be used:	Flow meter
Description of measurement methods and procedures to be applied:	The natural gas used as reducing agent is measured by standard flow meters. Flow is converted to standard conditions based on temperature and pressure measurement.
Value monitoring period:	**193,706 Nm^3**

Data / Parameter:	**ρ_HC**
Data unit:	t/m^3
Description:	Hydrocarbon density
Source of data to be used:	Hydrocarbon supplier
Description of measurement methods and procedures to be applied:	Hydrocarbon supplier or default value
Value monitoring period:	**7.58E-04 t/Nm^3** Standard Normal Conditions: 1,013.25 hPa, 273.15K

Data / Parameter:	**M_i**
Data unit:	h
Description:	Measuring Interval
Source of data to be used:	Delta V System, Monitoring System
Description of measurement methods and procedures to be applied:	Analyzers automatically take readings every 10 seconds. Based on raw data average hourly values are calculated and reported.
Value monitoring period:	**1 h**

Data / Parameter:	**Type_HC**
Data unit:	-
Description:	Type of hydrocarbon
Source of data to be used:	Hydrocarbon supplier
Description of measurement methods and procedures to be applied:	As per certificate of supplier.
Value monitoring period:	**Natural Gas**

Data / Parameter:	**EF_HC**
Data unit:	tCO_2e/t
Description:	Hydrocarbon CO_2 emission factor
Source of data to be used:	Hydrocarbon supplier or IPCC
Description of measurement methods and procedures to be applied:	The hydrocarbon CO_2 emission factor is given by the molecular weights and the chemical reaction when hydrocarbons are converted. In order to apply a conservative approach the HC emission factor for natural gas as reducing agent is set at 3.0 tCO_2e/t.
Value monitoring period:	**3.0 tCO_2e/t**

Data / Parameter:	**HCE_C**
Data unit:	tCO_2e
Description:	Converted hydrocarbon emissions
Source of data to be used:	Monitoring System
Description of measurement methods and procedures to be applied:	Calculated
Value monitoring period:	**421 tCO_2e**

Data / Parameter:	**HCE_NC**
Data unit:	tCO_2e
Description:	Non converted hydrocarbon emissions (methane)
Source of data to be used:	Monitoring System
Description of measurement methods and procedures to be applied:	Analysis is done by using non-dispersive infrared photometry for CH_4
Value monitoring period:	**136 tCO_2e**

Data / Parameter:	**OXID_HC**
Data unit:	%
Description:	Hydrocarbon oxidation factor
Source of data used:	Delta V
Description of measurement methods and procedures to be applied:	Based on continuous measurements hydrocarbon input and hydrocarbon outlet
Value monitoring period:	**95.4 %**

Data / Parameter:	**REG_NOx**
Data unit:	tNOx/m³
Description:	**National regulation on NO_x emissions**
Source of data to be used:	Regional authorities
Description of measurement methods and procedures to be applied:	Official notification local authorities
Value monitoring period:	**3,000 mg/m³**

Data / Parameter:	**QR_N2O,y** **RSE_N2O,y** **CR_N2O**
Data unit:	tN_2O tN_2O/t HNO_3 tN_2O/m^3
Description:	National regulation on N_2O emissions
Source of data used:	Regional authorities
Description of measurement methods and procedures to be applied:	Actual no regulations on N_2O emissions are in place, confirmed by the Arab Republic of Egypt, Ministry of State for Environmental Affairs.
Value monitoring period:	Not applicable

A comprehensive list of all monitored parameters can be seen in *Annex 3*.

Annex 2

Excel Sheet with daily monitoring parameters:

An Excel sheet containing the daily monitoring parameters, automatic checks and a detailed HNO_3 production check is attached to this Monitoring Report as the separate file "*MR_10_AFC_UNFCCC_FINAL.xls*".

Annex 3

Details of Data and Parameters monitored during Monitoring Period 10:

Monitoring Report Values			
PE_y	3,772	tCO_2e	Project Emissions
BE_y	444,339	tCO_2e	Baseline Emissions in year y
LE_y	0	tCO_2e	Leakage Emissions
ER_y	440,567	tCO_2e	Emission Reductions

ID N^O		Project Parameters			
AM0028 /1	**PDD**				
P1	P1	PE_y	3,772	tCO_2e	Project Emissions
P2	P2	PE_ND,y	3,215	tCO_2e	Project Emissions from N_2O not destroyed
P3	P3	PE_DF,y	557	tCO_2e	Project Emissions from destruction facility
P4	P4	PE_N2O, y	10.4	tN_2O	N_2O not destroyed by facility
P5	P5	F_TG,I	228,191	Nm^3/h	Volume flow tail gas at N_2O destruction facility
P6	P6	CO_N2O, i	1.67E-08	tN_2O/Nm^3	N_2O concentration at destruction facility outlet
P7	P7	M_i	1	h	Measuring Interval
P8	-	PE_NH3, y	0	tCO_2e	Emissions from ammonia use in destruction facility
P9	P8	PE_HC, y	557	tCO_2e	Emissions from hydrocarbon use in destruction facility
P10	-	Q_NH3, y	Not Applicable	tNH_3	N_2O destruction facility: Project Ammonia input
P11	-	EF_NH3, y	Not Applicable	tCO_2e/tNH_3	Ammonia production GHG emission Factor
P12	P9	HCE_C, y	421	tCO_2e	Converted hydrocarbon emissions
P13	P10	HCE_NC, y	136	tCO_2e	Non Converted Methane Emissions
P14	P11	Q_HC,y	193,706	Nm^3	Hydrocarbon input (reducing agent)
P15	P12	ρ_HC	7.58E-04	t/m^3	Hydrocarbon Density
P16	P13	EF_HC	3.00	tCO_2e/t	Hydrocarbon CO_2 Emission Factor
P17	P14	OXID_HC	95.4%	%	Hydrocarbon Oxidation Factor
P18	P15	Type_HC	Natural Gas	-	Type of Hydrocarbon

ID N°		Baseline Parameters				
AM0028 /1	PDD					
B1	B1	P_HNO3,y	203,923		$tHNO_3$	Plant output of HNO_3
B2	B2	QI_N2O, y	1,433		tN_2O	Quantity N_2O at inlet of destruction facility
B3	B3	CI_N2O,y	2.32E-06		tN_2O/Nm^3	N_2O concentration at destruction facility inlet
B4	B4	QR_N2O, y	Not Applicable		tN_2O	Regulation I annual quantity N_2O limited
B5	B5	RSE_N2O,y	Not Applicable		tN_2O/HNO_3	Regulation II N_2O emissions per unit of nitric acid
B6	B6	CR_N2O	Not Applicable		tN_2O/Nm^3	Regulation III N_2O concentration in tail gas limited
B7	B7	P_HNO3,hist	700,800		$tHNO_3/a$	Design capacity
B8	B8	Tg,hist	Burner I	850 : 910	℃	Historical Operating Temperature
			Burner II	850 : 910		
B9	B9	Pg,hist	2.0 : 4.5		bar g	Historical Operating Pressure
B10	B10	Tg	Burner I	875	℃	Actual Operating Temperature
			Burner II	894		
B11	B11	Pg	3.67		bar g	Actual Operating Pressure
B12	B12	Reg_NOX	3,000 mg/m^3		$tNOx/Nm^3$	National Regulation on NOx emissions
B13	B13	G_sup	Heraeus		-	Supplier of ammonia oxidation catalyst
B14	B14	G_com	90% Pt, 10% Rh		%	Compostion of the ammonia oxidation catalyst
B15	B15	G_sup,hist	Umicore		-	Historical supplier of ammonia oxidation catalyst
B16	B16	G_com,hist	90% Pt, 10% Rh		%	Historical composition of the ammonia oxidation catalyst
B17	B17	SE_N2O	7.03E-03		tN_2O/HNO_3	N_2O emission rate per ton of nitric acid
B18	B18	A_OR,hist	545		tNH_3/day	Max. Historical ammonia flow rate to the ammonia oxidation reactor
B19	B19	A_OR,d	507		tNH_3/day	Actual ammonia flow rate to the ammonia oxidation reactor