



Monitoring report form (Version 03.1)

Monitoring report

Title of the project activity	N ₂ O abatement in HP Nitric Acid plants at Rashtriya Chemicals & Fertilizers Limited, India
Reference number of the project activity	2792
Version number of the monitoring report	0
Completion date of the monitoring report	29/10/2013
Registration date of the project activity	20/11/2009
Monitoring period number and duration of this monitoring period	5, 11/05/2012 to 01/08/2013 (Both days inclusive)
Project participant(s)	Rashtriya Chemicals & Fertilizers Ltd. (Public Entity)
Host Party(ies)	India
Sectoral scope(s) and applied methodology(ies)	05, AM0034 Version 03.2
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	For Campaign period – 8: 172,795 tCO _{2e} (447,305 tCO _{2e} x 141 days / 365 days) For Campaign period – 9: 153,187 tCO _{2e} (447,305 tCO _{2e} x 125 days / 365 days) For Campaign period – 10: 223,040 tCO _{2e} (447,305 tCO _{2e} x 182 days / 365 days)
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	Total: 320,847 t CO _{2e} For Campaign – 8: 129,607 t CO _{2e} For Campaign – 9: 81,113 t CO _{2e} For Campaign – 10: 110,127 t CO _{2e}

SECTION A. Description of project activity**A.1. Purpose and general description of project activity**

RCF is a Public sector undertaking of Government of India. It is one of the leading producers of fertilizer in India. The fertilizer production facility of RCF is located in Trombay near Mumbai in the state of Maharashtra. RCF is having two Nitric Acid Plants, one is medium pressure plant which operates at 5 to 6 bar (absolute) and other is high pressure plant which operates at 7 to 8 bar (absolute) respectively, both the units are located at Trombay. This monitoring report is for project activity in the high pressure Nitric Acid Plant of RCF.

This project activity is about N₂O abatement generated during the process of nitric acid production. Nitric Acid production involves oxidation of ammonia on precious metal gauze of essentially platinum – rhodium in ammonia burner in the presence of air. This is an exothermic reaction which releases substantial heat. In the process, ammonia is oxidized to form NO, which is further oxidized to form NO₂, which is converted into Nitric Acid by absorbing NO₂ in water. N₂O is an undesirable and unavoidable by product resulted during oxidation of Ammonia which is potent greenhouse gas (GHG) and do not possess any economic value.

The purpose of the project activity is to reduce the emission of N₂O (a greenhouse gas) by installing of secondary N₂O decomposition (DeN₂O) catalyst in the ammonia reactors of HP Nitric Acid Plant of Rashtriya Chemicals and Fertilizers Limited (hereafter referred as RCF). The HP Nitric acid plant was commissioned in 1968. The plant was subsequently revamped and restarted in Jan. 2005 with annual capacity of 128,480 MT (352 MT per day) of 100 % Nitric Acid. The DeN₂O catalyst was procured from well-known supplier M/s BASF Germany, which has been installed down stream of platinum gauze. The project activity helps in catalytic reduction of N₂O which is an undesirable by product of nitric acid production process and reduces its emission in to the atmosphere. The N₂O is potent greenhouse gas with a very high global warming potential of 310. EN14181 compliant continuous emission monitoring system was procured from M/s ABB Germany.

SN	Particulars	Details
1.	Installation and commissioning of DeN ₂ O catalyst	31 st March 2009
2.	Commissioning of AMS	24 th July 2008
3.	QAL 2 Test 2008	21 st to 23 rd October 2008
4.	QAL 2 Test 2011	24 th to 27 th October 2011
5.	AST for the year 2010	4 th to 5 th March 2010
6.	AST for the year 2011	1 st to 3 rd March 2011
7.	AST for the year 2012	20 th to 22 nd September 2012
8.	Annual Maintenance of AMS (During the Monitoring Period)	ABB Engineer visited on 21/08/2012, 20/09/2012, 15/10/2012, 16/11/2012, 11/12/2012, 24/01/2013, 21/02/2013, 26/03/2013, 18/04/2013, 15/05/2013, 21/06/2013 and 19/07/2013 for routine maintenance job of AMS.
9.	Date of Replacement of Primary Catalyst (During Monitoring Period)	Primary Catalyst was replaced on, 11/05/2012, 28/09/2012 and 31/01/2013
10.	Jobs pertaining to Secondary Catalyst	Nil

Start and end dates of the all four campaign period with this monitoring period is as given below:

Campaign	From	To	Remarks
Campaign Period – 8	11/05/2012	28/09/2012	Both dates inclusive
Campaign Period – 9	29/09/2012	31/01/2013	Both dates inclusive
Campaign Period – 10	01/02/2013	01/08/2013	Both dates inclusive

The Purpose of this monitoring report is to calculate and clarify the GHG emission reduction quantity achieved by this project for periodic verification. The total emission reduction during the monitoring period through this project activity is 320,847 tCO₂e.

A.2. Location of project activity

Host Country : India
 State : Maharashtra
 Town : Trombay, Sion
 Latitude : 18°05'33" N
 Longitude : 72°07'50" E

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	Rashtriya Chemicals & Fertilizers Limited (Public entity)	No
Switzerland	Rashtriya Chemicals & Fertilizers Limited (Public entity)	No

A.4. Reference of applied methodology

- Approved baseline methodology AM0034 “**Catalytic reduction of N₂O inside the ammonia burner of nitric acid plants**”
 Reference: Version 03.2, Sectoral Scope 05, EB 41
- Tool for the demonstration and assessment of additionality**
 Reference: Version 05.2, EB39

A.5. Crediting period of project activity

Crediting Period: 21 Years (7 years x 3, Renewable Period)
 Crediting Period Starts from 20/11/2009

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

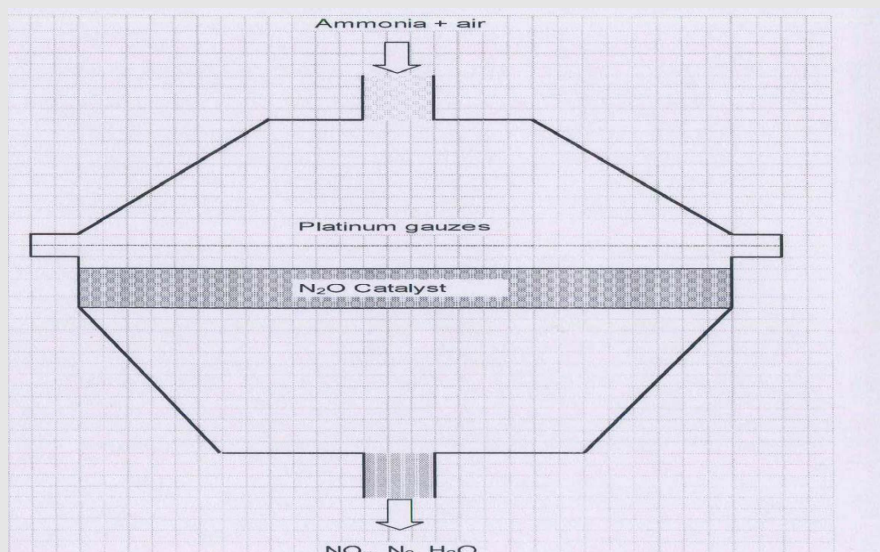
Nitric Acid (HNO₃) is produced through the oxidation of ammonia (NH₃) on precious metal catalyst gauze in the ammonia burner of a nitric acid plant. Nitrous Oxide (N₂O) is an undesirable by-product gas produced in the manufacture of nitric acid. Waste N₂O from nitric acid production was typically released into the atmosphere as it does not have any economic value at emission levels typical of nitric acid manufacture.

RCF has installed secondary catalyst in the ammonia burner of nitric acid unit after primary catalyst, which has resulted in reduction of N₂O emission.

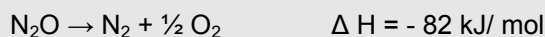
Technical Specifications:

RCF has purchased the catalyst from one of the reputed internationally well-known catalyst suppliers M/s

BASF. In presence of the catalyst N_2O is reduced to harmless N_2 . The catalyst has been installed just below the primary catalyst in place of rasching rings installed initially as shown below.



The technology is based on selective reduction of N_2O . The reduction is done as below in an exothermic reaction.



Following instrument was replaced during the Monitoring Period:

	Old Instrument details	New Instrument details	Date of replacement
Stack gas Temperature Meter (TI 120400)	R/I Converter	R/I Converter	08/08/2012
Stack gas Temperature Meter (TI 120400)	R/I Converter	R/I Converter	08/06/2013
Stack gas Temperature Meter (TI 120400)	R/I Converter	R/I Converter	13/07/2013

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

The AM0034 Methodology requires project proponent to monitor Operating Hour (OH) of Nitric acid Plant during any project campaign.

As per the registered PDD, OH is required to be monitored as "Recorded at CEM system based on temperature limits of Reactor hours of daily operation". However, PP for the period between 20/11/2009 to 09/07/2010 has used the data "Ammonia Flow to the Reactor" as the basis for monitoring OH.

Both the methods are equally good to record operating hours of the plant.

RCF however have switched to the temperature limit of Reactor for monitoring of Operating Hours since 09.07.2010 which is in line with the registered PDD.

The request for Deviation was submitted to UNFCCC for their approval. The UNFCCC reference for the deviation is DEV-0395. UNFCCC approved the deviation request on 08.11.2011 for 1st and 2nd Monitoring Periods provided that a revision of Monitoring Plan is requested to be consistent with the implemented

procedure in the baseline campaign where operating hours were also determined as per the ammonia flow. The request for revision in the Monitoring plan was submitted to UNFCCC and has been approved on 16th November 2012.

B.2.2. Corrections

NA

B.2.3. Permanent changes from registered monitoring plan or applied methodology

As per registered PDD, operating hour recording at CEM system is based on temperature limits of the reactor. However now the operating hours are recorded based on ammonia flow to the reactor.

This is in line with the deviation request (I-DEV0395) submitted by RCF and subsequent acceptance & recommendation from UNFCCC.

B.2.4. Changes to project design of registered project activity

NA

B.2.5. Changes to start date of crediting period

NA

B.2.6. Types of changes specific to afforestation or reforestation project activity

NA

SECTION C. Description of monitoring system

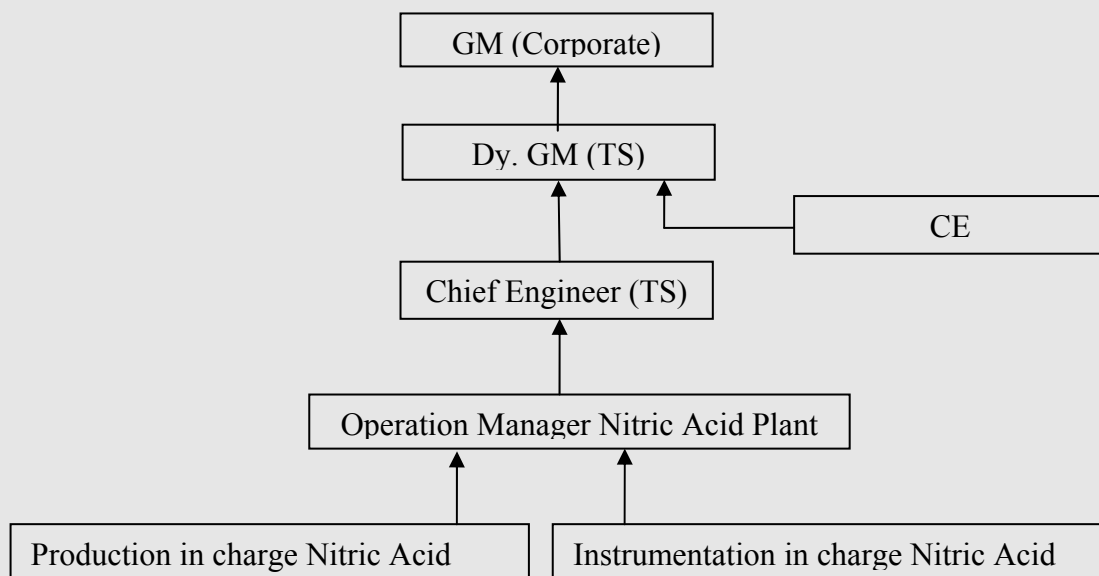
RCF is an ISO 9001 certified company and has procedure for monitoring and recording of data on operation of the plant/equipments. ISO 9001 procedures have been formulated for all new monitoring instruments. All instruments used for CDM project monitoring are calibrated as per ISO 9001 procedures.

1. CDM Team for monitoring & recording of data:

A CDM project team is constituted with participation from relevant sections. This team is responsible for data collection and archiving. This team is periodically reviews CDM project activity, check data collected and estimate emissions reduced. On a monthly basis, the monitoring reports are checked and discussed by the senior CDM team members. In case of any irregularity observed by any of the CDM team members, it is informed to the concerned person for necessary actions. Further these reports will then be forwarded to the management monthly basis.

Daily report (Hourly average, in pdf format) from CEM system is archived by plant personnel and forwarded to CDM team members. Corporate CDM team member convert these PDF file in excel format and consolidate the data for entire campaign. Consolidated data is used for emission reduction calculation for final verification by verifier.

Organizational structure for monitoring plan



1.1 Data collection and record keeping:

Frequency of data monitoring and recording:

The frequency for data monitoring is as per the monitoring details in Section D.

Archiving of data:

Data shall be kept for two years after the crediting period or the last issuance whichever is later

CDM data is archived in electronic and paper form.

1.2 Quality Control and Quality Assurance

RCF has installed EN 14181 compliant continuous emission monitoring system. As per detailed out in the methodology AM0034, a three level quality assurance has been implemented. These three levels are Quality Assurance Level 1 (QAL1), Quality Assurance Level 2 (QAL2) and Quality Assurance Level 3 (QAL3).

QAL1 precisely ensures the suitability of the CEM to meet the requirements. CEM system at RCF has already undergone this level and a report has been availed from reputed certifying agency TUV SUD, Germany. QAL2 has been carried out by M/s TUV SUD, Germany in 2008 and again in 2011 by TUV Rhinland. Under QAL3, the analyzer carries out auto calibration on weekly basis.

Annual Surveillance test (AST) is also carried out by third party as a part of EN14181. AST was carried out by SGS Netherland in 2011.

1.3 Span Gas Details:

The frequency of manual calibration of N2O analyser using span gas is done once in three months. This is in line with the QA/QC procedures defined under B-7 of Project Design Document. For this manual calibration span gas is used. The details of span gas are given below:

Span Gas Concentration	Supplier	Concentration Valid till
3672 ppm	M/s Chemtron Science Laboratories	25/03/2013
3892 ppm	M/s Chemtron Science Laboratories	14/04/2014

2. Description of the CEM installed at RCF HP Nitric Acid plant:

2.1 Components of CEM

In its HP Nitric Acid plant, RCF has installed an CEM system supplied by M/s ABB, AO2000 URAS 26 comprising of Continuous Emissions Analyser (for N₂O concentration in stack gas), Sample probe, Sample Conditioning System, SDF Flow Sensor (for stack gas flow measurement).

Following are the data logger and data acquisition system in the CEM system:

Data logger: Beckhoff DATA Logger

Data Acquisition System: ITBK EMI3000

2.2 Selection of Sample points

RCF has selected sample points for collection of samples to meet the requirements of EN14181. The sample points have been selected as advised by the supplier ensuring its correctness,

2.3 Analyser System

The ABB AO2000 URAS 26 is capable of analysing N₂O concentration in gas mixtures on continuous basis. The URAS 26 is continuous NDIR industrial photometer that can selectively measure concentrations of up to four sample components. In this case it is equipped for the measurement of N₂O only. The analyzer features gas-filled opto-pneumatic detectors. Detector is filled with corresponding gas being measured. This means that the detector provides optimum sensitivity and high selectivity compared with the other gas components in the sample. Calibration cells filled with N₂O gas is used for automatic calibration. The Analyser is QAL1 tested for the measurement of N₂O.

2.4 Sample Conditioning System

The gas sample is extracted at the sampling point, particles are removed by the heated filter unit and the clean sample gas is delivered through a heated sampling line to the analyser cabinet. Before being fed to the analyser, moisture is removed by the sample gas cooler and sample gas feed unit installed side-by-side in the analyser cabinet. This sample gas cooler unit maintains a constant dew point of the sample gas of 3°C and efficiently separates the moisture from the sampling gas. The minimum flow rate to the analyser is controlled and connected to an alarm. The dry gas after the cooler is controlled for moisture break through. In case of moisture leaks in due to a failure of the cooler, the sampling pump will be stopped automatically and an alarm is given to the EMI3000 system.

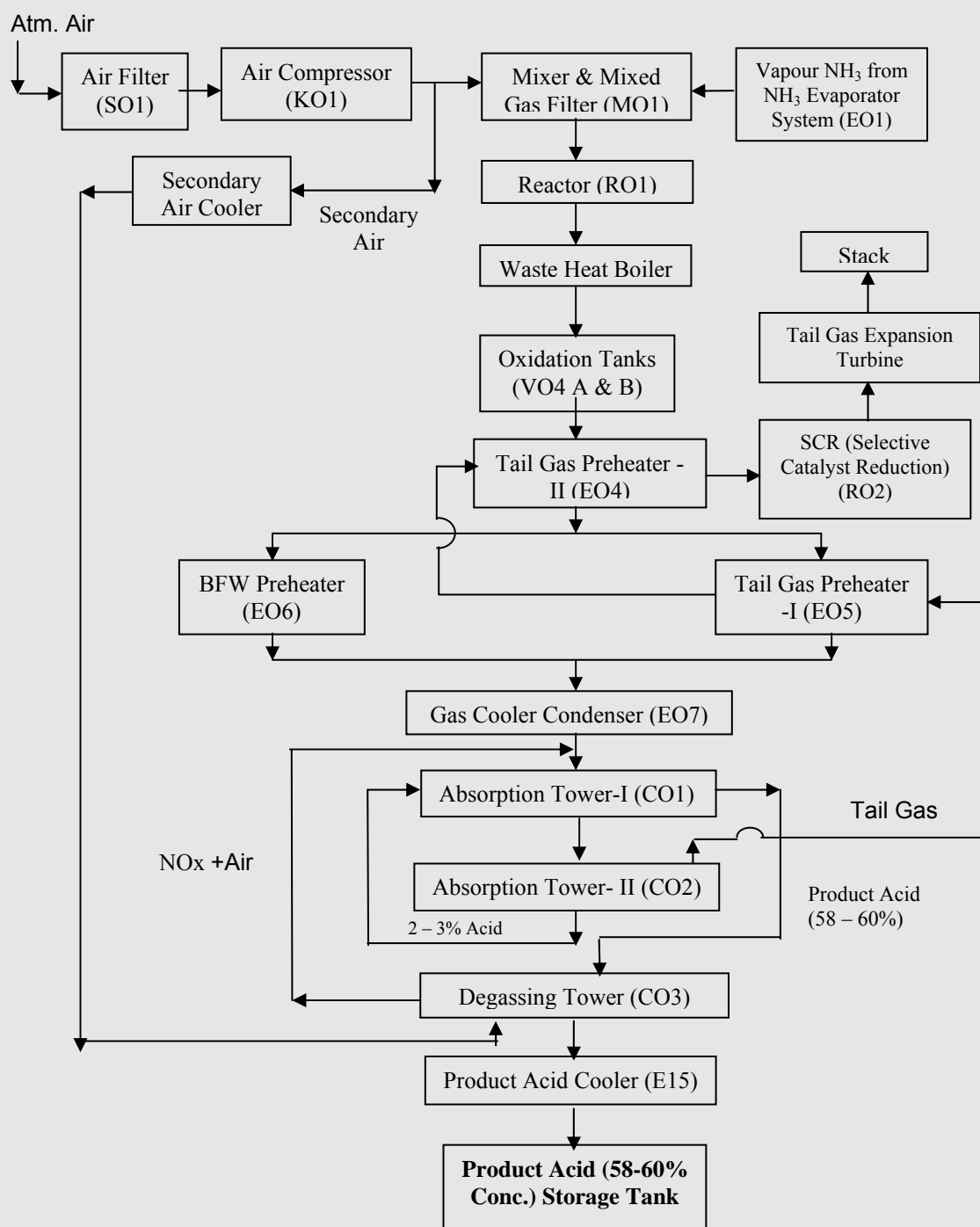
2.5 Flow Meter

The SDF Flow measuring system allows continuous determination of the flow rate of stack gas. It is performance tested according to 17. BlmSchV and "TA Luft" (test report No. 936/802015, TUV Rheinland 1993) for use in plants. The unit's suitability was tested by TUV Rheinland Germany.

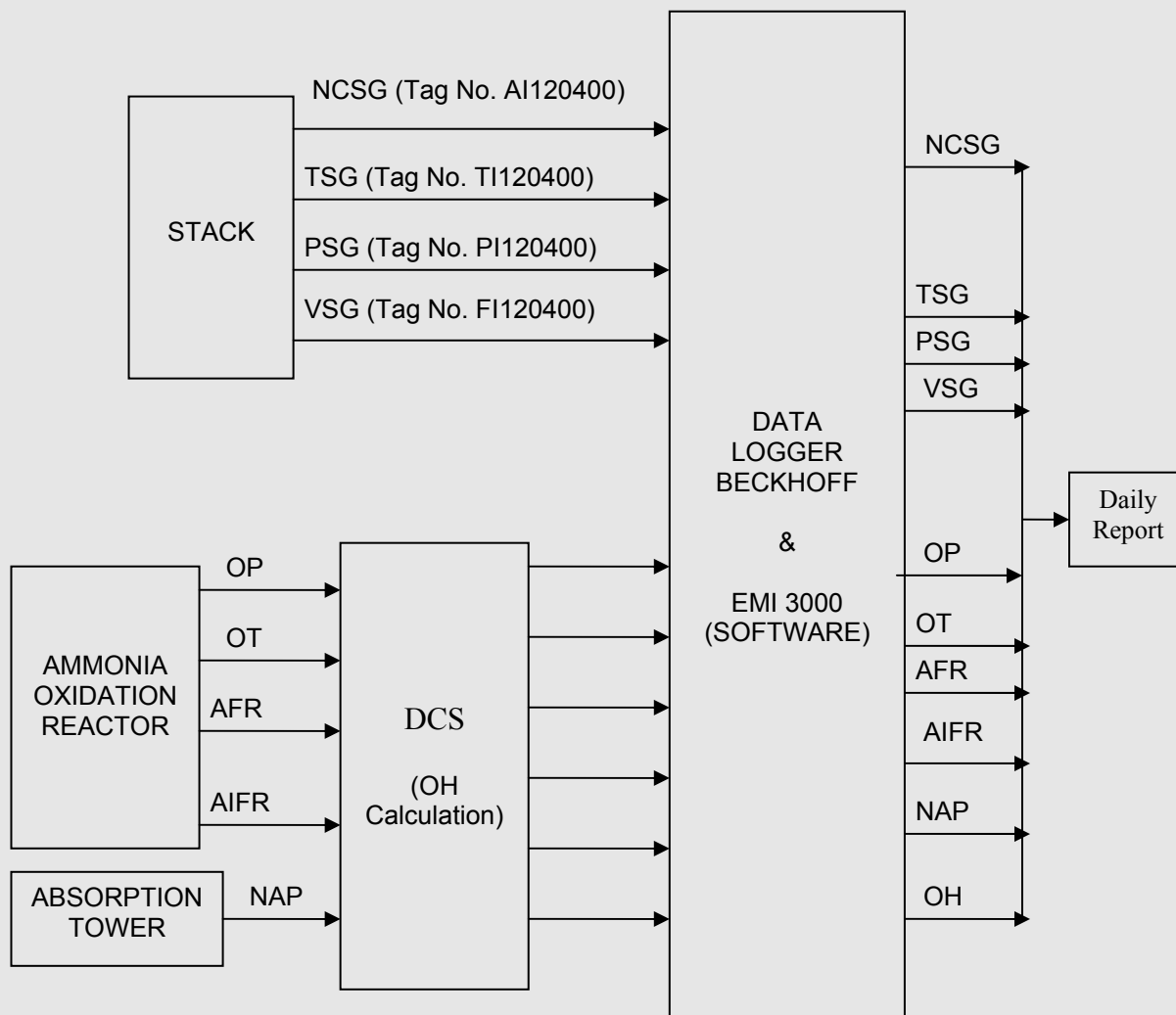
The SDF flow sensor which is a flow measuring device is a highly sensitive system for continuous, in-situ flow measurement. The stack gas flow is measured in the stack by measuring the dynamic differential pressure generated by the SDF flow sensor probe rod and using ABB's Differential pressure transmitter. Thereby the differential pressure is continuously measured and the signal is feed to Beckhoff DATA Logger and ITBK EMI3000 – CDM Data acquisition and data evaluation system. The Data Logger has been calibrated by ABB Germany during manufacturing stage and calibration was again rechecked during QAL2 test by TUV SUD Germany.

Process Block diagram for HP Nitric Acid Plant is given below.

Process Block Diagram: HP Nitric Acid Plant



The individual monitoring parameters with respect to each equipment are described below:



The ABB's Differential pressure type transmitter is used for stack gas flow measurement which gives 4 to 20 mA signal which is directly proportional to the stack gas flow. The differential pressure transmitter signal is fed to the Beckhoff data logger. The stack gas pressure and temperature is also measured separately by transmitters and the corresponding 4 to 20 mA signal generated is fed to data logger as input for further converting the stack flow from operating to standard conditions. This is done by EMI3000 by compensating the flow for pressure and temperature and correcting the volume flow.

2.6 The data acquisition system

The RCF HP nitric acid plant is equipped with a data communication unit that collects and stores all the raw values for NCSG, VSG, TSG, PSG, OT_n, OP_n, AFR, AIFR and NAP as well as different status signals from the AMS. From the data communication unit the data is transferred to the ITBK EMI3000 server grade PC in Analyser room. In the EMI3000 PC all data evaluation and storage takes place. The data is stored simultaneously on different hard disks to prevent the loss of data in case one hard disk fails.

3. Emergency preparedness

The maximum emissions possible during the crediting period, in case of emergency situation like complete deactivation of DeN₂O catalyst shall be same as that of base line emissions.

The emissions are monitored using CEM system which complies with EN14181 as required by the methodology in the project activity.

It is expected that all the instruments shall be functioning continuously for recording data. However in case AMS is not functioning due to any reason, RCF will follow the following emergency preparedness procedures.

Failure of Data Acquisition System	<p>A Provision of auto backup of data is provided in the system so that data is retrieved even if the system is down for 22 days.</p> <p>In case, due to any reason data is not available due to failure of data recording following shall be considered.</p>
Failure of N ₂ O Analyzer (NCSG)	In case N ₂ O analyzer is not functioning, data for the period shall be taken as highest measured value during the campaign for calculating the campaign average.
Failure of Stack gas Flow meter (VSG)	In case Stack gas flow meter is not functioning, data for this period shall be replaced with highest measured value during the campaign for calculating the campaign average.
Failure of Stack Gas Pressure (PSG)	In case Stack gas pressure meter is not functioning, Hourly average of measured data for next hour shall be considered for the down period, for taking further processing.
Failure of Stack gas Temperature (TSG)	In case Stack gas Temperature meter is not functioning, Hourly average of measured data for next hour shall be considered for the down period, for taking further processing.
Operating Hours OH	In case Operating hours counter is not functioning, data from Shift log book shall be taken after ascertaining for how many hours the plant has run.
Failure of Mass Flow meter (NAP)	<p>In case Mass flow meter is not functioning any time during the day, Nitric acid Production for the day shall be calculated using Average Ammonia Specific consumption for previous three operating days and Ammonia consumption for plant for the day from meter no FI 120101. The production data for the day shall be used for further processing; all other data from the Nitric acid mass flow meter for this day shall be ignored.</p> <p>In case concentration of nitric acid has not been determine for the day due to any reasons like shutdown, start-up etc, then:</p> <ul style="list-style-type: none"> ➤ In case of shut down data for concentration shall be taken from previous day. ➤ In case of start-up data for concentration shall be taken from next day. ➤ In case of shut down and start-up both data for concentration shall be taken from average of previous available day and next available day. ➤ For any other reason not foreseen now decision from production in charge of the plant shall be taken for correctness of data based on reason of not availability. He will give decision whether previous day data to be used or next day data to be used.
Operating Temperature(OT)	In case operating Temperature meter is not functioning, average of measured data for previous hour and next

	available hours, shall be considered for the down period, for taking further processing.
Operating Pressure(OP)	In case operating Pressure meter is not functioning, average of measured data for previous hour and next available hours, shall be considered for the down period, for taking further processing.
Ammonia Flow (AFR)	In case Ammonia Flow meter is not functioning, Hourly average of measured data for previous hour shall be considered for the down period, for taking further processing.
Ammonia to Air Ratio (AIFR)	In case Ammonia to Air Ratio meter is not functioning, Hourly average of measured data for previous hour shall be considered for the down period, for taking further processing.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	AFR_{max}
Unit:	Nm³/hr
Description:	Maximum Ammonia Flow Rate
Source of data:	Plant Records
Value(s) applied:	6,725 (This is equivalent to 5.113 tNH ₃ /h)
Purpose of data:	Baseline Emission
Additional comment:	The methodology gives the unit of measurement in tNH ₃ /h but RCF have been measuring the parameter in Nm ³ /h in the past. The conversion factor from Nm ³ /h to Kg/h is 0.7602 (which is 17.03/22.4). RCF has converted this measured value in Kg/h for the project activity.

Data / Parameter:	AIFR_{max}
Unit:	%
Description:	Maximum ammonia to air ratio
Source of data:	Calculated
Value(s) applied:	11.5
Purpose of data:	Baseline Emission/Project Campaign
Additional comment:	-

Data / Parameter:	OT normal
Unit:	Deg C
Description:	Normal Operating Temperature
Source of data:	Monitored
Value(s) applied:	Max = 900 Min = 863
Purpose of data:	Baseline Emission
Additional comment:	-

Data / Parameter:	OP_{normal}
--------------------------	----------------------------

Unit:	Bar (gauge)
Description:	Normal operating pressure
Source of data:	Monitored
Value(s) applied:	Max = 6.60 (660 kPa) (gauge) Min = 6.26 (626 kPa) (gauge)
Purpose of data:	Baseline Emission
Additional comment:	1 Pa = 10 ⁻⁵ bar. Methodology gives unit of measurement in Pa. But RCF were measuring this parameter in bar. In the project activity however, RCF has converted this measuring value in kPa for the project activity

Data / Parameter:	GS_{BL}
Unit:	-
Description:	Gauze Supplier for the baseline campaign
Source of data:	Monitored
Value(s) applied:	Rashtriya Chemicals & Fertilizer Ltd
Purpose of data:	Baseline Emission
Additional comment:	Rashtriya Chemicals & Fertilizers limited is getting fabricated the catalyst gauze from three vendors (Baseline Vendor RHPL) RHPL/ HPL/ Aurora Mathey, on labour charge basis, giving them metal and specification of catalyst.

Data / Parameter:	GC_{BL}
Unit:	-
Description:	Gauze Composition during Baseline Campaign
Source of data:	Monitored
Value(s) applied:	Pt – 92%, Rh – 8%
Purpose of data:	Baseline Emission
Additional comment:	-

Data / Parameter:	NCSG_{BC}
Unit:	mgN ₂ O/Nm ³
Description:	N ₂ O Concentration in the stack gas
Source of data:	N ₂ O analyser
Value(s) applied:	For the baseline campaign run by RCF during 01/07/2008 and 07/11/2008, the N ₂ O concentration values comes at 4,054.1 mg N ₂ O/Nm ³
Purpose of data:	Baseline Emission
Additional comment:	Regular Calibration is done according to ISO 9001 procedure. This analyser is tested as per QAL 2 test of recognized industry standards (EN 14181) by third party TUV SUD, Germany. Staff has been trained in maintenance of monitoring Instrument. Staff is also trained in monitoring procedures and a reliable technical support infrastructure is set up.

Data / Parameter:	VSG_{BC}
Unit:	Nm ³ /h
Description:	Volume flow rate of the stack gas

Source of data:	From CEM system supplied by M/s. ABB along with analyser
Value(s) applied):	For the baseline campaign run by RCF during 01/07/2008 and 07/11/2008, the volume flow rate of the stack gas comes at 49,077.4 Nm ³ /h
Purpose of data:	Baseline Emission
Additional comment:	Regular Calibration is done according to ISO 9001 procedure. This analyser is tested as per QAL2 test of recognised industry standards (EN 14181) by third party TUV SUD, Germany. Staff is also trained in monitoring procedures and a reliable technical support infrastructure is set up.
Data / Parameter:	OH_{BC}
Unit:	Hours
Description:	Operating Hours
Source of data:	From CEM System
Value(s) applied):	For the baseline campaign run by RCF during 01/07/2008 and 07/11/2008, the operating hours comes at 2,861 hours.
Purpose of data:	Baseline Emission
Additional comment:	Included in evaluation by third party validator.
Data / Parameter:	NAP_{BC}
Unit:	tHNO ₃
Description:	Nitric Acid (as 100%) over baseline campaign
Source of data:	This is calculated data based on the following- 1) Quantity of dilute nitric acid from mass flow meter. 2) Average concentration of nitric acid determined by the plant laboratory for the day.
Value(s) applied):	For the baseline campaign run by RCF during 01/07/2008 and 07/11/2008, the nitric acid comes at 43,326 tHNO ₃ .
Purpose of data:	Baseline Emission

Additional comment:	<p>Nitric Acid Flow: Calibration of flow meter once in three years as per OEM Recommendation.</p> <p>Nitric Acid Concentration: Calibration of Hydrometer and Thermometer shall be ensured by ISO 9001 procedures.</p> <p>In case mass flow meter is not functioning for any period during the day, Nitric acid production for the day is calculated using average ammonia specific consumption for previous operating days and ammonia consumption for plant for the day from meter no FI 120101. The calculated production value for the day is used for further processing; all other data from nitric acid mass flow meter for this day is ignored.</p> <p>In case concentration of nitric acid has not been determined for the day due to any reason like shut down, start-up etc. then;</p> <ul style="list-style-type: none"> • In case of shut down data for concentration is taken from previous day • In case of start-up data for concentration is taken from next day. • In case of shut down and start up both data for concentration is taken from average of previous available day and next available day. • For any other reason not foreseen now decision from production in charge of the plant is taken for correctness of data based on reason of not availability. He gives decision whether previous day data to be used or next day data to be used. Conservativeness of the value will be maintained <p>Operations Manager nitric acid plant takes appropriate decision for replacing the mass flow meter with similar or better instrument, if they are made available by instrument vendors in future.</p>
---------------------	---

Data / Parameter:	CL_{BL}
Unit:	tHNO ₃
Description:	Length of Baseline Campaign
Source of data:	As per the Production Data
Value(s) applied:	43,326
Purpose of data:	Baseline Emission
Additional comment:	-

Data / Parameter:	CL_{Normal}
Unit:	tHNO ₃
Description:	Normal Campaign Length
Source of data:	Calculated from nitric acid production data
Value(s) applied:	44,435
Purpose of data:	Baseline Emission
Additional comment:	-

Data / Parameter:	GS_{Normal}
Unit:	-
Description:	Normal gauze supplier for the operating conditions campaigns, there are three gauge fabricators for RCF, they work on labour charge basis for gauze fabrication, precious metal and specification is given by RCF. Hence RCF is the gauze supplier.
Source of data:	Plant Data
Value(s) applied:	Rashtriya Chemicals and Fertilizer Ltd.
Purpose of data:	Baseline Emission
Additional comment:	Frequency of recording: Each Campaign (Rashtriya Chemicals & Fertilizers limited is getting fabricated the catalyst gauze from any one of the three parties RHPL/ HPL/ Aurora Mathey, on labour charge basis, giving them metal and specification of catalyst)

Data / Parameter:	GC_{Normal}
Unit:	-
Description:	Gauze Composition during the operating campaign
Source of data:	Monitored
Value(s) applied:	Pt – 92%, Rh – 8%
Purpose of data:	Baseline Emission
Additional comment:	-

D.2. Data and parameters monitored

Data / Parameter:	NCSG
Unit:	mgN ₂ O/m ³
Description:	N ₂ O concentration in the stack gas
Measured/ Calculated / Default:	Measured
Source of data:	N ₂ O Analyser
Value(s) of monitored parameter:	For campaign period – 8 : 878 For campaign period – 9 : 1,770 For campaign period – 10 : 945
Monitoring equipment:	The N ₂ O analyser (model no.: AO2000 URAS 26) supplied by ABB is used for analysing N ₂ O concentration in stack gas. More details of the equipment are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Every second
Calculation method (if applicable):	-

QA/QC procedures:	N ₂ O monitor have auto calibration feature. Regular Calibrations according to ISO 9001 procedure and this analyzer was tested as per QAL2 test of recognized industry standards (EN 14181) by third party TUV SUD, Germany. Staffs have been trained in monitoring procedures and a reliable technical support infrastructure has been set up. In AST 2011, SGS has recommended that measuring inaccuracy constant for NCSG which is 62 should not be subtracted and the value of this constant should be made zero in the system. Accordingly, to comply with the recommendation of SGS, all NCSG readings during the monitoring period are added with 62 and further used for CER calculation.
Purpose of data:	Project Emission Calculation
Additional comment:	N ₂ O analyzer to be used for the data measurement proceeds using appropriate software. RCF have in place a Continuous Emission Monitoring (CEM) system from ABB. The repeatability of this instrument is < 0.5% of span.
Data / Parameter:	VSG
Unit:	Nm ³ /h
Description:	Volume flow rate of the stack gas
Measured/ Calculated / Default:	Measured
Source of data:	From CEM System
Value(s) of monitored parameter:	For campaign period – 8 : 42,308 For campaign period – 9 : 49,650 For campaign period – 10 : 49,495
Monitoring equipment:	For volume flow rate measurement of the stack gas, the SDF Flow measuring system is used which allows continuous determination of the flow rate of stack gas. More details of the equipment are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Every second
Calculation method (if applicable):	-
QA/QC procedures:	Regular Calibrations according to ISO 9001 procedure and this instrument was tested as per QAL2 test of recognized industry standards (EN14181) by third party TUV SUD, Germany.
Purpose of data:	Project Emission
Additional comment:	The data output from the stack flow meter is processed using appropriate software. RCF have in place a Continuous Emission Monitoring (CEM) System from ABB. The base accuracy of this instrument is ± 0.04%.
Data / Parameter:	OH
Unit:	Hours
Description:	Operating hours

Measured/ Calculated / Default:	Calculated
Source of data:	From CEM system
Value(s) of monitored parameter:	For campaign period – 8: 2,899 For campaign period – 9 : 2,890 For campaign period – 10 : 2,877
Monitoring equipment:	Given in Appendix III
Measuring/ Reading/ Recording frequency:	Frequency of recording: Hourly compiled for entire campaign
Calculation method (if applicable):	-
QA/QC procedures:	Included in evaluation by third party validator. In case data is not available for any period, data from log book will be taken.
Purpose of data:	Project Emission Calculation
Additional comment:	As soon as ammonia is introduced in the reactor OH counter starts automatically. Similarly when ammonia flow to reactor is cut off OH counter is stopped automatically.

Data / Parameter:	NAP
Unit:	tHNO ₃
Description:	Nitric Acid (As 100%)
Measured/ Calculated / Default:	Calculated
Source of data:	This is a calculated data based on the following 1. Quantity of dilute nitric acid from mass flow meter. 2. Average Concentration of nitric acid determined by the plant laboratory for the day.
Value(s) of monitored parameter:	For campaign period – 8 : 42,588 For campaign period – 9 : 41,254 For campaign period – 10 : 39,181
Monitoring equipment:	Mass flow meter, hydrometer and thermometer are used to determine the Nitric acid production. More details of the equipments are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Hourly Compiled for entire campaign
Calculation method (if applicable):	-

QA/QC procedures:	<p>Nitric Acid Flow: Calibration of flow meter once in three years as per OEM recommendation.</p> <p>Nitric Acid Concentration: Calibration of Hydrometer and Thermometer shall be ensured by ISO 9001 Procedures.</p>	
Purpose of data:	Project Emission Calculation	

Additional comment:	<p>Nitric Acid Flow: Mass flow meter installed at project site and displayed on CEM system shall give hourly average flow of dilute nitric acid (from the day report of CEM system). Plant laboratory will determine the average concentration of nitric acid for the day. Hourly value shall be multiplied with average concentration to arrive at hourly nitric acid production. The sum of hourly production shall be used to calculate day production.</p> <p>Nitric Acid Concentration: Concentration will be determined by measuring specific gravity by hydrometer and temperature by thermometer. Chart indicating concentration at various temperatures and specific gravity, available with production department shall be used for determining concentration of product nitric acid. In case Mass flow meter is not functioning for any period during the day, Nitric acid Production for the day shall be calculated using Average Ammonia Specific consumption for previous three operating days and Ammonia consumption for plant for the day from meter no FI 120101. The calculated production value for the day shall be used for further processing; all other data from the Nitric acid mass flow meter for this day shall be ignored.</p> <p>In case concentration of nitric acid has not been determine for the day due to any reasons like shutdown, start-up etc, then:</p> <ul style="list-style-type: none"> • In case of shut down data for concentration shall be taken from previous day. • In case of start-up data for concentration shall be taken from next day. • In case of shut down and start-up both data for concentration shall be taken from average of previous available day and next available day. • For any other reason not foreseen now decision from production in charge of the plant shall be taken for correctness of data based on reason of not availability. He will give decision whether previous day data to be used or next day data to be used. Conservativeness of the value will be maintained. <p>Operation manager Nitric acid plant shall take appropriate decision for replacing the mass flow meter with similar or better instrument, if they are made available by instrument vendors in future</p> <p>The NAP value is calculated based on the mass flow of dilute Nitric acid and the acid concentration. The Concentration of Nitric acid is determined by using Hydrometer and Thermometer. The instrument accuracy of Mass flow measurement of dilute Nitric acid is $\pm 0.1\%$ of rate.</p>
Data / Parameter:	TSG
Unit:	Deg C
Description:	Temperature of stack gas

Measured/ Calculated / Default:	Measured
Source of data:	Continuous Emission Monitoring system from ABB
Value(s) of monitored parameter:	Continuously Monitored
Monitoring equipment:	Measuring equipment used is RTD with R/I converter. More details of the equipment are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Every second
Calculation method (if applicable):	-
QA/QC procedures:	Regular calibrations according to ISO 9001 procedure and this instrument were tested as per QAL2 test of recognized industry standards (EN 14181) by Third Party TUV SUD, Germany.
Purpose of data:	-
Additional comment:	Temperature transmitter (TI 120400) is used for measurement of stack gas temperature. The accuracy of this instrument is ≤ 0.1 % of FS.
Data / Parameter:	PSG
Unit:	hPa
Description:	Pressure of stack gas
Measured/ Calculated / Default:	Measured
Source of data:	Continuous Emission monitoring system from ABB
Value(s) of monitored parameter:	Continuously Monitored
Monitoring equipment:	Measuring equipment used is pressure transmitter. More details of the measuring equipment are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Frequency of recording: Every second
Calculation method (if applicable):	-
QA/QC procedures:	Regular calibrations according to ISO 9001 procedure and this instrument were tested as per QAL2 test of recognized industry standards (EN 14181) by Third Party TUV SUD, Germany.
Purpose of data:	-
Additional comment:	Pressure transmitter (PI 120400) is used for measurement of stack gas pressure. The accuracy of this instrument is 0.5 % of FSO.
Data / Parameter:	AFR

Unit:	Kg NH ₃ /h
Description:	Ammonia gas flow rate to AOR
Measured/ Calculated / Default:	Measured
Source of data:	From CEM System
Value(s) of monitored parameter:	Continuously Monitored
Monitoring equipment:	Monitoring equipments used are, D.P. type transmitter, RTD with R/I converter and pressure transmitter. More details of the equipment are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Continuous.
Calculation method (if applicable):	-
QA/QC procedures:	To be obtained from operating condition campaign. Ammonia flow meter is used. Transmitted from DCS. The accuracy of this instrument is ± 0.075 % of span.
Purpose of data:	Project Emission Calculation
Additional comment:	To be obtained from operating condition campaign. Ammonia flow meter is used. Transmitted from DCS. The accuracy of this instrument is ± 0.075 % of span.

Data / Parameter:	UNC
Unit:	%
Description:	Overall measurement uncertainty of the monitoring system
Measured/ Calculated / Default:	Calculated
Source of data:	Calculated combined uncertainty factor determined by M/s TUV SUD, during QAL2 Test of monitoring equipment as per EN14181 guide line.
Value(s) of monitored parameter:	4.52
Monitoring equipment:	Not Applicable
Measuring/ Reading/ Recording frequency:	Frequency of recording: Once after monitoring system is commissioned.
Calculation method (if applicable):	UNC value was calculated as part of QAL2 procedures of EN14181.
QA/QC procedures:	This value is calculated by Third party TUV SUD, Germany
Purpose of data:	Baseline Emission
Additional comment:	QAL2 test by third party validator M/s. TUV SUD, Germany of Instrument as per guideline of EN14181.

Data / Parameter:	AIFR
Unit:	-
Description:	Ammonia to Air ratio
Measured/ Calculated / Default:	Measured
Source of data:	From CEM System
Value(s) of monitored parameter:	Obtained from DCS
Monitoring equipment:	Monitoring equipments used are, D.P. type transmitter, RTD with R/I converter and pressure transmitter. More details of the equipment are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Frequency of recording: Every Hour.
Calculation method (if applicable):	Ratio is obtained from Ammonia flow Tag no FY 120211-M and Air Flow tag no FI 120213, transmitted from DCS
QA/QC procedures:	Regular calibrations are carried out for Ammonia Flow meter FY 120211-M and Air Flow meter FI 120213 as per ISO 9001 procedure.
Purpose of data:	Project Emission
Additional comment:	Ammonia to Air ratio is calculated in DCS using signals transmitted from Ammonia flow transmitters (Tag no. FI 120211) and Air Flow transmitters (Tag no FI 120213). This signal is transmitted to CEM system. Accuracy of ammonia flow transmitter is $\pm 0.075\%$ of span and that of Air Flow Transmitter is $\pm 0.1\%$ of span.

Data / Parameter:	OT_h
Unit:	Deg C
Description:	Oxidation temperature of each hour
Measured/ Calculated / Default:	Measured
Source of data:	Continuous Emission Monitoring (CEM) system from ABB.
Value(s) of monitored parameter:	Continuously monitored
Monitoring equipment:	Temperature transmitter is used to measure the oxidation temperature. More details of the measuring equipment are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Every hour
Calculation method (if applicable):	Not Applicable

QA/QC procedures:	Instruments are regularly calibrated as per ISO 9001 procedure.
Purpose of data:	Project Emission
Additional comment:	Transmitted from DCS. There are three duplex K type thermocouples are installed in reactor. These are used for temperature measurement, with Tag No. TI120332A, TI120333A and TI120334A. The D/A accuracy of this instrument is ± 0.03 % of span.

Data / Parameter:	OP_h
Unit:	kPa (guage)
Description:	Oxidation pressure of each hour
Measured/ Calculated / Default:	Measured
Source of data:	Continuous Emission Monitoring (CEM) system from ABB.
Value(s) of monitored parameter:	Continuously monitored
Monitoring equipment:	Pressure transmitter is used to measure the oxidation pressure. More details of the measuring equipment are given in Appendix III.
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Every hour
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Instruments are regularly calibrated as per ISO 9001 procedure.
Purpose of data:	Project Emission
Additional comment:	Oxidation Pressure is measured by pressure transmitter tag no PT 120212A/B/C. The accuracy of this instrument is ± 0.075 % of span.

Data / Parameter:	GS_{project}
Unit:	-
Description:	Gauze Supplier for project campaign
Measured/ Calculated / Default:	Measured
Source of data:	Plant Data
Value(s) of monitored parameter:	Rashtriya Chemicals & Fertilizer Ltd.
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Every Campaign

Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Not applicable.
Purpose of data:	Project Emission Calculation
Additional comment:	Rashtriya Chemicals & Fertilizers limited is getting fabricated the catalyst gauze from any one of the three parties RHPL/ HPL/ Aurora Mathey, on labour charge basis, giving them metal and specification of catalyst

Data / Parameter:	GC_{project}
Unit:	-
Description:	Gauze Composition during project campaign
Measured/ Calculated / Default:	Measured
Source of data:	Monitored
Value(s) of monitored parameter:	Pt - 92%, Rh - 8%
Monitoring equipment:	Not Applicable
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Every Campaign
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Precious metal composition is checked by Third Party Ledoux & Company
Purpose of data:	Project Emission Calculation
Additional comment:	Rashtriya Chemicals & Fertilizers limited is getting fabricated the catalyst gauze from any one of the three parties RHPL/ HPL/ Aurora Mathey, on labour charge basis, giving them metal and specification of catalyst

Data / Parameter:	EF_{reg}
Unit:	
Description:	Emissions level set by incoming policies or regulations
Measured/ Calculated / Default:	Not Applicable
Source of data:	Maharashtra Pollution Control Board
Value(s) of monitored parameter:	Currently India does not have any regulation w.r.t. N ₂ O emissions
Monitoring equipment:	Not Applicable

Measuring/ Reading/ Recording frequency:	-
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Updated when new regulations comes into force
Purpose of data:	Project Emission Calculation
Additional comment:	Currently there is no regulation for N ₂ O emission. The new regulation will get reflected in consent to operate the plants. Consent to operate will be checked for N ₂ O emission applicability for each campaign.

QAL2 Correction Factors: (As per QAL2 test 2011):

Measuring Parameter	Correction Factor	
	a	b
N ₂ O	-2181.3	534.5
Volume Flow	-29,896	7487.1

D.3. Implementation of sampling plan

NA

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

As per the registered PDD, the baseline emission factor is 0.0125 tCO₂e/ tHNO₃:

Particulars	Unit	Value
Volume flow rate of stack gas	Nm ³ /h	49,077
N ₂ O concentration in stack gas - baseline	mg N ₂ O/ Nm ³	4,054.10
Operating hours	h/campaign	2,861
Baseline emissions	tN ₂ O/ campaign	569.23
Uncertainty UNC	%	4.52%
HNO ₃ production	tHNO ₃ / campaign	43,326
N₂O emission factor – baseline	tN₂O/ tHNO₃	0.0125

The CEM down time details is given in Annexure II. The lowest value between the IPCC default value and the last measured value is used in the down time period for the baseline emission factor. There is no change in the baseline emission factor as given in the registered PDD while considering the lowest value in the down time period.

Adjustment of baseline:

As per the methodology, baseline emission factor is to be adjusted in following cases –

If CL_n < CL_{normal}, recalculate EF_{BL} by eliminating those N₂O values that were obtained during the production of tonnes of nitric acid beyond the CL_n (i.e. the last tonnes produced) from the calculation of EF_n.

Project Campaign 8, 9 and 10:

SN	Description	Unit	Campaign – 8	Campaign – 9	Campaign – 10
1	CL _n	tHNO ₃	42,588	41,254	39,181
2	CL _{normal}	tHNO ₃	44,435	44,435	44,435
3	CL _{BL}	tHNO ₃	43,326	43,326	43,326

Here, for campaign – 8, 9 and 10, CL_n is less than CL_{normal}. Hence recalculation of Baseline emission factor is required. Baseline emission factor is recalculated but it is unchanged.

This is in compliance of “Clarification to AM0034 (Version 02): Catalytic Reduction of N₂O inside the Ammonia Burner of Nitric Acid Plants” given in EB 51 Annex 12.

E.2. Calculation of project emissions or actual net GHG removals by sinks

Over the duration of the project activity, N₂O concentration and gas volume flow in the stack of the nitric acid plant as well as the temperature and pressure of ammonia gas flow and ammonia-to-air ratio have been measured continuously. The daily report comprising of the data for the day is generated by N₂O measuring AMS. The daily reports for the campaign period are compiled. The data pertaining to shut-down period of the plant is deleted from this compiled data and procedures defined under emergency preparedness are applied wherever applicable. The data so obtained is called Base data.

All the individual data readings where parameters are not within the specification of the facility are deleted. The data so obtained is called valid data.

Sample mean i.e. average value and standard deviation is determined for VSG and NCSG values in valid data sheet. 95% confidence level value is determined by multiplying standard deviation value by 1.96. This value is then added and subtracted from the sample mean value to arrive at new maximum and minimum limits. The new sample mean is determined by taking average of the NCSG and VSG values which are within these maximum and minimum limits.

Estimation of campaign-specific project emissions:

$$PE_n = VSG * NCSG * OH * 10^{-9}$$

Where,

VSG = Mean Stack Gas volume flow rate for the project campaign (m³/h)
 NCSG = Mean Concentration of N₂O in the stack gas for the project campaign (mg N₂O/Nm³)
 OH = Number of hours of operation in the specific monitoring period (h)
 PE_n = Total N₂O emissions of the nth project campaign (tN₂O)

Derivation of a moving average emission factor

Step 1:

Campaign specific emissions factor for each campaign is estimated during the project's crediting period by dividing the total mass of N₂O emissions during that campaign by the total production of 100% concentrated nitric acid during that same campaign

$$EF_n = PE_n / NAP_n$$

Results:

Parameter	Unit	Campaign – 8	Campaign – 9	Campaign – 10
VSG	Nm ³ /h	42,308	49,650	49,495

NCSG	mgN ₂ O/ Nm ³	878	1,770	945
OH	Hours	2,899	2,890	2,877
NAP	tHNO ₃	42,588	41,254	39,181
PE n	tN ₂ O	108	254	135
EF	tN ₂ O/tHNO ₃	0.0025	0.0062	0.0034

Step 2: Estimate a moving average emissions factor is calculated at the end of a campaign 'n' as follows:

$$EF_{ma,n} = (EF_1 + EF_2 + \dots + EF_n) / n$$

And consider the maximum of $EF_{ma,n}$ and EF_n for estimation of project emissions.

Results:

Project Campaign 8:

$EF_1 = NA^1$	$EF_2 = 0.0032$
$EF_3 = 0.0026$	$EF_4 = 0.0043$
$EF_5 = 0.0016$	$EF_6 = 0.0018$
$EF_7 = 0.0019$	$EF_8 = 0.0025$

$$\text{Moving Average Emission Factor} = EF_{ma,8} = (EF_2 \text{ to } EF_8) / 7 \\ = 0.0027$$

$$\text{EF for the Project} = EF_8 = \text{Max} (EF_{ma,8}, EF_8) \\ = \text{Max} (0.0027, 0.0025) \\ = 0.0027$$

Project Campaign 9:

$EF_1 = NA$	$EF_2 = 0.0032$
$EF_3 = 0.0026$	$EF_4 = 0.0043$
$EF_5 = 0.0016$	$EF_6 = 0.0018$
$EF_7 = 0.0019$	$EF_8 = 0.0025$
$EF_9 = 0.0062$	--

$$\text{Moving Average Emission Factor} = EF_{ma,9} = (EF_2 \text{ to } EF_9) / 8 \\ = 0.0030$$

$$\text{EF for the Project} = EF_9 = \text{Max} (EF_{ma,9}, EF_9) \\ = \text{Max} (0.0030, 0.0062) \\ = 0.0062$$

Project Campaign 10:

$EF_1 = NA$	$EF_2 = 0.0032$
$EF_3 = 0.0026$	$EF_4 = 0.0043$
$EF_5 = 0.0016$	$EF_6 = 0.0018$
$EF_7 = 0.0019$	$EF_8 = 0.0025$
$EF_9 = 0.0062$	$EF_{10} = 0.0034$

$$\text{Moving Average Emission Factor} = EF_{ma,10} = (EF_2 \text{ to } EF_{10}) / 9 \\ = 0.0031$$

¹ As per Recommendation by the Meth Panel (Date of Meth Panel meeting: 7 - 11 March 2011) on request for clarification (AM_CLA_0204) on Approved Methodologies (reference 'F-CDM-AM-Clar_Respon_01.1 '). For the calculation of the moving average emission factor $EF_{ma,n}$, the emission factor of the first campaign shall be excluded if it is partially outside the crediting periods.]

$$\begin{aligned}
 \text{EF for the Project} &= \text{EF}_{10} = \text{Max} (\text{EF}_{\text{ma},10}, \text{EF}_{10}) \\
 &= \text{Max} (0.0031, 0.0034) \\
 &= 0.0034
 \end{aligned}$$

Emission reductions calculation:

The emission reduction is calculated by baseline emissions minus the project emissions. The following formula is adopted for calculating emission reductions generated by the project activity:

Emission Reductions:

$$\text{ER} = (\text{EF}_{\text{BL}} - \text{EF}_{\text{p}}) * \text{NAP} * \text{GWP}_{\text{N}_2\text{O}}$$

Where

- ER = Emission reductions of the project for the specific Monitoring period (tCO_{2e})
 EF_{BL} = Baseline Emission Factor (tN₂O/tHNO₃)
 EF_p = Emission Factor used to calculate the emissions from this particular Monitoring Period (i.e the higher of EF_{ma, n} and EF_n)
 NAP = Nitric Acid production for the Monitoring Period (tHNO₃). The Maximum Value of NAP shall not exceed the design capacity
 GWP_{N₂O} = Global Warming Potential for the N₂O as per IPCC default value.

Results:

Parameter	Unit	Campaign – 8	Campaign – 9	Campaign – 10
NAP	tHNO ₃	42,588	41,254	39,181
EF _{BL}	tN ₂ O/tHNO ₃	0.0125	0.0125	0.0125
EF _p	tN ₂ O/tHNO ₃	0.0027	0.0062	0.0034
GWP _{N₂O}	tCO _{2e} /tN ₂ O	310	310	310

Project Campaign – 8:

$$\begin{aligned}
 \text{ER} &= (0.0125 - 0.0027) * 42,588 * 310 \\
 &= 129,607 \text{ tCO}_{2e}
 \end{aligned}$$

Project Campaign – 9:

$$\begin{aligned}
 \text{ER} &= (0.0125 - 0.0062) * 41,254 * 310 \\
 &= 81,113 \text{ tCO}_{2e}
 \end{aligned}$$

Project Campaign – 10:

$$\begin{aligned}
 \text{ER} &= (0.0125 - 0.0034) * 39,181 * 310 \\
 &= 110,127 \text{ tCO}_{2e}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total Emission Reduction during Monitoring period} &= 129,607 + 81,113 + 110,127 \\
 &= 320,847 \text{ tCO}_{2e}
 \end{aligned}$$

E.3. Calculation of leakage

NA

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Campaign Period – 8 (11/05/2012 – 28/09/2012)	1,65,029	35,421	NA	129,607 (Round down figure)
Campaign Period – 9 (29/09/2012 – 31/01/2013)	1,59,859	78,746	NA	81,113 (Round down figure)
Campaign Period – 10 (01/02/2013 – 01/08/2013)	1,51,826	41,698	NA	110,127 (Round down figure)
Total	4,76,714	1,55,866	NA	320,847

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO ₂ e) for campaign period – 8	172,795 tCO ₂ e (447,305 tCO ₂ e x 141 days / 365 days)	129,607 tCO ₂ e
Emission reductions or GHG removals by sinks (tCO ₂ e) for campaign period – 9	153,187 tCO ₂ e (447,305 tCO ₂ e x 125 days / 365 days)	81,113 tCO ₂ e
Emission reductions or GHG removals by sinks (tCO ₂ e) for campaign period – 10	223,040 tCO ₂ e (447,305 tCO ₂ e x 182 days / 365 days)	110,127 tCO ₂ e

E.6. Remarks on difference from estimated value in registered PDD

The emission reduction during this monitoring period is less than the ex – ante value mainly due to lower catalyst efficiency of 75%, 49% and 73% during Campaign Period – 8, 9 and 10 respectively as against the estimated catalyst efficiency of 90% for ex-ante values.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO ₂ e)	190,604	130,243

Appendix-IBase Data (As validated during validation)

Parameter	Unit	Value
AFR max	kgNH ₃ / h	5113
AIFR max	%	11.50%
OT normal	Deg C	863-900
OP normal	Bar(guage)	660 – 626
GS BL		RCF
GC BL	-	Pt - 92%, Rh – 8%
NCSG BC	mgN ₂ O/ Nm ³	4054.1
VSG BC	Nm ³ /h	49,077
OH BC	hours	2861
NAP BC	tHNO ₃	43,326
CL BL	tHNO ₃	43,326
CL normal	tHNO ₃	44,435
GS normal	-	Rashtriya Chemicals & Fertilizer Ltd
GC normal	-	Pt – 92%, Rh - 8%
Design Capacity	MT/ annum	128,480

Historical Data:

Unit 1 : 352 TPD(HP) Campaign 1	Catalyst Running Hrs. : 2,879
Date: 08.11.2005 to 12.03.2006	Production : 44,469

Unit 1 : 352 TPD (HP) Campaign 2	Catalyst Running Hrs. : 2,871
Date: 13.03.2006 to 14.11.2006	Production : 43,796

Unit 1 : 352 TPD(HP) Campaign 3	Catalyst Running Hrs. : 2,879
Date: 17/11/2006 to 17/06/2007	Production : 45,570

Unit 1 : 352 TPD(HP) Campaign 4	Catalyst Running Hrs. : 2,880
Date: 21/06/2007 to 18/01/2008	Production : 43,715

Unit 1 : 352 TPD(HP) Campaign 5	Catalyst Running Hrs. : 2,902
Date: 20/01/2008 to 01/07/2008	Production : 44,625

Parameters	Unit	Historical Values (a)	Design Data (b)	Permitted Range
Oxidation Temp	Deg C	863-900	860-930	863-900
Oxidation Pr	bar(g)	6.60-6.26	7.65	6.60-6.26
Ammonia Flow Rate (Max)	Nm ³ / h	6,725	7,992	6,725
Ammonia Flow Rate (Max)	kg/ h	5,113	6,076	5,113
Ammonia - air ratio (Max)	%	11.9	11.5	11.5

Appendix - II**HP NA Plant shutdown/start-up and CEM System down time details**

CEM system down time records during monitoring period:

The details for down time of CEM system for monitoring various parameters for HP Nitric acid Plant is as follows:

SN	From	To	Duration (in hr)	Reason
1	10.06.2012 19:00	11.06.2012 13:00	19	Vacuum pump was OFF and sample flow was zero.
2	18.06.2012 15:00	19.06.2012 00:00	10	Power cut off due to UPS failure.
3	18.06.2012 20:00	19.06.2012 00:00	5	Power cut off due to UPS failure.
4	02.07.2012 22:00	03.07.2012 01:00	4	Power cut off due to UPS failure.
5	17.01.2013 16:00	17.01.2013 17:00	2	SCC2 cooler temp and CAN bus connected to module is interrupted error occurred.

Plant Shutdown / Start-up records during monitoring period:

HP Nitric acid Plant shutdown and start-up records during the monitoring period is as follows:

Plant Shutdown From	Plant Shutdown up-to	Duration of shutdown (In hr)	Reason of shutdown
Campaign – 8			
11.05.2012 00:00	12.05.2012 19:00	44	Primary catalyst replacement
18.05.2012 01:00	24.05.2012 16:00	160	Annual turnaround
03.06.2012 04:00	08.06.2012 19:00	136	High stock
13.06.2012 06:00	15.06.2012 01:00	44	Plant tripped due to low cooling water flow
10.07.2012 00:00	10.07.2012 19:00	20	Plant tripped due to power failure
16.07.2012 23:00	17.07.2012 03:00	5	Plant tripped due to low instrument air pressure
28.08.2012 14:00	28.08.2012 19:00	6	Plant tripped due to power dip
08.09.2012 10:00	09.09.2012 00:00	15	Plant tripped due to power dip
17.09.2012 21:00	19.09.2012 05:00	33	Plant tripped due to low cooling water flow
19.09.2012 13:00	19.09.2012 14:00	2	Plant tripped due to low cooling water flow
28.09.2012 04:00	28.09.2012 23:00	20	Primary catalyst replacement
Campaign – 9			
29.09.2012 00:00	29.09.2012 03:00	4	Primary catalyst replacement
09.10.2012 21:00	12.10.2012 20:00	72	High stock
17.01.2013 19:00	18.01.2013 09:00	15	Requirement of Ammonia – I plant
31.01.2013 05:00	31.01.2013 23:00	19	Primary catalyst replacement
Campaign – 10			
01.02.2013 00:00	01.02.2013 19:00	20	Primary catalyst replacement
05.02.2013 01:00	12.02.2013 03:00	171	High stock
15.02.2013 18:00	15.02.2013 19:00	2	Plant tripped
27.02.2013 03:00	06.03.2013 20:00	186	High stock
13.03.2013 02:00	29.03.2013 15:00	398	High stock
05.04.2013 04:00	13.04.2013 05:00	194	High stock
22.04.2013 09:00	02.05.2013 16:00	248	High stock and annual turnaround
05.05.2013 21:00	16.05.2013 03:00	247	Water shortage
17.06.2013 19:00	17.06.2013 23:00	5	Plant tripped due to low cooling water flow
01.08.2013 04:00	01.08.2013 23:00	20	Primary catalyst replacement

Appendix - III

Technical Details of Monitoring Instruments:

Data Variable	Description	Data Unit	Instrument Type	Instrument Tag no.	Sr. No	Accuracy	Data of Previous calibration	Date of calibration	Calibration frequency	Next calibration conducted on	Calibration Agency
AFR	Amm gas to N 001	Nm3/Hr	D.P Type Transmitter	FT120 211A	S01987 44	± 0.075% of span	28/03/2012	16/03/2013	1 Year	15/03/2014	Plant
AFR	Amm gas to N 001	Nm3/Hr	D.P Type Transmitter	FT120 211B	S01987 45	± 0.075% of span	28/03/2012	16/03/2013	1 Year	15/03/2014	Plant
AFR	Amm gas to N 001	Nm3/Hr	D.P Type Transmitter	FT120 211C	S01987 46	± 0.075% of span	28/03/2012	16/03/2013	1 Year	15/03/2014	Plant
OP	Amm - inlet to N001	Barg	Pressure Transmitter	PT 120212A	012099 36	± 0.075% of span	29/03/2012	14/03/2013	1 Year	13/03/2014	Plant
OP	Amm - inlet to N001	Barg	Pressure Transmitter	PT 120212B	012099 34	± 0.075% of span	29/03/2012	14/03/2013	1 Year	13/03/2014	Plant
OP	Amm - inlet to N001	Barg	Pressure Transmitter	PT 120212C	012099 37	± 0.075% of span	29/03/2012	14/03/2013	1 Year	13/03/2014	Plant
AFR & AIFR	Amm - inlet to N001 temp	Deg.cen	RTD with R/I converter	TT 120212A	NA	Deviation after calibration: 0.1% of F.S. value	30/03/2012	15/03/2013,	1 Year	14/03/2014	Plant
AFR & AIFR	Amm - inlet to N001 temp	Deg.cen	RTD with R/I converter	TT 120212B	NA	Deviation after calibration: 0.1% F.S. value	30/03/2012	15/03/2013,	1 Year	14/03/2014	Plant
AFR & AIFR	Amm - inlet to N001 temp	Deg.cen	RTD with R/I converter	TT 120212C	NA	Deviation after calibration: 0.1% F.S. value	30/03/2012	15/03/2013,	1 Year	14/03/2014	Plant
AIFR	Air Flow-N001	Nm3/Hr	D.P Type Transmitter	FT 120213A	S01987 40	± 0.10% of span	28/03/2012	16/03/2013,	1 Year	15/03/2014	Plant
AIFR	Air Flow-N001	Nm3/Hr	D.P Type Transmitter	FT 120213B	S01987 41	± 0.10% of span	28/03/2012	16/03/2013,	1 Year	15/03/2014	Plant
AIFR	Air Flow-N001	Nm3/Hr	D.P Type Transmitter	FT 120213C	S01987 42	± 0.10% of span	28/03/2012	16/03/2013,	1 Year	15/03/2014	Plant
AIFR	Air inlet to N001	Barg	Pressure Transmitter	PT120 214A	S01987 60	± 0.075% of span	29/03/2012	15/03/2013,	1 Year	14/03/2014	Plant
AIFR	Air inlet to N001	Barg	Pressure Transmitter	PT120 214B	S01987 61	± 0.075% of span	29/03/2012	15/03/2013,	1 Year	14/03/2014	Plant
AIFR	Air inlet to N001	Barg	Pressure Transmitter	PT120 214C	S01987 62	± 0.075% of span	29/03/2012	15/03/2013,	1 Year	14/03/2014	Plant
AIFR	Air inlet to N001 temp	Deg.cen	RTD with R/I converter	TT 120214A	NA	Deviation after calibration: 0.1% of F.S. value	30/03/2012	15/03/2013	1 Year	14/03/2014	Plant
AIFR	Air inlet to N001 temp	Deg.cen	RTD with R/I converter	TT 120214B	NA	Deviation after calibration: 0.1% of F.S. value	30/03/2012	15/03/2013	1 Year	14/03/2014	Plant
AIFR	Air inlet to N001 temp	Deg.cen	RTD with R/I converter	TT 120214C	NA	Deviation after calibration: 0.1% of F.S. value	30/03/2012	15/03/2013	1 Year	14/03/2014	Plant
OT	Catalys	Deg.ce	Temp.	TT120332	199556	D/A	28/03/2	14/03/20	1 Year	13/03/2	Plant

	t Temp ROO1	nt	Transmitt er	A		Accuracy ± 0.03% of span	012	13,		014	
OT	Catalys t Temp ROO1	Deg.ce nt	Temp. Transmitt er	TT120333 A	199558	D/A Accuracy ± 0.03% of span	29/03/2 012	14/03/20 13,	1 Year	13/03/2 014	Plant
OT	Catalys t Temp ROO1	Deg.ce nt	Temp. Transmitt er	TT120334 A	199560	D/A Accuracy ± 0.03% of span	29/03/2 012	14/03/20 13,	1 Year	13/03/2 014	Plant
NCS G	N2O Analys er	Mg/m3	N2O Analyser	AI 120400	024007 1228/2 400	Repeatability ≤ 0.5% of span	28/3/20 12	22/05/20 12, 13/06/20 12, 08/09/20 12, 05/12/20 12, 04/03/20 13, 03/06/20 13	3 Months	02/09/ 2013	Plant
VSG	Stack Flow	mBar	D.P Type Transmitt er	FI120400	265DS 660002 8331	Base Accuracy ± 0.04%	30/03/2 012	18/03/20 13,	1Year	17/03/2 014	Plant
PSG	Stack Pressur e	hPa	Pressure Transmitt er	PI120400	119894 9	0.5% of FSO	30/03/2 012	18/03/20 13	1Year	17/03/2 014	Plant
TSG	Stack Temp	Deg. cent	RTD with R/I converter	TI120400	NA	Linearity error : <0.1 % FS	30/03/2 012	08/08/20 12, 18/03/20 13, 08/06/20 13, 13/07/20 13	1Year	12/07/2 014	Plant
NAP	Produc t acid flow	T/hr	Mass flow meter	FI10121	NEW SENSOR SR.NO 14206043 NEW TRANS. SR.NO 3170443 OLD SEN.- 12031565 TRANS.- 3781972	± 0.1% of rate	19/04/2 011	--	3 Years	18/04/2 014	Emers on
NAP	Acid Densit y	gm/cc	Hydrome ter	NA	NA	Least count: 0.001	14/11/2 011	12/05/20 12, 02/11/20 12, 02/05/20 13	6 months	01/11/2 013	Plant
NAP	Acid Temper ature	Deg C	Thermom eter	NAG/L/T M-1	NA	Least count: 1	25/10/2 011	22/10/20 12	1 Year	21/10/2 013	Plant

* Replaced on 05/05/2011.

Appendix –IV

Abbreviations

AFR

Ammonia Gas Flow Rate to AOR

AIFR	Ammonia to Air Ratio
AOR	Ammonia Oxidation Reactor
BC	Baseline Campaign
BE	Baseline Emission
CDM	Clean Development Mechanism
CEM	Continuous Emission Monitoring
ER	Emission Reduction
FSO	Full Scale Operation
FS	Full Scale
GHG	Green House Gases
GWP	Global Warming Potential
MR	Monitoring Report
NAP	Nitric Acid Production
NH₃	Ammonia
N₂O	Nitrous Oxide
OH	Operating Hours
OP	Operating Pressure
OT	Operating Temperature
RCF	Rashtriya Chemicals and Fertilizers Limited
TSG	Temperature of Stack Gas
VSG	Volume flow rate of the Stack Gas

- - - - -

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory		
Document Type: Form		
Business Function: issuance		
Keywords: monitoring report, performance monitoring		