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CDM Ref 490	TRIKA/MLEH	21 January 2008

Response to request for review

"Catalytic N2O Destruction Project in the Tail Gas of the Nitric Acid Plant of Abu Qir Fertiliser Co." (490)

Dear Members of the CDM Executive Board,

We refer to the requests for review raised by three Board members concerning DNV's request for issuance for CER's for the monitoring periodic 1 July 2008 to 31 September 2008 of project activity the 0490 "Catalytic N_2O Destruction Project in the Tail Gas of the Nitric Acid Plant of Abu Qir Fertiliser Co." project and we would like to provide the following initial response to the issues raised by the requests for review. We also refer to the response provided by the project participants.

The DOE is requested to clarify the reasons for the repeated failures of the analysers as observed in this and the past verifications.

In the below table an overview of N_2O analyser failures as observed from the monitoring period 1 to period 8 are given. In monitoring period 1 to 3 no failures were observed. In monitoring period 4 longer periods with low sample flow alarms were observed. The PP has taken actions to solve the sample flow problems and due to the developed procedures, this failure was not repeated to the extent observed in period 4. In monitoring period 5 problems with analyser alarms caused negative signal for some periods. The PP has taken actions to investigate the cause of the problem, and this type of error has not been repeated. In monitoring period 6 alarms for low sample flow was observed, however due to the procedures developed the periods out of operation was low. In monitoring period 7 the N_2O analyser was out of operation due to calibration and maintenance activities and thus no failure were observed for this period.
In this monitoring period 8, a new failure was observed (chopper failure).

The observed failures thus differ and can not be regarded as repeated failures. Moreover the PP has taken actions to prevent failures to be repeated. After the new service contract with EMERSON Germany for quarterly Inspection Visits was in place (April 2008) and the training for the Egyptian service engineers was performed at EMERSON Germany in Hasselroth in May 2008 the recurrent analyzer failures have not occurred again.

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Verification period	Reasons for N_2O analyser being out of operation	Preventive action taken
1. Period	No failure	Not applicable
2. Period	No failure	Not applicable
3. Period	No failure	Not applicable
4. Period	Low sample flow alarms	-Immediate consultation with ENTRAG, EMERSON – July 2007 -EMERSON Germany service engineers onsite as Emergency Service (overall test of the system, cleaning; fine tuning on flow balance) – 16th July 2007 -DNV raised a FAR 2 recommending that CARBON evaluates the need for extended analysis of the flow system (see period 5). -A training program for ENTRAG service engineers by Emerson Germany was planned to be executed (see period 7)
	Analyser for maintenance	Not a failure, but part of regular procedures.
	N_2O outlet analyzer drift caused by defective cell.	- EMERSON Germany emergency service called for troubleshooting. -Analyser spare parts are available on stock on-site and EMERSON Germany replaced the defective cell 22 August 2007. DNV raised a FAR 1 related to improvement of the procedure for handling spare parts. The procedure should include the requirement of reordering new spare parts at the time a spare part is taken out of storage. Further a new contract was planned to be established between Carbon Egypt Ltd. and EMERSON Germany for regular inspection of the monitoring system and also emergency service. Spare part supply would be included in this contract (see period 7).
5. Period	Analyser alarms caused by negative value at outlet analyzer. (13-19 October 2007)	ENTRAG in coordination with EMERSON Germany developed a special maintenance procedure for the sample handling system (including regular cleaning, flow balance)
	Negative values at outlet analyzer (19 November 2007)	Immediate consultation with ENTRAG. ENTRAG was onsite 20 November 2007, 9 December 2007, 13 December 2007 and 30 December 2007 for system check (special maintenance procedure, washing the filters with distilled water, adjustment of flows and pressure).
	Calibration/maintenance	Quarterly Inspection Visit carried out by ENTRAG – December 2007
6. Period	Low sample flow alarm	Minor problems 5 January, 17 January, 4 February, 22 to 27 March. These failures were fixed immediately by following the failure

		handling procedures in place (see period 5). ENTRAG was onsite at 9 February 2008, 24 March 2008 and 26 March 2008 for system check (special maintenance procedure). Organization and preparation of the training at technology provider EMERSON Germany for onsite service engineers and external monitoring experts from Germany (see period 7)
7. Period	Calibration/maintenance	New Service contract in place: Quarterly Inspection Visits carried out by EMERSON Germany (to ensure highest possible quality of the monitoring data through regular calibration/maintenance checks) -April 2008. Example of inspection report is given in attachment 1. Training at EMERSON Germany in Hasselroth for Egyptian service engineers and external monitoring experts from Germany (4th May 2008 – 8th May 2008).
8. Period	Chopper failure	The physical life of the chopper device was determined to approx. 5-10 years by the supplier EMERSON Germany hence a chopper failure was unexpected. Carbon Egypt kept the period of analyzer downtime short since crucial spare parts were available on stock on-site.
	Regular calibration/maintenance	Quarterly Inspection Visits carried out by EMERSON Germany (to ensure highest possible quality of the monitoring data through regular calibration/maintenance checks) – July 2008

The DOE is requested to clarify what systematic measures are in place to ensure the quality of the monitored data during analyser down times.

DNV Response:
The verification report chapter 3.7 "Management System and Quality Assurance" describes the quality assurance in place to ensure the quality of the monitoring system as follows:

"The project is operated by Abu Qir Fertilizer Co. Responsibility for monitoring and reporting of data under the CDM activity has been contracted to CARBON, and is performed by CARBON Egypt Ltd. The quality assurance and quality control procedures in terms of equipment operation and maintenance as well as data reporting are covered by project operator's management system certified to comply with ISO 9001:2000 and ISO 14001:2004.
There are two data streams coming from Abu Qir Fertiliser (nitric acid production data) and EnviNOx (N_2O reduction system operation parameters), which compiled by CARBON Egypt result in emission reduction calculations and monitoring report. The EnviNOx system and the monitoring system are designed as an automatic process, so the involvement of the personnel during normal operation is minimised. Local operators and instrumentation engineers of the system have been trained by equipment suppliers. Responsibilities of personnel taking part in the monitoring process are defined in job descriptions. Data handling solutions involve redundancy, data manipulation protection, integrity check as well as proper archiving. In case of any deficiency, procedures are in place. A contract with the technology provider (Uhde) has been

concluded for continuous supervision and maintenance of the EnviNOx and measuring equipment. In addition a service contract is in place between CARBON Egypt Ltd. and Engineering & Trading Group (ENTRAG agent in Egypt for Emerson Management Process Management). This contract covers as main items "On site" Delta V system health checks (on a monthly basis), 24 hour emergency service, inspections visits and respective reporting. A new service contract is in place with EMERSON Germany for quarterly inspection visits. The verification team was able to check reports from July, August and September 2008".

In addition DNV would like to mention the following specific observations and routines in place to ensure the quality of the monitored parameters during analyser down time. The parameters that are important in this respect are the parameters mentioned below in Request 3 since these parameters are used to check that the EnviNOx®-System was operating at normal efficiency during analyser downtime. The below table is showing that these parameters have adequate maintenance and calibration routines established.

Monitoring parameter	*Systematic measures in place to ensure quality*
AOR,d Actual ammonia input to oxidation reactor (tNH_3/day)	The transmitter was calibrated during the scheduled downtime 26 July 2008, /6/. The calibration and maintenance is performed in accordance to Abu Qir Fertilisers Co. Instrumentation and measurement procedure QSPR 409/2/E, document no. 409/2/E/F3.
Tg,d Actual operating temperature AOR on day d (°C)	Thermocouples were calibrated during scheduled downtime on date 26 July 2008 /6/ The calibration and maintenance is performed in accordance to Abu Qir Fertilisers Co. Instrumentation and measurement procedure QSPR 409/2/E, document no. 409/2/E/F3.
Pg,d Actual operating pressure AOR on day d (barg)	The pressure transmitter was calibrated during scheduled downtime on date 26 July 2008 /6/. The calibration and maintenance is performed in accordance to Abu Qir Fertilisers Co. Instrumentation and measurement procedure QSPR 409/2/E, document no. 409/2/E/F3.
P_HNO_3 Plant output of nitric acid $tHNO_3$	The flow transmitter was calibrated during the scheduled downtime 26 July 2008, /6/. The calibration and maintenance is performed in accordance to Abu Qir Fertilisers Co. Instrumentation and measurement procedure QSPR 409/2/E, document no. 409/2/E/F3.
F_TG Volume flow of tail gas from N_2O destruction unit at monitoring period	Venturi tube is designed according to ISO 5167-Part 4:2003 automatically adjusted to standard temperature and pressure. Differential pressure is measured with two differential pressure transmitters (P218007A and P21007B). For calculation of volume flow at standard conditions the system was equipped with two temperature (T218005A/B) and two pressure transmitters (P218006A/B). All transmitters were properly installed. The calibration of the transmitters is performed by ENTRAG. The inspection reports including the test results from the calibration procedures performed during operation were checked and all transmitters were reported with no remarks /6/.

	Further the following calibration procedures are preformed during operation every 6 months: 1) 4-20 mA analog Output Trim, 2) Hart Devices Diagnostics and 3) Loop Test for communication Transmitter – Delta V calibration.
CI_N2O N_2O concentration at destruction facility inlet (tN_2O/Nm^3)	Regular zero and span check is automatically performed. Span check (every second day) and zero check (daily). The calibration gases used is found to cover the range of measurements in the verifying period: High concentration 1859 ppmv. The calibration gases are stable until May 2009.
Q_HC Nm^3 Hydrocarbon (natural gas reducing agent)	The calibration of the transmitters is performed by Engineering & Trading Group (ENTRAG agent in Egypt for Emerson Management Process Management). The inspection reports including the test results from the calibration procedures performed during operation are available for check /5/.
Feed of ammonia to the EnviNOx®-System (not required by AM0028 for this project)	The calibration of the transmitters is performed by Engineering & Trading Group (ENTRAG agent in Egypt for Emerson Management Process Management). The inspection reports including the test results from the calibration procedures performed during operation are available for check /5/. Although this parameters is not required for the CDM project it is important for the operation of EnviNOx®-System.
Inlet and Outlet temperature of the EnviNOx®-System (not required by AM0028 for this project)	The calibration of the transmitters is performed by Engineering & Trading Group (ENTRAG agent in Egypt for Emerson Management Process Management). The inspection reports including the test results from the calibration procedures performed during operation are available for check /5/. Although this parameters is not required for the CDM project it is important for for follow-up the operation of EnviNOx®-System. It is used to demonstrate that EnviNOx®-System is operating normally.

Further the following systematic measures are in place:

-The EnviNOx system automatic DCS system is equipped with an alarm system in order to take actions immediately when an alarm is activated. Alarms are indicated on the operator console in the control room at AFC. The AFC personnel will take immediate action to solve the problems. Alarm and event logs are available in order to analyse repeating alarms and implement actions accordingly.
-Carbon Egypt has established spare parts on stock on site including recommended spare parts for the analyzer system.
Service contract in place with ENTRAG, EMERSON and Uhde as described in the verification report.
-CDM quality procedures: In addition to the quality control and quality assurance procedures according to AFC quality management system several CDM/QA procedures are implemented for the project activity. Examples of CDM procedures related to quality assurance /7/:

a. "Daily Report" - data file extracted from the Delta V system is to be sent daily to Carbon Austria

b. "Monday Sheets" submitted to Carbon Austria containing analyser check excel file; New analyser check list data excel file; Test gas bottle check excel file; Deviation check; AFC weekly inspection check; AFC & CARBON weekly meeting minutes.
c. Procedure for spare parts management
d. Procedure for manual transportation of data -Ammonia oxidation parameters as nitric acid and ammonia and transfer of data from mdi files to excel sheet.
e. ENTRAG and EMERSON report check: Procedure established to structure the follow-up during on site visits from the service engineers and check of reports received.

The DOE is requested to clarify: How the PP demonstrated that the destruction facility was operational at normal efficiency for the period when the analysers were out of operation (01/07/08 to 12/07/08, and 29/07/08 to 31/07/08).

DNV Response:

EnviNOx®-System comprises one reactor with two catalyst beds arranged in series where nitrogen oxides (NO_X) is reduced by reaction with ammonia in the first bed and nitrous oxide (N_2O) is decomposed to nitrogen and oxygen by using natural gas as the reducing agent in the second bed. The inlet amount of ammonia and natural gas is monitored in order to ensure optimal efficiency of the reactions.

For the periods 1 July to 12 July 2008 and 29 July to 31 July 2008 when the outlet analyser where out of operation due to a chopper failure and for regular calibration/maintenance respectively, it was demonstrated that the destruction facility was operating at normal efficiency as follows:

-The PP demonstrated that the nitric acid plant was in operation by providing monitoring data for ammonia oxidation temperature, ammonia oxidation pressure and ammonia flow to the ammonia oxidation reactor and produced nitric acid. DNV verified these four parameters and were able to confirm that the nitric acid plant were in operation. Further DNV verified that the monitoring data for ammonia oxidation parameters were within the normal ranges of operation /1/, /2/.

-The PP demonstrated that the inlet tail gas flow to the EnviNOx®-System was within the normal range by providing monitoring data and trend curves for the actual period. DNV was able to verify that the tail gas inlet flow were within expected range according to the level of nitric acid production in this period and also within the same range as prior to and after the analyser was out of operation or out for maintenance /1/, /2/, /3/.

-The PP demonstrated that the feed of ammonia to the EnviNOx®-System was within the normal range in order to ensure the NO_X reduction to take place by providing monitoring data for this parameter. DNV was able to confirm that the inlet flow of ammonia to the EnviNOx®-System reactor was within the same range as prior to and after the analyser was out of operation or out for maintenance. 1/, /2/, /3/.

-The PP demonstrated that the feed of natural gas to the EnviNOx®-System was within the normal range in order to ensure N_2O reduction to take place. DNV was able to confirm that the inlet flow of natural gas to the EnviNOx®-System reactor was within the same range as prior to and after the analyser was out of operation or out for maintenance. 1/, /2/, /3/.

-The reactions taking place is exothermic and the PP demonstrated a temperature increase over the reactor by providing the monitoring data for reactor inlet and outlet temperature. DNV was able to verify that the temperature increase was in the range 2-6 ^oC and within the same range as prior to and after the analyser was out of operation or out for maintenance /5/. Note the temperature

increase of 2 ^{o}C in the period 29-30 July is in lower due to the start up following the installation of new primary gauzes (25-27 July) and corresponding lower inlet concentrations.

-The PP demonstrated that the efficiency of reduction of N_2O was within the same range as prior to and after the analyser was out of operation or out for maintenance. The N_2O efficiency calculated 30 June and 13 July was 99.7%. The N_2O efficiency calculated 28 July and 1 August was 99.7% and 99.5 % respectively.

The situation of failure in outlet analyser was earlier observed for monitoring period 1 September 2007 to 30 September 2007. DNV requested at that time an explanation from PP regarding how it could be verified that the EnviNOx®-System was operating normally. The PP provided a statement by the technology supplier Uhde at that time as follows /4/:

"The Uhde EnviNOx®-System for the abatement of N2O and NOx emissions, especially from nitric acid plants, is characterised by the stability of its catalysts. Our observations from work in the miniplant in Linz, Austria and in the commercial scale reactors that have been in operation for dome time indicate that, after a possible initial activation phase which may last for up to a few days, any change in the activity of an EnviNox catalyst – if it takes place at all – occurs slowly and monotonically "

The efficiency used in the period of the outlet analyser being out of operation or out for maintenance is 98.12 %. This value is the historical minimum N_2O removal rate for normal operating days of the previous campaigns. This value (98.12%) and the historical minimum methane oxidation factor (88.34%) have been used for the determination of emissions reductions. The applied approach is hence conservative and in compliance with the registered monitoring plan for the project activity, AM0028 version 1 and para 109 (b) of the report of the 26th meeting of the CDM Executive Board.

The project proponent has provided sufficient documentation to demonstrate that the EnvoNOx system was in normal operation during the period when the N_2O analyser was out of function.

References

/1/ CDM Project Spreadsheet for the verification period from 1 July 2008 to 30 September 2008:

- Summary Spreadsheet of monitoring parameters
- Spreadsheet of operating data and permitted ranges
- Spread sheet with zero readings
- Spread sheet of error log (alarms and actions from Delta V)
- Summary spread sheet of emission reduction calculations (as submitted to UNFCCC for CER issuance and including ammonia oxidation reactor parameters and nitric acid production and checks for permitted operating ranges).
- Spread sheet: MR 8 Maha 1 and 3 corrected details_dg.xls

/2/ AFC daily monitoring reports (verified at site)

MDI files generated by Delta V system. 1 July 2008 to 30 September 2008

/3/ Trend curves for the mentioned periods for the parameters:

- NOx inlet to EnviNOx reactor

- N_2O inlet EnviNOx reactor
- Tail gas inlet flow EnviNOx reactor
- Tail gas flow downstream of EnviNOx reactor
- Ammonia inlet mass flow to EnviNOx reactor

Delta V Charst: NH3 in_26 July to 03 August 2008.mdi; NH3 in_28 June to 15 July 2008.mdi; CH4 in_26 July to 03 August 2008.mdi; CH4 in_28 June to 15 July 2008.mdi; Temp_26 July to 03 August 2008.mdi; Temp_28 June to 15 July 2008.mdi; N2O inlet June to August 2008; N2O outlet June to August 2008; Tail gas flow_26 July to 3 August 2008; Tail gas flow_28 June to 14 July 2008

/4/ Letter from Uhde regarding performance of EnviNOx during interruptions in Monitoring. Dated 11 October 2007.

/5/ Abu Qir Monthly Check reports:
ENTRAG: "Abu Qir Inspection Visit report" dated August 2008
ENTRAG: "Abu Qir Inspection Visit report" dated September 2008
Emerson Process Management: Visit reports dated 28 July to 1 August 2008.

/6/ Calibration certificates for:

-Ammonia flow to AOR, flow meter: FI- 21401

-Ammonia oxidation reactor thermocouples TI-21014/15 and TI-21020/21

-Ammonia oxidation pressure P-21353

-Nitric acid production flow transmitter: FT- 21411

/7/ Procedures for Carbon Egypt CDM project at the Catalytic N_2O Destruction Project in the Tail Gas of the Nitric Acid Plant of Abu Qir Fertiliser Co.

Attachments:

1. Emerson Process Management: Visit reports dated 28 July to 1 August 2008.
2. Letter from Uhde regarding performance of EnviNOx during interruptions in Monitoring. /4/
3. Delta V charts as given in reference /3/

We sincerely hope that the Board accepts our above explanations.

Yours faithfully
for DET NORSKE VERITAS CERTIFICATION AS

Michael Lehmann
Technical Director
Climate Change Service

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