UNFCCC Clean Development Mechanism Monitoring Report

Jinxiang – Golden Elephant Line 1 N2O Abatement Project

CDM registration number 1455

Monitoring period 20/03/08 – 09/05/08

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Project background

Project 1455: Jinxiang – Golden Elephant Line 1 N2O Abatement has been registered as CDM project by the UNFCCC on 20 March 2008.

Further background on this project can be found in the PDD and associated documents, which are available on the UNFCCC website: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1196258546.06/view.

Parties involved are China (Host Country) and the United Kingdom of Great Britain and Northern Ireland (other Parties). The project participants are Sichuan Golden Elephant Chemical Co. Ltd. (public entity) and EcoSecurities PLC.

Monitoring background

Basis for the calculation of emission reductions is the monitoring plan in the Project Design Document [PDD]. Applicable methodology is AM0034 version 2 - Catalytic reduction of N2O inside the ammonia burner of nitric acid plants.

There were no Forward Action Requests remaining from the validation. Since this is the first monitoring period there are no Forward Action Requests from previous verifications.

Monitoring results summary

The calculated emission reductions amount to **47,495** ton CO2eq.

Data were monitored over the period 18/04/07 – 09/05/08. This includes the baseline campaign and the project campaign. The CDM monitoring period is 20/03/08 – 09/05/08.

All process monitoring equipment was calibrated to relevant national standards. Quality of stack monitoring equipment was ensured by applying EN14181.

Due to a software error, the measuring interval for flow and N2O was not always 2 seconds as prescribed in the validated monitoring plan. An approach to assess the theoretically most conservative assumption was established by the Statistical Advisory Services of Imperial College of the University of London. The consequences of the lowered measurement frequency were found to be very small and limited to the uncertainty of the hourly measured values of NCSG and VSG. The effect is small because the process has relatively stable NCSG and VSG; a very high frequency of NCSG and VSG measurements do therefore not contribute substantially to the accuracy of the measurements. The increased uncertainty was calculated and applied on EFbc [downward correction] and EFp [upward correction].

Analysis of historic campaigns

The site has carried out 3 historic campaigns since it started operations. Data from these campaigns span the period 01/11/05 to 16/04/07.

All data were put into a spreadsheet and checked for transposition errors. The data were processed as per methodology in order to calculate permitted operating conditions for OH, OTnormal, OPnormal, AFRnormal and AIFRnormal. A plausibility check was then done against the design manual and a technical assessment report of a specialized engineering company.

The NAP was previously measured from fertilizer output [18/10/06 to 09/03/07]. From 10/03/07 onwards a nitric acid flow meter was used. The calculated CLnormal is much lower than expected from the design manual, so no overestimation of CLnromal has been made.

A summary of the results is included in Annex A.

Information on GCnormal and GSnormal was collected. The management has confirmed that any changes in either gauze supplier or composition will be communicated immediately.

Analysis of baseline campaign

The baseline campaign took place from 18/04/2007 to 04/11/2007.

Process data

The project site staff has measured and recorded hourly data on OT, OP, AFR and AIFR. The number of records for which the site was producing nitric acid is OH. The process parameters OT, OP, AFR and AIFR were compared against the permitted operating conditions [OTnormal, OPnormal, AIFRnormal and AFRnormal].

More than 50% of the measured values during the baseline campaign were within permitted operating conditions. A statistical test was carried out in order to compare the baseline process conditions and the permitted operating conditions. It was found that the conditions were not different at the 95% confidence level. All measurements were done using equipment that was calibrated according to relevant national standards.

The GCbaseline and GSbaseline were compared against GCnormal and GSnormal. Gauze supplier and gauze composition in the baseline did not deviate from gauze supplier and gauze composition during the historic campaigns.

The nitric acid production was measured using a flow meter that is calibrated according to relevant national standards. Measured NAPbc has been recorded on a daily basis. The cumulative NAPbc has been used in order to calculate CLbl. Weak acid produced during process startup was not metered by the acid flow meter. It was temporarily stored in a weak acid storage tank, and then pumped back into the absorber. Only the acid with the desired concentration pass through the acid flow meter. The weak acid production and storage during process startup does therefore not affect the measured NAP.

Stack data measurements and calculations

Sample ports were installed in the stack according to international standards. An averaging pitot flow meter was installed as well as a heated sample line leading to a N2O analyzer. A computerized system records the samples to a data storage unit. Flow meter, sample system and analyzer were installed by the manufacturer of the analyzer.

The stack system measures VSGbc, NCSGbc, TSGbc and PSGbc. Invalid data for NCSGbc are recorded and flagged. These data were not used for the calculation of EFbc. VSGbc, TSGbc and PSGbc are used to calculate and record the VSGbc in Nm3/h. Flow was normalized at 0°C and 1 atm.

Hourly stack data have been combined with the hourly process data. Stack data values that were recorded when the process was outside the permitted operating conditions were not used. When the monitoring system was temporarily down and the process was within permitted operating range, a default emission factor for N2O of 4.5 kg N2O/tHNO3 was used as per methodology. Records for the situation in which CLbl > CLnormal have been ignored.

From the remaining data set, the 95% confidence interval was calculated for VSGbl and NCSGbl. The upper and lower 2.5% extremes were removed from the dataset and a new average for VSGbl and NCSGbl was calculated.

BEbc and EFbl were calculated as per equations [1] and [2] of the methodology. A summary of the calculation is shown in Annex B.

Factor UNC has been calculated by the independent laboratory that performed parallel stack measurements that were required as per EN14181. According to the QAL2 report, the AMS flowrate correction factor is 1.147; no factor needs to be applied to N2O measurement. The uncertainty of the monitoring system is assessed at 5.1%.

Stack data quality assurance and quality control

The manufacturer of the N2O analyzer has trained the site staff in the operation of the analyzer. Procedures have been developed for daily checks, calibrations, handling of calibration gas, maintenance and error handling. Compliance with these procedures has been checked by the site CDM manager and by EcoSecurities.

EN14181 is applicable for QA/QC of the stack monitoring equipment. The supplier of the N2O analyzer has issued installation certificates for the flow meter, sample system and analyzer. The supplier did also issue QAL1 certificates. An independent accredited laboratory has carried out QAL2 parallel stack measurements. This has resulted in a correction factor for NCSG, VSG and an overall UNC, see paragraph “stack data measurements and calculations” above. The site has introduced a QAL3 QA/QC system. Regular calibration of the analyzer took place with span and zero gas according to requirements from the manufacturer.

Measurement frequency of VSGbc and NCSGbl baseline campaign

Due to a software error the measurement frequency of the stack monitoring system was not always 2 seconds. EcoSecurities has commissioned Statistical Advisory Services [SAS] of Imperial College, University of London to [a] assess the consequences hereof and [b] estimate the theoretically most conservative scenario.

SAS has analyzed baseline and project campaign data and come to the following conclusions. First, there is no impact on the hourly averages for NCSG and VSG themselves. This is due to the central limit theorem, which says that the mean value found is more reliable with a large sample size, and the sample size is considered to be large in this case. Secondly, the uncertainty of the hourly values increases. This is because the 95% confidence interval widens with a decreasing sample size. SAS has analyzed the effect of the decreased sampling frequency with using an autocorrelation [time series] approach using a specialized statistical software package. The increased uncertainty was found to be small in terms of the calculated average. The small effect is due to the fact that the NCSG and VSG remain very constant in time and any fluctuations occur slowly. In other words, the 2 seconds measurement interval does not contribute substantially to the accuracy of the hourly averages of NCSG and VSG.

SAS has developed a sampling strategy that allows EcoSecurities to further assess the impact of the decreased measurement frequency on the hourly averages of NCSG and VSG. This requires the analysis of 2 samples per week. EcoSecurities has developed a system for selecting random samples and applies statistical software macros that were developed by SAS. The baseline correction factor found has been added to factor UNC as assessed during the QAL2 procedure, therewith decreasing EFbl. This is conservative. The results of the uncertainty assessment calculation have been made fully available to the verifier. The correction factors in baseline were 0.080% and 0.860% for flow rate and N2O concentration respectively.

Analysis of project campaign

The project campaign took place from 07/11/2007 to 09/05/2008.

Process data

The project site staff has measured and recorded hourly data on OT, OP, AFR and AIFR. The number of records for which the site was producing nitric acid is OH. All data were collected using monitoring equipment that was calibrated according to relevant national standards.

The GCproject and GSproject were compared against GCbl and GSbl. Gauze supplier and gauze composition in the project campaign did not deviate from gauze supplier and gauze composition during the baseline campaign.

Stack data

The stack system measures VSGbc, NCSGbc, TSGbc and PSGbc. Invalid data for NCSGbc are recorded and flagged. These data were not used for the calculation of EFbc. VSGbc, TSGbc and PSGbc are used to calculate and record the VSGbc in Nm3/h. Flow was normalized at 0°C and 1 atm.

When the monitoring system was temporarily down and the process was running a default factor for N2O has been applied. This default value is the highest value measured during the project campaign.

Average values and a 95% confidence interval for NCSG and VSG were calculated. Values outside the 95% confidence interval were eliminated and new averages for NCSG and VSG were calculated as per methodology.

In order to achieve a good accuracy of measurements the N2O analyzer needed to set at a smaller measurement range for the project campaign [lower N2O values]. This required new parallel measurements, which were done by the same independent and accredited laboratory that did the QAL2 measurements, see paragraph "stack data quality control and quality assurance" above. The measurements resulted in a new correction factor for N2O that is applicable for the re-ranged analyzer.

Quality of stack data measurements was ensured by compliance with onsite quality procedures, regular calibration of the analyzer with span gas and zero gas according to manufacturer requirements and a QAL3 procedure.

PEn and EFn were calculated as per equations [3] and [4] of the methodology. Since this is the first project campaign of this site, moving averages and minimum project emission factor does not apply [equations 5 and 6]. The results of the calculations are included in Annex C.

Measurement frequency of VSG and NCSG project campaign

Due to a software error the measurement frequency of the stack monitoring system was not always 2 seconds. EcoSecurities has assessed the resulting increase in uncertainty of the project campaign as per methodology developed by Statistical Advisory Services of Imperial College, University of London [see "Measurement frequency of VSGbc and NCSGbl baseline campaign" above].

The results of the uncertainty calculation have been made fully available to the verifier. The uncertainties in project campaign were 0.099% and 0.536% for flow rate and N2O concentration respectively, which had been applied on EFp, therewith increasing EFp. This is conservative.

Calculation of emission reductions

The emission reductions have been calculated as per equation 7 of the methodology. The results are included in Annex C.

The NAP production level did not exceed the design capacity of the plant.

No N2O emissions legislation that applies to nitric acid plants has been introduced during the baseline campaign or project campaign.

The project campaign took place from 07/11/2007 to 09/05/2008, whereas the project was registered on 20/03/2008. This means that no emission reductions were claimed over the period 07/11/2007 to 19/03/2008.

Annex A – Historic campaign

	OT1 [C]	OT2 [C]	OP [MPa]	AFR [Nm3/h]	AIFR [-]
2.5 Percentile	826	834	0.240		
97.5 Percentile	873	884	0.301		
Max				8427	10.7

	t 100% HNO3		Operation Days	
campaign 1	69,932	t HNO3	150.7	Days
campaign 2	69,179	t HNO3	162.2	Days
campaign 3	76,862	t HNO3	174.8	Days
campaign 4		t HNO3		
campaign 5		t HNO3		
sum	215,974	t HNO3		
CL normal	71,991	t HNO3/ Campaign		
hrs production	11,704	hour		
days prod	488	days		
prod cap	443	t HNO3/Day		

Annex B – baseline campaign

calc CI	N2O (mg/Nm3)	FLOW (Nm3/hr)
average	2,565	52,672
SD	281	2,899
CI low	2,015	46,989
CI high	3,115	58,355

	N2O (mg/Nm3)	Flow (Nm3/hr)
Meth mean	2,520	52,965

VSGcalc	52,965	Nm3/hr
correction factor QAL2	1.147	-
NCSG	2,520	mg N2O/Nm3
VSGcorrected	60,751	Nm3/hr
OH	4,758	hrs
BE	728	ton N2O

NAPbc	94,095	tHNO3
UNC AMS	5.10%	-
UNC NAP	0.50%	-
2 Sec Flow Correction	0.08%	-
2 Sec N2O Correction	0.86%	-
2 Sec Combined Correction	0.86%	-
UNC Combined	5.99%	-
EFbl	0.01	t N2O/t HNO3
	7.28	kg N2O/tHNO3

Hrs mon system down	116	hrs
OH	4,758	hrs
%	2%	-
EF default	4.50	kg N2O/tHNO3
weighed	0.11	kg N2O/tHNO3
EF calc	7.28	kg N2O/tHNO3
weighed	7.10	kg N2O/tHNO3
EFbl final	7.21	kg N2O/tHNO3

Annex C - project campaign

calc CI	N2O (mg/Nm3)	FLOW (Nm3/hr)
average	261	62,029
SD	107	2,979
CI low	52	56,189
CI high	471	67,868

	N2O (mg/Nm3)	Flow (Nm3/hr)
Meth mean	252	62,341

VSGcalc	62,341	Nm3/hrs
correction factor QAL2	1.000	-
NCSG	252	mg N2O/Nm3
VSGcorrected	62,341	Nm3/hr
OH	4,066	hrs
PE1	64	ton N2O

NAPp1	85,071	tHNO3
2 Sec Flow Correction	0.10%	-
2 Sec N2O Correction	0.54%	-
2 Sec Combined Correction	0.54%	-
EFp1	0.00	t N2O/t HNO3
	0.76	kg N2O/tHNO3

Hrs mon system down	146	hrs
OH	4,066	hrs
%	4%	-
EF AMS down	1.89	kg N2O/tHNO3
weighed	0.07	kg N2O/tHNO3
EF calc	0.76	kg N2O/tHNO3
weighed	0.73	kg N2O/tHNO3
EFp1 final	0.80	kg N2O/tHNO3

EFbl	7.21	kg N2O/tHNO3
NAPcredit	23,891	tHNO3
GWP N2O	310	-
ER	47,495	tCO2e