VERIFICATION REPORT

DONAUCHEM NITROUS OXIDE ABATEMENT PROJECT IN ROMANIA

(ITL Project ID: RO1000219)

Monitoring Period:
1 June 2009 to 12 September 2010

REPORT NO. 2011-0703

REVISION NO. 01

DET NORSKE VERITAS

VERIFICATION REPORT

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Summary:

DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions reported for the Joint Implementation (track 1) project activity "DonauChem Nitrous Oxide Abatement Project in Romania" (ITL Project ID RO1000219) for the period 1 June 2009 to 12 September 2010.

In our opinion, the GHG emission reductions reported for the project in the monitoring report (Version 02) of 25 May 2011 are fairly stated.

The GHG emission reductions were calculated correctly on the basis of the approved CDM monitoring methodology AM0034 (version 3.2) and the monitoring plan contained in the Project Design Document of 28 January 2010.

DNV Climate Change Services AS is able to verify that the emission reductions from the Joint Implementation (track 1) project activity "DonauChem Nitrous Oxide Abatement Project in Romania" during the period 1 June 2009 to 12 September 2010 amount to 547 593 tonnes of CO_2 equivalent.

Report No.: 2011-0703	Subject Group: Environment	
Report title: DonauChem Nitrous Oxide Abatement Project in Romania		
Work carried out by: Zuzana Andrtová, Rafi-ud-Din Khawaja, Trine Kopperud		
Work verified by: Weidong Yang		
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Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CH_4	Methane
CL	Clarification request
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DNV	Det Norske Veritas
ERU	Emission reduction units
FAR	Forward Action Request
GHG	Greenhouse gas(es)
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
JISC	Joint Implementation Supervisory Committee
LoA	Letter of approval
N_2O	Nitrous oxide
PDD	Project Design Document
tCO_2e	Tonnes of CO_2 equivalents
UNFCCC	United Nations Framework Convention on Climate Change
GWP	Global Warming Potential

1 INTRODUCTION

MGM Worldwide, LLC. has commissioned DNV Climate Change Services AS (DNV) to carry out the verification of the emission reductions reported for the Joint Implementation (track 1) project activity "DonauChem Nitrous Oxide Abatement Project in Romania" (the project) in the period 1 June 2009 to 12 September 2010. This report contains the findings from the verification and a verification statement for the certified emission reductions.

1.1 Objective

Verification is the periodic independent review and *ex post* determination by an Accredited Independent Entity (AIE) of the monitored reductions in GHG emissions that have occurred as a result of a Joint Implementation (JI) project activity during a defined monitoring period.

The objective of this verification was to verify the emission reductions reported for the "DonauChem Nitrous Oxide Abatement Project in Romania" for the period 1 June 2009 to 12 September 2010.

DNV is an Independent Entity accredited by the Joint Implementation Supervisory Committee (JISC) for all sectoral scopes.

1.2 Scope

The scope of the verification is:

- To verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan.
- To evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement.
- To verify that reported GHG emission data is sufficiently supported by evidence.

The verification shall ensure that reported emission reductions are complete and accurate in order to be certified.

1.3 Description of the Project Activity

Project Parties:	*Romania (Host) and Sweden*
Title of project activity:	*DonauChem Nitrous Oxide Abatement Project in Romania*
ITL Project ID:	RO1000219
CDM baseline and monitoring methodology	*AM0034 (version 3.2)*
Project Entity:	*S.C. DonauChem S.R.L. and MGM International Group LLC*
Location of the project activity:	*Turnu Magurele in Teleorma Province in Romania*

Project's crediting period: 17 July 2009 to 31 December 2012 (should be extended beyond 2012 to 2018 – 10 years operational lifetime).

Period verified in this verification: 1 June 2009 to 12 September 2010. The monitoring report covers date from 1 June 2009 but real project campaign started from 17 July 2009.

1.4 Methodology for Determining Emission Reductions

The project applied a baseline and monitoring methodology approved for CDM projects, i.e. AM0034, version 3.2 "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants" /18/.

The baseline emissions are to be determined by multiplying baseline emission factor ($tN_2O/tHNO_3$), nitric acid production ($tHNO_3$) and the global warming potential of N_2O (GWP: 310). The baseline emission factor was determined from the data obtained during a baseline campaign before De-N_2O catalyst was installed.

The project emission is determined similarly by multiplying project emission factor ($tN_2O/tHNO_3$), nitric acid production ($tHNO_3$) and the global warming potential of N_2O (GWP: 310). Project emission factor was determined from the data obtained during a project campaign after De-N_2O catalyst was installed.

The amounts of N_2O emitted that are used to determine the baseline and project emission factors are the product of N_2O concentration (mgN_2O/m^3) and gas flow rate (m^3/h) monitored at the tail gas line before and after the installation of De-N_2O catalyst, respectively.

The emission reductions are calculated by using the following formula;

$$ER = (EF_{BL} - EF_P) * NAP * GWP_{N2O} \qquad (tCO_2e)$$

where:

ER:	Emission reductions of the project for the Project campaign (tCO_2e)
NAP:	Nitric acid production for the Project campaign ($tHNO_3$). The maximum value of NAP shall not exceed the design capacity.
EF_{BL}:	Baseline emissions factor ($tN_2O/tHNO_3$)
EF_P:	Emissions factor used to calculate the emissions from this particular campaign

The average mass of N_2O baseline emissions per hour is estimated as product of the NCSG and VSG after applying statistical process as per the methodology requirements. The N_2O emissions per campaign are estimates product of N_2O emission per hour and the total number of complete hours of operation of the campaign using the following equation:

$$BE_{BC} = VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC} \qquad (tN_2O)$$

The plant specific baseline emissions factor representing the average N_2O emissions per tonne of nitric acid over one full campaign is derived by dividing the total mass of N_2O emissions by the total output of 100% concentrated nitric acid for that period. The overall uncertainty of

the monitoring system is determined and the measurement error is expressed as a percentage (*UNC*). The N_2O emission factor per tonne of nitric acid produced in the baseline period (EF_{BL}) shall then be reduced by the estimated percentage error as follows:

$$EF_{BL} = (BE_{BC} / NAP_{BC})*(1 - UNC/100) \qquad (tN_2O/tHNO_3)$$

where:

EF_{BL}: Baseline emissions factor ($tN_2O/tHNO_3$)
BE_{BC}: Total N_2O emissions during the baseline campaign (tN_2O)
$NCSG_{BC}$: Mean concentration of N_2O in stack gas during the baseline campaign (mgN_2O/m^3)
OH_{BC}: Operating hours of AORs during the baseline campaign (h)
VSG_{BC}: Mean stack gas volume flow rate in the baseline measurement period (m^3/h)
NAP_{BC}: Nitric acid production during the baseline campaign ($tHNO_3$)

The average mass of N_2O project emissions per hour is estimated as product of the NCSG and VSG. The N_2O emissions per campaign are estimates product of N_2O emission per hour and the total number of complete hours of operation of the campaign using the following equation:

$$PE_n = VSG * NCSG * 10^{-9} * OH \qquad (tN_2O)$$

where:

VSG: Mean stack gas volume flow rate for the project campaign (m^3/h)
NCSG: Mean concentration of N_2O in stack gas for the project campaign (mgN_2O/m^3)
PEn: Total N_2O emissions during the nth project campaign (tN_2O)
OH: Operating hours of AORs in the specific monitoring period (h)

A campaign specific emissions factor is calculated by dividing the total mass of N_2O emissions during that campaign by the total production of 100% concentrated nitric acid during that same campaign as follows:

$$EF_n = PE_n / NAP_n \qquad (tN_2O/tHNO_3)$$

In order to take into account possible long-term emissions trends over the duration of the project activity and to take a conservative approach a moving average emission factor is estimated estimated as follows:

$$EF_{ma,n} = (EF_1 + EF_2 + \ldots + EF_n) / n \qquad (tN_2O/tHNO_3)$$

To calculate the total emission reductions achieved in a campaign, the higher of the two values $EF_{ma,n}$ and EF_n is applied as the emission factor relevant for the particular campaign to be used to calculate emissions reductions (EF_p) in equation given for ER above. Thus:

If $EF_{ma,n} \geq EF_n$ then $EF_p = EF_{ma,n}$

If $EF_{ma,n} < EF_n$ then $EF_p = EF_n$

Further a campaign-specific emissions factor shall be used to cap any potential long-term trend towards decreasing N_2O emissions that may result from a potential built up of platinum deposits. After the first ten campaigns of the crediting period of the project, the lowest EF_n observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in a EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall used EF_{min} and not EF_n As 10 project campaigns are not yet completed this is not applicable to this verification period.

In AM0034 version 3.2 no leakage calculation is required.

2 METHODOLOGY

The verification of the emission reductions has assessed all factors and issues that constitute the basis for emission reductions from the project. These include:

i) Records related to measuring quantity of produced HNO_3 /11//13/;

ii) Emission factors for baseline, 1st and 2nd campaigns calculated as describe above /3/;

iii) Records on validation and/or calibration of the measuring equipment, standards and calculation software /4//8//9//12//14/;

iv) Records related to collected data in AMS system (Sidor NDIR analyzer, flow, temperatures, pressures) /11/;

v) Catalyst information /10/;

Verification team

				Type of involvement					
Role	***Last Name***	***First Name***	***Country***	Desk review	Site visit / Interviews	Reporting	Supervision of work	Technical review	TA5.1 competence
Team leader (Verifier)	Khawaja	Rafi –ud-Din	Norway	✓	✓	✓	✓		
Verifier	Andrtová	Zuzana	Czech Republic	✓	✓	✓			
Expert	Kopperud	Trine	Norway	✓		✓			✓
Technical reviewer	Yang	Weidong	USA					✓	✓

Duration of verification

Preparations:	*From 26 October to 28 October 2010*
On-site verification:	*4 November 2010*
Reporting, calculation checks and QA/QC:	*From 5 April 2011 to 9 June 2011*

2.1 Review of Documentation

Basic document for the verification was the monitoring report for monitoring period from 1 June 2009 to 12 September 2010, version 1 dated 15 October 2010 /2/ and Spreadsheets with raw data and ERU calculation for baseline, 1st and 2nd campaign /3/, which covers first monitoring period and which were submitted prior to the site visit.

In addition, the PDD version 2.13 dated 28 January 2010 /1/ was reviewed simultaneously with DNV determination report /5/ as well as the approved baseline and monitoring methodology AM0034 version 3.2 /18/. The project owner also provided evidences related to QAL1 and QAL2 and AST tests /8//9//15/, information about catalysts and certificates of calibration gases /14/.

All provided documents were assessed in accordance with Romanian Track 1 procedure and JI determination and verification manual /16/.

The primary documents logbooks of nitric acid production /11//13/, weekly maintenance checks /4/ and calibration report /8//9//12//15/, laboratory records, trainings and information about legal requirements were available during the site visit.

2.2 Site Visits

The site visit was performed on 4 November 2010 at DonauChem plant. During the site visit, the following personnel were interviewed or assisted the verification team:

Name	***Organization***	***Position***
Constantin Neagoe	DonauChem	Technical Director
Octavian Tabara	DonauChem	Counsellor
Iulian Iana	DonauChem	AMS supervisor
Sergii Klibus	MGM	Projec Manager
Marilena Filip		Interpreter

2.2.1 Audit Programme

08:00 Opening meeting - Project implementation and JI project management and responsibilities
- Project status; deviations to the monitoring plan
- Operational and management structure of the project.

08:30 Assessment of monitoring equipment and calibration procedures incl. plant inspection (AOR)
- Ammonia oxidation reactor (AOR) monitoring equipment -inspection
- Calibration routines and documentation for all AOR parameters
- Documentation of primary catalyst installations (baseline - and project campaigns)
- Documentation of secondary catalyst installed (project campaigns)

10:00 Permitted Operating Conditions & the Baseline campaign data
- Checking the historical campaign data
- Checking baseline campaign AOR parameters (operational logs and monitored data)
- Checking statistical test/analysis
- Final verification of the permitted operating conditions and the baseline campaign data

11:30 Assessment of monitoring equipment and calibration procedures including plant inspection
- N2O analyzer and stack gas flow meter
- QAL1 certificates and QAL 2 test reports
- Calibration routines and calibration gases
- Determination of overall uncertainty of the automated measuring system (AMS)
- Nitric acid production and mass balance calculations

14:00 Check of raw data for baseline- and project campaigns
- Assessment of raw data for baseline campaign incl. trend curves
- Assessment of raw data for project campaigns including trend curves
- Calculation spread sheets

16:00 Assessment of Management system and Quality assurance
- Procedures for training of monitoring personnel
- Procedures for maintenance of monitoring equipment (spare parts, service agreements with supplier)
- Procedures to handle unexpected problems (troubleshooting)
- Procedure for accessing the data
- Routines for handling, archiving and securing of all required data; transfer of data to MGM
- Procedure for internal audit
- Procedure for follow-up regulation on N_2O and NO_x emissions

17:00 Preparation for close-out meeting
17:30 Close-out meeting and presentation of findings

2.2.2 Assessment

Data and information provided by project participants were assessed and confirmed with primary records /11//13/ provided during the site visit and interviews with personnel at DonauChem and MGM. Procedures established for ensure monitoring and recording of individual parameters /7/ required by monitoring plan and monitoring methodology AM0034, version 3.2 /18/ were presented to verification team for assessment.

This has enabled the verification team to assess the accuracy and completeness of the reported monitoring results and to verify the correct application of the approved monitoring methodology and the determination of the reductions in N_2O emissions except findings found and reported in this document. All issued CARs and CLs were properly solved by project participants prior to finalization of this version of report.

2.3 Reporting of Findings

A corrective action request (CAR) is issued, where:

i. Non-conformities with the monitoring plan or methodology are found in monitoring and reporting, or if the evidence provided to prove conformity is insufficient;
ii. Mistakes have been made in applying assumptions, data or calculations of emission reductions which will impair the estimate of emission reductions;
iii. Issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants.

A clarification request (CL) shall be raised if information is insufficient or not clear enough to determine whether the applicable JI requirements have been met.

A forward action request (FAR) is issued for actions if the monitoring and reporting require attention and/or adjustment for the next monitoring period.

Three CARs were issued mostly related errors in ERUs calculation spreadsheets and two CLs related to NAP calculation and Shewarts diagram. The CARs and CLs were sufficiently solved prior to finalization of this version of the report. Five FARs were identified also during this verification which will be reviewed during next verification period.

3 VERIFICATION FINDINGS

This section summarises the findings from the verification of the emission reductions reported for the "DonauChem Nitrous Oxide Abatement Project in Romania" for the period 1 June 2009 to 12 September 2010.

3.1 Remaining Issues, CARs, FARs from Previous Validation or Verification

Two FARs were opened from determination. First FAR was related to calculation of baseline campaign and operational conditions and the request were transformed to CAR1 and CAR2 of this verification. Both of the CARs were solved by project participant and closed. Thus the FAR1 is closed too.

Second FAR was related to calculation of confidence interval of data. The calculation was provided and deemed correct. The FAR2 is closed

For more details see Appendix A.

3.2 Project Implementation

The project is fully implemented in accordance with the approved PDD /1/ and the baseline campaign was from 31 May 2008 to 31 May 2009. DNV has verified the actual project implementation by means of site visit and document review /8/ /9/ /10/ /14/ /15/.

Campaigns covered in this verification period:

The 1st project campaign started on 5 June 2009 and was finished on 12 March 2010. The 2nd project campaign started on 13 March 2010 and was finished on 12 September 2010.

The determination of the permitted operating ranges and the monitoring data in the baseline campaign is verified by DNV during this 1st periodic verification.

The types of the primary and secondary catalysts used during the both project campaign were confirmed to be identical with the baseline campaign and the historical project campaigns through the certificates of catalysts and the catalyst invoices /10/.

In addition, for N_2O analyser, weekly checking was performed by Shewhart chart /4/. The QAL1 /9/, QAL2 /8/ and annually AST test /15/ have been presented.

3.3 Completeness of Monitoring

The monitoring of the project is complete and in accordance with the approved monitoring methodology AM0034 version 3.2 /18/. All parameters stated in the monitoring plan are monitored and reported appropriately. The monitoring arrangements and sustaining records are sufficient to enable verification of emission reductions.

DonauChem used Sidor Sick Maihak NDIR analyzer for N_2O concentration monitoring and Sick Maihak model FLSE100 for monitoring stack gas flow rate. The provided QAL1 and QAL2 tests as well as AST test were reviewed during the desk review and the site visit /8/ /9/ /15/. The QAL1 test was realized by TÜV Nord Umweltschutz GmbH & Co. KG for Sidor on 28 March 2007 and by TÜV Rheinland Group for Flowsick 100 on 8 May 2007.

QAL2 test was done by SGS Environmental Services in October 2008 /8/. As was found that the Sidor had an offset in linearity, which was corrected on 8 October 2008 thus two different correction factors are used in baseline campaign calculation as well as uncertainty was calculated from two uncertainties for data before and after correction. The application of all these factors was verified during this verification.

The AST test was realized by SGS Environmental Services in November 2009 and confirmed that as Sidor so Flowsick are in compliance with standard (EN 14181).

As QAL3 realization was provided records and Shewart chart /4/. The zero and span correction is provided every week and the data are resulted to the Shewart chart. The chart shows some abnormality, which were corrected by span and zero calibration.

All main parameters stated in the monitoring plan are monitored and reported appropriately except for the observations described in the CARs. The CARs was addressed properly in the revised monitoring report (version 2 of 25 May 2011).

3.4 Accuracy of Emission Reduction Calculations

According to AM0034 /18/, the emission reductions for the project activity over a specific campaign were determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid in the period from 1 June 2009 to 12 September 2010 and the GWP of N_2O.

The calculations used to determine the baseline emission factor, the project emission factor and the emission reductions were correctly applied according to AM0034 /18/. It was confirmed through checking the spreadsheets /3/ provided from the project participants. The detailed assessment is described as follows.

3.4.1 Campaign length

The length of the 1st project campaign is 108 360 $tHNO_3$ and the length of the 2nd project campaign is 117 588 $tHNO_3$. Both of the campaigns are longer than the average historical campaign length (92 859 $tHNO_3$). Further length of the baseline campaign is 88 516 $tHNO_3$. Thus the CL_n is longer than CL_{BL}, thus all the N_2O values that were measured during the baseline campaign can be used for the calculation of baseline emission factor and the same is valid for the two project campaigns.

3.4.2 Baseline emission factor

According to the AM0034 Version 3.2, the baseline emission factor is calculated by dividing the total mass of N_2O emissions by the total output of 100% concentrated nitric acid produced in the baseline period and then reduced by the overall uncertainty of the monitoring system.

In order to determine the baseline emission factor, the overall uncertainty of the monitoring system has been determined by QAL2 report which was carried out by SGS Environmental Services in October 2008 /8/.

The baseline emission factor is calculated 0.00824 $tN_2O/tHNO_3$. The baseline calculation was verified by DNV during this verification and deemed correct.

3.4.3 Project emission factor

According to the AM0034 Version 3.2, the campaign specific emissions factor (EF_n) is

calculated by dividing the total mass of N_2O emitted during that campaign by the total production of 100% concentrated nitric acid during the campaign.

The project emission factor for the 1st project campaign is calculated to be 0.00024 $tN_2O/tHNO_3$. The project emission factor for the 2nd project campaign is calculated to be 0.00059 $tN_2O/tHNO_3$. The project emission factors calculations were verified by DNV during this verification and deemed correct.

3.4.4 Moving average emission factor

The moving average project emission factor up to 2nd campaign was 0.000415 $tN_2O/tHNO_3$ and it is lower than project emission factor for the 2nd campaign of 0.00059 $tN_2O/tHNO_3$. Thus the emission factor for the 2nd project campaign is to be applied as the particular emission factor for the campaign towards emission reduction calculations.

3.4.5 Nitric acid production

The nitric acid production during the monitoring period was assessed as follows;

The nitric acid production is 108 360 $tHNO_3$ for the 1st project campaign and 117 588 $tHNO_3$ for the 2nd campaign. Daily designed production is 725 $tHNO_3$.

The 1st campaign covers 3 722 hours, which correspond with 155 days and 112 435 $tHNO_3$ of the designed capacity, this result confirmed that the nitric acid production in the same period is below designed capacity of the plant.

The 2nd campaign covers 4 005 hours, which correspond with 167 days and 120 984 $tHNO_3$ of the designed capacity and the result again confirmed that the production is lower than designed capacity of the plant.

3.4.6 Comparison of emission reductions

The predicted emission reductions in the approved PDD are 174 233 tCO_2e for 2009 (from 17 July 2009 to 31 December 2009 i.e. for 167 days) and 488 756 tCO_2e for 2010 (365 days). Thus, the daily emission reductions estimated in the PDD are 1 043 tCO_2e/day and 1 339 tCO_2e/day for 2009 and 2010, respectively. The emission reductions for both the campaigns, which covers period 1 June 2009 to 12 September 2010 (i.e. 559 days) are 516 073 tCO_2e. This corresponds to 1000 tCO_2e/day of daily emission reductions for the monitoring period. Thus the actual emission reductions are lower than the one estimated in the PDD.

The emission reductions and the relevant values are compared in the following table:

Parameters	Values in the approved PDD	Values obtained during 1st campaign period	Values obtained during 2nd campaign period	Comparison of current with PDD values
Baseline Emission Factor	0.00867 $tN_2O/tHNO_3$	0.00824 $tN_2O/tHNO_3$	0.00824 $tN_2O/tHNO_3$	95% / 95%
Project Emission Factor	0.001371 $tN_2O/tHNO_3$	0.00024 $tN_2O/tHNO_3$	0.00059 $tN_2O/tHNO_3$	18% / 43%
N_2O	84%	97%	92%	-

destruction Efficiency				
Nitric Acid Production	725 $tHNO_3$/day	699 $tHNO_3$/day	705 $tHNO_3$/day	96% / 97%

3.5 Quality of Evidence to Determine Emission Reductions

The main data are collected by common AMS system and software used is Sick Maihak system covers Sidor Sick Maihak NDIR N_2O analyser, Sick Maihak model FLSE flow meter with transducer FLE-100, temperature measurement PT 100 and pressure sensor ABB.

The verification team confirmed the consistency of the logbooks /11/ and excel sheets /3/. Errors, which were found was corrected prior to finalization of this report.

Calibration of test measurement devices was demonstrated by individual certificates presented on site /8//9//12//14//15/. All calibrations were found as correct and cover whole period of both campaigns.

The NDIR N_2O analysers have been calibrated once every week by a built-in calibrator with standard test gases /14/. The calibration frequency is in line with the recommendation of producer. The certificates of the test gases /14/ were available for verification and they are valid for whole period covers both campaign.

The other measurements are performed by calibrated equipment according to the documented calibration procedures. The key data were also cross-checked by the verification team via other sources, such as production log sheets and meters available in the operators control room or on-site.

3.6 Assessment of Monitoring Parameters

3.6.1 Historical data and permitted operating conditions

The historical data and the permitted operating conditions have been verified during this 1st periodic verification by DNV and the values are summarized in the following table:

Data variable	**Reported value**
Design capacity	725 $tHNO_3$/day
OT_{normal} Normal operating temperature of ammonia oxidation reactors	805 - 839 °C
OP_{normal} Normal operating pressure of ammonia oxidation reactors	210 - 290 kPa
AFR_{max} Maximum ammonia input to AOR	10.372 $kgNH_3$/h (13 672.27 Nm^3/h)
$AIFR_{max}$ Maximum ammonia input to air ratio	0.0895 kg/kg
CL_{normal}	92 859 $tHNO_3$

Normal campaign length	
GS_{normal}	Umicore
GC_{normal}	Pt 95%, Rh 5%

3.6.2 Monitored data for baseline emissions within the project boundary

The verification of the baseline campaign data and the determination of the baseline campaign emission factor were done during this verification period. The baseline campaign was from 31 May 2008 to 30 May 2009. The verification of the baseline campaign data and the determination of the baseline campaign emission factor were verified against primary data from logbooks, mass balance summary tables for HNO_3 production and production reports presented during site visit.

The following parameters, corresponding equipments and related documentations have been assessed in detail:

Data variable	**Tag. No.**	**Reported value for the baseline campaign period*)**
VSG_{BC} Normal gas volume flow rate of the stack gas during baseline campaign	Flowsick FLSE 100 ABB Range for pressure compensation (Monitoring range: 800 – 1200 mbar) PT100 for temperature compensation (Monitoring range: 0-200 °C)	89 561 Nm^3/h
$NCSG_{BC}$ N_2O concentration in the stack gas during the baseline campaign (mgN_2O/Nm^3)	SIDOR Sick-Maihak (monitoring range 0-2000 ppm)	2 658 mgN_2O/Nm^3
NAP_{BC} $tHNO_3$ Nitric acid 100% concentrated produced over a baseline campaign	Measured by float type level indicator and controlled by mass balance	88 516 $tHNO_3$
OH_{BC} Operating hours during baseline campaign	N/A	3 225 hours
EF_{BL} Emission factor	Calculated	0.00824 $tN_2O/tHNO_3$

for baseline period		
GS_{BL} Gauze supplier for baseline campaign	N/A	Umicore
GC_{BL} Gauze composition for baseline campaign	N/A	Pt 95%, Rh 5%

3.6.3 Monitored data for project emissions within the project boundary

The verification of the project campaigns data were provided during this verification period. The 1st project campaign covers period from 1 June 2009 to 12 March 2010 and 2nd project campaign is dated 13 March 2010 to 12 September 2010. The verification of project campaigns data and the project campaigns' emission factors were verified against primary data from logbooks and production reports presented during site visit.

The only emission source from the project is the remaining quantity of N_2O in the stack gas. The following parameters, corresponding equipments and related documentations have been assessed in detail:

Data variable	**Tag. No.**	**Reported value for the baseline campaign period*)**	**Assessment/Observation**
VSG Normal gas volume flow rate of the stack gas during project campaign	Flowsick FLSE 100 ABB Range for pressure compensation (Monitoring range: 800 – 1200 mbar) PT100 for temperature compensation (Monitoring range: 0-200 °C)	1st campaign: 90 832 Nm^3/h 2nd campaign: 87 916 Nm^3/h	The stack gas flow rate is continuously measured with an ultra-sound Flowsick FLGE flow meter with pressure and temperature measuring function for normalization. The normalized flow is recorded as well as pressure and temperature reading. The flow rates have been measured every second and 60 seconds average have been recorded. Although AM0034 specifies the measurement frequency as "every 2 seconds", every second data is acceptable in terms of accuracy. The monitoring ranges of the equipments are appropriate. The calibration frequencies of the

			equipment are once per year by AST/QAL2. The calibration records were available for verification. It was conducted on October 2008 (QAL2) /8/for all three equipments and November 2009 (AST) /15/ The project campaign period was confirmed to be covered through the calibration record.
NCSG N_2O concentration in the stack gas (mgN_2O/Nm^3)	SIDOR Sick-Maihak (monitoring range 0-2000 ppm)	1st campaign: 77.98 mgN_2O/Nm^3 2nd campaign: 198.5 mgN_2O/Nm^3	N_2O concentration in the stack gas during the project campaign is continuously measured with a non-dispersion infrared absorption analyzer Sidor Sick Maihak. The N_2O concentration has been measured every second and 60 seconds average have been recorded. Although AM0034 specifies the measurement frequency as "every 2 seconds", every second data is acceptable in terms of accuracy. The monitoring ranges of the equipments are appropriate. The calibration has been conducted once every week using standard test gases according to the manufacturer recommendation. The calibration records and Shewart chart /4/ were available for verification.
NAP $tHNO_3$ Nitric acid 100% concentrated produced over a project campaign	Measured by float type level indicator and controlled by mass balance	1st campaign: 108 360 $tHNO_3$ 2nd campaign: 117 588 $tHNO_3$	The nitric acid is measured with a float type level indicator and controlled by mass balance Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
OH Operating hours during project campaign	N/A	1st campaign: 3 722 hours 2nd campaign: 4 005	The operating hours is determined from the primary logbooks
EF_n Project emission factor	Calculated	EF_1 = 0.00024 $tN_2O/tHNO_3$ EF_2 = 0.00059	The value has been calculated from monitoring data using the algorithm described in report. The calculations are exported to a spread

for n^{th} campaign		$tN_2O/tHNO_3$ As $EF_{ma,2}$ is lower than the emission factor for the 2^{nd} project campaign thus $EF_{2\ is}$ applied for calculating project emission. Refer to Moving average emission factor: $EF_{ma,n}$: 0.000415 $tN_2O/tHNO_3$ = $EF_{ma,2}$	sheet and its calculations have been checked and found to be correct. Hourly raw data was made available for verification.
$GS_{project}$ Gauze supplier for project campaign	N/A	Umicore	The supplier of the ammonia oxidation catalysts used during 1^{st} and 2^{nd} campaign were confirmed to be identical with the previous historical campaigns and baseline campaign
$GC_{project}$ Gauze composition for project campaign	N/A	Pt 95%, Rh 5%	The type of the ammonia oxidation catalysts during 1^{st} and 2^{nd} campaign were confirmed to be identical with the previous historical campaigns and baseline campaign

3.6.4 Other factors and calculated parameters

The following parameters are used in the calculation of emissions reductions or are parameters needed to be reported in relation to regulation of N_2O emissions. The verification team has manually checked the calculated values by use of raw data. Other data as required according to AM0034 version 3.2 has been checked as described below and the source of data has also been checked by DNV.

Data variable	Reported value	Assessment/ Observation
$EF_{ma,n}$ Moving average emission factor after n^{th} campaign	At 2^{nd} campaign: 0.000415 $tN_2O/tHNO_3$	**$EF_{ma,2}$** = (EF_1 + EF_2) / 2 = (0.00024 + 0.00059) / 2 = 0.000415 $tN_2O/tHNO_3$ < EF_2 Then EF_P = EF_2 = 0.00059 $tN_2O/tHNO_3$ The determination approach is in line with AM0034 version 3.2.
EF_{min} The lowest of EF_n observed during the first ten campaigns of the project crediting period	N/A	N/A

EF_{reg} National regulation on N_2O emissions	No regulation	Three kinds of legislation movement on N_2O emissions have been assessed; - An absolute cap on the total volume of N_2O emissions for a set period - A relative limit on N_2O emissions expressed as a quantity per unit of output - A threshold value for specific N_2O mass flow in the stack

3.6.5 Emissions outside the project boundary and leakages

There are no additional emissions to be recorded outside the project boundary or any leakages related to the project activity.

3.7 Management System and Quality Assurance

The project is operated by DonauChem. The monitoring and reporting of data under the JI activity have been conducted by the collaboration of DonauChem and MGM International. The quality assurance and quality control procedures in terms of equipment operation and maintenance as well as data reporting are covered by the documented procedures.

Data handling solutions involve redundancy, data manipulation protection, integrity check as well as proper archiving.

4 VERIFICATION STATEMENT

DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions that have been reported for the Joint Implementation (track 1) project activity "DonauChem Nitrous Oxide Abatement Project in Romania" (ITL Project ID: RO1000219) for the period 1 June 2009 to 12 September 2010.

The project participants are responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the project.

It is DNV's responsibility to express an independent verification statement on the reported GHG emission reductions from the project. DNV does not express any opinion on the selected baseline scenario or on the validated and registered PDD.

DNV conducted the verification on the basis of the CDM monitoring methodology AM0034 (version 3.2), the monitoring plan contained in the registered Project Design Document of 28 January 2010 and the monitoring report (Version 02) dated 25 May 2011. The verification included i) checking whether the provisions of the monitoring methodology and the monitoring plan were consistently and appropriately applied and ii) the collection of evidence supporting the reported data.

DNV's verification approach draws on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. DNV planned and performed the verification by obtaining evidence and other information and explanations that DNV considers necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

In our opinion the GHG emissions reductions of the Joint Implementation (track 1) project activity "DonauChem Nitrous Oxide Abatement Project in Romania" (ITL project ID RO1000219) for the period 1 June 2009 to 12 September 2010 are fairly stated in the monitoring report (Version 02) dated 25 May 2011.

The GHG emission reductions were calculated correctly on the basis of the approved CDM baseline and monitoring methodology AM0034 (version 3.2) and the monitoring plan contained in the registered PDD of 28 January 2010.

DNV Climate Change Services AS is able to verify that the emission reductions from the Joint Implementation (track 1) project activity "DonauChem Nitrous Oxide Abatement Project in Romania" during the period 1 June 2009 to 12 September 2010 amount to 547 593 tonnes of CO_2 equivalent.

Oslo, 9 June 2011

Rafi-ud-Din Khawaja
Verifier
DNV City, Country

Michael Lehmann
Director of Services and Technologies
DNV Climate Change Services AS

5 REFERENCES

Documents provided by the Project Participants that relate directly to the GHG components of the project. These have been used as direct sources of evidence for the periodic verification conclusions, and are usually further checked through interviews with key personnel.

/1/ MGM International: Project design document for the "DonauChem Nitrous Oxide Abatement Project", version 2.1, 28 January 2010

/2/ MGM International: Monitoring report, version 2 dated 25 May 2011 (previous version 1 dated 15 October 2010

/3/ MGM International: Donau First Project Campaign -25-05-11.xls
Donau Second Project Campaign -25-05-11.xls
Baseline EF calculation Donau_25-05-11_sk.xls
New historical data-Donau_04042011.xls

/4/ MGM International: Stewart charts – Donau 18-02-11.xls

/5/ DNV : JI Determination report No.2008-1335, rev. 01 dated 3 May 2010

/6/ IPPC Permit (Nr.157 from 29.10.2007) - N2O reduction via JI project Appendix 10.8 and Action plan (Valid until 31.12.2013)

/7/ S.C. DonauChem SRL: Working procedure for monitoring data regarding the greenhouse gas emissions (N_2O) of the nitric acid plant**.** Code: P.Ld.-05-01. Edition 2008/1

/8/ SGS Environmental Services: QAL2 report. Investigation period October 2008.

/9/ QAL 1 certificates according to En 14181 and ISO 14956:
-TÜV Rheinland Group: QAL 1 for Flowsick 100-USD (tail gas flow meter)
- TÜV Nord Umweltschutz GmbH & Co. KG for Sidor N_2O analyser.

/10/ Catalyst invoices and gauzes information dated 12 January 2006, 4 August 2006, 9 February 2007, 26 March 2007, 23 October 2007, 3 January 2008, 14 February 2008, 17 July 2008, 5 Dercember 2008, 14 July 2009, 19 January 2010, 30 April 2010 and 7 September 2010

/11/ S.C. DonauChem SRL: Production logbook and operational reports scanned copies for period 2005 till 2010

/12/ SC Timarom Star SRL: Calibration certificates for tanks' float-level indicators historical and from 14 February 2011 (No. 277-TM.ST.-11, 278-TM.ST.-11, 279-TM.ST.-11)

/13/ S.C. DonauChem SRL: Technical report of production 2008, 2009 and 2010 with Mass balance for 2008, 2009 and 2010

/14/ Linde: Sampling gases certificates for N_2O: cylinder No. 335 691 dated 14 August 2007 and valid till 14 August 2008, cylinder No. 335700 dated 5 March 2008 and valid till 5 March 2009, cylinder No. K-76-80-239 dated 21 July 2009 and valid till 21 July 2010 and cylinder No. 2367964 dated 5 August 2010 and valid till 5 August 2011

/15/ SGS Environmental Services: AST report Investigation period November 2009

Background documents related to the design and/or methodologies employed in the design or other reference documents.

/16/ JI Supervisory Committee, Determination and verification manual, version 01 adopted at JISC 19

/17/ JI Supervisory Committee, Guidance on criteria for baseline setting and monitoring, version 02 adopted at JISC18

/18/ CDM-EB: *Approved Baseline and Monitoring Methodology AM0034 - "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants"*, Version 3.2, 14 March 2008

/19/ Feasibility study, IPRAN design Institute for Inorganic Chemistry and non Ferdous metals. Approval of feasibility study. Licence No. 135 date of issue 5 Feb. 1966

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APPENDIX A

CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS

Corrective action requests

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 1	Referring to FAR 1 from the determination report the strange development of N_2O concentration (concentration values exceeding 6000 mgN_2O/m^3) after the shutdown period ending on 01 March 2009 until 12 March 2009, it has been stated that these values do not represent the actual concentrations due to errors that occurred during QAL 3 calibration procedures and thus these could not be deemed correct. These values need to be conservatively corrected or removed from the calculations as per the requirements of the methodology. It should also be noted that the measurement range of the of the analyzer is 0-4000 mgN_2O/m^3, however some of the values measured after 23 March 2009 are also exceeding the measurement range of the analyzer and thus these values also need to be conservatively corrected or removed from the calculations as per the requirement of the methodology.	EF_{BL} has been recalculated. For the period 01 March 2009 until 12 March 2009 emissions have been recalculated on the base of 4,5 $kgN_2O/tHNO_3$ conservative factor. All values during baseline period that was higher than 4000 mgN_2O/m^3 have been replaced by 4000 mgN_2O/m^3	The recalculated baseline data was provided to DNV and deemed correct. The CAR is closed.

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 2	During sampling check of the historical data, reported values did not match with the records reviewed during onsite visit. In addition some of the daily acid production values reported did not match with the production records. For the values that did not match higher production values have been reported in the spreadsheets. Thus the corrected historical data spreadsheet needs to be provided including the production records along with copies of the historical and production records supporting the updated values.	The corrected historical data spreadsheet has been provided.	After receiving the updated corrected historical data spreadsheet, client was asked to provide scans of the some of the randomly picked days. The provided scans corresponded with excel sheets. Thus, the historical data was verified as correct. The CAR is closed.
CAR 3	QAL 2 correction factor of 1.008 for N_2O concentration values after 8 Oct 2008 has not been correctly applied to the concentration values measured during 1st and the 2nd project campaigns. Rather a conservative value of 1.023 has been applied which is applicable to the data measured before 8 Oct 2008. Since all the data measured during 1st and the 2nd project campaigns were measured after 8 Oct 2008, please correct calculation.	Correction factor for the period after 8 Oct 2008 has been changed. Correction factor of 1.008 is applied in calculation.	The coefficient is correctly applied in new versions of excel sheets. The CAR is closed.

Clarification requests

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CL 1	NAP values that have been measured by the float-type level indictors have been reviewed and found in conformity with the reported values. For some of the months measured values have been cross-checked with the mass-balance calculations. The mass balance calculations done on a monthly basis need to be provided for all the months during the monitoring period. It should be noted that proper calibration of the float-level tanks and maintenance needs to be ensured in the future.	Copies of Technical reports with the connection between the acid mass balance and the acid consumed for the ammonium nitrate production has been submitted. Confirmations of calibration have been submitted.	The provided Technical report was cross-checked with data in the excel sheet and the data was confirmed. Provided calibration certificates for individual storage tanks are valid for next 10 years. The CL is closed
CL 2	Weekly QAL 3 related deviations in the form of spreadsheets have been provided, however Shewart chart as per the requirements of EN14181 needs to be provided.	Shewart charts have been submitted	The Shewart chart is correctly presented. The CL is closed

Forward action requests from determination

FAR ID	Forward action request	Summary of how FAR has been addressed in this reporting period	Assessment of how FAR has been addressed
FAR 1	The final verification of the permitted operating conditions that have been preliminarily determined by DNV from the data of 4 historical campaigns from 17 May 2005 to 29 May 2008 should be confirmed during the first verification by the verifying AIE. In addition, the final verification of the baseline campaign data from 2008 should be confirmed during the first verification by the verifying AIE. DNV observed some strange development of N_2O concentration during the baseline campaign, specifically after the shutdown period from 22 December 2008 to 1 March 2009 the N_2O concentration increased considerably. This period of monitoring should be especially checked during verification and any incorrect measured values are to be excluded from the determination of the baseline emission factor.	Correspondent changes have been made in historical data evaluation spreadsheet and in baseline calculations in accordance with CAR1 and CAR2	The FAR was transformed to CAR1 and CAR2 thus this FAR is closed

FAR ID	Forward action request	Summary of how FAR has been addressed in this reporting period	Assessment of how FAR has been addressed
FAR 2	The PDD does not include the requirement of AM0034 stating: "*In order to further ensure that operating conditions during the baseline campaign are representative of normal operating conditions, statistical tests should be performed to compare the average values of the permitted operating conditions with the average values obtained during the baseline determination period. If it can be concluded with 95% confidence level, in any of the tests, that the two values are different, then the baseline determination should be repeated.*" Since the final determination of the permitted operating conditions and the baseline campaign data would be verified by the verifying AIE during first verification, this needs to be confirmed during the first verification.	Analysis has been submitted. Calculated with using KeyPlot tool 2.0 http://www.kyenslab.com/en/products/kyplot.html	The calculation was provided and deemed correct. The FAR is closed.

Forward action requests from this verification

FAR ID	Forward action request	Response by Project Participants	DNV's assessment of response by Project Participants
FAR 1	As per JI procedures P.Ld.-05-01, JI Technical Coordinator is responsible for planning and ensuring of internal audits; however this has not been insured and needs to be insured in the future.	The internal audits will be insured and confirmation will be submitted during verification visit	The FAR will be review during next verification
FAR 2	AST needs to be planned for every year and after any events that would require AST test to be conducted.	AST is performed on annual basis. The correspondent statement will be added to JI manual	The FAR will be review during next verification
FAR 3	EPA checking of JI project /track I project needs to be ensured according to Romanian JI Track I procedures	Correspondent checking will be organized according to Romanian legislation	The FAR will be review during next verification
FAR 4	Calibration gas of lower range needs to be procured and implemented during QAL 3 tests as per the AST report.	Clarification of analyser manufacturer has been submitted. It is not recommended to change concentration of the gas.	The clarification was accepted. The FAR is closed
FAR 5	The risk approach should be implemented to JI procedures in the light of spare parts and calibration procedures. Company provided calibration without taking into account result of Shewart chart and a problem related to measurement devices maintenance. Also any policy for spare of important measuring is not established.	The correspondent changes will be made in PDD and will be presented during next verification	The FAR will be review during next verification

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