



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006**

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**SECTION A. General description of project activity****A.1 Title of the project activity:**Title: Omnia N₂O Abatement Project II

Version: 02

Date: 19/12/2011

A.2. Description of the project activity:

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 already operates one nitric acid plant in Sasolburg, South Africa including N₂O Abatement registered as CDM Project 0752. A new nitric acid plant is currently being built and expected to be commissioned in the first half of 2012. This new plant is designed by Uhde GmbH with a confirmed production capacity of 400,000 tonnes 100% concentrated nitric acid per year.

Nitrous Oxide (N₂O) is an undesired by-product of the nitric acid (HNO₃) production process at the synthetic fertilizer production facility. However, N₂O emissions from nitric acid production are not regulated in South Africa. No N₂O abatement system was designed into the plant. Without the incentive of the proposed CDM project activity, approx. 800,000tCO₂e per year¹ would be emitted at the new nitric acid plant.

The aim of the project activity is to reduce N₂O emissions in the tail gas by installing a tertiary catalyst after the absorption unit. It is expected that the N₂O abatement catalyst reduces 98 % of the N₂O². Against the standardized baseline emissions factor the project would generate an estimated 3,392,375 tCO₂e emission reductions during a 10 year crediting period.

A.3. Project participants:

Name of Party involved (*) (host indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
South Africa (host)	Omnia Fertilizer, Division of Omnia Group (Pty) Ltd., South Africa ("Omnia")	No

A.4. Technical description of the project activity:**A.4.1. Location of the project activity:**

¹ Taken into account an estimated business-as-usual emissions factor of 6.45kgN₂O/tHNO₃ (Average Baseline Emissionfactor of the first 5 monitoring periods of the first N₂O abatement project at Omnia's existing nitric acid plant) and annual confirmed capacity of 400,000tHNO₃/year.

² While the calculations are based on this conservative assumption it should be noted that from experience from Omnia's first N₂O reduction project as well as from other similar projects with the same technology even higher abatement efficiencies of up to 99.9 % were observed.

A.4.1.1. Host Party(ies):

Republic of South Africa

A.4.1.2. Region/State/Province etc.:

Free State Province, Republic of South Africa

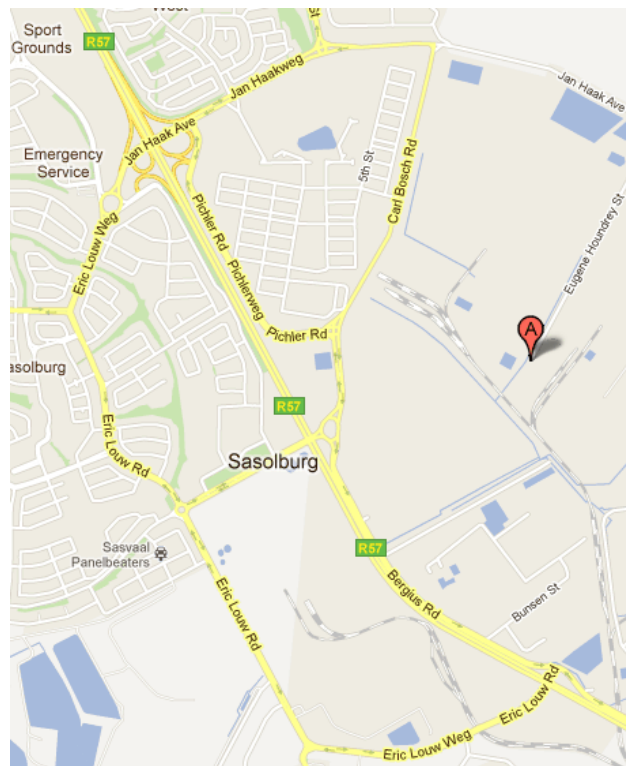
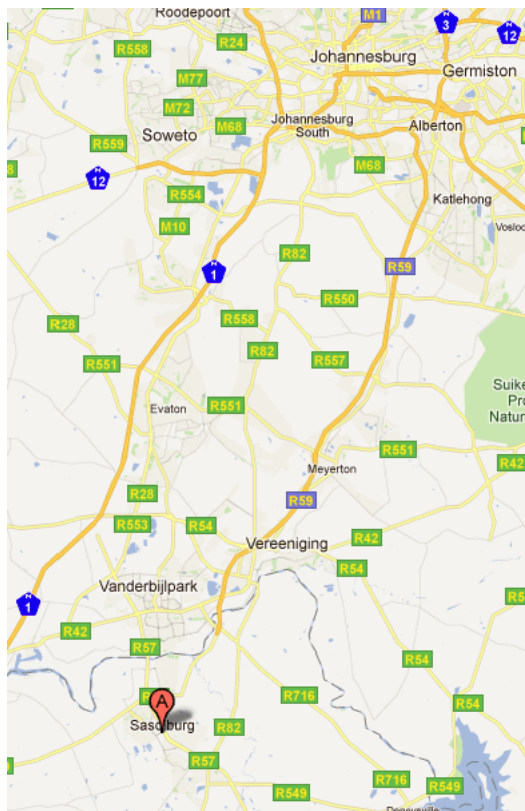




Figure 1: Physical location of the Omnia II nitric acid plant in Sasolburg, South Africa

A.4.1.3. City/Town/Community etc:

Sasolburg in the municipality of Metsimaholo

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

Omnia's plant is located at latitude of approx. 26°48'48" South and a longitude of 27°51'23" East.

A.4.2. Category(ies) of project activity:

Category 5: "Chemical industries"

A.4.3. Technology to be employed by the project activity:

The project activity entails the installation of:

- Tertiary N₂O abatement technology,
- Specialized monitoring equipment that is installed at the tail gas stream after the abatement of N₂O emissions (see Monitoring Plan in this PDD for further information).

Catalyst Technology

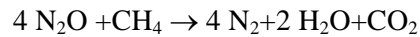
In the production process of nitric acid (HNO₃), NO₂ is produced as an intermediate material from ammonia (NH₃). The associated chemical reactions of oxidizing ammonia and simultaneous unwanted reactions are as follows:

- | | | |
|----|--|--|
| 1. | $\text{NH}_3 + 2 \text{O}_2 \rightarrow \text{HNO}_3 + \text{H}_2\text{O}$ | (overall desirable reaction) |
| 2. | $4 \text{NH}_3 + 5 \text{O}_2 \rightarrow 4 \text{NO} + 6 \text{H}_2\text{O}$ | (desirable in the NH ₃ oxidization process) |
| 3. | $2\text{NO} + \text{O}_2 \rightarrow 2 \text{NO}_2$ | (desirable in the NO oxidization process) |
| 4. | $3 \text{NO}_2 + \text{H}_2\text{O} \rightarrow 2 \text{HNO}_3 + \text{NO}$ | (desirable in the NO ₂ absorption process) |
| 5. | $4 \text{NH}_3 + 3 \text{O}_2 \rightarrow 2 \text{N}_2 + 6 \text{H}_2\text{O}$ | (undesirable) |
| 6. | $4 \text{NH}_3 + 4 \text{O}_2 \rightarrow 2 \text{N}_2\text{O} + 6 \text{H}_2\text{O}$ | (undesirable) |
| 7. | $2 \text{NH}_3 + 8 \text{NO} \rightarrow 5 \text{N}_2\text{O} + 3 \text{H}_2\text{O}$ | (undesirable) |

Through the sixth and seventh reactions, some N₂O is generated in the process.

The N₂O abatement technology will be installed in the tail gas downstream after the HNO₃ absorber and before the tail gas turbine. A tertiary catalyst reduces N₂O 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 N₂O abatement catalysts. The abatement efficiency of this pelleted catalyst has been shown to be up to 99.9% in the following reaction³:

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 N₂O



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

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

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

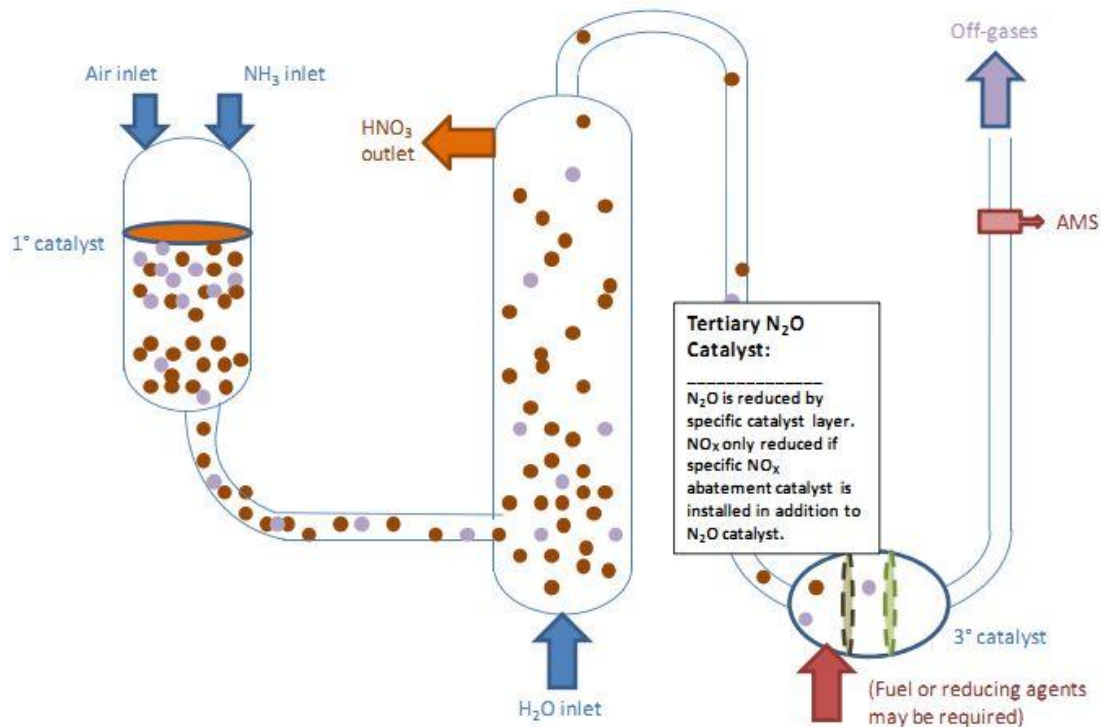


Figure 2: Image flow of tertiary catalyst unit

reduction project as well as from other similar projects with the same technology even higher abatement efficiencies of up to 99.9 % were observed.

A.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

The estimated quantity of emission reductions against the benchmark emissions factor during the crediting period is displayed in the following table.

Year	EF _{default,y} (kgN ₂ O/ tHNO ₃)	ER _n (tCO ₂ e)	Omnia Financial Year (April to March)	ER _n (tCO ₂ e)
04/2012	3.90	171,544	2012	279,707
2013	3.70	432,652	2013	426,452
2014	3.50	407,852	2014	404,752
2015	3.40	395,452	2015	389,252
2016	3.20	370,652	2016	364,452
2017	3.00	345,852	2017	339,652
2018	2.80	321,052	2018	317,952
2019	2.70	308,652	2019	302,452
2020	2.50	283,852	2020	283,852
2021	2.50	283,852	2021	283,852
03/2022	2.50	70,963	Total	3,392,375
Total		3,392,375		
Annual Average over the crediting period		339,238		

Table 1a: Estimated emission reductions in Omnia’s Financial Years (for convenience only) during the crediting period

Table 1 Overview of estimated emission reductions generated in the 10 years crediting period from 01/04/2012 until 31/03/2022

Table 1a is inserted for convenience purpose only. It translates the emission reduction estimates per calendar year into estimates as per Omnia’s financial year which runs from April 01 to March 31.

For the calculation of the estimated emission reductions it was taken into account:

- The confirmed capacity of 400,000 tHNO₃/year,
- A default factor (EF_{default,y}) (see B.6.2) for calculating baseline emissions (BE_n), Please note that factual business as usual emissions are assumed to be approximately 6.45kgN₂O/tHNO₃. However, as defined in the methodology, instead of factual business as usual emissions, the default factor is used in order to calculate credible emission reductions.
- A reduction efficiency of 98% and
- 10,152 tCO₂e⁴/year for the operation of the tertiary system

⁴ The project emissions stemming from the operation of the tertiary abatement system have been calculated ex-ante on basis of the design fossil fuel consumption figures provided by Uhde. Calculations have been undertaken in accordance with the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” (version 2.0)”. For a more detailed explanation and figures please see section B.6.3. and Table 4.

**A.4.5. Public funding of the project activity:**

No development aid funds countries are involved in the project activity. The project is solely financed by Omnia.

SECTION B. Application of a baseline and monitoring methodology**B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:**

Applicable baseline and monitoring methodology:

ACM0019 Version 01.0.0: “N₂O abatement from nitric acid production”

Methodological tools referred to in ACM0019 as applied in this PDD:

“Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”

(Version 02)

“Tool to determine the mass flow of a greenhouse gas in a gaseous stream”

(Version 02.0.0)

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The chosen baseline methodology ACM0019 is applicable to projects in which tertiary N₂O abatement technology is installed in the tail gas leaving the absorption column in the nitric acid plant. This corresponds with the proposed project activity.

The applicability criteria of the chosen methodology are met by the project:

- Presently, no N₂O abatement technology is installed in the plant.
- The plant will be equipped with a complete Automated Monitoring System (AMS). It is used to continuously measure N₂O concentration and total gas volume flow in the stack during the plant’s operation throughout the crediting period.
- The host country does not apply any legal requirements to reduce N₂O emissions from nitric acid plants (see B.4 for further information).

B.3. Description of the sources and gases included in the project boundary

The spatial extent of the project boundary encompasses the facility and equipment for the nitric acid production process from the inlet of the ammonia burner to the outlet of the tail gas section.

As the project activity introduces tertiary N₂O abatement, any remaining N₂O emissions from the project plant and CO₂ emissions arising from the operation of the tertiary abatement system are included as project emissions in the project boundary.



The greenhouse gases included in or excluded from the project boundary are shown in the below table:

Source		Gas	Included	Justification/Explanation
Baseline	NH ₃ oxidation at the primary catalyst gauze	CO ₂	NO	The project activity has no influence on these types of emissions, if present
		CH ₄	NO	
		N ₂ O	Yes	Included, main emission source
Project activity	NH ₃ oxidation at the primary catalyst gauze	CO ₂	NO	The project activity has no influence on these types of emissions, if present
		CH ₄	NO	
		N ₂ O	Yes	Included, main emission source
	Operation of a tertiary N ₂ O Abatement facility	CO ₂	Yes	In some cases, fossil fuels are used as reducing agent and/or for decomposing the tail gas as part of a tertiary N ₂ O abatement facility. In this case the fossil fuels are mainly converted to CO ₂ . CO ₂ emissions arising from the production of ammonia are assumed to be small and not taken into account.
		CH ₄	NO	
	N ₂ O	Yes	Included	

Table 2: Emission sources included in or excluded from the project boundary (source: ACM0019 version 01.0.0)

The boundary of the project will be from the inlet of the Ammonia Oxidation Reactor to the outlet of the stack of the nitric acid plant.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The Department of Environmental Affairs of the government of South Africa is responsible of any national/regional emission regulations. Air Quality legislation has changed recently in South Africa. The 1st of April 2010 marked the full enactment of the National Environmental Management: Air Quality Act (Act No. 39 of 2004). The responsibility for the implementation of the act was delegated to the regional municipalities from the national government, this is stipulated in section 36(1) of the act. The act itself was preceded by the promulgation of the listed activities and their associated minimum emission standards on 31 March 2010, as contemplated in section 21(1)(a) of the act. The listed activities describes the processes for which air quality licenses will be required.

There are currently no national regulations in South Africa that limit N₂O emissions from nitric acid production. This has been confirmed for the specific case of the Omnia nitric acid plant in a confirmation letter issued by Department of Environmental Affairs of the government of South Africa .

In the absence of regulations requiring the abatement of N₂O emissions, the operator of the nitric acid plant has no economic incentives to take any N₂O abatement measures because this entails capital and operating costs but no financial benefits.



Therefore, the CDM project activity is considered additional and the baseline scenario is that the N₂O is emitted to the atmosphere with no N₂O abatement measure being implemented.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

According to the baseline methodology procedure of the methodology ACM0019 Version 1.0.0, the project activity is considered to be additional in the absence of regulations requiring the abatement of N₂O emissions. The operator of the nitric acid plant has no economic incentives to take any N₂O abatement measure because this entails capital and operation costs but no financial benefits. In the absence of any regulation, the baseline scenario is emitting N₂O to the atmosphere with no N₂O abatement measure being implemented.

Since the project start date is after 02/08/2008 a “prior consideration” form has been submitted to the UNFCCC and the South African DNA within 6 months of the project start date.

Omnia closely followed the developments of new methodologies which would allow it to register a CDM project at its new nitric acid plant. The decision to implement an N₂O abatement project was taken on 30/06/2011 and the Omnia project team was instructed by management to request a quotation from Uhde GmbH for a tail gas N₂O abatement system. Omnia placed the order for the N₂O abatement system (“ENVINOX”) 20 July 2011.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

ACM0019, Version 01.0.0., is the methodology chosen for the implementation of this project activity.

In the following, the explanation of the calculation of baseline and project emissions, as required under the ACM0019, is presented.

Baseline emissions:

Explanation of calculation method and applicable formula

$$(1) \quad BE_n = P_{NA,n} * EF_{BL, N_2O,n} * GWP_{N_2O} * 10^{-3}$$

Where:

BE_n = Baseline emissions in monitoring period n (tCO₂e)

P_{NA,n} = Nitric acid produced in the monitoring period n (tHNO₃)

EF_{BL, N₂O,n} = Baseline N₂O emission factor for nitric acid production in the monitoring period n (kgN₂O/tHNO₃).

GWP_{N₂O} = Global Warming Potential of N₂O valid for the commitment period (310 tCO₂e)

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

The baseline N₂O 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 tables for EF_{default,y}), as follows:

$$(2) \quad EF_{BL, N_2O, n} = EF_{default, y}$$

Where:

EF_{BL, N₂O,n} = Baseline N₂O emission factor for nitric acid production in the monitoring period n (kgN₂O/tHNO₃).

EF_{default,y} = Default N₂O baseline emissions factor in the calendar year of the monitoring period n (kgN₂O/tHNO₃) (see list of EF_{default, y} values under B.6.2).

If the monitoring period n spans across two (or more) calendar years, the baseline emissions (BE_n) shall be calculated separately for each calendar year, first establishing EF_{BL,N₂O,n} and then applying this to the nitric acid production of that calendar year.

Project Emissions:

Project emissions include emissions of N₂O which have not been destroyed by the project activity and, in case of the installation of a tertiary N₂O abatement facility, CO₂ emissions resulting from the operation of the N₂O abatement facility.

Project emissions are calculated using the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” (version 2.0) referred to in ACM0019.

Project emissions are calculated as follows:

$$(3) \quad PE_n = PE_{N_2O, n} + PE_{CO_2, tertiary, n}$$

Where:

PE_n = Project emissions in monitoring period n (tCO₂e)

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

PE_{CO₂, tertiary, n} = Project emissions of CO₂ from the operation of the tertiary N₂O abatement facility in monitoring period n (tCO₂)

The amount of N₂O emissions from the project activity includes two emission sources:

- The N₂O contained in the tail gas stream of the plant which is released to the atmosphere and;
- In the case of a tertiary N₂O abatement, the N₂O contained in any by-pass streams to the tertiary N₂O abatement facility.

$$(4) \quad PE_{N_2O, n} = (Q_{tail\ gas, n} + Q_{N_2O, by-pass, n}) * GWP_{N_2O}$$

Where:

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



- $Q_{\text{tail gas},n}$ = Amount of N_2O released through the tail gas of the project plant to the atmosphere in monitoring period n (tN_2O)
- $Q_{N_2O, \text{by-pass},n}$ = 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)⁵
- GWP_{N_2O} = Global warming potential of N_2O valid for the commitment period (310 tCO_2e)

Determination of $Q_{N_2O, \text{tail gas},n}$

The amount of N_2O emissions from the tail gas stream of the project plant shall be 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 to be installed and maintained throughout the crediting period based on the European Norm 14181 (2004), or any more recent update of that standard;
- The monitoring system should provide separate hourly average values for the N_2O concentration and the volume or mass flow of the tail gas based on (generally) 2 seconds interval readings that are recorded and stored electronically. These N_2O data sets shall be 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 EN14181 must be 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 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;

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.

⁵ Please note that for the underlying project activity no by-pass option is foreseen in the current project design. Accordingly, no by-pass emissions will occur throughout the project activity: However, in order to comply with the methodology and for keeping up flexibility in the event of a possible by-pass installation at a later point of time the parameter $T_{\text{open},n}$ will be monitored throughout the crediting period and has been added to section B.7.2.



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 ($C_{H_2O,t,db,n}$) will be measured and it shall be demonstrated that it is less or equal to 0.05 kg H₂O/m³.

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 ($F_{i,t}$) is calculated as follows:

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

With:

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

Where:

- $F_{i,t}$ = mass flow of greenhouse gas N₂O 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 (m³ dry gas/h)
 $v_{i,t,db}$ = Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m³ gas i /m³ dry gas)
 $\rho_{i,t}$ = Density of greenhouse gas i in the gaseous stream in a time interval t (kg gas i /m³ gas i)
 P_t = Absolute pressure of the gaseous stream in time interval t (Pa)
 MM_i = Molecular mass of greenhouse gas i (kg/kmol)
 R_u = Universal ideal gases constant (Pa.m³/kmol.K)
 T_t = Temperature of the gaseous stream in time interval t (K)

The hourly values are then aggregated for the duration of the monitoring period n , as follows:

$$(7) \quad Q_{N_2O,tailgas,n} = \sum_{h=1}^{h=h_n} F_{N_2O,tailgas,h} * 10^{-3}$$

Where:

- $Q_{N_2O,tailgas,n}$ = Amount of N₂O released through the tail gas of the project plant to the atmosphere in monitoring period n (tN₂O)
 $F_{N_2O,tailgas,h}$ = Mass flow of N₂O in the gaseous stream of the tail gas in the hour h (kgN₂O/h)
 h_n = Number of hours in monitoring period n during which the plant was in operation



During any periods in which a tertiary abatement system is by-passed, $F_{N_2O, tailgas, h}$ is set to zero in order to avoid double counting of project emissions.

$$(8) \quad Q_{N_2O, by-pass; n} = EF_{BL, N_2O, n} * P_{NA, n} * T_{open, n} * 10^{-3}$$

Where:

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

$EF_{BL, N_2O, n}$ = Default N_2O baseline emissions factor in the calendar year y of the monitoring period n (kg N_2O /t HNO_3)

$P_{NA, n}$ = Nitric acid produced in the monitoring period n (t HNO_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.

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 ($PE_{CO_2, tertiary, n}$)

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:

$$(9) \quad PE_{CO_2, tertiary, n} = PE_{FF, n}$$

Where:

$PE_{CO_2, tertiary, n}$ = Project emissions of CO_2 from the operation of the tertiary N_2O abatement facility in monitoring period n (t CO_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:

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

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:

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



Where:

- $PE_{FC,j,n}$ = CO₂ emissions from fossil fuel combustion in process j in monitoring period n (tCO₂/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)
- $COEF_{i,n}$ = CO₂ 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

$COEF_{i,n}$ is calculated based on net calorific value and CO₂ emission factor of the fuel type i as follows:

$$(12) \quad COEF_{i,n} = NCV_{i,n} * EF_{CO_2,i,n}$$

Where:

- $COEF_{i,n}$ = CO₂ emission coefficient of fuel type i in monitoring period n (tCO₂/mass or volume unit)
- $NCV_{i,n}$ = Weighted average net calorific value of the fuel type i in monitoring period n
- $EF_{CO_2,i,n}$ = Weighted average CO₂ emission factor of fuel type i in monitoring period n (tCO₂/GJ)
- i = Fuel types combusted in process j during the monitoring period n

Leakage emissions:

Any leakage emissions sources are deemed to be negligible.

Emission reductions:

Emission reductions are calculated as follows:

$$(13) \quad ER_n = BE_n - PE_n$$

Where:

- ER_n = Emission reductions in monitoring period n (tCO₂e)
- BE_n = Baseline emissions in monitoring period n (tCO₂e)
- PE_n = Project emissions in monitoring period n (tCO₂e)

**B.6.2. Data and parameters that are available at validation:**

Data / Parameter:	$EF_{\text{default},y}$																																						
Data unit:	kgN ₂ O/tHNO ₃																																						
Description:	Default N ₂ O baseline emissions factor in the calendar year y of the monitoring period n																																						
Source of data used:	<p>According to ACM0019 Version 01.0.0, the default N₂O 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:</p> <table border="1" data-bbox="496 734 853 1447"> <thead> <tr> <th>Year</th> <th>Emissions factor (kgN₂O/tHNO₃)</th> </tr> </thead> <tbody> <tr><td>2005</td><td>5.10</td></tr> <tr><td>2006</td><td>4.90</td></tr> <tr><td>2007</td><td>4.70</td></tr> <tr><td>2008</td><td>4.60</td></tr> <tr><td>2009</td><td>4.40</td></tr> <tr><td>2010</td><td>4.20</td></tr> <tr><td>2011</td><td>4.10</td></tr> <tr><td>2012</td><td>3.90</td></tr> <tr><td>2013</td><td>3.70</td></tr> <tr><td>2014</td><td>3.50</td></tr> <tr><td>2015</td><td>3.40</td></tr> <tr><td>2016</td><td>3.20</td></tr> <tr><td>2017</td><td>3.00</td></tr> <tr><td>2018</td><td>2.80</td></tr> <tr><td>2019</td><td>2.70</td></tr> <tr><td>2020</td><td>2.50</td></tr> <tr><td>2021</td><td>2.50</td></tr> <tr><td>Year n</td><td>2.50</td></tr> </tbody> </table>	Year	Emissions factor (kgN ₂ O/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
Year	Emissions factor (kgN ₂ O/tHNO ₃)																																						
2005	5.10																																						
2006	4.90																																						
2007	4.70																																						
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2016	3.20																																						
2017	3.00																																						
2018	2.80																																						
2019	2.70																																						
2020	2.50																																						
2021	2.50																																						
Year n	2.50																																						
Value applied:	Not applicable																																						
Justification of the choice of data or description of measurement methods and procedures actually applied:	No measurement procedures, specified in the methodology.																																						
Any 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 6.45 kgN ₂ O/tHNO ₃ .																																						

Data / Parameter:	GWP_{N_2O}
Data unit:	tCO ₂ e/tN ₂ O
Description:	Global warming potential of the nitrous oxide
Source of data used:	Relevant decisions by the CMP



Value applied:	310
Justification of the choice of data or description of measurement methods and procedures actually applied:	Specified in the methodology.
Any comment:	

Parameters from the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” (Version 02):

Data / Parameter:	$NCV_{i,j}$
Data unit:	GJ/ton
Description:	Weighted average net calorific value of fuel type i in year y
Source of data used:	IPCC default values at the upper limit of uncertainty at a 95% confidence interval as provided in table 1.2 of chapter 1 Vol. 2 (Energy) of the 2006 IPCC Guidelines in National GHG Inventories
Value applied	50.4
Justification of the choice of data or description of measurement methods and procedures actually applied:	N/A
Any comment:	Ex-ante value for the ex-ante calculation of Project emissions

Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tCO ₂ /GJ
Description:	Weighted average CO ₂ emission factor fuel type i in year y
Source of data used:	IPCC default values at the upper limit of uncertainty at a 95% confidence interval as provided in table 1.4 of chapter 1 Vol. 2 (Energy) of the 2006 IPCC Guidelines in National GHG Inventories
Value applied:	0.0583
Justification of the choice of data or description of measurement methods and procedures actually applied:	N/A
Any comment:	Ex-ante value for the ex-ante calculation of Project emissions

Parameters from the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0):

Data / Parameter:	R_u
Data unit:	Pa,m ³ /kmol.K
Description:	Universal ideal gases constant
Source of data used:	Universal ideal gases constant
Value applied	8,314



Justification of the choice of data or description of measurement methods and procedures actually applied:	n/a
Any comment:	

Data / Parameter:	MM _i
Data unit:	kg/mol
Description:	Molecular mass of greenhouse gas <i>i</i> (N ₂ O)
Source of data used:	Molecular mass of greenhouse gas <i>i</i> (N ₂ O)
Value applied	44.02
Justification of the choice of data or description of measurement methods and procedures actually applied:	n/a
Any comment:	

Data / Parameter:	P _n
Data unit:	Pa
Description:	Total pressure at normal conditions
Source of data used:	
Value applied	101,325
Justification of the choice of data or description of measurement methods and procedures actually applied:	Normalization of gas measurement
Any comment:	

Data / Parameter:	T _n
Data unit:	K
Description:	Temperature at normal conditions
Source of data used:	
Value applied	273.15 K
Justification of the choice of data or description of measurement methods and procedures actually applied:	Normalization of gas measurement
Any comment:	

Data / Parameter:	T _{open,n}
Data unit:	%



Description:	Fraction of time in monitoring period n during which the by-pass valve on the line feeding the tertiary N ₂ O abatement facility was open to vent the gas directly to the atmosphere.
Source used:	N/A
Value applied	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	N/A
Any 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.

B.6.3 Ex-ante calculation of emission reductions:

For the calculation of the estimated emission reductions it was taken into account:

- The confirmed capacity of 400,000 tHNO₃/year,
- A default factor (EF_{default,y}) (see B.6.2) for calculating baseline emissions (BE_n), Please note that factual business as usual emissions are assumed to be approximately 6.45 kgN₂O/tHNO₃. However, as defined in the methodology, instead of factual business as usual emissions, the default factor is used in order to calculate credible emission reductions.
- An expected reduction efficiency of 98% and
- 10,152 tCO₂e (ex-ante calculation) for the operation of the tertiary system.

Baseline emissions:

$$(1) \quad BE_n = P_{NA,n} * EF_{BL, N_2O,n} * GWP_{N_2O} * 10^{-3}$$

Where:

BE_n = Baseline emissions in monitoring period n (tCO₂e)

P_{NA,n} = Nitric acid produced in the monitoring period n (tHNO₃)

EF_{BL, N₂O,n} = Default N₂O baseline emissions factor in the calendar year y of the monitoring period n (kgN₂O/tHNO₃). The baseline N₂O 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 tables for EF_{default, y})

GWP_{N₂O} = Global Warming Potential of N₂O valid for the commitment period of 310 tCO₂e

The following table displays the estimated baseline emissions for the project activity over the crediting period of 10 years starting in 2012.



Year	EF _{default,y} (kgN ₂ O/ tHNO ₃)	P _{NA,n} (tHNO ₃)	GWP (N ₂ O)	BE _n (tCO ₂ e)
2012	3.90	150,000	310	181,350
2013	3.70	400,000	310	458,800
2014	3.50	400,000	310	434,000
2015	3.40	400,000	310	421,600
2016	3.20	400,000	310	396,800
2017	3.00	400,000	310	372,000
2018	2.80	400,000	310	347,200
2019	2.70	400,000	310	334,800
2020	2.50	400,000	310	310,000
2021	2.50	400,000	310	310,000
2022	2.50	100,000	310	77,500
Total		3,850,000		3,644,050

Table 3: Overview of estimated baseline emissions during the project activity over the 10 year crediting period.

Project Emissions:

- (2) $PE_n = PE_{N_2O,n} + PE_{CO_2,tertiary,n}$
- (3) $PE_{N_2O,n} = (Q_{tail\ gas,n} + Q_{N_2O,by-pass,n}) * GWP_{N_2O}$

Where:

- PE_n = Project emissions in monitoring period n (tCO₂e)
- PE_{N₂O,n} = Project emissions of N₂O from the project plant in monitoring period n (tCO₂e)
- PE_{CO₂,tertiary,n} = Project emissions of CO₂ from the operation of the tertiary N₂O abatement facility in monitoring period n (tCO₂)
- Q_{tail gas,n} = Amount of N₂O released through the tail gas of the project plant to the atmosphere in monitoring period n (tN₂O)
- Q_{N₂O, by-pass,n} = Amount of N₂O released through the by-pass to a tertiary N₂O abatement system to the atmosphere in monitoring period n (tN₂O)
- GWP_{N₂O} = Global warming potential of N₂O valid for the commitment period

Project emissions of CO₂ from the operation of the tertiary N₂O abatement facility will be assessed by using the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” (version 2.). However, since no abatement technology is installed yet, the parameter will be correctly determined during the first verification.

For the purpose of estimating the complete project emissions, an ex-ante calculation was undertaken on the basis of design consumption figures provided by Uhde. The catalyst system will be fed with natural gas providing CH₄, which will be utilized as a reduction agent for the decomposition of N₂O in a quantity of 0.35 mol CH₄/1 mol N₂O. Formula (11) is applied for the determination of the parameter

PE_{FC,i,j}, which is equal to parameter PE_{CO₂,tertiary,n} of the applied methodology ACM0019 resulting in estimated emissions from the operation of the tertiary abatement facility of 10,152 tCO₂/year.

Year	PE _{N₂O,n} (tCO ₂ e)	PE _{CO₂,tertiary,n} (tCO ₂ e)	PE _n (tCO ₂ e)
2012	5,999	3,807	9,806
2013	15,996	10,152	26,148
2014	15,996	10,152	26,148
2015	15,996	10,152	26,148
2016	15,996	10,152	26,148
2017	15,996	10,152	26,148
2018	15,996	10,152	26,148
2019	15,996	10,152	26,148
2020	15,996	10,152	26,148
2021	15,996	10,152	26,148
2022	3,999	2,538	6,537
Total	153,962	97,713	251,675

Table 4: Overview of estimated project emissions during the project activity over the 10 year crediting period.

Emission reductions

$$(4) \quad ER_n = BE_n - PE_n$$

Where:

ER_n = Emission reductions in monitoring period n (t CO₂e)

BE_n = Baseline emissions in monitoring period n (t CO₂e)

PE_n = Project emissions in monitoring period n (t CO₂e)

Year	BE _n (tCO ₂ e)	PE _n (tCO ₂ e)	ER _n (tCO ₂ e)
2012	181,350	9,806	171,544
2013	458,800	26,148	432,652
2014	434,000	26,148	407,852
2015	421,600	26,148	395,452
2016	396,800	26,148	370,652
2017	372,000	26,148	345,852
2018	347,200	26,148	321,052
2019	334,800	26,148	308,652
2020	310,000	26,148	283,852
2021	310,000	26,148	283,852
2022	77,500	6,537	70,963
Total	3,644,050	251,675	3,392,375



Table 5: Overview of estimated emission reductions during the project activity over the 10 year crediting period

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	BE _n (tCO ₂ e)	PE _n (tCO ₂ e)	ER _n (tCO ₂ e)
2012	181,350	9,806	171,544
2013	458,800	26,148	432,652
2014	434,000	26,148	407,852
2015	421,600	26,148	395,452
2016	396,800	26,148	370,652
2017	372,000	26,148	345,852
2018	347,200	26,148	321,052
2019	334,800	26,148	308,652
2020	310,000	26,148	283,852
2021	310,000	26,148	283,852
2022	77,500	6,537	70,963
Total	3,644,050	251,675	3,392,375

Table 6: Summary of the ex-ante estimation of emission reductions

B.7 Application of the monitoring methodology and description of the monitoring plan:

The monitoring points for key parameters are shown below:

B.7.1 Data and parameters monitored:

Data / Parameter:	P _{NA,n}
Data unit:	tHNO ₃
Description:	Nitric acid produced in the monitoring period n
Source of data to be used:	Mass flow of HNO ₃ is continuously measured by a mass flow meter. Density & acid concentration are determined by laboratory analysis.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available for validation. Will be monitored ex-post.
Description of measurement methods and procedures to be applied:	Volume of HNO ₃ is continuously measured by a flow meter. Density & acid concentration are determined by laboratory analysis. 100 % HNO ₃ is calculated by the available data.
QA/QC procedures to be applied:	Maintenance and calibration of the flow meter and density meter are applied under the internal QA/QC procedures.
Any comment:	
Data / Parameter:	F _{N2O, tailgas,h}
Data unit:	kg N ₂ O/h



Description:	Mass flow of N ₂ O in the gaseous stream of the tail gas in the hour h
Source of data to be used:	N ₂ O concentration: N ₂ O analyser Stack gas volume flow: flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available for validation. Will be monitored ex-post.
Description of measurement methods and procedures to be applied:	<ul style="list-style-type: none"> Throughout the crediting periods of the project activity, the N₂O concentration and volume or mass flow of the tail gas are to be monitored continuously. The monitoring system is to be installed and maintained throughout the crediting period based on the European Norm 14181 (2004); The monitoring system should provide separate hourly average values for the N₂O concentration and the volume or mass flow of the tail gas based on 2 seconds (or shorter) interval readings that are recorded and stored electronically. These N₂O data sets shall be 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 EN14181 must be applied to both the N₂O 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; <p>If data for either the N₂O 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 shall be replaced with the maximum value of N₂O concentration or volume or mass flow of the tail gas observed during the monitoring period. If data for neither the N₂O 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 N₂O 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;</p> <p>The hourly values are then aggregated as follows</p> $Q_{N2O,tailgas,n} = \sum_{h=1}^{h=h_n} F_{N2O,tailgash} * 10^{-3}$
QA/QC procedures to be applied:	<ul style="list-style-type: none"> According to EN 14181, the flow meter and the analyzer will be 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.
Any comment:	

Data / Parameter:	h _n
Data unit:	Hours
Description:	Number of hours in monitoring period n during which the plant was in operation
Source of data to be used:	Omnia production log and continuous monitoring according to operational parameters
Value of data applied	Not available for validation. Will be monitored ex-post.



for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The total operating hours are logged continuously in the production log.
QA/QC procedures to be applied:	
Any comment:	In order to calculate the expected emission reductions in section B.5 the expected operating hours of the plant within one year were applied.

Data / Parameter:	$T_{open,n}$
Data unit:	%
Description:	Fraction of time in monitoring period n during which the by-pass valve on the line feeding the tertiary N ₂ O abatement facility was open to vent the gas directly to the atmosphere.
Source of data to be used:	measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available for validation. Will be monitored ex-post.
Description of measurement methods and procedures to be applied:	N/A
QA/QC procedures to be applied:	N/A
Any 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.

Data / Parameter:	$PE_{FF,n}$ (corresponding to $PE_{CO_2,tertiary,n}$)
Data unit:	tCO ₂ e
Description:	Project emissions related to fossil fuel input to the destruction facility and/or re-heater in monitoring period n (tCO ₂)
Source of data to be used:	The emissions related to the operation of the N ₂ O destruction facility include only on-site emissions due to fossil fuel use as input to the N ₂ O destruction facility. Natural gas consumption will be measured by a mass-flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Parameter $PE_{CO_2,tertiary,n}$ (see further above)
Description of measurement methods	calculated based on measurement of natural gas consumption and NCV



and procedures to be applied:	
QA/QC procedures to be applied:	Maintenance and calibration of the mass flow meter is applied under the internal QA/QC procedures.
Any comment:	

Data / Parameter:	$NCV_{i,j}$
Data unit:	GJ/mass or volume unit (e.g. GJ/m ³ , GJ/ton)
Description:	Weighted average net calorific value of fuel type <i>i</i> in monitoring period <i>n</i>
Source of data to be used:	<p>a) Value provided by the fuel supplier invoices</p> <p>If a) is not available, one of the following can be used:</p> <p>b) Measurements by the project participants (if a. is not available)</p> <p>c) Regional or national default values (if a. is not available)</p> <p>d) IPCC default value at the upper limit of uncertainty at a 95% confidence interval as provided in table 1.2 of chapter 1 Vol. 2 (Energy) of the 2006 IPCC Guidelines in National GHG Inventories (if a. is not available)</p>
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	<p>For a. and b. measurements are undertaken in line with national or international standards.</p> <p>For c. and d. default values will be applied</p>
Monitoring frequency:	<p>For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated</p> <p>For c): Review appropriateness of the values annually</p> <p>For d): Any future revision of the IPCC Guidelines should be taken into account</p>
QA/QC procedures to be applied:	Verify if the values under a), b) and c) 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.
Any comment:	Ex-post determination

Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tCO ₂ /GJ
Description:	Weighted average CO ₂ emission factor fuel type <i>i</i> in year <i>y</i>
Source of data to be used:	<p>a) Value provided by the fuel supplier invoices</p> <p>If a) is not available, one of the following can be used:</p> <p>b) Measurements by the project participants (if a. is not available)</p> <p>c) Regional or national default values (if a. is not available)</p> <p>d) IPCC default value at the upper limit of uncertainty at a 95% confidence interval as provided in table 1.2 of chapter 1 Vol. 2 (Energy) of the 2006 IPCC Guidelines in National GHG Inventories (if a. is not available)</p>
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A



Description of measurement methods and procedures to be applied:	For a) and b): Measurements should be undertaken in line with national or international fuel standards
Monitoring frequency	For a) and b): The CO ₂ emission factor should be obtained for each fuel delivery, from which weighted averages annual values should be calculated. For c) review appropriateness of the values annually For d) Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures to be applied:	n/a
Any comment:	For a): If the fuel supplier does provide the NCV value and the CO ₂ emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO ₂ factor should be used. If another source for the CO ₂ emission factor is provided, Options b), c) or d) should be used.

Data / Parameter:	$V_{t,db}$
Data unit:	m ³ dry gas/h
Description:	Volumetric flow of the gaseous stream in time interval <i>t</i> on a dry basis
Source of data to be used:	Tail gas volume flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available for validation. Will be monitored ex-post.
Description of measurement methods and procedures to be applied:	Volumetric flow measurements should always refer to the actual pressure and temperature.
Monitoring frequency	Continuous
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. For details on calibration and calibration frequency, please refer to section B.7.2.
Any comment:	

Data / Parameter:	$V_{i,t,db}$
Data unit:	m ³ gas <i>i</i> /m ³ dry gas
Description:	Volumetric fraction of greenhouse gas <i>i</i> in a time interval <i>t</i> on a dry basis
Source of data to be used:	N ₂ O gas analyzer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available for validation. Will be monitored ex-post.
Description of measurement methods and procedures to be applied:	Continuous gas analyser operating in dry-basis.
Monitoring frequency	Continuous



QA/QC procedures to be applied:	Calibration should include 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 must have a certificate provided by the manufacturer and must be under their validity period.
Any comment:	

Data / Parameter:	C _{H₂O,t,db,n}
Data unit:	mg H ₂ O/m ³ dry gas
Description:	Moisture content of the gaseous stream at normal conditions, in time interval <i>t</i>
Source of data to be used:	Measurements according to the USEPA CF42 method 4 – Gravimetric determination of water content
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	Discrete measurement procedure
Monitoring frequency	The mean value among three consecutive measurements performed in the same day (at least 2 hours each) shall be considered. 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.
QA/QC procedures to be applied:	According to the USEPA CF42 method 4
Any comment:	Required for proving that the gaseous stream is dry.

Data / Parameter:	T _t
Data unit:	K
Description:	Temperature in the gaseous stream in time interval <i>t</i>
Source of data to be used:	Tail gas temperature measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available for validation. Will be monitored ex-post.
Description of measurement methods and procedures to be applied:	Instruments with recordable electronic signal (analogical or digital) are required.
Monitoring frequency	Continuous.
QA/QC procedures to be applied:	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
Any comment:	Required for conversion of parameter to normal conditions.

Data / Parameter:	P_t
Data unit:	Pa
Description:	Pressure of the gaseous stream in time interval t
Source of data to be used:	Tail gas pressure measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available for validation. Will be monitored ex-post.
Description of measurement methods and procedures to be applied:	Instruments with recordable electronic signal (analogical or digital) are required
Monitoring frequency	Continuous
QA/QC procedures to be applied:	Periodic calibration against a primary device must be performed periodically and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) must be calibrated monthly
Any comment:	Required for conversion of parameter to normal conditions.

Data / Parameter:	ER_n
Data unit:	tCO ₂ e
Description:	Emission reductions in monitoring period n
Source of data to be used:	Calculated
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available for validation. Will be third party audited during the first verification.
Description of measurement methods and procedures to be applied:	Not applicable. Is calculated using the following formula: $ER_n = BE_n - PE_n$
QA/QC procedures to be applied:	N/A
Any comment:	

B.7.2 Description of the monitoring plan:

1. 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 is accustomed to operating technical equipment adhering to high quality standards.



Omnia Fertilizer will train 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 will be maintained throughout the crediting period. Measuring instruments will be 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 N₂O for the project will be the responsibility of the monitoring department. All relevant data will be recorded automatically and stored on electronic media.

2. Quality Assurance

ACM0019 requires the use of the European Norm EN14181 (2004) “Stationary source emissions - Quality assurance of automated measuring systems” as a guidance for installing and operating the Automated Monitoring System (AMS) for the monitoring of N₂O emissions in the nitric acid plant. The plant will be equipped with such Automated Monitoring Systems (AMS) to monitor the mass emissions of N₂O in the tail gas of the nitric acid plant.

In the following, it is described how the procedures given in EN14181 for QAL1-3 will be applied at the plant.

QAL 1

In accordance with EN14181, the monitoring system for N₂O concentration measurements shall have been proven suitable for its 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 is to prove that the total uncertainty of the results obtained from the AMS meets the specification for uncertainty stated in the applicable regulations. Such suitability testing has to be 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 EN14181, the QAL2 test including the SRM need to be conducted by an independent “testing house” or laboratory which has to be accredited to EN ISO/IEC 17025. The QAL2 tests are performed on suitable AMS that have been correctly installed and commissioned on-site (as opposed to QAL 1 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 to be performed at least every 5 years according to EN 14181.

AST

In addition, Annual Surveillance Tests (AST) should be 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 QAL 2 test is performed (at least every 5 years), an additional AST test is not necessary in that same year.

QAL3

QAL3 describes the ongoing 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, staff performs QAL 3 procedures through the established calibration procedures.

Accuracy and calibration of instruments

All meters will be purchased and maintained to ensure a high level of accuracy. The exact specifications of each meter will be determined during the detailed design of the project. Thereafter the meter accuracies will be included in this procedure and steps taken to maintain those levels of accuracy.

All key meters will be subject to a quality control regime that will include regular maintenance and calibration. A record will be 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) and who performs the calibration service. Calibration certificates will be retained for all meters until two years after the end of the crediting period.

Archiving of data

The monitoring team will periodically archive data to a secure and retrievable storage format on a periodic basis. This step of data archiving can also be implemented as an automated routine within the data collection unit. Calibration records may be archived by scanning and storage in an accessible electronic format. These data will be stored until 2 years after the end of the crediting period or the last issuance of CER's whichever occur later.

Document Control

The Project Manager will implement a document control system that ensures that the current versions of necessary documents are available at the point of use. All documents must be maintained in English with local translations because English is the formal language of the CDM.

Preparation of monitoring report

The archived / live data will be used to prepare a periodic monitoring report to be submitted to the UNFCCC secretariat for verification and issuance of CERs. An internal technical review process will be conducted and documented before such a report will be submitted for verification.

Data recording system

The CDM Project Manager will implement a data recording system for collection and archiving of the monitoring raw data. The data recording frequency for the continuously monitored parameters is 2 seconds. From these raw data hourly average values are calculated automatically.

Treatment of missing or corrupted data

If data for either the N₂O 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 shall be replaced with the maximum value of N₂O concentration or volume or mass flow of the tail gas observed during the monitoring period. If data for neither the N₂O 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 N₂O 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.



Similar provision may apply for the CH₄ inflow and the nitric acid produced. If data for the CH₄ inflow 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 CH₄ inflow observed during the monitoring period.

In case of missing hourly data for the nitric acid produced in the monitoring period n ($P_{NA,n}$) the value will be replaced by a nitric acid production value from another source of data e. g. measurements of nitric acid storage tank levels in combination with a production – consumption mass balance. Only in the case that there should be no other reliable data source available the missing value should be replaced with the lowest measured value during plant operations of that monitoring period. 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 and minimum values.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

Company	Responsibility	Project Proponent
N.serve Environmental Services GmbH	Martin Stilkenbäumer and Albrecht von Ruffer	No
Omnia Fertilizers, Omnia Group (Pty) Ltd.	Eden Jack and Johann Peek	Yes

30/09/2011

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting date of a CDM project activity is the earliest date at which either the implementation or construction or real action of a project activity begins. The start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity.

In the light of the above definition the project start date is defined as the date on which Omnia placed the order for the N₂O abatement system (“ENVINOX”). This order was placed 20 July 2011.

Starting date of the project activity: 20/07/2011.

C.1.2. Expected operational lifetime of the project activity:

The nitric acid plant has a remaining operational lifetime of at least 25 years and is not expected to be decommissioned before that time.

**C.2 Choice of the crediting period and related information:**

The project participants have chosen a fixed term crediting period of ten years.

C.2.1. Renewable crediting period

N/A

C.2.1.1. Starting date of the first crediting period:

N/A

C.2.1.2. Length of the first crediting period:

N/A

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

01/04/2012 or the day of the registration of the project at UNFCCC whichever occurs later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts**D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

The project will reduce gaseous emissions of nitrous oxide (N₂O) from the plant tail gas and will therefore contribute to international efforts to reduce greenhouse gas emissions. The project will have no negative effects on local air quality.

The project will have no impact on water pollution. No additional water is required for the project activity's implementation or operation. Therefore, there is no impact on the sustainable use of water.

The contributions to sustainable development from the project activity are as follows:

- The project will reduce 98% of existing N₂O emissions during the crediting period and thus contributes to reducing the negative impact on global climate change.
- The technology will be introduced to the project, promoting the application of advanced emission reduction technology in South Africa.



- The implementation of the project activity includes the training course for operation of the total unit of a tertiary catalyst unit including guidance on accurate monitoring, which will provide the staffs of Omnia Fertilizer with an opportunity to improve skills.
- The implementation of the project activity is likely to create local employment.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Environmental Impact Assessments (EIA) are required by South African legislation for listed activities as published by the regulator. Even though the Nitric Acid process is a listed activity, it is listed specifically for the regulation of NO_x and it is not listed or prescribing any requirements for the regulation of N₂O. Therefore, for the installation of a N₂O-destruction facility, no EIA is required under South African legislation.

SECTION E. Stakeholders' comments**E.1. Brief description how comments by local stakeholders have been invited and compiled:**

Stakeholders have been invited for comments and for participation at the local stakeholder consultation by publishing public notices in the following local newspapers from 12 to 16 September 2011:


- Vaalweekblad
- Vaal Ster
- Vaal Vision


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OMNIA

NOTICE OF MEETING TO INFORM STAKEHOLDERS OF PROJECT TO REDUCE THE N₂O / NO_x EMISSIONS FROM OMNIA FERTILIZER'S PROPOSED NEW NITRIC ACID PLANT IN SASOLBURG.

Omnia Fertilizer, a division of the Omnia Group (Pty) Ltd obtained an environmental authorization for the establishment of a new Nitric Acid Plant at its Sasolburg site. The scope of the EIA and environmental authorization included the installation of a De-NO_x facility to reduce the NO_x emissions (which is regulated in terms of the National Environmental Management Air Quality Act 39 of 2004) from the tail gas of the proposed Nitric Acid Plant, within acceptable limits.

Omnia Fertilizer, after investigating the feasibility of a Clean Development Mechanism Project, decided to implement proven ErviNO_x abatement technology that was developed by Unde GmbH, Germany, in addition to the proposed De-NO_x facility. The technology, once implemented will reduce both the Nitrogen Oxide (NO_x) and Nitrous oxide (N₂O) emissions by more than 80%. The reduction of N₂O is not required by current state and/or Provincial Regulations and the ErviNO_x facility will be registered as a Clean Development Mechanism project in terms the Kyoto Protocol.

Interested and affected parties who wish to enquire about the project, are invited to attend a public meeting that is scheduled to be held from 09:00 – 12:00 in the Leeu Conference Room, Omnia Fertilizers factory, 1 Eugene Houdry Street, Sasolburg Northern Industrial Area on Friday the 30th of September 2011.

Enquiries regarding the Project can alternatively also be directed to:

- Peet Janse van Rensburg (082) 889 3202 or E-mail: pjansevanrensburg@omnia.co.za
- Julia Mnengwane (082) 968 3554 or E-mail: mnengwane@omnia.co.za
- Eden Jack (083) 655 4617 or E-mail: ejack@omnia.co.za

89-1111E

On 30 September 2011 from 09h00 to 12h00 hours a local stakeholder meeting took place at the premises of Omnia at Eugene Houdry Drive, Sasolburg, South Africa.

The meeting was attended by three stakeholders. One stakeholder sent an apology for not being able to attend. One of the attendees was from the local government and two of the attendees were



from local industry. A presentation was made to on the details of the project. Positive feedback was received from each of the stakeholders, with no concerns raised.

The documentation of the attendee list and the comments and questions received can be made available to the validator.

The presentation given to the participants were focused on the following:

- History of Omnia as a company
- An explanation of the structure within the company
- An overview of the operations at the Omnia Factory
- An overview of Omnia's commitment to sustainability in terms of Quality, Safety and Environmental Management
- An overview of the principles, general design and intention of the project
- An overview of the projects' impact on the environment

E.2. Summary of the comments received:

The meeting was held in a conference facility at the Omnia plant in Sasolburg, South Africa. The information regarding the project was presented using a Powerpoint presentation. After the presentation a discussion was held where-in the participants were able to raise any questions arising from the presentation. The attendees signed an attendance register and were provided with a form onto which they gave their details and also could raise any concerns or positive comments. No concerns were raised. The only requests received from the participants were:

- For the distribution of the powerpoint slide. This has been done.
- For the discussion of the project at other local stakeholder meetings in the immediate area, such as the Local Sasolburg Community Working Group and the Vaal Triangle Air Pollution Association, in order to increase awareness of positive projects regarding air quality improvements in the area. This will be done if and when such meetings are scheduled.

E.3. Report on how due account was taken of any comments received:

The information regarding the presentation given was sent to all the participants on the day of the meeting. The communication to the participants is attached. The project will be presented to the two forums requested at the first available date.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Omnia Fertilizer, Division of Omnia Group (Pty) Ltd.
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City:	Sasolburg
State/Region:	Free State
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Country:	South Africa
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FAX:	
E-Mail:	
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Represented by 1:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funds are used for this project activity.



Annex 3

BASELINE INFORMATION

Not applicable



Annex 4

MONITORING INFORMATION

See Section B.7.2.
