Monitoring report form
(Version 05.1)

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

MONITORING REPORT		
Title of the project activity	Omnia N_2O Abatement Project II	
UNFCCC reference number of the project activity	6083	
Version number of the monitoring report	01	
Completion date of the monitoring report	14/08/2015	
Monitoring period number and duration of this monitoring period	Monitoring Period 3 1/06/2014 – 31/07/2015 Duration (426 days)	
Project participant(s)	Omnia Fertilizer, Division of Omnia Group (Pty) Ltd.	
Host Party	South Africa	
Sectoral scope(s)	Sectoral Scope: 05	
Selected methodology(ies)	Applied Methodology: ACM0019 v01.0.0.	
Selected standardized baseline(s)	Not applicable	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	479,382	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	0	389,707

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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a) The increasing demand for fertilizer in South Africa induces the development of new and additional facilities related to fertilizer manufacturing. Omnia Fertilizer, a division of Omnia Group (Pty) Ltd. (hereafter “Omnia”) is a leading Nitrogen Fertilizer producer in South Africa. Omnia operates two nitric acid plants in Sasolburg, South Africa. The second nitric acid plant was commissioned second quarter 2012, designed by Uhde GmbH with a confirmed production capacity of 400,000 ton 100% concentrated nitric acid per year. The CDM project at this second plant was registered as “Omnia N_2O Abatement Project II”.

Nitrous Oxide (N_2O) is an undesired by-product of the nitric acid (HNO_3) production process at the synthetic fertilizer production facility. However, N_2O emissions from nitric acid production are not regulated in South Africa. No N_2O abatement system was designed into the plant. Without the incentive of the proposed CDM project activity, approx. 800,000 tCO_2e per year[1] would be emitted at Omnia Nitric Acid Plant II. Therefore the baseline scenario without the CDM project would be the operation of the nitric acid plant without N_2O reduction catalyst.

The aim of the project activity is to reduce N_2O emissions in the tail gas by installing a tertiary catalyst after the absorption unit. It is expected that the N_2O abatement catalyst reduces 98 % of the N_2O[2]. Against the standardized baseline emissions factor the project would generate an estimated 3,481,376 t CO_2e emission reductions during a 10 year crediting period.

b) The N_2O abatement system consists of a tertiary N_2O catalyst unit, which is installed downstream of the HNO_3 absorber and before the tail gas turbine. It was designed and constructed by Uhde (Germany) and is called the EnviNox™ system. The tertiary catalyst consists of an additional catalysts containment facility that was erected at the plant.

c) Relevant Dates for the Project Activity

Date	Event
14/09/2009	Basic Engineering Nitric Acid Plant
09/03/2010	Detailed engineering Design Nitric Acid Plant
04/06/2011	Approval of ACM0019 by UNFCCC
18/07/2011	Change Order UHDE from De-NOx to EnviNox™
31/03/2012	Commission Nitric Acid Plant
31/032012	Commission Project
30/04/2012	Project registered at UNFCCC
30/04/2012	Start Crediting period
30/04/2012 – 30/11/2012	1st Monitoring period – status: issued
01/12/2012 – 31/05/2014	2nd Monitoring period – status: issued
01/06/2014 – 31/07/2015	3rd Momitoring period – this Monitoring period

d) The total emission reductions achieved in this monitoring period **389,707** tCO_2e.

A.2. Location of project activity

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a) Host Party: Republic of South Africa

b) Free State Province, Sasolburg, Metsimaholo Municipality

c) Omnia’s plant is located at latitude of approximately 26°48’48” South and a longitude of 27°51’23” East.

[1] An estimated business-as-usual emissions factor of 6.45$kgN_2O/tHNO_3$ (Average Baseline Emission factor of the first 5 monitoring periods of the first N_2O abatement project at Omnia’s existing nitric acid plant) and annual confirmed capacity of 400,000$tHNO_3$/year was taken into account.

[2] While the calculations are based on this conservative assumption it should be noted that from experience from Omnia´s first N_2O reduction project as well as from other similar projects with the same technology even higher abatement efficiencies of up to 99.9 % were observed.

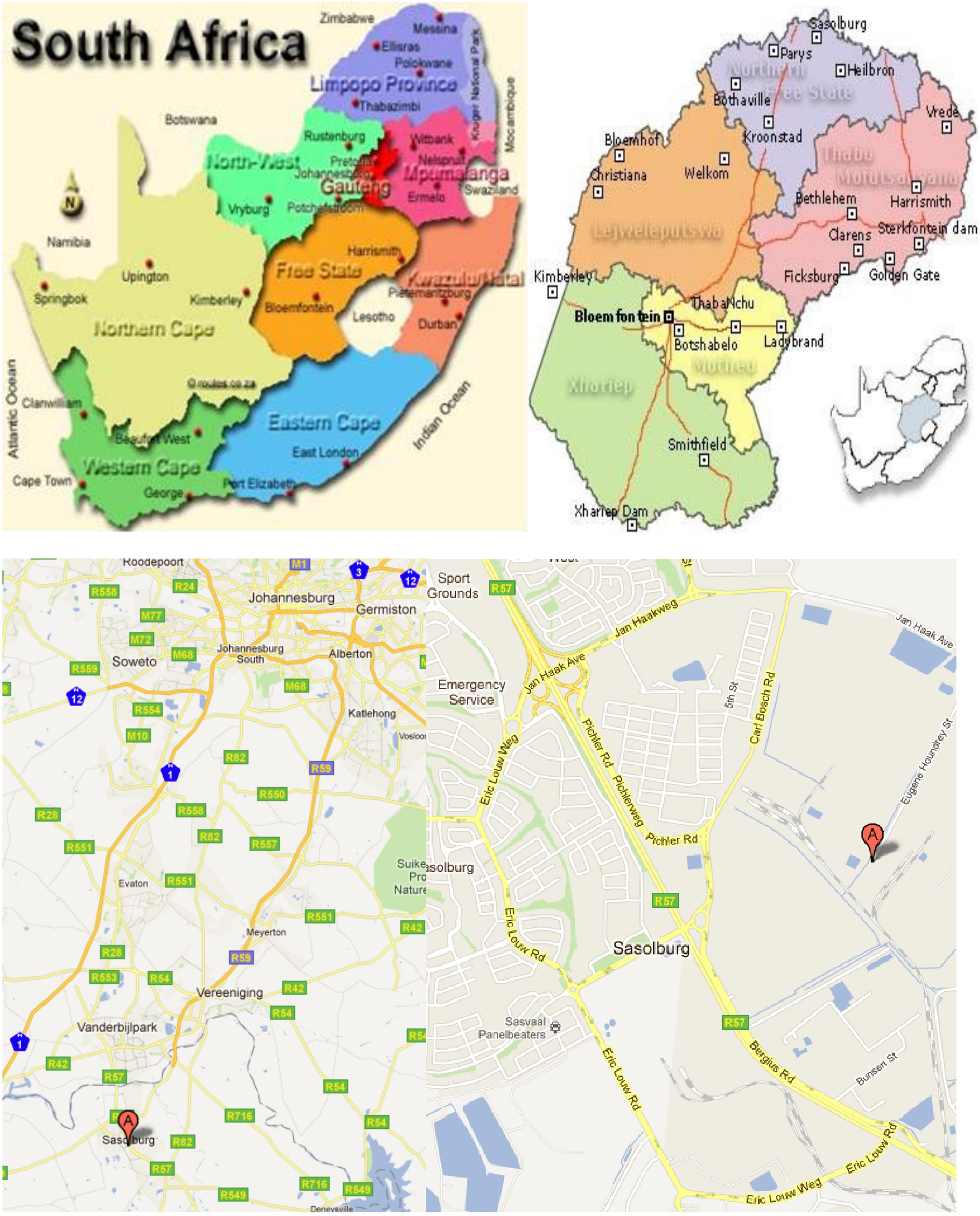

Figure 1: Physical location of the Omnia II nitric acid plant in Sasolburg, South Africa

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 whether the Party involved wishes to be considered as project participant (yes/no)
South Africa (host)	Omnia Fertilizer, Division of Omnia Group (Pty) Ltd.	No

A.4. Reference of applied methodology and standardized baseline

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1. (a) Applied methodology: ACM0019 Version 01.0.0: “N_2O abatement from nitric acid production”
   (b) Applied tools:

i. “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (Version 02)
ii. “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0)

A.5. Crediting period of project activity

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(a) Type of Crediting Period: Non-renewable 10 years and 0 months
(b) Start date of Crediting Period: 30/04/2012
(c) Start of this Monitoring Period: 01/06/2014
(d) End date of this Monitoring Period: 31/07/2015
(e) Length of this Monitoring Period: 426 days

A.6. Contact information of responsible persons/entities

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See table in annex 1

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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a) The project activity entails the installation of:
• Tertiary N_2O abatement technology,
• Specialized monitoring equipment that is installed at the tail gas stream after the abatement of N_2O emissions (see Monitoring Plan in this PDD for further information).

Catalyst Technology
In the production process of nitric acid (HNO_3), NO_2 is produced as an intermediate material from ammonia (NH_3). The associated chemical reactions of oxidizing ammonia and simultaneous unwanted reactions are as follows:

1.	$NH_3 + 2\ O_2$	$\rightarrow$	$HNO_3 + H_2O$	(overall desirable reaction)
2.	$4\ NH_3 + 5\ O_2$	$\rightarrow$	$4\ NO + 6\ H_2O$	(desirable in the NH_3 oxidization process)
3.	$2NO + O_2$	$\rightarrow$	$2\ NO_2$	(desirable in the NO oxidization process)
4.	$3\ NO_2 + H_2O$	$\rightarrow$	$2\ HNO_3 + NO$	(desirable in the NO_2 absorption process)
5.	$4\ NH_3 + 3\ O_2$	$\rightarrow$	$2\ N_2 + 6\ H_2O$	(undesirable)
6.	$4\ NH_3 + 4\ O_2$	$\rightarrow$	$2\ N_2O + 6\ H_2O$	(undesirable)
7.	$2\ NH_3 + 8\ NO$	$\rightarrow$	$5\ N_2O + 3\ H_2O$	(undesirable)

Through the sixth and seventh reactions, some N_2O is generated in the process.

The N_2O abatement technology is installed in the tail gas downstream after the HNO_3 absorber and before the tail gas turbine. A tertiary catalyst reduces N_2O that is formed in the primary ammonia oxidation reaction. A wide range of metals (e.g. Cu, Fe, Mn, Co and Ni) have been shown to be of varied efficiency in N_2O

abatement catalysts. The abatement efficiency of this pelleted catalyst has been shown to be up to 99.9% in the following reaction[3]:

$$4N_2O + CH_4 \rightarrow 4\ N_2 + 2H_2O + CO_2$$

In the tertiary abatement system N_2O is removed by catalytic reduction with a hydrocarbon, such as methane from natural gas.

The applied technology is chosen because it has negligible risk of decreasing HNO_3 production and a high expected N_2O reduction.

The expected lifetime of the N_2O reduction unit is at least 10 years. It is expected to be in the range of 25 years. However the installed catalyst itself may need to be replaced after a few years, depending on the achieved abatement performance.

In addition NO_x is reduced in a separate catalyst bed by reduction with ammonia.

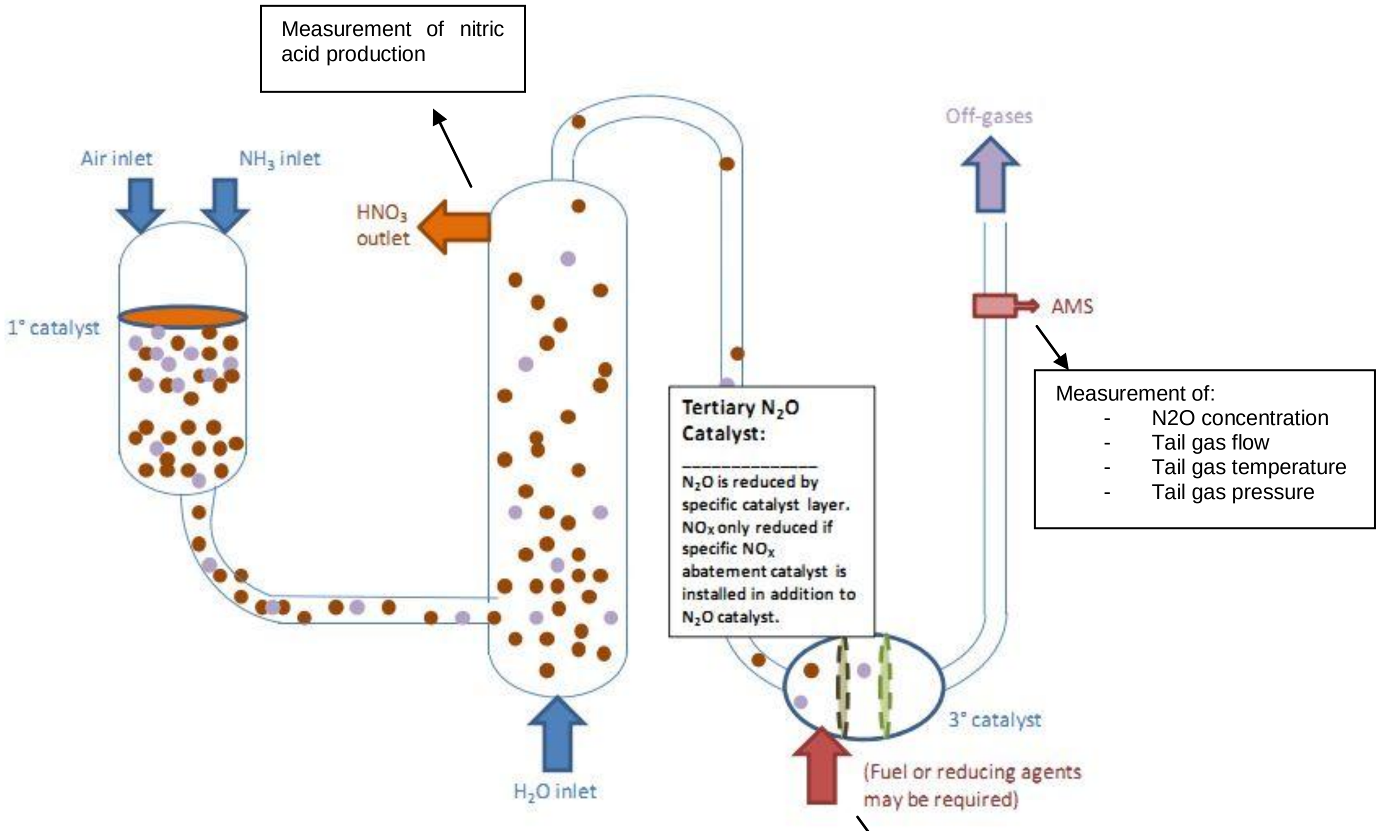

Figure 2: Image flow of tertiary catalyst unit

b) Events or situations of plant downtime during this monitoring period

Begin of downtime	End of downtime	Time duration (hours)	Reason
13/06/2014 10:00	14/06/2014 20:00	35	Plant trip on high gauze temperature, loss of ammonia suction pressure – off loading of

[3] While the calculations of estimated emission reductions are based on the conservative estimation of an abatement efficiency of 98 %, it should be noted that from experience from Omnia´s first N_2O reduction project as well as from other similar projects with the same technology even higher abatement efficiencies of up to 99.9 % were observed.

			ammonia rail tankers
17/08/2014 04:00	24/08/2014 10:00	175	Gauze Change – Mini shutdown
29/08/2014 09:00	29/08/2014 19:00	11	Plant trip loss of ammonia suction pressure – off loading of ammonia rail tankers
14/09/2014 17:00	18/09/2014 09:00	89	Repairs on cooler condenser 2
03/01/2015 22:00	04/01/2015 16:00	19	Plant trip due to a high ratio spike
16/01/2015 18:00	17/01/2015 09:00	16	Power outage from Eskom
13/03/2015 07:00	30/03/2015 19:00	421	Annual shutdown, gauze change, replacement of economizer
23/04/2015 14:00	24/04/2015 00:00	11	Power outage from Eskom
13/06/2015 17:00	14/06/2015 13:00	21	Triveni 2 trip on high vibration causing NA 2 to trip as well due to sudden pressure increase on MAN turbine
01/07/2015 21:00	03/07/2015 05:00	33	Low Pressure Steam control valve malfunctioned and caused NAP2 to trip

c) Description of:
i. Events or situations that may have impacted the applicability of the applied methodology:
None

ii. The following describes how these events or situations have been addressed:
N/A

B.2. Post-registration changes

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

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No

B.2.2. Corrections

>>
No

B.2.3. Changes to start date of crediting period

>>
No

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

>>
No

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>
No

B.2.6. Changes to project design of registered project activity

>>
No

B.2.7. Types of changes specific to afforestation or reforestation project activity

>>
Not Applicable

SECTION C. Description of monitoring system

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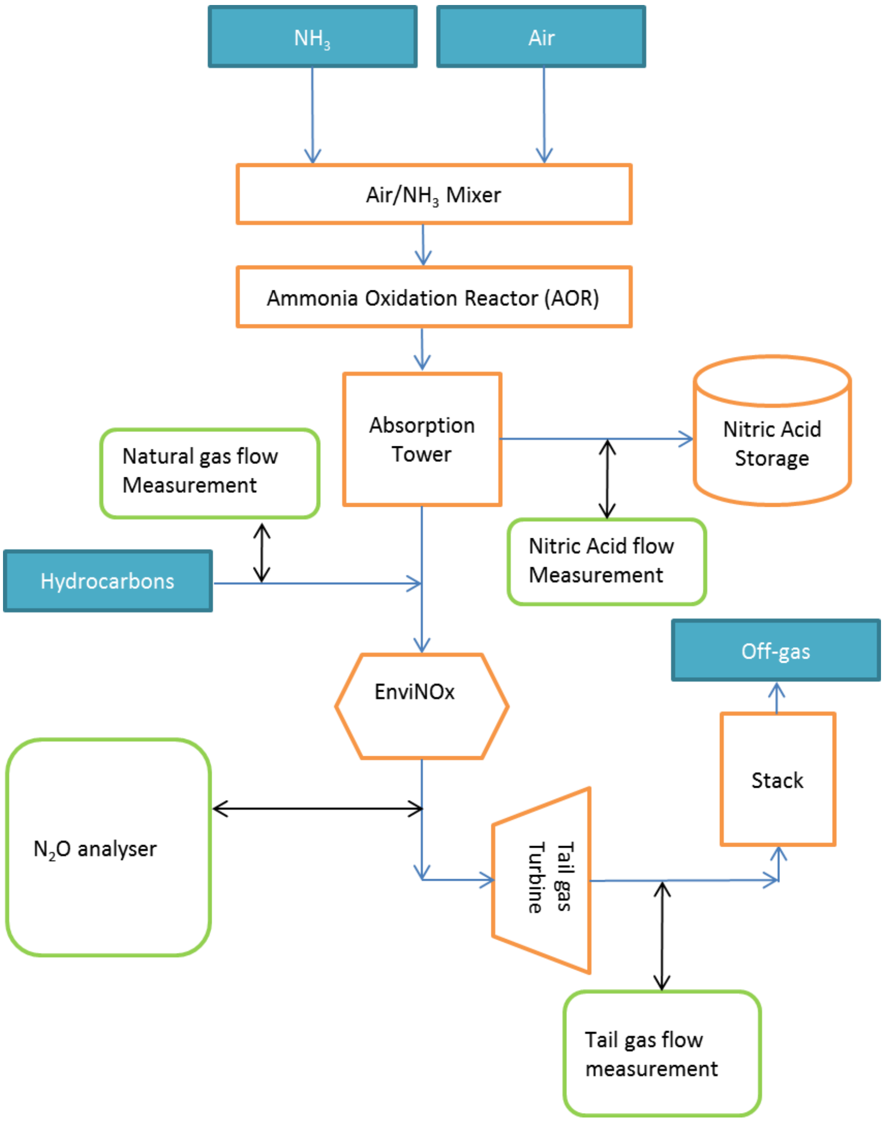

Figure 3: Schematic diagram of location of sample points

<u>Sample points</u>
The sample points were chosen in accordance with the AMS requirements, EN 14181 requirements and the plant design specifications to allow an optimum of data collecting quality.

The location of the sample point was selected to provide ease of access and a location close to the analyser. The most suitable position is in the horizontal section of the exit stack. At this point, the gas is still hot and well mixed. The graph above shows the location of the sample point schematically.

Analyser

The Emerson NGA 2000 is capable of analysing N_2O concentration in gas mixtures. The continuous NDIR industrial photometer can selectively measure concentrations of up to four sample components. In this case it is equipped for the measurement of N_2O and NO. The analyser features gas-filled opto-pneumatic detectors. The detector provides optimum sensitivity and high selectivity compared with the other gas components in the sample. The Analyser is QAL1 tested according to EN 14181 for the measurement of N_2O.

Sample Conditioning System

The gas sample is extracted at the sampling point particles are removed with a heated filter unit and the clean sampling gas is delivered through a heated sampling line to the analyser cabinet. Before being fed to the analyser, traces of moisture are removed by a sample conditioning system that is installed in the analyser cabinet. The minimum flow rate to the analyser is controlled and connected to an alarm.

Stack gas flow meter

The Durag annubar measuring system D-FL 100 operates according to the differential pressure principle. The probe has two separate chambers, between which the flow builds up a differential pressure. Taking into account the other flow parameters such as, e.g. absolute pressure and temperature, the volume flow is converted from operating to standard conditions. This calculation is performed in the DURAG data system D-EMS 2000. The D-FL 100 is QAL1 tested according to EN 14181 (see below).

Accuracy and Calibration of Instruments

All meters are maintained to ensure a high level of accuracy. The exact specifications of each meter have been included in procedures to maintain those levels of accuracy. These procedures can be found for each parameter in section D.2.

ACM0019 requires all key meters to be subject to a quality control regime that will include regular maintenance and calibration according to the European Norm EN 14181. A record is being maintained showing the location and unique identification number of each meter, the calibration status of that meter (when last calibrated, when next due for calibration).

Equipment Name	**Serial Number**	**Description**	**Calibration frequency**	**Last Calibration Date**
FIC-95060 Transmitter	SN:3816752	NATURAL GAS FLOW TO ENVINOX	+/- Every 6 months or a Gauze change	05/02/2014 19/08/2014 24/03/2015
FIC-95060 Sensor	SN:14257727	NATURAL GAS FLOW TO ENVINOX	+/- Every 6 months or a Gauze change	05/02/2014 19/08/2014 24/03/2015
DY-95023	SN:3811087 TRANSMITTER	HNO CONSENTRATE	+/- Every 6 months or a Gauze change	05/02/2014 19/08/2014 24/03/2015
DI-95023	SN:14206070 SENSOR	HNO CONSENTRATE	+/- Every 6 months or a Gauze change	05/02/2014 19/08/2014 24/03/2015
AI-95005	SN:9910103055428	OUTLET ANALYSER CLD	Main Service once a year. QAL3 done automatically, zero every day, span every second day. AST done every year and QAL2 every 5 years.	QAL2: 23/06/2012 - 27/06/2012 AST: 24/06/2013 - 29/06/2013 11/06/2014 – 17/06/2014 26/05/2015
Durag D-FL 100 FI-95014	SN:9084944	Volume Flow Measure System including the measureme	AST done every year and QAL2 every 5 years	QAL2: 23/06/2012 - 27/06/2012 AST: 24/06/2013 - 29/06/2013 11/06/2014 – 17/06/2014

		nt of stack gas temperature and stack gas pressure		26/05/2015

In the following, it is described how the procedures given in EN 14181 for QAL1-3 have been applied at the plant.

QAL1
In accordance with EN 14181, the monitoring system for N_2O concentration measurements are suitable for the measuring task (parameter and composition of the flue gas) by use of the QAL1 procedure as specified by EN ISO 15267 or equivalent standards. This standard's objective proves that the total uncertainty of the results obtained from the AMS meets the specification for uncertainty stated in the applicable regulations. Such suitability testing is carried out under specific conditions by an independent third-party on a specific testing site.

QAL2
QAL2 is a procedure for the determination of the calibration function and its variability. According to EN 14181, the QAL2 test including the SRM is conducted by an independent testing house which is accredited to EN ISO/IEC 17025. The QAL2 tests are performed on suitable AMS that is correctly installed and commissioned on-site (as opposed to QAL1 which is conducted off-site).
A calibration function is established from the results of a number of parallel measurements performed with a Standard Reference Method (SRM). The variability of the measured values obtained with the AMS is then evaluated by the independent qualified "testing house".
QAL2 tests are performed at least every 5 years according to EN 14181.
.
QAL2 Test for N_2O and volume flow combined with measurements of the moisture content of the tail gas

Date of QAL2 test	23.06.2012 until 27.06.2012
Date of previous QAL2 test	n. a.
Date of next QAL2 test	23/06/2017

QAL2 test was done by TÜV SÜD Industrie Service GmbH.

AST
In addition, Annual Surveillance Tests (AST) is conducted in accordance with EN 14181; these are a series of measurements with independent measurement equipment in parallel to the existing AMS. The AST tests are performed annually. If a full QAL2 test is performed (at least every 5 years), an additional AST test is not necessary in that same year.
.
AST test for N_2O and tail gas volume flow combined with measurements of the moisture content of the tail gas

Date of AST test:	26/05/2015
Date of previous AST test:	11.06.2014 until 17.06.2014
Date of next AST test:	26/05/2016

AST was done by TÜV SÜD Industrie Service GmbH.

QAL3
QAL3 describes the on-going quality assurance and maintenance procedures and documentation for the AMS conducted by the plant operator. With this documentation it can be demonstrated that the AMS is in control during its operation so that it continues to function within the required specifications.
In essence, the instrumentation personnel perform QAL3 procedures through the established calibration procedures as outlined for the applicable parameter in section D.2.

N_2O-Analyser Zero Calibration
Nitrogen gas is used as reference gas for zero calibration. The zero calibration is conducted automatically every 24 hours.

N_2O-Analyser Span calibration

Span calibrations are performed every second day by means of a certified calibration gas and are automatically triggered. Manual initiation of the span calibration can also be performed if required. The calibration results and subsequent actions are all documented as part of the CDM procedure. In addition, the analyser room and equipment is visually inspected on a regular basis.

Flow meter calibration procedures

The flow meter itself does not need to be calibrated since it is a physical device which does not have drift. Therefore, it is sufficient to regularly inspect its physical condition by means of visual and electric checks of the probe. It shall be cleaned if deemed necessary. In addition the flow meter is checked during the QAL2 and AST tests by an independent laboratory by comparison to a standard reference method (SRM) as stated above.

Organization Structure with Management & Operation Process

As an operator of nitric acid plants since many years, the plant's staff in general and its instrument department in particular have been accustomed to operating technical equipment adhering to high quality standards.

Omnia has trained the staff selected for the operation of the relevant monitoring systems and ensures that the operational standards required for the appropriate handling of the equipment is maintained throughout the crediting period. Measuring instruments are calibrated by the instrumentation engineer in accordance with the requirements of the instrument suppliers. The operations and equipment engineers of the nitric acid plant are responsible for the daily operation and maintenance of the systems.

The monitoring of the parameters for the determination of the mass flow of the N_2O is the responsibility of the operational personal. All relevant data is recorded automatically and stored on electronic media.

Data Processing

Archiving of data

In accordance with the PDD, all of the data collected for the project activity is stored in electronic format for the duration of the crediting period + 2 years. To meet these criteria, Omnia provides an extensive data storage system covering both the raw data received by the Delta V DCS as well as the output reports from the Durag system and drives and the main server as follows:

- All data collected by the Delta V DCS is stored on its internal hard drive for 1 month.
- The EnviNoxTM data is stored on the plant Durag system and is designed to carry the full crediting + 2 years. This system comprises of two hard disc drives, as a backup to the process.
- The Envinox TM data on the server is also backed up to an external USB HDD which is kept at the parent company's head office and also retained there for the duration of the crediting period + 2 years.

Audit function and management review

The Project Manager arranges for an internal audit of the management system once per year. The auditor is involved in the daily operation of the plant and if necessary, may be sourced from a third party. The auditor assesses the implementation of the monitoring procedure, quality assurance steps and data collection and archiving. Audit findings, and steps taken to address findings will be recorded and reviewed in a Management Review meeting (convened at least annually) at which time the effectiveness of these procedures are reviewed and necessary changes implemented.

SECTION D. Data and parameters

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

(Copy this table for each piece of data and parameter)

Data / Parameter:	$EF_{default,y}$
Unit:	$kgN_2O/tHNO_3$
Description:	Default N_2O baseline emissions factor in the calendar year y of the monitoring period n
Source of data:	According to ACM0019 Version 01.0.0, the default N_2O baseline emission factor will vary every year. In year 2005, the emission factor will be 5.1 and then it will decrease every year until it reaches a final value of 2.5 in the year 2020. The value of 2.5 will remain constant after 2020, as provided in the following table: (see table below)
Value(s) applied):	Not applicable
Choice of data or measurement methods and procedures	Default value

Year	Emissions factor ($kgN_2O/tHNO_3$)
2005	5.10
2006	4.90
2007	4.70
2008	4.60
2009	4.40
2010	4.20
2011	4.10
2012	3.90
2013	3.70
2014	3.50
2015	3.40
2016	3.20
2017	3.00
2018	2.80
2019	2.70
2020	2.50
2021	2.50
Year n	2.50

Purpose of data:	Calculation of Baseline emissions or baseline net GHG removal by sinks
Additional comment:	**The decrease in the value for the baseline emission factor over time is to reflect the technological development. Please note that the factual business as usual emissions are estimated to be 6.45kgN_2O/tHNO_3.**

Data / Parameter:	GWP_{N2O}
Unit:	tCO_2e/tN_2O
Description:	Global warming potential of the nitrous oxide
Source of data:	Relevant decisions by the CMP
Value(s) applied):	298
Choice of data or measurement methods and procedures	Default value
Purpose of data:	Calculation of Baseline emissions or baseline net GHG removal by sinks
Additional comment:	-

Data / Parameter:	R_u
Unit:	Pa,m^3/kmol.K
Description:	Universal ideal gas constant
Source of data:	“Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0)
Value(s) applied):	8,314
Choice of data or measurement methods and procedures	Default value
Purpose of data:	Calculation of Baseline emissions or baseline net GHG removal by sinks
Additional comment:	-

Data / Parameter:	MM_i
Unit:	kg/mol
Description:	Molecular mass of greenhouse gas *i* (N_2O)
Source of data:	“Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0)
Value(s) applied):	44.02
Choice of data or measurement methods and procedures	Default value
Purpose of data:	Calculation of Baseline emissions or baseline net GHG removal by sinks
Additional comment:	-

Data / Parameter:	P_n
Unit:	Pa
Description:	Total pressure at normal conditions
Source of data:	“Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0)
Value(s) applied):	101,325
Choice of data or measurement methods and procedures	Default value

Purpose of data:	Calculation of Baseline emissions or baseline net GHG removal by sinks
Additional comment:	-

Data / Parameter:	T_n
Unit:	K
Description:	Temperature at normal conditions
Source of data:	“Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0)
Value(s) applied):	273.15
Choice of data or measurement methods and procedures	Default value
Purpose of data:	Calculation of Baseline emissions or baseline net GHG removal by sinks
Additional comment:	-

Data / Parameter:	$T_{open,n}$
Unit:	%
Description:	Fraction of time in monitoring period n during which the by-pass valve on the line feeding the tertiary N_2O abatement facility was open to vent the gas directly to the atmosphere.
Source of data:	ACM0019 v.01.0.0
Value(s) applied):	0
Choice of data or measurement methods and procedures	Plant operation documents
Purpose of data:	Calculation of Baseline emissions or baseline net GHG removal by sinks
Additional comment:	No by-pass is foreseen in the project design and therefore no by-pass valve will be installed from the beginning of the project activity. If necessary, plant will shut down.

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter)

Data / Parameter:	$P_{NA,n}$
Unit:	$tHNO_3$
Description:	Nitric Acid Produced
Measured/ Calculated / Default:	Measured and Calculated

Source of data:	The mass flow of HNO_3 is continuously measured by a mass flow meter. HNO_3 concentration is calculated on the DCS using density and temperature from DCS. The mass flow is then multiplied by the concentration to calculate the 100% HNO_3 mass flow. Density & acid concentration are crosschecked by laboratory analysis.
Value(s) of monitored parameter:	388,460
Monitoring equipment:	TAG number/ model specification of meter: FIT 95023/ Micro Motion, Mass flow Refer to Calibration frequency table Density & acid concentration are crosschecked by laboratory analysis.
Measuring/ Reading/ Recording frequency:	HNO3: Mass flow and concentration Continuously at 1 second intervals. Density & concentration analysis for crosschecks: approximately 12 samples per day are collected, which is sent to the plant laboratory for analysis. Another sample is taken daily to the central laboratory for analysis. This is for cross reference purposes.
Calculation method (if applicable):	Mass flow measurements (kg/h) are multiplied with acid concentration determined on the DCS to calculate $P_{NA,n}$ mass flow in tHNO3/h. This method of calculation is used instead of manual inputs of lab data into the DCS to prevent finger mistakes and is also done on a continuous basis at 1 second intervals.
QA/QC procedures:	Maintenance and calibration of the flow meter and density meter has been applied under the internal QA/QC procedures implemented for this project activity. Omnia is accredited with ISO9001, ISO 14001 and OHS18000. All plant equipment and piping are designed as per ASME standards and their maintenance/QAQC is based on relevant API standards, vendor recommendations and prevailing practices in fertilizer industry. Refer to Section C for calibration frequency tables.
Purpose of data:	Calculation of Baseline emissions or baseline net GHG removal by sinks
Additional comment:	-

Data / Parameter:	$F_{N2O,Tailgas,h}$
Unit:	kgN_2O/h

Description:	Mass Flow of N_2O in the gaseous stream of the tail gas in hours h
Measured/ Calculated / Default:	Measured and Calculated
Source of data:	N_2O concentration: Emerson N_2O Analyzer Stack gas volume flow: Durag Annubar D-FL 100 flow meter
Value(s) of monitored parameter:	Average value for this monitoring period: 3.1231 Applied for the determination of $Q_{N2O,tailgas,n}$ and overall Project Emissions. See calculation sheet and sample calculation of section E.2.
Monitoring equipment:	N_2O concentration: Emerson N_2O Analyzer Stack gas volume flow: Durag Annubar D-FL 100 flow meter
Measuring/ Reading/ Recording frequency:	Continuously / 1 second

Calculation method (if applicable):	• The monitoring system provides separate hourly average values for the N_2O concentration and the volume or mass flow of the tail gas based on 1 second interval readings that are recorded and stored electronically. These N_2O data sets are identified by means of a unique time / date key indicating when exactly the values were observed; • The correction factors derived from the calibration curve of the QAL2 audit for the monitoring components as determined during the QAL2-test in accordance with EN 14181 must be applied to both the N_2O concentration and the volume or mass flow of the tail gas. If the data for either the N_2O concentration or the volume or mass flow of the tail gas is not available for more than 1/3 of any hour while the plant was in operation, the value for that hour shall be replaced with the maximum value of N_2O concentration or volume or mass flow of the tail gas observed during the monitoring period. If data for neither the N_2O concentration nor the volume or mass flow of the tail gas are available for more than 1/3 of any hour while the plant was in operation, the maximum value of mass flow of N_2O calculated during the monitoring period shall be applied to any such hour. Values observed during five operating hours before and after a plant start-up and shut-down shall not be used for the determination of the maximum values. The hourly values are then aggregated as follows: $Q_{N2O,tailgas,n} = \sum_{h=1}^{h=h_n} F_{N2O,tailgas,h} * 10^{-3}$ $Q_{N2O,tailgas,n}$ = Amount of N_2O released through the tail gas of the project plant to the atmosphere in monitoring period *n* (tN_2O) $F_{N2O,tailgas,h}$ = Mass flow of N_2O in the gaseous stream of the tail gas in the hour h (kgN_2O/h) h_n = Number of hours in monitoring period n during which the plant was in operation
QA/QC procedures:	Overall measurement accuracy +/- 0.5% of the adjusted range Serial Number SN:9910103055428 Tag No. AI-95005 Outlet Analyser Refer to QAL 2 and AST tables in Section C.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks

Additional comment:	As per EN 14181 standards, the flow meter and the analyser is tested and calibrated by an external laboratory with EN ISO IEC 17025 Accreditation. The QAL2 test is conducted once every 5 years; the AST test is conducted once per year. Every 5 years the AST test is part of the QAL2 test. QAL2 & 3 calibration schedules are performed according to plant internal procedures

Data / Parameter:	h_n
Unit:	Hours
Description:	Number of hours in monitoring period n the plant was in operation
Measured/ Calculated / Default:	Measured
Source of data:	Omnia production log and continuous monitoring according to operational parameters
Value(s) of monitored parameter:	9,393
Monitoring equipment:	The total operating hours are logged continuously in the production log
Measuring/ Reading/ Recording frequency:	Continuously/ 1 second
Calculation method (if applicable):	-
QA/QC procedures:	-
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	-

Data / Parameter:	$T_{open,n}$
Unit:	%
Description:	Fraction of time in monitoring period *n* during which the by-pass valve on the line feeding the tertiary N_2O abatement facility was open to vent the gas directly to the atmosphere.
Measured/ Calculated / Default:	Measured
Source of data:	N/A

Value(s) of monitored parameter:	0
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	No by-pass is foreseen in the project design and therefore no by-pass valve will be installed from the beginning of the project activity.

Data / Parameter:	$PE_{FF,n}$
Unit:	tCO_2e
Description:	Project emissions related to fossil fuel input to the destruction facility and/or re-heater in monitoring period *n* (tCO_2)
Measured/ Calculated / Default:	Calculated
Source of data:	The emissions related to the operation of the N_2O destruction facility include only on-site emissions due to fossil fuel use as input to the N_2O destruction facility. Natural gas consumption will be measured by a mass-flow meter
Value(s) of monitored parameter:	1,195.55
Monitoring equipment:	-
Measuring/ Reading/ Recording frequency:	Continuously/ 1 second

Calculation method (if applicable):	Calculated based on measurement of natural gas consumption according to the following formula, as provided in the applicable tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02): 2) $PE_{FF,n} = PE_{FC,i,j,}$ 3) $PE_{FC,j,n} = \sum_i FC_{i,j,n} * COEF_{i,n}$ $COEF_{i,n} = W_{c,i,n} * 44/12$ Where: $PE_{FC,j,n}$ = CO_2 emissions from fossil fuel combustion in process *j* in monitoring period *n* (tCO_2/n) $FC_{i,j,n}$ = Quantity of fuel type *i* combusted in the process *j* during the monitoring period *n* (mass or volume unit/n) $COEF_{i,n}$ = CO_2 emission coefficient of fuel type *i* in monitoring period *n* (tCO_2/mass or volume unit) i = fuel types combusted in process *j* during monitoring period *n* $W_{c,i,y}$ = Weighted mass average fraction of carbon in fuel type i in year y
QA/QC procedures:	Maintenance and calibration of the mass flow meter is applied under the internal QA/QC procedures. Serial Number SN:14257727 Tag No. FI-95060
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	Calibration procedures are performed according to plant internal procedure

Data / Parameter:	$W_{c,i,n}$
Unit:	tC/mass unit of fuel type natural gas
Description:	Weighted average mass fraction of carbon in fuel type *i* in year *y*
Measured/ Calculated / Default:	Measured

<table>
<tr><td>Source of data:</td><td>The following data source may be used if the relevant conditions apply:
<table><tr><td>Data Source</td><td>Conditions for using the data source</td></tr><tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr><tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr></table>
Option a) Not received from Invoices but by request from supplier.</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td><table><tr><td>Wc,i,2014</td><td>0.732</td><td>tC/mass unit of fuel type natural gas</td></tr><tr><td>Wc,i,2015</td><td>0.732</td><td>tC/mass unit of fuel type natural gas</td></tr></table></td></tr>
<tr><td>Monitoring equipment:</td><td>-</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>The mass fraction of carbon is obtained by request from supplier.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>The mass fraction is calculated by using the composition obtained from the supplier.</td></tr>
<tr><td>QA/QC procedures:</td><td>Verify if the values under a) and b) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in b) should have ISO17025 accreditation or justify that they can comply with similar quality standards.</td></tr>
<tr><td>Purpose of data:</td><td>Calculation of project emissions or actual net GHG removals by sinks</td></tr>
<tr><td>Additional comment:</td><td>None</td></tr>
</table>

Data / Parameter:	$FC_{i,j,n}$
Unit:	Mass unit per monitoring period (ton)
Description:	Quantity of fuel type i combusted in process j during the monitoring period n
Measured/ Calculated / Default:	Measured
Source of data:	Measurements from Micro Motion (Rosemount)
Value(s) of monitored parameter:	445.476 t

Monitoring equipment:	Micro motion (Rosemount)
Measuring/ Reading/ Recording frequency:	Continuously/ 1 second
Calculation method (if applicable):	-
QA/QC procedures:	Overall measurement accuracy +/- 0.5% of the adjusted range Serial Number SN:14257727 Tag No. FI-95060 For calibration information refer to tables in section C.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	Calibration schedules are performed according to plant internal procedure.

Data / Parameter:	Vt,wb
Unit:	Nm3 wet gas/h
Description:	Volumetric Flow of the gaseous stream in time interval t on a wet basis
Measured/ Calculated / Default:	Measured
Source of data:	Measurements from Durag Annubar flow meter
Value(s) of monitored parameter:	Average Value: 131,543
Monitoring equipment:	Durag Annubar Flow meter
Measuring/ Reading/ Recording frequency:	Continuously / 1 second
Calculation method (if applicable):	-
QA/QC procedures:	Overall measurement accuracy +/- 0.5% of the adjusted range Serial Number SN:9084944 Tag No. FI-95014 Refer to QAL2 and AST test tables in Section C.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	Calibration schedules are performed according to plant internal procedures

Data / Parameter:	$V_{i,t,db}$
Unit:	m^3 gas i/m^3 dry gas

Description:	Volumetric fraction of greenhouse gas i in a time interval t on a dry basis
Measured/ Calculated / Default:	Continuously
Source of data:	-
Value(s) of monitored parameter:	Average value: 0.00001197
Monitoring equipment:	Emerson N_2O Analyser
Measuring/ Reading/ Recording frequency:	Continuously/ 1 second
Calculation method (if applicable):	-
QA/QC procedures:	Calibration includes zero verification with an inert gas (e.g. N_2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases have a certificate provided by the manufacturer and are under their validity period. Refer to QAL2 test tables in Section C.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	Calibration schedules are performed according to plant internal procedures

Data / Parameter:	$C_{H2O,t,db,n}$
Unit:	kg H_2O/m^3 drygas
Description:	Moisture content of the gaseous stream at normal conditions, in time interval *t*
Measured/ Calculated / Default:	Measured
Source of data:	Measurements according to the USEPA CF42 method 4 – Gravimetric determination of water content
Value(s) of monitored parameter:	2014: 0.0057 2015: 0.0057
Monitoring equipment:	Manual sampling by external laboratory or testing house.
Measuring/ Reading/ Recording frequency:	Annually, Measurements should coincide with the Annual Surveillance Test (associated with requirements of the EN 14181 standard) or the calibration of the flow meter for the gaseous stream.
Calculation method (if applicable):	-
QA/QC procedures:	According to the USEPA CF42 method 4
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	Required for proving that the gaseous stream is dry.

Data / Parameter:	T_t
Unit:	°C
Description:	Temperature in the gaseous stream in time interval t
Measured/ Calculated / Default:	Measured
Source of data:	Tail Gas temperature measurement
Value(s) of monitored parameter:	Average value: 136.89
Monitoring equipment:	Thermocouples
Measuring/ Reading/ Recording frequency:	Continuously/ 1 second
Calculation method (if applicable):	-
QA/QC procedures:	Periodic calibration against a primary device is provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications Refer to QAL2 and AST test tables in Section C.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	As parameters are converted to normal conditions during the monitoring process, this parameter is not needed. Calibration schedules are performed according to plant internal procedures

Data / Parameter:	P_t
Unit:	Pa
Description:	Pressure of the gaseous stream in time interval t
Measured/ Calculated / Default:	Measured
Source of data:	Pressure probe
Value(s) of monitored parameter:	Average value 85,436
Monitoring equipment:	Pressure probe
Measuring/ Reading/ Recording frequency:	Continuously/ 1 second
Calculation method (if applicable):	-

QA/QC procedures:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications. Refer to QAL2 and AST test tables in Section C.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	As parameters are converted to normal conditions during the monitoring process, this parameter is not needed. Calibration schedules are performed according to plant internal procedures.

Data / Parameter:	ER_n
Unit:	tCO_2e
Description:	Emission reduction in monitoring period
Measured/ Calculated / Default:	Calculated
Source of data:	-
Value(s) of monitored parameter:	389,707
Monitoring equipment:	-
Measuring/ Reading/ Recording frequency:	-
Calculation method (if applicable):	4) $ER_n = BE_n - PE_n$
QA/QC procedures:	-
Purpose of data:	Calculation of project emissions or actual net GH removals by sinks
Additional comment:	-

D.3. Implementation of sampling plan

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Not applicable

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

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

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Baseline emissions:

The calculation of the baseline emissions or baseline net GHG removals sinks has been established in accordance with ACM0019 Version 01.0.0. The formulae are numbered according to the according to the numbering in the registered PDD.

$$(1) \qquad BE_n = P_{NA,n} * EF_{BL,\ N2O,n} * GWP_{N2O} * 10^{-3}$$

Where:

BE_n = Baseline emissions in monitoring period n (tCO_2e)

$P_{NA,n}$ = Nitric acid produced in the monitoring period n ($tHNO_3$)

$EF_{BL,\ N2O,n}$ = Baseline N_2O emission factor for nitric acid production in the monitoring period n ($kgN_2O/tHNO_3$).

GWP_{N2O} = Global Warming Potential of N_2O valid for the commitment period (298 tCO_2e)

Sample calculation applying summed-up values of the whole monitoring period

Year	BE_n	P_{NA}	$EF_{BL,N2O,n}$	GWP_{N2O}	
2014	**212,014**	203,273	3.50	298	0.001
2015	**187,631**	185,186	3.40	298	0.001
Total	**399,645**				

Determination of the baseline N_2O emission factor ($EF_{BL,N2O,n}$)

The baseline N_2O emission factor in the monitoring period n ($EF_{BL,N2O,n}$) shall be determined as a default emission factor $EF_{default,y}$ given for each calendar year y for which BE_n is calculated (see monitoring table for $EF_{default,y}$), as follows:

$$(2) \qquad EF_{BL,\ N2O,n} = EF_{default,\ y}$$

Where:

$EF_{BL,\ N2O,n}$ = Baseline N_2O emission factor for nitric acid production in the monitoring period n ($kgN_2O/tHNO_3$).

$EF_{default,\ y}$ = Default N_2O baseline emissions factor in the calendar year of the monitoring period n ($kgN_2O/tHNO_3$) (see list of EFdefault, y values under B.6.2).

Year	$EF_{BL,\ N2O,n}$	$EF_{default,n}$
2014	3.50	3.50
2015	3.40	3.40

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

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Project emissions include emissions of N_2O which have not been destroyed by the project activity and, in case of the installation of a tertiary N_2O abatement facility, CO_2 emissions resulting from the operation of the N_2O abatement facility.

Project emissions are calculated using the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (Version 02) referred to in ACM0019.
Project emissions are calculated as follows:

$$PE_n = PE_{N2O,n} + PE_{CO2,tertiary,n} \quad (3)$$

Where:

PE_n = Project emissions in monitoring period n (tCO_2e)
$PE_{N2O,n}$ = Project emissions of N_2O from the project plant in monitoring period n (tCO_2e)
$PE_{CO2,tertiary,n}$ = Project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in monitoring period n (tCO_2)

Sample calculation applying summed-up values of the whole monitoring period:

Year	PE_n	$PE_{N2O,n}$	$PE_{CO2,tertiary,n}$
2014	**4,547.6**	3920.0	627.6
2015	**5,389.8**	4821.8	567.9
Total	**9,937**		

The amount of N_2O emissions from the project activity includes two emission sources:

- The N_2O contained in the tail gas stream of the plant which is released to the atmosphere and;
- In the case of a tertiary N_2O abatement, the N_2O contained in any by-pass streams to the tertiary N_2O abatement facility.

$$PE_{N2O,n} = (Q_{N2O,tail\ gas,n} + Q_{N2O,by\text{-}pass,n}) * GWP_{N2O} \quad (4)$$

Where:

$PE_{N2O,n}$ = Project emissions of N_2O from the project plant in monitoring period (tCO2e)

$Q_{N2O,tail\ gas,n}$ = Amount of N_2O released through the tail gas of the project plant to the atmosphere in monitoring period n (tN_2O)

$Q_{N2O,by\text{-}pass,n}$ = Amount of N_2O released through the by-pass to a tertiary N_2O abatement system to the atmosphere in monitoring period n (tN_2O)

GWP_{N2O} = Global warming potential of N_2O valid for the commitment period (310 tCO_2e)

Sample calculation applying summed-up values of the whole monitoring period:

Year	$PE_{N2O,n}$	$Q_{N2O,tail\ gas,n}$	$Q_{N2O,by\text{-}pass,n}$	GWP_{N2O}
2014	**3,920.0**	13.15	0	298
2015	**4,821.8**	16.18	0	298
Total	**8,742**			

The methodology and for keeping up flexibility in the event of a possible by-pass installation at a later point of time the parameter $T_{open,n}$ will be monitored throughout the crediting period and has been added to section B.7.1.

Determination of $Q_{N2O,tail\ gas,n}$

The amount of N_2O emissions from the tail gas stream of the project plant is determined using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream.” In applying the tool, the following provisions apply:

- Throughout the crediting periods of the project activity, the N_2O concentration and volume or mass flow of the tail gas are to be monitored continuously. The monitoring system is maintained throughout the crediting period based on the European Norm 14181 (2004), or any more recent update of that standard;
- The monitoring system provides separate hourly average values for the N_2O concentration and the volume or mass flow of the tail gas based on 1 second interval readings that are recorded and stored electronically. These N_2O data sets are identified by means of a unique time / date key indicating when exactly the values were observed;
- The correction factors derived from the calibration curve of the QAL2 audit for the monitoring components as determined during the QAL2-test in accordance with EN 14181 are applied to both the N_2O concentration and the volume or mass flow of the tail gas. This can either be applied automatically to the raw data recorded by the data storage system at the plant or it can be applied to the calculated hourly averages as part of the calculation of project emissions;
- If data for either the N_2O concentration or the volume or mass flow of the tail gas are not available for more than 1/3 of any hour while the plant was in operation, the value for that hour is replaced with the maximum value of N_2O concentration or volume or mass flow of the tail gas observed during the monitoring period. If data for neither the N_2O concentration nor the volume or mass flow of the tail gas are available for more than 1/3 of any hour while the plant was in operation, the maximum value of mass flow of N_2O calculated during the monitoring period is applied to any such hour. Values observed during five operating hours before and after a plant start-up and shut-down is excluded for the determination of the maximum values.

According to the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0) the mass flow of greenhouse gas i in the gaseous stream in time interval t ($F_{i,t}$) is calculated based on measurements of

a) The total volume flow or mass flow of the gas stream and
b) The volumetric fraction of the gas in the gaseous stream and
c) The water content and gas composition.

The tool covers possible measurement options, providing six different calculation options to determine the volume or mass flow of a particular greenhouse gas (A-F).
Furthermore, the tool provides several options for the determination of the moisture content of the gaseous stream. As the gaseous stream is assumed to be dry, Option A is applied. In order to apply this option, it shall be demonstrated that the gaseous stream is dry. As described in part (a) of Option A, the moisture content of the gaseous stream ($CH_2O_{,t,db,n}$) will be measured and it shall be demonstrated that it is less or equal to 0.05 kg H_2O/m^3 dry gas. The moisture measurement shall coincide with the Annual Surveillance Test or the calibration of the flow meter for the gaseous stream.
In accordance with Option A of the tool, the mass flow of greenhouse gas i ($F_{i,t}$), which is calculated as follows:

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t} \quad (5)$$

With

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \quad (6)$$

Where:

$F_{i,t}$ = mass flow of greenhouse gas N_2O in the gaseous stream in time interval t (kg gas /h)
$V_{t,db}$ = Volumetric flow of the gaseous stream in time interval t, on dry basis (m^3 dry gas/h)

$v_{i,t,db}$ = Volumetric fraction of greenhouse gas N_2O in the gaseous stream in a time interval t on a dry basis (m^3 gas N_2O/m^3 dry gas)
$\rho_{i,t}$ = Density of greenhouse gas N_2O in the gaseous stream in a time interval t (kg gas N_2O/m^3 gas N_2O)
P_t = Absolute pressure of the gaseous stream in time interval t (Pa)
MM_i = Molecular mass of greenhouse gas N_2O (kg/kmol)
R_u = Universal ideal gases constant ($Pa.m^3/kmol.K$)
T_t = Temperature of the gaseous stream in time interval t (K)

Sample calculation for equation (5) applying average values for the monitoring period:

$F_{i,t}$	$V_{t,db}$	$v_{i,t,db}$	$\rho_{i,t}$
3.093	131,543	0.0000120	1.964

Calculation for equation (6) applying standard condition values:

$\rho_{i,t}$	P_t	MM_{N2O}	Ru	T_t
1.96	101.33	44.02	8.31	273.150

$V_{(t,db)}=V_{(t,wb)}/1+v_{(H2O,t,db)} =V_{(t,wb)}$

$V_{i,t,db}$	$V_{i,t,wb}$	$1 + v_{H2O,t,db}$
131,543	131,543	1

$$v_{H2O,t,db} = \frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}}$$

($m_{H2O,t,db}$ = “0”)

The volumetric flow of the gaseous stream in time interval t on a dry basis ($V_{t,db}$) is determined by converting the measured volumetric flow from wet basis to dry basis. The absolute humidity of the gaseous stream (mH2O,t,db) is determined using Option 2 above and accordingly set to be 0. Consequently, equation (8) will result in 0 and thus equation (7) will result in:

$$(7) \qquad Q_{N2O,tailgas,n} = \sum_{h=1}^{h=h_n} F_{N2O,tailgas,h} * 10^{-3}$$

Where:

$Q_{N2O,tailgas,n}$ = Amount of N_2O released through the tail gas of the project plant to the atmosphere in monitoring period n (tN_2O)
$F_{N2O,tailgas,h}$ = Mass flow of N_2O in the gaseous stream of the tail gas in the hour h (kgN_2O/h)
h_n = Number of hours in monitoring period n during which the plant was in operation

Sample calculation applying summed-up values of the whole monitoring period:

Year	$Q_{N2O,tail gas,n}$	$\sum F_{N2O,tail gas,h}$	
2014	**13.15**	13,154.44	0.001
2015	**16.18**	16,180.59	0.001
Total	**29.34**		

During any periods in which a tertiary abatement system is by-passed, $F_{N2O,tailgas,h}$ is set to zero in order to avoid double counting of project emissions.

$$(8) \qquad Q_{N2O,\ by\text{-}pass;n} = EF_{BL,\ N2O,n} * P_{NA.n} * T_{open,n} * 10^{-3}$$

Where:

$Q_{N2O,\ by\text{-}pass;n}$ = Amount of N_2O released through the by-pass to a tertiary N_2O abatement system to the atmosphere in monitoring period n (tN_2O)

$EF_{BL, N2O,n}$ = Default N_2O baseline emissions factor in the calendar year y of the monitoring period n ($kgN_2O/t\ HNO_3$)
$P_{NA.n}$ = Nitric acid produced in the monitoring period n ($tHNO_3$)
$T_{open,n}$ = Fraction of time in monitoring period n during which the by-pass valve on the line feeding the tertiary N_2O abatement facility was open to vent the gas directly to the atmosphere.

Sample calculation applying summed-up values of the whole monitoring period:

Year	$Q_{N2O,by\text{-}pass,n}$	$EF_{BL,N2O,n}$	P_{NA}	$T_{open,n}$
2014	**0.00**	3.50	203,273	0
2015	**0.00**	3.40	185,186	0
Total	**0.00**			

The emissions related to the operation of the N_2O destruction facility include only on-site emissions due to the fossil fuel use as input to the N_2O destruction facility:

Project emissions from the operation of the tertiary N_2O abatement facility ($PE_{CO2,tertiary,n}$)

The emissions related to the operation of the N_2O destruction facility include only on-site emissions due to the fossil fuel use as input to the N_2O destruction facility:

$$PE_{CO2,tertiary,n} = PE_{FF,n} \quad (9)$$

Where:

$PE_{CO2,tertiary,n}$ = Project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in monitoring period n (tCO_2)
$PE_{FF,n}$ = Project emissions related to fossil fuel input to the destruction facility and/or re-heater in monitoring period n ($t\ CO_2$)

For the determination of the project emissions related to the operation of the tertiary abatement system in monitoring period n the project proponents are required to use the latest version of the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion.”

The parameter $PE_{FC,j,y}$ used in the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” corresponds to the parameter $PE_{FF,n}$ in the applied methodology:

$$PE_{FF,n} = PE_{FC,i,j,} \quad (10)$$

CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,n} = \sum_i FC_{i,j,n} * COEF_{i,n} \quad (11)$$

Where:

$PE_{FC,j,n}$ = CO_2 emissions from fossil fuel combustion in process j in monitoring period n (tCO_2/n)
$FC_{i,j,n}$ = Quantity of fuel type i combusted in the process j during the monitoring period n (mass or volume unit/n)

$COEF_{i,n}$= CO_2 emission coefficient of fuel type i in monitoring period n (tCO2/mass or volume unit)
i = fuel types combusted in process j during monitoring period n

Sample calculation applying summed-up values of the whole monitoring period:

Year	$PE_{CO2,tertiary,n}$	$\sum FC_{i,j,n}$	$COEF_{i,n}$
2014	**627.61**	233.75	2.685
2015	**567.94**	211.73	2.682

Total	**1,195.55**		

As data about the chemical composition of the fuel type i is available COEFi,n is calculated based on its chemical composition of the fossil fuel type i using Option A of the “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion” (Version 02):

$$COEF_{i,n} = W_{c,i,n} * 44/12 \quad (12)$$

Where:

$COEF_{i,n}$ = CO_2 emission coefficient of fuel type i in monitoring period n (tCO_2/mass or volume unit)
$wC_{,i,n}$ = Is the weighted average mass fraction of carbon in fuel type i in monitoring period n (tC/mass unit of the fuel)

Sample calculation applying summed-up values of the whole monitoring period:

Year	$COEF_{i,n}$	$w_{C,i,y}$	
2014	**2.685**	0.732	44/12
2015	**2.682**	0.732	44/12

$wC_{,i,y}$ is calculated according to a mass fraction calculation of carbon in the fuel type applied

2014						
Component	**Atoms Carbon per molecule**	**Molar weight**	**mol Fraction**	**mass fraction**	**mass fraction of carbon**	**mass fraction of carbon in fuel = wc,i,y**
		g/mol	%	**g/mol**	**g/mol**	
Carbon		12.011				
Nitrogen	0	28.013	1.964	0.55	0.00	
Carbon dioxid	1	44.01	0	0.00	0.00	
Methane	1	16.043	93.93	15.07	11.28	
Ethane	2	30.07	2.174	0.65	0.52	
Propane	3	44.096	1.007	0.44	0.36	
i Butane	4	58.12	0.241	0.14	0.12	
n Butane	4	58.12	0.3	0.17	0.14	
i pentane	5	72.15	0.077	0.06	0.05	
n pentane	5	72.15	0.003	0.00	0.00	
neo Pentane	5	72.15	0.005	0.00	0.00	
Hexane	7	86.18	0.047	0.04	0.04	
Heptane	7	100.21	0.168	0.17	0.14	
Octane	8	114.23	0	0.00	0.00	
Nonane	9	128.26	0.077	0.10	0.08	
			Total	17.4	12.7	**0.732**

2015						
Component	**Atoms Carbon per molecule**	**Molar weight**	**mol Fraction**	**mass fraction**	**mass fraction of carbon**	**mass fraction of carbon in fuel = wc,i,y**
		g/mol	%	**g/mol**	**g/mol**	
Carbon		12.011				
Nitrogen	0	28.013	2.012	0.56	0.00	
Carbon dioxid	1	44.01	0	0.00	0.00	
Methane	1	16.043	93.89	15.06	11.28	
Ethane	2	30.07	2.221	0.67	0.53	
Propane	3	44.096	0.978	0.43	0.35	
i Butane	4	58.12	0.252	0.15	0.12	
n Butane	4	58.12	0.291	0.17	0.14	
i pentane	5	72.15	0.086	0.06	0.05	
n pentane	5	72.15	0.054	0.04	0.03	
neo Pentane	5	72.15	0.006	0.00	0.00	
Hexane	7	86.18	0.058	0.05	0.05	
Heptane	7	100.21	0.097	0.10	0.08	
Octane	8	114.23	0.023	0.03	0.02	
Nonane	9	128.26	0.045	0.06	0.05	
			Total	17.4	12.7	**0.732**

E.3. Calculation of leakage

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Any leakage emissions sources are deemed to be negligible.

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

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	GHG emission reductions or net GHG removals by sinks (t CO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
2014	212,014	4547.637	0	0	**207,466**	**207,466**
2015	187,631	5389.752	0	0	**182,241**	**182,241**
Total	**399,644.8**	**9,937.4**	0	0	**389,707**	**389,707**

E.5. Comparison of actual emission reductions or net 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_2e)	479,382	**389,707**

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

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Due to the lower nitric acid production during the monitoring period, the achieved emission reductions were below the expected value.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Omnia Fertilizer Limited
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Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
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Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
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Document information

Version	Date	Description
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
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 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.

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