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Att: CDM Executive Board

Your ref.:  
CDM Ref 1443

Our ref.:  
YKK/TRIKA/MLEH

Date:  
19 January 2008

## Response to request for review

**“Catalytic reduction of N<sub>2</sub>O emissions with a secondary catalyst inside the ammonia reactor of the nitric acid plant at Dongbu Hannong Chemicals Ltd., Ulsan Korea.” (1443)**

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 CERs for the monitoring period 1 April 2008 to 15 May 2008 of project activity 1443 “Catalytic reduction of N<sub>2</sub>O emissions with a secondary catalyst inside the ammonia reactor of the nitric acid plant at Dongbu Hannong Chemicals Ltd., Ulsan Korea (“Dongbu”)), 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.

### ***Request 1:***

*The PP shall submit all the required monitoring parameters at the intervals required by the methodology.*

### **DNV Response:**

DNV is referring to the response given by the project participant (PP) and the submitted verification report chapter 3.4 “Assessment of monitoring parameters” and related excel files provided from the PP during verification /1/. In addition to the reported assessments and observations for the monitoring parameters the monitoring frequency for the parameters was verified as given below:

### *Ammonia oxidation plant operating data:*

Parameter name	Frequency required by AM0034 version 2	DNV assessment/observation *)
<b>OT<sub>h</sub></b> -Oxidation temperature	Every hour	The data acquisition system of the nitric acid plant accumulates the analogue plant operating data from the Process Control System (PCS) into a PC. Minute average data is generated. Hourly average values are extracted and converted into EXCEL format to get a complete data set which is then imported into the N.serve Database

		Management System (N.DBMS). It was verified by DNV that the oxidation temperature is recorded at the required frequency according to the methodology AM0034 v2.
<b>OPh</b> -Oxidation pressure	Every hour	Same as OTh
<b>AFR</b> -Ammonia gas flow rate to AOR	Continuously	Same as OTh
<b>AIFR</b> - Ammonia to Air ratio	Every hour	Same as OTh
<b>NAP</b> - Nitric Acid production (100% concentrate)	Daily	100% nitric acid is calculated from the measurements from the mass flow meter, the density and temperature. The density is measured three times a day in the laboratory. The specific concentration is derived from a standard specific gravity table. Each day the total production volume of the nitric acid plant is calculated according to a specific formula /1/. Hence it is verified that the monitoring frequency is according to AM0034 v2.
<b>GS<sub>BL</sub></b> Gauze supplier for baseline campaign	Each campaign	Catalyst supplier information is available for each campaign from supplies invoices. /1/
<b>GC<sub>BL</sub></b> Gauze composition for baseline campaign	Each campaign	Catalyst gauze composition information is available for each campaign from supplies invoices. /1/

\*) Prior to the start of the CDM project activity, the plant operating parameters were recorded in a handwritten log-book as a spot value every two hours. As described in the PDD, the historic campaigns' operating parameters have been derived from this log.

The handwritten log is still continued as a back-up in case the PC storing the data from the PCS has problems or is down for a period of time.

Stack gas emission data:

Parameter name	Frequency required by AM0034 version 2	DNV assessment/observation
<b>VSG<sub>BC</sub></b> Normal gas volume flow rate of the stack gas during baseline	Every 2 sec	The analyser unit contains its own Central Processing Unit (CPU) which receives the NCSG (converted from 4-20 mA analogue data into digital signal). This CPU generates minute-by-minute average values from the 2 second raw data which are sent via Ethernet cable to the same PC in the control
<b>VSG</b> Normal gas volume flow rate		

of the stack gas during project		room that collects the plant operating data. It is confirmed at the site visit that the raw data is available at a 2 second frequency. During the QAL 2 and Annual Surveillance Test (AST) the correct implementation of the correction of VSG to standard conditions was audited by independent testing laboratories with EN ISO/IEC 17025 accreditation (SGS) /2/.
<b>NCSG<sub>BC</sub></b> N <sub>2</sub> O concentration in the stack gas during baseline campaign  <b>NCSG</b> N <sub>2</sub> O concentration in the stack gas during project campaign  (tN <sub>2</sub> O/Nm <sup>3</sup> )	Every 2 sec	It is confirmed at the site visit that the raw data is available at a 2 second frequency.
<b>TSG</b> Temperature of stack gas	Every 2 sec	Process temperature is measured with a single pipe penetration at a 2 sec interval.
<b>PSG</b> Pressure of stack gas	Every 2 sec	Static pressure is measured with a single pipe penetration at 2 sec interval.

During the verification, the separate excel file for historic campaigns (5 historic campaign data rev\_1.xls), baseline campaign (Baseline 070406-070614 (hourly avg) rev\_1.xls (hourly baseline campaign data)) and project campaign (Project 080226~080515 (hourly avg) rev\_1.xls) hourly raw data) as well as handwritten log-book was verified /1/. Those excel files are re-arranged by PP as the attached excel file to the PPs response to this request for review. There are separate folders for historic campaigns, baseline campaign and project campaign. Other required parameters (calculated) is based on the submitted data for monitored parameters and verified as described in the verification report /1/. As N.Serve has developed the N.serve Database Management System (N.DBMS) for data handling and processing only the excel sheet including the emission reductions calculations together with the monitoring report (explaining the queries used for the statistical tests and calculation within the program) were originally submitted for the request of issuance. It should be noted that N.Serve has in place routines to ensure that the correct data is used in the N.DBMS program. To ensure that the calculations are done correctly, plausibility checks are done by N.serve using manual EXCEL calculations on the received data from the plant. For example the average values for the different parameters are calculated by EXCEL and compared to the results of Query 1 of the N.DBMS calculation.

### **Request 2:**

*Further clarification is required on how the baseline data were accepted since the equipment used for baseline monitoring does not follow EN 14181 as specified by the methodology.*

### **DNV Response:**

DNV verification team accepted the baseline data based on following reasons:

The N<sub>2</sub>O analyser installed during the baseline campaign, ADC MGA 3000, was tested according to the QAL 2 procedure conducted by SGS Environmental Services (SGS). SGS is accredited according to EN ISO/IEC 17025 /3/. The aim of the QAL 2 procedure was to ensure that the N<sub>2</sub>O measurement system comply with the requirement of the European standard EN 14181. The test program also included the main items of QAL 1 of the European standard EN 14181. From the test report it was verified that the program included:

- Functional test (control of installation of equipment, visual inspection of the sampling system and analyser, control of calibration , leak test, determination of response time, check of documentation and records)
- Tests for the calculation of uncertainty of the analyser and the data acquisition system (determination of zero and span drift, check of the linearity of the analyser, check of the correspondence of the measured values of the analyser with the recorded values of the data acquisition system)
- Determination of the calibration function and calculation of the variability (comparative measurements with the Standard Reference Method (SRM), calculation of the calibration function, calculation of the variability, check if the requirement of the variability are met).
- Estimation of the total uncertainty

The combined standard uncertainty was determined to be  $\pm 5\%$ . DNV verified that the uncertainty was correctly applied for the calculation of the baseline emission factor.

During the QAL2 reference measurements it was determined that the analyzer overestimated the N<sub>2</sub>O concentration in the stack. It was verified that this was corrected by applying a correction factor of 0.945 to all NCSG measurements. Similarly it was also verified that a correction factor (of 1.096) was correctly applied for the stack gas flow.

It is further confirmed that QAL 3, the ongoing quality assurance during operation of AMS, was performed. The calibration frequency (zero and span) was verified to be once a week. The calibration records were verified at the site visit and found to be acceptable. A standard gas certificate was available and verified for the calibration gases (N<sub>2</sub> : 21 June, 2007, N<sub>2</sub>O 21 June, 2007). Further as reported in the verification report the quality assurance and quality control procedures in terms of equipment operation and maintenance as well as data reporting are covered by documented procedures. The nitric acid plant of Dongbu HiTek Co., Ltd. is ISO 9001 certified.

In accordance with EN 14181 an AMS “shall have been proven suitable for its measuring task” (parameter and composition of the flue gas) by use of the QAL1 procedure as specified by EN ISO 14956. Using this standard, it “shall be proven that the total uncertainty of the results obtained from the AMS meets the specification for uncertainty stated in the applicable regulations”.

As explained by the PP at the time of placing the purchase order for the AMS at Dongbu in autumn 2006, only one analyser was available that had been certified suitable for N<sub>2</sub>O monitoring under QAL1 of EN 14181 and ISO 14956. The supplier of the certified analyser however, was at the time unable to provide sufficient local support for the commissioning and servicing of the analyser. Further, it is referred to AM0034 version 2 where the following guidance documents are recommended as references for the Quality Assurance and Control procedures:

- a) European Standard, Technical Committee Air Quality: Working Document, Air quality – Certification of automated measuring systems (AMS). Part 3: Performance specifications and test procedures for AMS for monitoring emissions from stationary sources, prEN 264022, CEN/TC 264:2005/1.
- b) European Norm EN 14181: Quality assurance of automated measuring systems, 2004;

c) Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: Bundeseinheitliche Praxis bei der Überwachung der Emissionen. RdSchr. d. BMU v. 13.06.2005 – IG 12 – 45053/5

Hence it was interpreted that EN 14181 should be used as “guidance” and it was not clear at the time of the commissioning that EN 14181 should be fully complied with. The analyser which could be supported locally was hence selected by the PP.

DNV has verified that an accredited test laboratory (SGS) has reported the main items of QAL 1 (included in the test program conducted during the QAL 2) and that the overall conclusion from the test program is that the equipment used to monitor the N<sub>2</sub>O concentration and flow rate complies with the EN 14181 standard. /2/

It is therefore the opinion of DNV based on the report from SGS Environmental Services and our own verifications that the baseline can be accepted.

## References

- /1/ DNV verification report: “Catalytic reduction of N<sub>2</sub>O emissions with a secondary catalyst inside the ammonia reactor of the nitric acid plant at Dongbu Hannong Chemicals Ltd., Ulsan Korea (“Dongbu”)”. Verification period 1 April 2008 to 15 May 2008.
- /2/ SGS Environmental Services : « Validation N<sub>2</sub>O emission measurements nitric acid plant of Dongbu Hannong Chemical in Ulsan, Republic of Korea « . Author Dirk Peeters. Report no. EZ/07/2023. 31 August 2007. (ADC MGA 3000 N<sub>2</sub>O analyser). Test program was conducted in March and June 2007.
- /3/ SGS accreditation : NEN-EN-ISO/IEC 17025-2000 accreditation no. L-092

We sincerely hope that the Board accepts our above explanations.

Yours faithfully

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