



**Monitoring report form  
(Version 04.0)**

*Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.*

**MONITORING REPORT**

<b>Title of the project activity</b>	N <sub>2</sub> O abatement in HP Nitric Acid plants at Rashtriya Chemicals & Fertilizers Limited, India
<b>Reference number of the project activity</b>	2792
<b>Version number of the monitoring report</b>	5
<b>Completion date of the monitoring report</b>	10/09/2014
<b>Registration date of the project activity</b>	20/11/2009
<b>Monitoring period number and duration of this monitoring period</b>	3, 08/07/2010 to 04/12/2010 (Both days inclusive)
<b>Project participant(s)</b>	Rashtriya Chemicals & Fertilizers Ltd. (Public Entity)
<b>Host Party(ies)</b>	India
<b>Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)</b>	05, AM0034 Version 03.2
<b>Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD</b>	183,824 tCO <sub>2</sub> (447,305 tCO <sub>2</sub> x 150 days / 365 days)
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period</b>	135,013 t CO <sub>2</sub>
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)</b>	135,013 t CO <sub>2</sub>
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).</b>	0 t CO <sub>2</sub>

## 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 N<sub>2</sub>O 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 NO<sub>2</sub>, which is converted into Nitric Acid by absorbing NO<sub>2</sub> in water. N<sub>2</sub>O 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 N<sub>2</sub>O (a greenhouse gas) by installing of secondary N<sub>2</sub>O decomposition (DeN<sub>2</sub>O) 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 DeN<sub>2</sub>O 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 N<sub>2</sub>O which is an undesirable by product of nitric acid production process and reduces its emission in to the atmosphere. The N<sub>2</sub>O 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 <sub>2</sub> O catalyst	31 <sup>st</sup> March 2009
2	Commissioning of AMS	24 <sup>th</sup> July 2008
3	QAL 2 Test	21 <sup>st</sup> to 23 <sup>rd</sup> October 2008
4	AST for the year 2010	4 <sup>th</sup> and 5 <sup>th</sup> March 2010
5	AST for the year 2011	1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> March 2011
6	Annual Maintenance of AMS (During the Monitoring Period)	ABB Engineer visited on 14/08/2010 for routine maintenance job of AMS.
7	Date of Replacement of Primary Catalyst (During Monitoring Period)	09/07/2010
8	Jobs pertaining to Secondary Catalyst	Nil

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 135,013 tCO<sub>2</sub>.

**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 Ltd. (Public entity)	No
Switzerland	Rashtriya Chemicals & Fertilizers Ltd. (Public entity)	No

**A.4. Reference of applied methodology and standardized baseline**

- Approved baseline methodology AM0034 **“Catalytic reduction of N<sub>2</sub>O 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

**A.6. Contact information of responsible persons/ entities**

Mr. ☒ Ms. ☐

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## SECTION B. Implementation of project activity

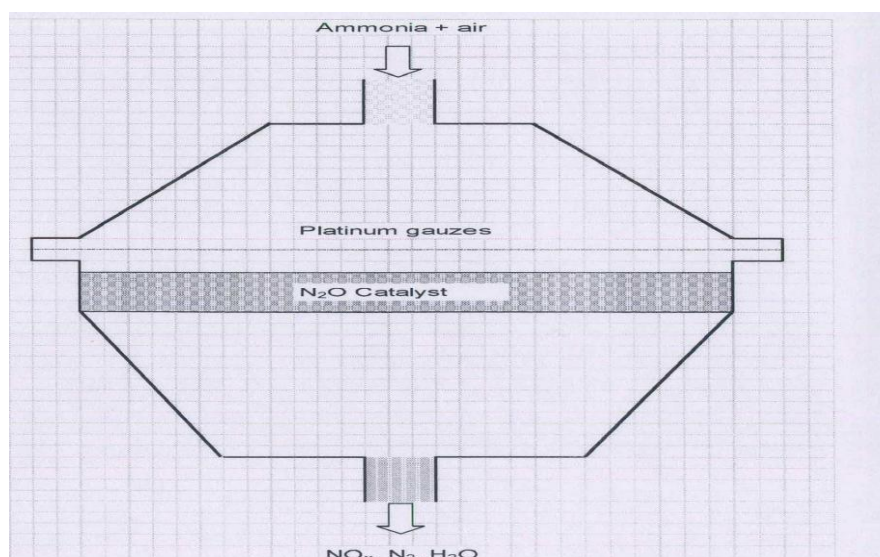
### B.1. Description of implemented registered project activity

Nitric Acid ( $\text{HNO}_3$ ) is produced through the oxidation of ammonia ( $\text{NH}_3$ ) on precious metal catalyst gauze in the ammonia burner of a nitric acid plant. Nitrous Oxide ( $\text{N}_2\text{O}$ ) is an undesirable by-product gas produced in the manufacture of nitric acid. Waste  $\text{N}_2\text{O}$  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  $\text{N}_2\text{O}$  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  $\text{N}_2\text{O}$  is reduced to harmless  $\text{N}_2$ . 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  $\text{N}_2\text{O}$ . The reduction is done as below in an exothermic reaction.



### B.2. Post registration changes

#### B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

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 1<sup>st</sup> and 2<sup>nd</sup> 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 16<sup>th</sup> October 2012.

#### **B.2.2. Corrections**

NA

#### **B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline**

As per registered PDD, operating hour recording at CEM system is based on temperature limits of the reactor. On 1<sup>st</sup> Day of the monitoring period i.e. 08/07/2010, OH was being monitored based on the Ammonia flow to the reactor, however plant was not in operation on this day. From 09/07/2010 upto end of monitoring period OH was monitored based on the temperature of 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**

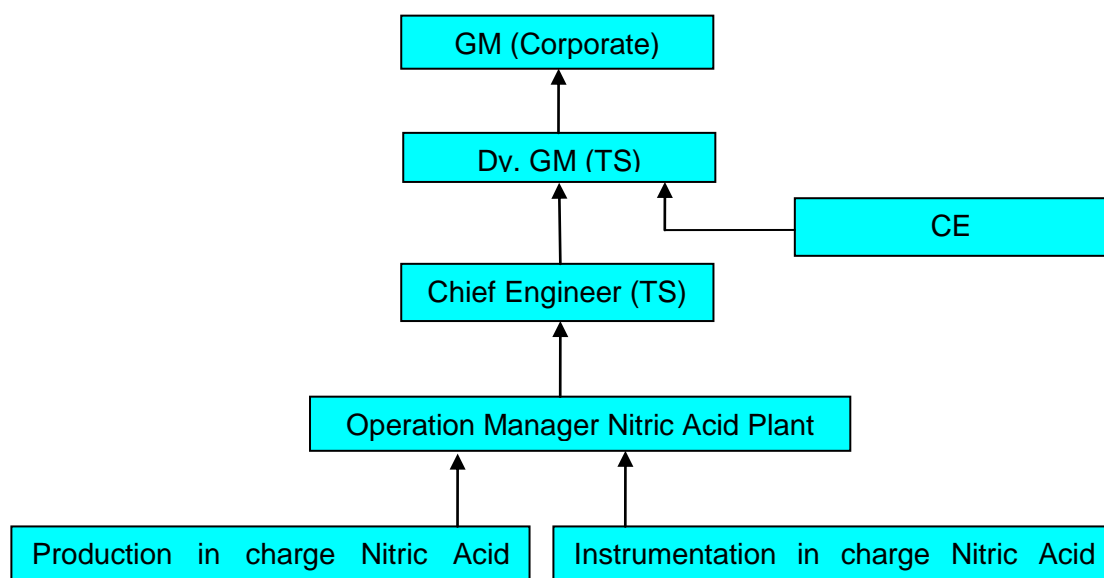
RCF is an ISO 9001 certified company and has procedure for monitoring and recording of data on operation of the plant/equipments. ISO 9001 procedures have been formulated for all new monitoring instruments. All instruments used for CDM project monitoring are calibrated as per ISO 9001 procedures.

### 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**

Exact Concentration	3,650 PPM
Supplier	Chemtron Science Laboratories Pvt. Ltd.
Concentration Valid till	29/04/2011

## **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 N<sub>2</sub>O 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 N<sub>2</sub>O 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 N<sub>2</sub>O 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 N<sub>2</sub>O gas is used for automatic calibration. The Analyser is QAL1 tested for the measurement of N<sub>2</sub>O.

## 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.

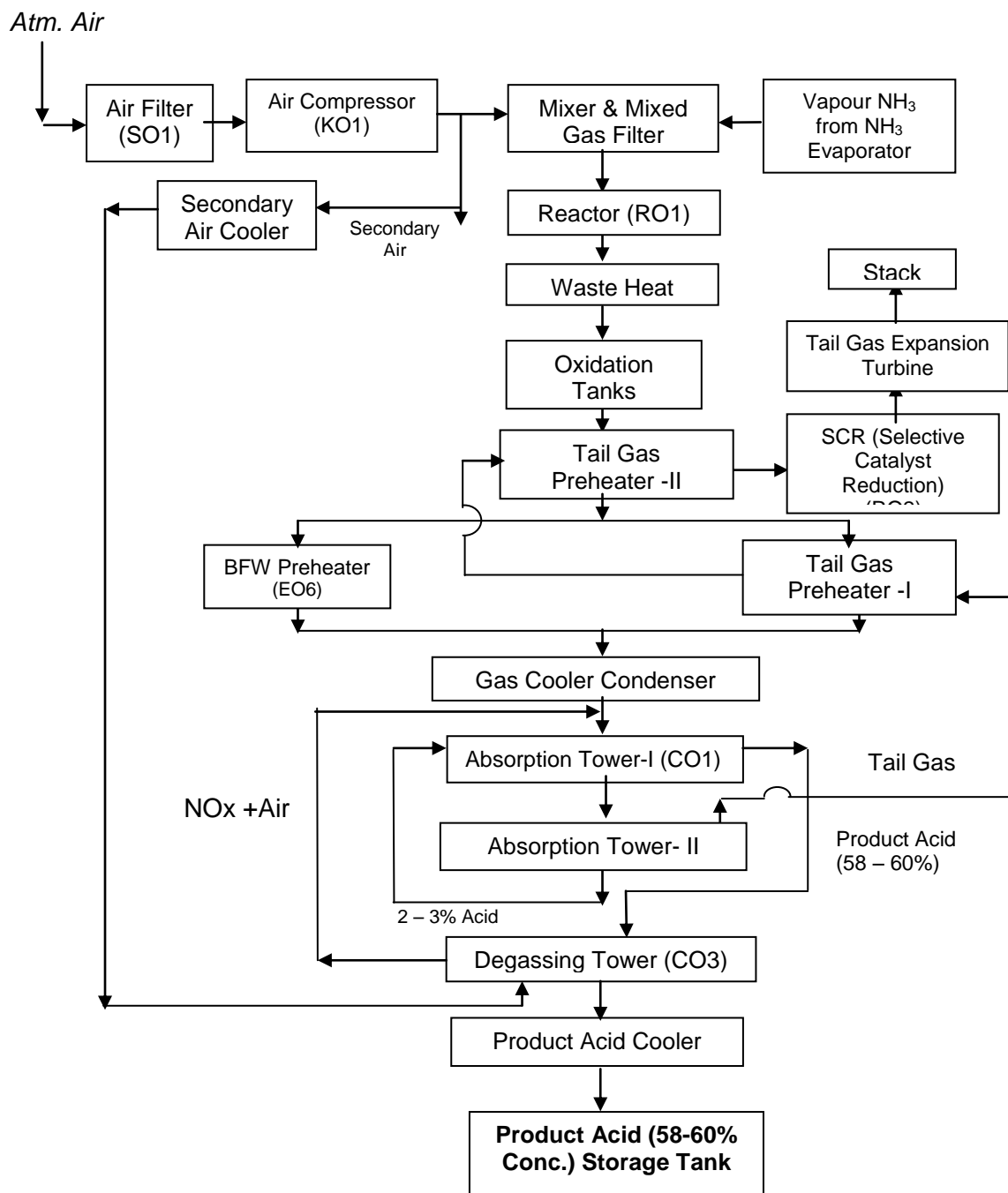
## 2.5 Flow Meter

The SDF Flow measuring system allows continuous determination of the flow rate of stack gas. It is performance tested according to 17. BImSchV 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.

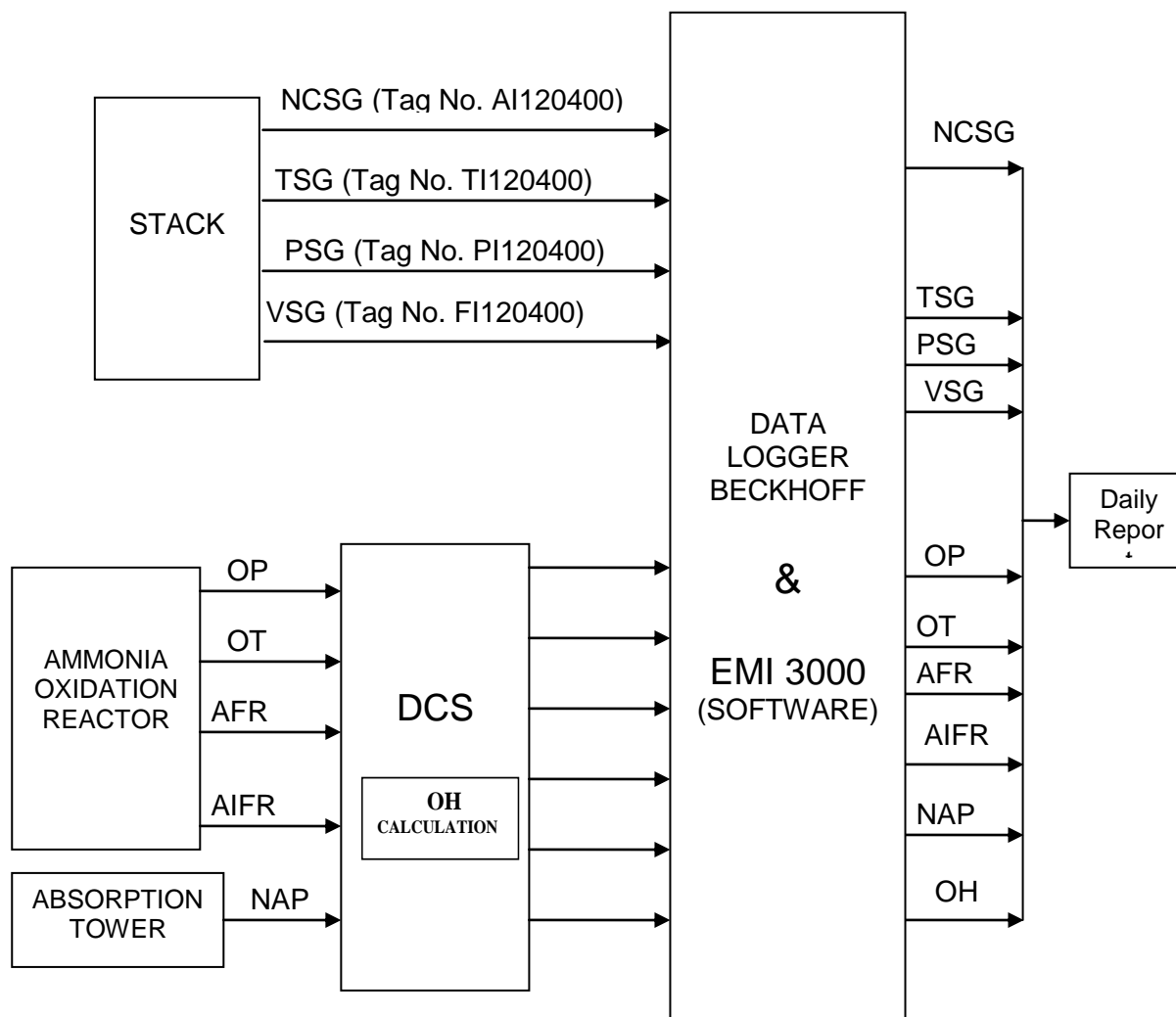
The SDF flow sensor which is a flow measuring device is a highly sensitive system for continuous, in-situ flow measurement. The stack gas flow is measured in the stack by measuring the dynamic differential pressure generated by the SDF flow sensor probe rod and using ABB's Differential pressure transmitter. 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.**



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<sub>h</sub>, OP<sub>h</sub>, 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 DeN<sub>2</sub>O 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 <sub>2</sub> O Analyzer (NCSG)	In case N <sub>2</sub> 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> <p>➤ In case of shut down data for concentration shall be</p>

	<p>taken from previous day.</p> <ul style="list-style-type: none"> <li>➤ In case of start-up data for concentration shall be taken from next day.</li> <li>➤ 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.</li> <li>➤ 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.</li> </ul>
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

<b>Data / Parameter:</b>	<b>AFR<sub>max</sub></b>
<b>Unit:</b>	<b>Nm<sup>3</sup>/hr</b>
<b>Description:</b>	Maximum Ammonia Flow Rate
<b>Source of data:</b>	Plant Records
<b>Value(s) applied:</b>	6,725 (This is equivalent to 5.113 tNH <sub>3</sub> /h)
<b>Purpose of data:</b>	Baseline Emission
<b>Additional comment:</b>	The methodology gives the unit of measurement in tNH <sub>3</sub> /h but RCF have been measuring the parameter in Nm <sup>3</sup> /h in the past. The conversion factor from Nm <sup>3</sup> /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.

<b>Data / Parameter:</b>	<b>AIFR<sub>max</sub></b>
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:	-

<b>Data / Parameter:</b>	<b>OT normal</b>
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:	-

<b>Data / Parameter:</b>	<b>OP<sub>normal</sub></b>
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 <sup>-5</sup> 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

<b>Data / Parameter:</b>	<b>GS<sub>BL</sub></b>
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.

<b>Data / Parameter:</b>	<b>GC<sub>BL</sub></b>
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:	-

<b>Data / Parameter:</b>	<b>NCSG<sub>BC</sub></b>
Unit:	mgN <sub>2</sub> O/Nm <sup>3</sup>
Description:	N <sub>2</sub> O Concentration in the stack gas
Source of data:	N <sub>2</sub> O analyser
Value(s) applied):	For the baseline campaign run by RCF during 01/07/2008 and 07/11/2008, the N <sub>2</sub> O concentration values comes at 4,054.1 mg N <sub>2</sub> O/Nm <sup>3</sup>
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 recognised 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.

<b>Data / Parameter:</b>	<b>VSG<sub>BC</sub></b>
Unit:	Nm <sup>3</sup> /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 <sup>3</sup> /h
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 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.

<b>Data / Parameter:</b>	<b>OH<sub>BC</sub></b>
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.

<b>Data / Parameter:</b>	<b>NAP<sub>BC</sub></b>
Unit:	tHNO <sub>3</sub>
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 <sub>3</sub> .
Purpose of data:	Baseline Emission
Additional comment:	<p><b>Nitric Acid Flow:</b> Calibration of flow meter once in three years as per OEM Recommendation.</p> <p><b>Nitric Acid Concentration:</b> 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"> <li>• In case of shut down data for concentration is taken from previous day</li> <li>• In case of start up data for concentration is taken from next day.</li> <li>• In case of shut down and start up both data for concentration is taken from average of previous available day and next available day.</li> <li>• 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</li> </ul> <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>

<b>Data / Parameter:</b>	<b>CL<sub>BL</sub></b>
Unit:	tHNO <sub>3</sub>
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:	-

<b>Data / Parameter:</b>	<b>CL<sub>Normal</sub></b>
Unit:	tHNO <sub>3</sub>
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:	-

<b>Data / Parameter:</b>	<b>GS<sub>Normal</sub></b>
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)

<b>Data / Parameter:</b>	<b>GC<sub>Normal</sub></b>
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

<b>Data / Parameter:</b>	<b>NCSG</b>
Unit:	mgN <sub>2</sub> O/m <sup>3</sup>
Description:	N <sub>2</sub> O concentration in the stack gas
Measured/ Calculated / Default:	Measured
Source of data:	N <sub>2</sub> O Analyser
Value(s) of monitored parameter:	861.34
Monitoring equipment:	Given in Appendix III
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Every second
Calculation method (if applicable):	-



QA/QC procedures:	N <sub>2</sub> 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
Additional comment:	N <sub>2</sub> 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.

<b>Data / Parameter:</b>	<b>VSG</b>
Unit:	Nm <sup>3</sup> /h
Description:	Volume flow rate of the stack gas
Measured/ Calculated / Default:	Measured
Source of data:	From CEM System
Value(s) of monitored parameter:	48,283.91
Monitoring equipment:	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%.

<b>Data / Parameter:</b>	<b>OH</b>
Unit:	Hours
Description:	Operating hours
Measured/ Calculated / Default:	Calculated
Source of data:	From CEM system
Value(s) of monitored parameter:	2,873

Monitoring equipment:	OH calculation was based on Ammonia Flow to Reactor for 1 <sup>st</sup> day however plant was not in operation on this day. Thereafter OH was monitored based on temperature of the reactor. Details of equipments used for measurement of temperature of the Reactor (OT) is given in Appendix III. The tag no. of OT are TT120332A, TT120333A and TT120334A.
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.
Purpose of data:	Project Emission
Additional comment:	On 1st Day of the monitoring period i.e. 08/07/2010, OH was being monitored based on the Ammonia flow to the reactor however plant was not in operation on this day. From 09/07/2010 upto end of monitoring period OH was monitored based on the temperature of the reactor. This is in line with approved deviation request (UNFCCC deviation reference no. DEV-0395) by UNFCCC. .

<b>Data / Parameter:</b>	<b>NAP</b>
Unit:	tHNO <sub>3</sub>
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:	45,534
Monitoring equipment:	Given in Appendix III
Measuring/ Reading/ Recording frequency:	Hourly Compiled for entire campaign
Calculation method (if applicable):	-
QA/QC procedures:	<b>Nitric Acid Flow:</b> Calibration of flow meter once in three years as per OEM recommendation.  <b>Nitric Acid Concentration:</b> Calibration of Hydrometer and Thermometer shall be ensured by ISO 9001 Procedures.
Purpose of data:	Project Emission

Additional comment:	<p><b>Nitric Acid Flow:</b> 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><b>Nitric Acid Concentration:</b> 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"> <li>• In case of shut down data for concentration shall be taken from previous day.</li> <li>• In case of start-up data for concentration shall be taken from next day.</li> <li>• 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.</li> <li>• 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.</li> </ul> <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 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 <math>\pm 0.1\%</math> of rate.</p>
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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:	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 $\leq 0.1$ % of FS.

<b>Data / Parameter:</b>	<b>PSG</b>
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:	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.

<b>Data / Parameter:</b>	<b>AFR</b>
Unit:	Kg NH <sub>3</sub> /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:	Given in Appendix III
Measuring/ Reading/ Recording frequency:	Frequency of monitoring: Continuous.
Calculation method (if applicable):	-
QA/QC procedures:	Included in evaluation by third party validator
Purpose of data:	Project Emission
Additional comment:	To be obtained from operating condition campaign. Ammonia flow meter is used. Transmitted from DCS. The accuracy of this instrument is $\pm 0.075$ % of span.

<b>Data / Parameter:</b>	<b>UNC</b>
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.

<b>Data / Parameter:</b>	<b>AIFR</b>
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:	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.

<b>Data / Parameter:</b>	<b>OT<sub>h</sub></b>
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:	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 $\pm 0.03\%$ of span.

<b>Data / Parameter:</b>	<b>OP<sub>h</sub></b>
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:	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 $\pm 0.075\%$ of span.

<b>Data / Parameter:</b>	<b>GS<sub>project</sub></b>
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
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.

<b>Data / Parameter:</b>	<b>GC<sub>project</sub></b>
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
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.

<b>Data / Parameter:</b>	<b>EF<sub>reg</sub></b>
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 <sub>2</sub> 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
Additional comment:	Currently there is no regulation for N <sub>2</sub> O emission. The new regulation will get reflected in consent to operate the plants. Consent to operate will be checked for N <sub>2</sub> O emission applicability for each campaign.

QAL 2 Correction Factors: (As per QAL 2 test August 2008)

Measuring Parameter	Correction Factor	
	a	b
N <sub>2</sub> O	-1,979.8	494.9
Volume Flow	-29,898	7,474.5
Temperature	-63.2	15.8
Pressure	-398	99.6

There is no change in the QAL2 Correction Factors.

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.

### 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 tCO<sub>2</sub>e/ tHNO<sub>3</sub>

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



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  $N_2O$  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 3:**

No.	Description	Unit	Value
1	$CL_n$	tHNO <sub>3</sub>	45,534
2	$CL_{normal}$	tHNO <sub>3</sub>	44,435
3	$CL_{BL}$	tHNO <sub>3</sub>	43,326

Here,  $CL_n$  is greater than  $CL_{normal}$ . Hence Baseline is applicable. This is also in compliance of “Clarification to AM0034 (Version 02): Catalytic Reduction of  $N_2O$  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,  $N_2O$  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  $N_2O$  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 (m<sup>3</sup>/h)  
 NCSG = Mean Concentration of  $N_2O$  in the stack gas for the project campaign (mg  $N_2O$ /Nm<sup>3</sup>)  
 OH = Number of hours of operation in the specific monitoring period (h)  
 $PE_n$  = Total  $N_2O$  emissions of the n<sup>th</sup> project campaign (t $N_2O$ )

### 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 N<sub>2</sub>O 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	Values During Monitoring Period
VSG	Nm <sup>3</sup> /h	48,283.91
NCSG	mgN <sub>2</sub> O/ Nm <sup>3</sup>	861.34
OH	Hours	2,873
NAP	tHNO <sub>3</sub>	45,534
PE <sub>n</sub>	tN <sub>2</sub> O	119.48
<b>EF</b>	<b>tN<sub>2</sub>O/tHNO<sub>3</sub></b>	<b>0.0026</b>

**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<sub>ma, n</sub> and EF<sub>n</sub> for estimation of project emissions.

**Results:**

*Project Campaign 3:*

EF <sub>1</sub> = NA <sup>1</sup>	EF <sub>2</sub> = 0.0032
EF <sub>3</sub> = 0.0026	

$$\begin{aligned} \text{Moving Average Emission Factor} &= EF_{ma,3} = (EF_2 + EF_3) / 2 \\ &= (0.0032 + 0.0026) / 2 \\ &= 0.0029 \end{aligned}$$

$$\begin{aligned} \text{EF for the Project} &= EF_3 = \text{Max} (EF_{ma,3}, EF_3) \\ &= \text{Max} (0.0029, 0.0026) \\ &= 0.0029 \end{aligned}$$

**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:**

$$ER = (EF_{BL} - EF_p) * NAP * GWP_{N_2O}$$

<sup>1</sup> 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\_Resp\_ver 01.1'). For the calculation of the moving average emission factor EF<sub>ma,n</sub>, the emission factor of the first campaign shall be excluded if it is partially outside the crediting periods.]

Where

- ER = Emission reductions of the project for the specific Monitoring period (tCO<sub>2</sub>e)  
 EF<sub>BL</sub> = Baseline Emission Factor (tN<sub>2</sub>O/tHNO<sub>3</sub>)  
 EF<sub>P</sub> = Emission Factor used to calculate the emissions from this particular Monitoring Period (i.e the higher of EF<sub>ma, n</sub> and EF<sub>n</sub>)  
 NAP = Nitric Acid production for the Monitoring Period (tHNO<sub>3</sub>). The Maximum Value of NAP shall not exceed the design capacity  
 GWP<sub>N<sub>2</sub>O</sub> = Global Warming Potential for the N<sub>2</sub>O as per IPCC default value.

### Results:

Parameter	Unit	Campaign - 3
NAP	tHNO <sub>3</sub>	45,533.90
EF <sub>BL</sub>	tN <sub>2</sub> O/tHNO <sub>3</sub>	0.0125
EF <sub>p</sub>	tN <sub>2</sub> O/tHNO <sub>3</sub>	0.0029
GWP <sub>N<sub>2</sub>O</sub>	tCO <sub>2</sub> /tN <sub>2</sub> O	310

### Project Campaign 3:

$$\begin{aligned} \text{ER} &= (0.0125 - 0.0029) * 45,533.90 * 310 \\ &= 135,013 \text{ tCO}_2 \end{aligned}$$

### 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 <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (t CO <sub>2</sub> e)	Leakage (t CO <sub>2</sub> e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO <sub>2</sub> e)
Total	177,090	39,614	NA	135,013 (Round down figure)

### 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 (t CO <sub>2</sub> e)	183,824 tCO <sub>2</sub> (447,305 tCO <sub>2</sub> x 150 days / 365 days)	135,013

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

The emission reduction during this monitoring period is 135,013 tCO<sub>2</sub>e which is less than the ex – ante value of 183,824 tCO<sub>2</sub>e mainly due to lower catalyst efficiency of 81% as against the estimated catalyst efficiency of 90%.

**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 <sub>2</sub> e)	135,013	0

**Appendix-I****Base Data (As validated during validation)**

Parameter	Unit	Value
AFR max	kgNH <sub>3</sub> / 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 <sub>BC</sub>	mgN <sub>2</sub> O/ Nm <sup>3</sup>	4054.1
VSG <sub>BC</sub>	Nm <sup>3</sup> /h	49,077
OH <sub>BC</sub>	hours	2861
NAP <sub>BC</sub>	tHNO <sub>3</sub>	43,326
CL BL	tHNO <sub>3</sub>	43,326
CL normal	tHNO <sub>3</sub>	44,435
GS normal	-	Rashtriya Chemicals & Fertilizer Ltd
GC normal	-	Pt – 92%, Rh - 8%
Design Capacity	MT/ annum	128,480

**Historical Data:**

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

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

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

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

<b>Unit 1 : 352 TPD(HP) Campaign 5</b>	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 <sup>3</sup> / h	6,725	7,992	6,725
Ammonia Flow Rate (Max)	kg/ h	5113	6076	5113
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:

Sr. No.	From	To	Reason
1	19.07.2010 02:00	19.07.2010 08:00	Test gas knob remained in atmosphere mode
2	05.11.2010 01:00	05.11.2010 08:00	Cooler temperature too low

**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
07.07.2010 24:00 (campaign 2 end)		-	-
-	08.07.2010 01:00 (Campaign 3 Start)	-	-
08.07.2010 01:00	19.07.2010 02:00	265	Due to high stock
29.07.2010 16:00	07.08.2010 01:00	201	Due to high stock
03.09.2010 16:00	03.09.2010 21:00	6	For instrumentation maintenance job
14.09.2010 10:00	19.09.2010 10:00	119	Due to high stock
19.09.2010 21:00	20.09.2010 13:00	15	For mechanical maintenance job
29.09.2010 13:00	01.10.2010 18:00	53	For mechanical maintenance job
04.11.2010 11:00	05.11.2010 01:00	13	For primary catalyst inspection
17.11.2010 19:00	17.11.2010 00:00	5	Power failure
21.11.2010 18:00	22.11.2010 02:00	6	Power failure
27.11.2010 15:00	27.11.2010 18:00	2	Mechanical problem
30.11.2010 13:00	30.11.2010 17:00	4	Power failure
04.12.2010 03:00	04.12.2010 23:00	20	For primary catalyst replacement
04.12.2010 23:00 (Campaign 3 End)	-	-	-

**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 N001	Nm <sup>3</sup> /Hr	D.P Type Transmitter	FT120 211A	S019 8744	± 0.075% of span	17/08/2009	06/08/2010	1 Year	19/04/2011	Plant
AFR	Amm gas to N001	Nm <sup>3</sup> /Hr	D.P Type Transmitter	FT120 211B	S019 8745	± 0.075% of span	17/08/2009	06/08/2010	1 Year	19/04/2011	Plant
AFR	Amm gas to N001	Nm <sup>3</sup> /Hr	D.P Type Transmitter	FT120 211C	S019 8746	± 0.075% of span	19/08/2009	06/08/2010	1 Year	19/04/2011	Plant
OP	Amm - inlet to N001	Barg	Pressure Transmitter	PT 120212 A	01209 936	± 0.075% of span	19/08/2009	04/08/2010	1 Year	16/04/2011	Plant
OP	Amm - inlet to N001	Barg	Pressure Transmitter	PT 120212 B	01209 934	± 0.075% of span	19/08/2009	04/08/2010	1 Year	16/04/2011	Plant
OP	Amm - inlet to N001	Barg	Pressure Transmitter	PT 120212 C	01209 937	± 0.075% of span	19/08/2009	04/08/2010	1 Year	16/04/2011	Plant
NA	Amm - inlet to N001 temp	Deg.c ent	RTD with R/I converter	TT 120212 A	NA	Deviation after calibration: 0.1% of F.S. value	19/08/2009	02/08/2010	1 Year	19/04/2011	Plant
NA	Amm - inlet to N001 temp	Deg.c ent	RTD with R/I converter	TT 120212 B	NA	Deviation after calibration: 0.1% F.S. value	17/08/2009	02/08/2010	1 Year	19/04/2011	Plant
NA	Amm - inlet to N001 temp	Deg.c ent	RTD with R/I converter	TT 120212 C	NA	Deviation after calibration: 0.1% F.S. value	17/08/2009	02/08/2010	1 Year	19/04/2011	Plant
NA	Air Flow-N001	Nm <sup>3</sup> /Hr	D.P Type Transmitter	FT 120213 A	S019 8740	± 0.10% of span	17/08/2009	06/08/2010	1 Year	19/04/2011	Plant
NA	Air Flow-N001	Nm <sup>3</sup> /Hr	D.P Type Transmitter	FT 120213 B	S019 8741	± 0.10% of span	17/08/2009	06/08/2010	1 Year	19/04/2011	Plant
NA	Air Flow-N001	Nm <sup>3</sup> /Hr	D.P Type Transmitter	FT 120213 C	S019 8742	± 0.10% of span	19/08/2009	06/08/2010	1 Year	19/04/2011	Plant
NA	Air inlet to N001	Barg	Pressure Transmitter	PT120 214A	S019 8760	± 0.075% of span	17/08/2009	05/08/2010	1 Year	18/04/2011	Plant
NA	Air inlet to N001	Barg	Pressure Transmitter	PT120 214B	S019 8761	± 0.075% of span	19/08/2009	05/08/2010	1 Year	18/04/2011	Plant
NA	Air inlet to N001	Barg	Pressure Transmitter	PT120 214C	S019 8762	± 0.075% of span	19/08/2009	05/08/2010	1 Year	18/04/2011	Plant
NA	Air inlet to N001 temp	Deg.c ent	RTD with R/I converter	TT 120214 A	NA	Deviation after calibration: 0.1% of F.S. value	17/08/2009	04/08/2010	1 Year	19/04/2011	Plant
NA	Air inlet	Deg.c	RTD with	TT	NA	Deviation	19/08/2	04/08/2	1	19/04/	Plant

	to N001 temp	ent	R/I converter	120214 B		after calibration: 0.1% of F.S. value	009	010	Year	2011	
NA	Air inlet to N001 temp	Deg.c ent	RTD with R/I converter	TT 120214 C	NA	Deviation after calibration: 0.1% of F.S. value	19/08/2009	04/08/2010	1 Year	19/04/2011	Plant
OT	Catalyst Temp ROO1	Deg.c ent	Temp. Transmitter	TT1203 32A	19955 6	D/A Accuracy $\pm$ 0.03% of span	18/08/2009	02/08/2010	1 Year	20/04/2011	Plant
OT	Catalyst Temp ROO1	Deg.c ent	Temp. Transmitter	TT1203 33A	19955 8	D/A Accuracy $\pm$ 0.03% of span	18/08/2009	02/08/2010	1 Year	20/04/2011	Plant
OT	Catalyst Temp ROO1	Deg.c ent	Temp. Transmitter	TT1203 34A	19956 0	D/A Accuracy $\pm$ 0.03% of span	18/08/2009	02/08/2010	1 Year	20/04/2011	Plant
NCS G	N2O Analyser	Mg/m <sup>3</sup>	N2O Analyser	AI 120400	02400 71228 /2400	Repeatability $\leq$ 0.5% of span	28/05/2010	28/8/10 , 19/11/10	3 Months	2/2/11	Plant
VSG	Stack Flow	mBar	D.P Type Transmitter	FI12040 0	265D S660 00283 31	Base Accuracy $\pm$ 0.04%	06/07/2009	08/07/2010	1 Year	21/04/2011	Plant
PSG	Stack Pressure	hPa	Pressure Transmitter	PI12040 0	11989 49	0.5% of FSO	06/07/2009	08/07/2010	1 Year	21/04/2011	Plant
TSG	Stack Temp	Deg.c ent	RTD with R/I converter	TI12040 0	NA	Linearity error : $<0.1\%$ FS	06/07/2009	08/07/2010	1 Year	21/04/2011	Plant
NAP	Product acid flow	T/hr	Mass flow meter	FI10121	SEN.-12031 565, TRANS.-37819 72	$\pm$ 0.1% of rate	24/04/2008		3 Years	24/04/2011	External Agency
NA	Acid Density	gm/cc	Hydrometer	NA	NA	Least count: 0.001	28/5/2010	17/11/2010	6 months	16/5/2011	CC Lab
NA.	Acid Temperature	Deg C	Thermometer	NAG/L/ TM-1	NA	Least count: 1	25/11/2009	18/11/2010	1 Year	25/10/2011	Instrument Workshop



**Appendix –IV****Abbreviations**

<b>AFR</b>	Ammonia Gas Flow Rate to AOR
<b>AIFR</b>	Ammonia to Air Ratio
<b>AOR</b>	Ammonia Oxidation Reactor
<b>BC</b>	Baseline Campaign
<b>BE</b>	Baseline Emission
<b>CDM</b>	Clean Development Mechanism
<b>CEM</b>	Continuous Emission Monitoring
<b>ER</b>	Emission Reduction
<b>FSO</b>	Full Scale Operation
<b>FS</b>	Full Scale
<b>GHG</b>	Green House Gases
<b>GWP</b>	Global Warming Potential
<b>MR</b>	Monitoring Report
<b>NAP</b>	Nitric Acid Production
<b>NH<sub>3</sub></b>	Ammonia
<b>N<sub>2</sub>O</b>	Nitrous Oxide
<b>OH</b>	Operating Hours
<b>OP</b>	Operating Pressure
<b>OT</b>	Operating Temperature
<b>RCF</b>	Rashtriya Chemicals and Fertilizers Limited
<b>TSG</b>	Temperature of Stack Gas
<b>VSG</b>	Volume flow rate of the Stack Gas

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## Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	25 June 2014	<p>Revisions to:</p> <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
03.2	5 November 2013	Editorial revision to correct table in page 1.
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		