JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

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DonauChem Nitrous Oxide Abatement Project
Sectoral Scope: 5 (Chemical industry)
Version 2.1
28 January 2010

A.2. Description of the project:

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Nitrous oxide (N_2O) is an undesired by-product gas from the manufacture of nitric acid. Nitrous oxide is formed during the catalytic oxidation of ammonia. Over a suitable catalyst, a maximum 98% (typically 92-96%) of the ammonia fed is converted to nitric oxide (NO). The remainder participates in undesirable side reactions that lead to the production of nitrous oxide, among other compounds.

Waste N_2O from nitric acid production is typically released into the atmosphere, as it does not have any economic value or toxicity at typical emission levels. N_2O is an important greenhouse gas which has a high global warming potential (GWP) of 310.

The project activity involves the installation of a secondary catalyst to abate N_2O inside the reactor once it is formed.

The baseline scenario is determined to be the release of N_2O emissions to the atmosphere at the currently measured rate, in the absence of regulations to restrict N_2O emissions. If regulations on N_2O emissions are introduced during the crediting period, the baseline scenario shall be adjusted accordingly.

The baseline emission rate will be determined by measuring the N_2O emission factor (kg N_2O/tonne HNO_3) during a *complete* production campaign before project implementation. To ensure that the data obtained during the initial N_2O measurement campaign for baseline emission factor determination are representative of the actual GHG emissions from the source plant, a set of process parameters known to affect N_2O generation and under the control of the plant operator will be controlled from historical data.

Baseline emissions will be dynamically adjusted from activity levels on an ex-post basis through monitoring the amount of nitric acid production. Project N_2O emissions will be monitored directly in real time. Additional N_2O monitoring and recording facilities will be installed to measure the amount of N_2O emitted by the project activity.

Project additionality is determined using the most recent version of the “tool for demonstration and assessment of additionality”, approved by the CDM Executive Board.

The project activity will contribute to the sustainable development of the country through industrial technology transfer (catalyst technology from a developed country to Romania). The project activity will reduce N_2O emissions and will neither increase nor decrease direct emissions of other air pollutants.

The project does not impact the local communities or access of services in the area. The project activity will not cause job losses at DonauChem’s plant.

DonauChem Nitrous Oxide Abatement Project has the potential to be replicated by other nitric acid plants in the country.

A.3. Project participants:

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Party involved	**Legal entity project participant (as applicable)**	**Please indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Romania (host)	S.C. DonauChem S.R.L. Private entity Project developer	No
Sweden	MGM International Group LLC, Private enity	No

InterAgro S.A. is a privately owned Romanian-English company founded in 1994, mainly involved in growing cereals and foreign trade, especially the export of fertilizers for agriculture. The foreign trade activity was taken over from the majority shareholder, the mother company Interaction S.R.L., a privately owned Romanian-English company, founded in 1991.

Despite the economic and financial constraints prevalent in mid-nineties Romania, InterAgro's reported performance led to a company policy review and reorientation towards vertical integration. The result is the InterAgro Group, which consists of a complex chain of integrated companies.

InterAgro S.A. specializes in the export of chemical fertilizers. In December 1997, S.C. InterAgro S.A. became the majority shareholder in two of the largest chemical fertilizer plants in Romania: S.C. Sofert S.A. Bacau and S.C. Azochim S.A. Savinesti – Piatra Neamt.

In autumn 2004 S.C. Viromet S.A. acquired Turnu Magurele Chemical Plant, currently doing business as S.C. DonauChem S.R.L. Upon acquisition, the plant was revamped to be an important integrated producer of ammonia as semi-finished product and of the entire range of chemical fertilizers as final products (urea, ammonium nitrate, calcium ammonium nitrate (CAN), complex and liquid fertilizers), taking into account the location of the plant on the Danube River, giving it strategic and geographical advantages.

The ammonia results from the chemical synthesis of nitrogen and hydrogen which is obtained from natural gas in a facility that uses the Kellogg method at 150 bars. The ammonia is the raw material for complex fertilizers, ammonium nitrate, urea and nitric acid.

Urea is obtained in two facilities under the license of Stamicarbon using ammonia and carbon dioxide as raw materials.

The ammonium nitrate is obtained in a plant under the license of Kaltenbach through the neutralization of nitric acid with ammonia and represents a granulated product or an intermediate product for complex fertilizers.

Currently the plant produces CAN with minimum of 27% N. CAN is obtained by adding dolomite to ammonium nitrate.

NPK complex fertilizers are produced in two stream facilities under Norsk – Hydro license. On demand, the plant can produce other types of fertilizers: with sulfur, magnesium or microelements.
All fertilizers in pill or granular form are treated against caking. The chemical plant also produces urea ammonium nitrate (UAN) fertilizer. This is a product obtained by mixing ammonium nitrate and urea solutions resulting in a liquid fertilizer with 32% nitrogen.

A.4. Technical description of the project:

A.4.1. Location of the project:

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A.4.1.1. Host Party(ies):

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Romania is located in South-Eastern Europe and is a member of the European Union.

Figure 1: Map of Romania showing project location

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

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Teleorman

A.4.1.3. City/Town/Community etc.:

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Turnu Magurele

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

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The project is located in the City of Turnu Magurele, County of Teleorman on the bank of the Danube River, the natural boundary between Romania and Bulgaria.
The GPS coordinates of the plant are:

43^{o}43'00.80" northern latitude and
24^{o}53'33.17" eastern longitude.

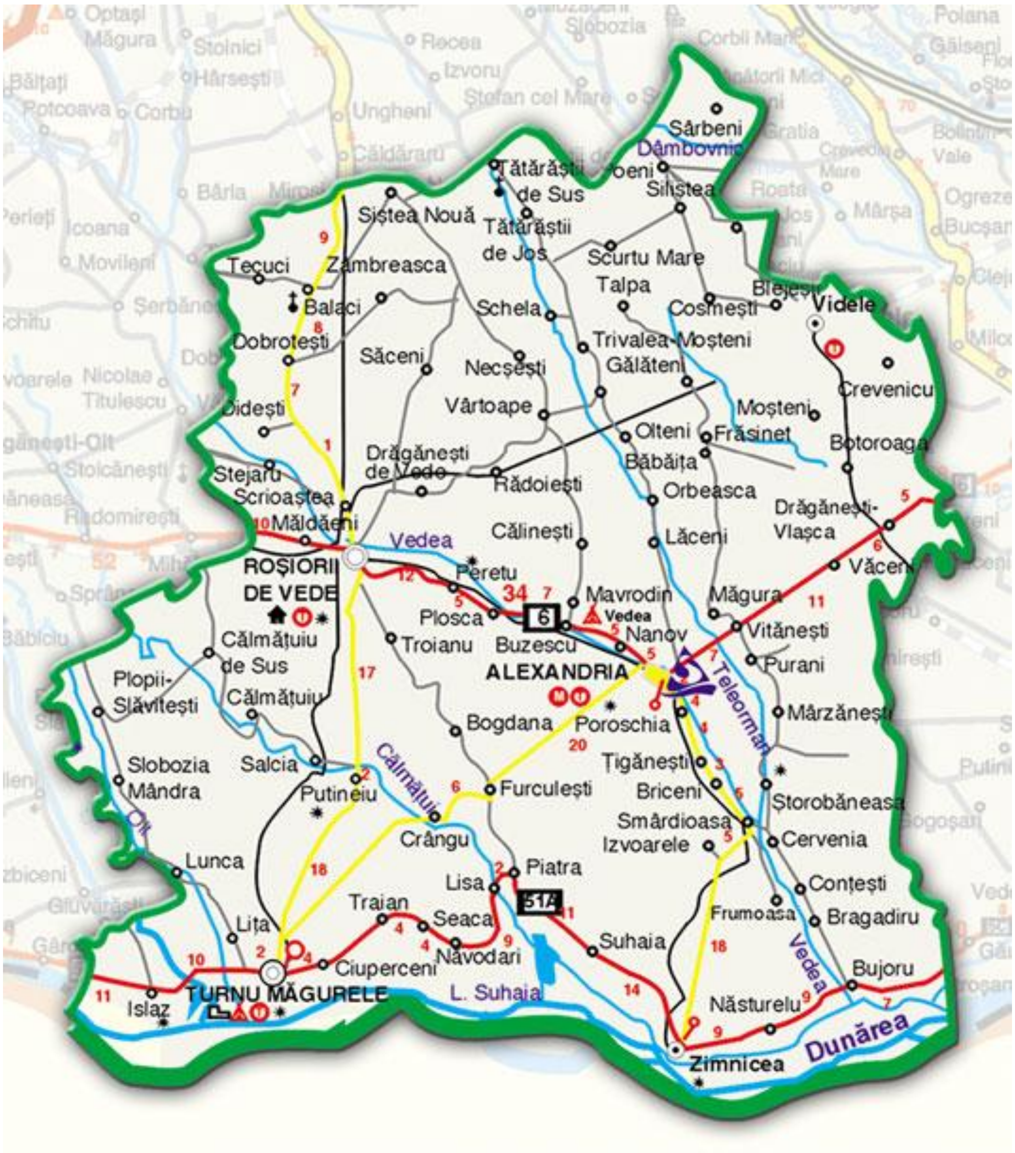

Figure 2: DonauChem plant locations

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

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The Ostwald process

Nowadays, all commercial nitric acid is produced by the oxidation of ammonia, and subsequent reaction of the oxidation products with water, through the Ostwald process.

The basic Ostwald process involves 3 chemical steps:

A) Catalytic oxidation of ammonia with atmospheric oxygen, to yield nitrogen monoxide (or nitric oxide)

(1) $4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$

B) Oxidation of nitrogen monoxide to nitrogen dioxide or dinitrogen tetroxide

(2) $2\ NO + O_2 \rightarrow 2\ NO_2 \rightarrow N_2O_4$

C) Absorption of the nitrogen oxides in water to yield nitric acid

(3) $3\ NO_2 + H_2O \rightarrow 2\ HNO_3 + NO$

Reaction 1 is favored by lower pressure and higher temperature. Nevertheless, at excessively high temperature, secondary reactions take place that lower yield (affecting nitric acid production). Thus, an optimal reaction temperature is found between 850 and 950°C, affected by other process conditions and catalyst chemical composition (Figure 3)[1]. Reactions 2 and 3 are favored by higher pressure and lower temperatures.

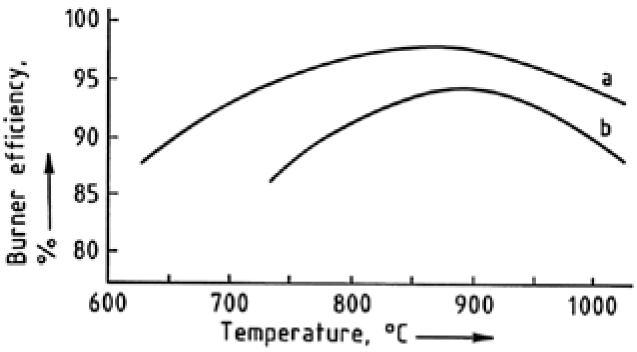

Figure 3: Conversion of ammonia to nitrogen monoxide on platinum gauze as a function of temperature at (a) 100 kPa; (b) 400 kPa[1]**Error! Bookmark not defined.**

The way in which these three steps are implemented characterizes the various nitric acid processes found throughout the industry. In mono-pressure or single pressure processes ammonia combustion and nitrogen oxide absorption take place at the same working pressure. In dual pressure or split pressure plants the absorption pressure is higher than the combustion pressure.

Nitrous oxide formation

Nitrous oxide is formed during the catalytic oxidation of ammonia. Over a suitable catalyst, a maximum 98% (typically 92-96%) of the ammonia fed is converted to nitric oxide (NO) according to Reaction 1

[1] "Nitric Acid, Nitrous Acid, and Nitrogen Oxides", *Ullmann's Encyclopedia of Industrial Chemistry 6th Edition,* Wiley-VCH Verlag GmbH & Co. KGaA. All rights reserved.

above. The remainder participates in undesirable side reactions that lead to nitrous oxide (N_2O), among other compounds.

Side reactions during oxidation of ammonia:

(4) $4\ NH_3 + 4\ O_2 \rightarrow 2\ N_2O + 6\ H_2O$ (nitrous oxide formation)

(5) $4\ NH_3 + 3\ O_2 \rightarrow 2\ N_2 + 6\ H_2O$

(6) $2\ NO \rightarrow N_2 + O_2$

(7) $4\ NH_3 + 6\ NO \rightarrow 5\ N_2 + 6\ H_2O$

N_2O abatement technology classification

The potential technologies (proven and under development) to treat N_2O emissions at nitric acid plants have been classified as follows, on the basis of the process location of the control device:

Primary: N_2O is prevented from forming in the oxidation gauzes.
Secondary: N_2O once formed is eliminated anywhere between the outlet of the ammonia oxidation gauzes and the inlet of the absorption tower.
Tertiary: N_2O is removed at the tail gas, after the absorption tower and before the expansion turbine.
Quaternary: N_2O is removed following the expansion turbine and before the stack.

Selected technology for the project activity

General description

The current project activity involves the installation of a new (not previously installed) catalyst below the oxidation gauzes (a “secondary catalyst”) whose sole purpose is the decomposition of N_2O. The secondary approach has the following advantages:

- The catalyst does not consume electricity, steam, fuels or reducing agents (all sources of leakage) to eliminate N_2O emissions; thus, operating costs are negligible and the overall energy balance of the plant is not affected.
- Installation is relatively simple and does not require any new process unit or re-design of existing ones (the reactor basket needs some modifications to accommodate the new catalyst).
- Installation can be done simultaneously with a primary gauze changeover; thus, the loss in production due to incremental downtime will be limited.
- Considerably lower capital cost when compared to other approaches.

DonauChem has decided to install a secondary catalyst system (upon successful baseline monitoring implementation registration as a JI project) and has selected BASF as technology provider. BASF has developed a solution for a “secondary” catalyst, whose sole purpose is to decompose N_2O without affecting nitric acid production. Typically, the catalyst has a very high activity for N_2O decomposition (the expected removal efficiency is 85-90%). Beyond high abatement of N_2O, some other advantages of the use of secondary catalyst are: proven performance, no measurable effect on ammonia to nitric oxide yield, and its implementation does not lead to increased NO_x emissions.
There are several secondary catalyst suppliers who in essence offer the same technical approach (high temperature N_2O heterogeneous decomposition). DonauChem will re-evaluate performance and cost advantages of the BASF system with those available then in the market, and may eventually switch to another secondary catalyst supplier, in order to assure the best available technology is utilized for the

project. Nevertheless, this decision will not in any way affect the project activity as described in this PDD.

The secondary abatement technology has been tested in several industrial trials in which it has proven to be reliable in reducing N_2O and environmentally safe. Especially, its implementation does not lead to increased NO_x emissions. Nor is the environment directly or indirectly harmed in any other way.
DonauChem and BASF will ensure that the N_2O abatement catalyst is returned to the supplier at the end of its useful life and refine, recycle or dispose of it according to the prevailing EU standards.

Once installed, the catalyst itself and the automated measuring system (AMS) will be operated by the local DonauChem employees. All project participants will work together on training DonauChem workers to reliably supervise the effective operation of the catalyst technology, apply the installed monitoring system to measure the emission levels and collect the data in a manner that allows the successful completion of each verification procedure.

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

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The project activity consists of the installation of a secondary catalyst inside the ammonia burner, and beneath the primary catalyst, whose sole purpose is to reduce the N_2O emissions.
Due to high temperature and the presence of the secondary catalyst, the N_2O previously formed is converted into N_2 and O_2.
N_2O is typically released into the atmosphere as common practice in the industry, since it does not have any economic value or toxicity at typical emission levels.
Currently, there are no national regulations or legal obligations in Romania concerning N_2O emissions. It is unlikely that any such limits on N_2O emissions will be imposed in the near future.
From what was said earlier, it is concluded that N_2O would not be removed in the absence of the proposed project activity.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

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Length of the crediting period	10 years
Year	**Annual estimated emission reduction in tonnes of CO_2e**
Year 2009	174,472
Year 2010	489,426
Year 2011	532,477
Year 2012	532,477
Subtotal (1^{st} Kyoto commitment period)	**1,728,852**
Year 2013	532,477
Year 2014	532,477
Year 2015	532,477
Year 2016	532,477
Year 2017	532,477
Year 2018	288,425
Subtotal[2]	**2,950,810**
Total estimated reductions (tonnes of CO_2e)	**4,679,662**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**467,966**

These estimated amounts are calculated on the base of DonauChem long-term production plan:

2009 – 168,000 tonnes,
2010 – 216,000 tonnes,
2011-2018 – 235,000 tonnes,

and taking in account that project campaign will start in the August of 2009.

Drop in production in early years is consequence of worldwide economic crisis, but host plant forecasts increasing production to almost design capacity by year 2011. Note that actual emission reductions will be based on monitored data and may differ from this estimate.

A.5. Project approval by the Parties involved:

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LoE Ref.no.2937/AK/01.10.2007 of the host country DFP was issued. This section will be finally completed after receiving the LoA.

[2] The crediting period can extend beyond 2012 subject to the approval by the host Party. The status of emission reductions generated by JI projects after the end of the first commitment period may be determined by any relevant agreement under the UNFCCC (Guidelines for users of the JI PDD form, Ver. 03, page 14).

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

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Following JI criteria for baseline setting and monitoring methodologies adopted during the fourth meeting of the Joint Implementation Supervisory Committee (JISC) that took place in Bonn, Germany, on September 13-15, 2006, an approved methodology for CDM project activities can be applicable for JI project activities.

AM0034 version 03.2 (EB 41) is the baseline and monitoring methodology chosen to develop the project activity. Thus, the baseline scenario will be chosen following the procedures stated in AM0034.

The proposed project activity meets the applicability conditions required by the methodology:

- DonauChem's plant limits the application of this project activity to existing nitric acid production installed in November 1970;
- The project activity will not result in the shutdown of any existing N_2O destruction or abatement facility or equipment in the plant;
- The project activity will not affect the level of nitric acid production;
- There are currently no regulatory requirements or incentives to reduce levels of N_2O emissions from nitric acid plants in Romania;
- The project activity will not increase NO_x emissions;
- DonauChem's plant has no non-selective catalytic reduction (NSCR) $DeNO_x$ abatement system installed;
- Operation of the secondary N_2O abatement catalyst installed under the project activity does not lead to any process emissions of greenhouse gases, directly or indirectly;
- Continuous real-time measurements of N_2O concentration and total gas volume flow will be carried out in the stack:
    - Before the installation of the secondary catalyst for one campaign, and;
    - After the installation of the secondary catalyst throughout the chosen crediting period of the project activity.

The baseline methodology application first involves an identification of possible baseline scenarios, and eliminating those that would not qualify. The procedures followed for baseline scenario selection correspond to AM0028 "Catalytic N_2O destruction in the tail gas of Nitric Acid and Caprolactam Production Plants" version 04.1 (EB 28) as it is specified in the selected AM0034 version 03.2; for more details see the following link at the UNFCCC website:

http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

The analysis of baseline scenarios involves five steps:

Step 1. Identify technically feasible baseline scenario alternatives to the project activity.

The first step in determining the baseline scenario is to analyze all options available to project participants. These include the business-as-usual case, considering sectoral policies and circumstances to determine whether this case corresponds to the continuation or not of the current operation of the nitric acid industry, the project scenario, and any other scenarios that might be applicable. This *first step* can be further broken down into two sub-steps:

Sub-step 1a: The baseline scenario alternatives should include all possible options that are technically feasible to handle N_2O emissions. These options include:

- Continuation of *status quo.* The continuation of the current situation, where there will be no installation of technology for the destruction or abatement of N_2O;
- Switch to an alternative production method not involving the ammonia oxidation process;

- Alternative use of N_2O, such as:
    - Recycling N_2O as a feedstock;
    - Use of N_2O for external purposes;
- The installation of an N_2O destruction or abatement technology:
    - Primary approach;
    - Secondary approach;
    - Tertiary approach, including NSCR De NO_x[3].

The options include the JI project activity not implemented as a JI project.

Sub-step 1b: In addition to the baseline scenario alternatives of Sub-step 1a, all possible options that are technically feasible to handle NO_x emissions should be considered, since some NO_x technical solutions could also have an effect on N_2O emissions. The alternatives include:

- The continuation of the current situation, whether a DeNO_x unit is installed or not;
- Installation of a selective catalytic reduction (SCR) DeNO_x unit;
- Installation of a new non-selective catalytic reduction (NSCR) DeNO_x unit;
- Installation of a combined NO_x/N_2O abatement unit (e.g., Uhde's EnviNOx process).

Step 2: Eliminate baseline alternatives that do not comply with legal or regulatory requirements.

Currently, there are no national regulations or legal obligations in Romania concerning N_2O emissions. It is unlikely that any such limits on N_2O emissions will be imposed in the near future. In fact, given the cost and complexity of suitable N_2O destruction and abatement technologies, it is unlikely that a limit would be introduced in Romania considering it has ratified the Kyoto Protocol and actively participates in JI. In accordance with Integrated Environmental Permit #157 from 29.10.2007 plant took voluntary commitment to implement JI Project to reduce N2O emissions in accordance with following schedule:

- from 30.09.2007 to 31.12.2009 is 800 mg/m3 (400 ppm)
- from 01.01.2010 the limit is 150 mg/m3 (75 ppm)

Plant now ensures N2O reductions according to this schedule. Secondary catalyst have been installed in July 2009

The Environmental Protection Ministry of Romania made public in 1993 an ordinance (No. 462, din 1.07) which set a cap on total emissions of nitrogen oxides (NO_x), although such regulation was never enforced. In 2005, and as a consequence of Romania's negotiations to become a member of the European Union, DonauChem was granted a grace (or transition) period before having to comply with EU regulations on NO_x. This period ends December 31, 2013 (Official Diary of Romania, Part 1 No. 1.078/30.XI.2005). DonauChem plans to take corrective actions (the installation of a DeNO_x system) during 2009-2013 to be prepared for this future legal requirement. This plan of action is included in Integrated Environmental Permit #157 from 29.10.2007 which is issued by the Agency of Environmental Protection and valid until 31.12.2013. . In accordance with this document DonauChem should reduce NOx emissions in accordance with following schedule:

[3] NSCR: A NSCR DeNO_x unit will reduce N_2O emissions as a side reaction to the NO_x reduction. Consequently, a new NSCR installation can be considered an alternative N_2O reduction technology.

- from 01.01.2008 to 31.12.2010 the limit is 1,140 mg/m3

- from 01.01.2011 to 30.09.2011 the limit is 1,020 mg/m3

- starting with 01.10.2011 the limit will be 300 mg/m3

Plant now ensures NOx reductions according to this schedule. After 2009 annual revision and maintenance works (i.e. heat exchangers repair, economizer, boilers and reaction water condenser change, turbo-compressor repair) plant achieved NOx emission average concentration per campaign lower than 1,140 mg/m3. Plant plan to install DeNOx system before September of 2011 to reduce NOx emissions by 90% according to the BASF tertiary catalyst specification.

Since DonauChem's plant should install the NO_x reduction catalyst to be in compliance with applicable future local NO_x regulations, the installation of a $DeNO_x$ unit is a valid baseline alternative.

- None of the baseline alternatives can be eliminated in this step because they are all in compliance with legal and regulatory requirements.

Step 3: Eliminate baseline alternatives that face prohibitive barriers (barrier analysis).

Sub-Step 3a: On the basis of the alternatives that are technically feasible and in compliance with all legal and regulatory requirements, a complete list of barriers that would prevent the deployment of alternatives in the absence of JI is established.

The identified barriers are:

- Investment barriers, inter alia:
    - Debt funding is not available for this type of innovative project activity;
    - Limited access to international capital markets due to real or perceived risks associated with domestic or foreign direct investment in the country where the project activity is to be implemented;

- Technological barriers, inter alia:
    - Technical and operational risks of alternatives;
    - Technical efficiency of alternatives (e.g., N_2O destruction, abatement rate);

- Barriers due to prevailing practice, inter alia:
    - The project activity is the "first of its kind": no project activity of this type is currently operational in the host country or region.

Sub-Step 3b: We will show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed CDM project activity):

- Primary abatement technology: Currently, there is no technology from the primary approach group that reaches removal efficiency high enough to represent a potential N_2O abatement solution in itself.

- Tertiary abatement technology: Available tertiary approaches include the NSCR (non-selective catalytic reduction) and the EnviNOx® process commercialized by Uhde GmbH (Germany); both systems are not selective towards N_2O abatement, and also actuate over acidic species (NO_x). Although Uhde's process is more efficient than the traditional NSCR system, both technologies have significant requirements regarding space and downtime for installation, and consume reducing agents (natural gas and/or ammonia) to attain N_2O abatement (high operating costs). Additional natural gas consumption for heating the tail gases from temperatures below 100ºC to the reaction temperature (about 350 ºC) leads to raised operational costs and GHG emissions (leakage).
- Switch to an alternative production method not involving the ammonia oxidation process: This is not an option because there is no other commercially viable alternative to produce nitric acid.
- The use of N_2O for external purposes: This is technically not feasible at DonauChem's plant, as the quantity of gas to be treated is extremely high, compared to the amount of nitrous oxide that could be recovered. The use of N_2O for external purposes is practiced neither in Romania nor anywhere else.
- Recycling N_2O as a feedstock: We may discard recycling N_2O as a feedstock for the nitric acid plant. This is because nitrous oxide is not a feedstock for nitric acid production. Nitrous oxide is not recycled at nitric acid plants either in Romania or anywhere else.

Therefore the baseline alternatives that are not eliminated in this step are:

- Installation of a selective catalytic reduction (SCR) $DeNO_X$ unit;
- Installation of a secondary catalytic DeN_2O plus a (SCR) $DeNO_X$ unit.

Step 4: Identify the most economically attractive baseline scenario alternative.

To conduct the investment analysis, the following sub-steps are used:

Sub-step 4a: Determine appropriate analysis method:

Since the project alternatives generate no financial or economic benefits other than JI-related income, simple cost analysis should be applied.

Sub-step 4b: Apply simple cost analysis:

The possible alternatives listed in Sub-step 1a above, and not discarded at the barrier analysis stage, involve the installation of some form of secondary DeN_2O system plus a (SCR) $DeNO_x$ unit, or a selective catalytic reduction (SCR) $DeNO_x$ unit.

The installation of a secondary DeN_2O system or combined tertiary $DeNO_x/DeN_2O$ destruction approaches involve substantial investment and operational costs, and would need to provide benefits (other than JI revenue) in order to qualify as valid baselines. No income from any kind of potential product or by-product except Emission Reduction Units (ERUs) is able to pay back investment costs and running costs for the installation of any such abatement systems as no marketable products or by-products are generated by these treatment methods.

Thus, there is no incentive to install a secondary catalyst for the abatement of N_2O and the most attractive alternative is the installation of a selective catalytic reduction (SCR) unit, which leads to the following advantages:

- NO_x decomposition in accordance with EU standards;
- No consumption of natural gas for heating the tail gas in the process of NO_x decomposition;
- Low operational costs.

According to the baseline methodology,

> *"If all alternatives do not generate any financial or economic benefits, then the least costly alternative among these alternatives is pre-selected as the most plausible baseline scenario."*

As a result the only feasible baseline is the installation of a selective catalytic reduction unit, which will meet NO_x regulations, and requires lower investments and operational costs. The period of installation of the SCR $DeNO_x$ unit is inessential, since modern SCR technologies have no influence on GHG emissions.

Sub-step 4c is not applied, since a simple cost analysis is adequate for this project.

Sub-step 4d: Sensitivity analysis:

Since the economic analysis is based on simple cost analysis, the baseline methodology does not require a sensitivity analysis: the results are not sensitive to such factors as inflation rate and investment costs, since there are no economic benefits.

Step 5: Re-assessment of baseline scenario in the course of proposed project activity lifetime.

At the start of a crediting period, a re-assessment of the baseline scenario due to new or modified NO_x or N_2O emission regulations in Romania will be executed as follows.

Sub-step 5a: New or modified NO_x emission regulations:

If new or modified NO_x emission regulations are introduced after the project starts, the baseline scenario will be re-assessed at the start of a crediting period. Baseline scenario alternatives to be analyzed will include, inter alia:
- Selective catalytic reduction (SCR);
- Non-selective catalytic reduction (NSCR);
- Tertiary measures incorporating a selective catalyst for destroying N_2O and NO_x emissions;
- Continuation of baseline scenario.

For the determination of the adjusted baseline scenario, the baseline determination process will be applied as stipulated above (Steps 1-5).

Sub-step 5b: New or modified N_2O regulations:

If legal regulations on N_2O emissions are introduced or changed during the crediting period, the baseline emissions will be adjusted at the time the legislation is legally implemented.
The methodology is applicable if the procedure to identify the baseline scenario results in that the most likely baseline scenario is the continuation of N_2O emission to the atmosphere, without the installation of N_2O destruction or abatement technologies, including technologies that indirectly reduce N_2O emissions (e.g., NSCR $DeNO_x$ units).

Key information and data used to establish the baseline:

a) Data and parameters not monitored and demanded to confirm applicability conditions:

Data/Parameter:	**OT_{normal} (Normal Operating Temperature)**
Data unit:	ºC
Description:	Normal range of oxidation temperature of the ammonia reactor
Time of determination/monitoring	Operating temperature was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data (to be) used:	Historical data was used. Calculated on the base of operating temperature during operating condition campaigns.
Value applied (for ex ante calculations/determinations):	806ºC-838ºC
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal oxidation temperature. Reactor temperature is measured by measuring loops in each factor consisting of thermocouple (Cr-Al) and analog (4-20 mA) output Honeywell transmitters, type STT 173-BS. For determination of normal range of OT the median of four measurements in each reactor is applied
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**OP_{normal} (Normal Operating Pressure)**
Data unit:	Pa
Description:	Normal range of oxidation pressure of the ammonia reactor
Time of determination/monitoring	The parameter was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data (to be) used:	Historical data were used. Pressure at the oxidation reactors is not a process control parameter and isn't monitored on a routine basis. Air pressure is available, and represent an accurate parallel parameter (pressure drop between compressor and reactors is constant at 0.1 bar); then air pressure in the point after compressor before the mixer is used to determine OP_{normal}.
Value applied (for ex ante calculations/determinations):	2.5 – 2.9 bar
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal oxidation pressure on the basis of air pressure data figures. Pressure is measured by an in-line Honeywell smart pressure transmitter model ST3000 with measuring range 0-4 bar.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**AFR_{max} (Maximum Ammonia Flow Rate)**

Data unit:	kg NH_3/hour
Description:	Maximum value of ammonia flow rate to the ammonia oxidation reactor
Time of determination/monitoring	The parameter was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data used:	Historical data was used.
Value applied (for ex ante calculations/determinations):	10,500 kg NH_3/hour
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine the maximum ammonia flow rate. The flow is measured by a Honeywell differential pressure type transmitter with square root extraction.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**$AIFR_{max}$ (Maximum Ammonia to Air Flow Ratio)**
Data unit:	kg NH_3/kg air
Description:	Maximum ammonia to air ratio
Time of determination/monitoring	Monitored during operating condition campaigns and will be verified during the verification visit
Source of data used:	Historical data was used. Calculated on the basis of ammonia and air flow to oxidation reactor.
Value applied (for ex ante calculations/determinations):	0.0864 kg NH_3/kg air
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine maximum ammonia to air flow ratio. Air flow to the oxidation reactor is measured by a differential pressure type Honeywell transmitter with square root extraction. The ammonia to air ratio is calculated on the basis of the actual flow analysis from the individual streams (ammonia and air).
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**CL_{normal} (Normal Campaign Length)**
Data unit:	tonnes 100% HNO_3
Description:	Total number of tonnes of nitric acid at 100% concentration produced between two consecutive gauze changes
Time of determination/monitoring	Monitored during operating condition campaigns and will be verified during the verification visit
Source of data used:	Historical data was used. Calculated from nitric acid production data as the average of operation condition campaign lengths.
Value applied (for ex ante calculations/determinations):	92,293 tonnes 100% HNO_3
Justification of the choice of data or description of measurement methods and	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal campaign length. (One of the consecutive historical campaigns was

procedures actually applied:	eliminated from processed historical data as untypical because of being an abnormal campaign, much shorter than a standard one (56,453 ton because of gauzes contamination with oil drops.).
QA/QC procedures (to be) applied	Not necessary
Any comment:	Calculated once before the end of the baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**GS_{normal}** **(Normal Gauze Supplier)**
Data unit:	Umicore
Description:	Gauze supplier during normal operating condition campaigns (the previous five campaigns).
Time of determination/monitoring	The parameter was monitored during historical campaigns and will be verified during the verification visit.
Source of data used:	Historical data of nitric plant procurement office was used.
Value applied (for ex ante calculations/determinations):	Umicore
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine the normal gauze supplier.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**GC_{normal} (Normal Gauze Composition)**
Data unit:	%
Description:	Gauze composition during normal operation condition campaigns (the previous five campaigns)
Time of determination/monitoring	The parameter was monitored during historical campaigns and will be verified during the verification visit.
Source of data used:	Historical process data from nitric acid plant procurement office was used.
Value applied (for ex ante calculations/determinations):	Pt 95% Rh 5%
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal gauze composition. The composition of the ammonia oxidation catalyst to operate during the baseline campaign will be the same as the one used for the previous 5 historical campaigns.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

a) Data and parameters monitored

Data/Parameter:	**$NCSG_{BC}$ (Baseline N_2O Concentration in the Stack Gas)**
Data unit:	mgN_2O/m^3 under normal conditions (101.325 kPa, 0 deg C).(converted from ppm if necessary)
Description:	Mean concentration of N_2O in the stack gas during the baseline campaign
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	N_2O analyzer. The values for $NCSG_{BC}$ calculation are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	2843 mgN_2O/m^3
Justification of the choice of data or description of measurement methods and procedures actually applied:	N_2O concentration is measured by a Sidor on-line analyzer (non dispersive infrared principle). A gas stream is continuously drawn from the stack by the sampling system under proper conditions (the line is heat traced to avoid condensation), and driven to the infrared cell.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**VSG_{BC} (Baseline Volume Flow of the Stack Gas)**
Data unit:	m^3/h
Description:	Mean gas volume flow rate at the stack in the baseline measurement period. . Should be stated for normal conditions (101.325 kPa, 0 deg C). AMS automatically normalizes values that are received from sensors and represents normalized value in report.
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Flow meter. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	88,238 Nm^3/h
Justification of the choice of data or description of measurement methods and procedures actually applied:	Ultra-sound Flowsick FLSE 100 gas volume flow meter
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**TSG (Temperature of the Stack Gas)**
Data unit:	ºC
Description:	Temperature of the stack gas
Time of	Over the period of the baseline campaign and will be verified during the

determination/monitoring	verification visit.
Source of data to be used:	Temperature probe. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for $\mathbf{VSG_{BC}}$ and **VSG** normalization.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Platinum temperature sensors (PTS) model P100 produced by Jumo which use variation of the electrical resistance of metals with temperature
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. The values are scanned each second and used for calculation of one minute averages.

Data/Parameter:	**(Pressure of the Stack Gas)**
Data unit:	Pa
Description:	Pressure of stack gas
Time of determination/monitoring	Over the period of the baseline and project campaigns and will be verified during the verification visit.
Source of data to be used:	Pressure probe. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for VSG_{BC} and VSG normalization.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Stack pressure is measured by the pressure transmitter of P121 type made by Bourdon Haenni with dry ceramic sensor, analog output and pressure measuring range 0.8-1.2 bar.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project The values are scanned each second and used for calculation of one minute averages.

Data/Parameter:	$\mathbf{OH_{BC}}$ **(Baseline Operating Hours)**
Data unit:	Hours
Description:	Total operating hours during the baseline campaign
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Plant automated control system and production log. Recorded daily, compiled for the entire campaign.
Value of data applied (for ex ante calculations/determination)	3225 hours.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Plant operating status is determined on the basis of present thresholds for oxidation temperature.

QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**NAP_{BC} (Nitric Acid Production)**
Data unit:	$tHNO_3$
Description:	Total nitric acid production (100% concentrated) during the baseline campaign
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Production log. Calculated on the basis of recorded daily values, compiled for the entire campaign.
Value of data applied (for ex ante calculations/determination)	88,516 $tHNO_3$
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Daily production is measured by a float-type level indicator.To check this data daily, plant makes mass-balance calculations of the ammonia consumption, the production results and ammonia consumption is registered by the Planning Office.
QA/QC procedures to be applied:	Critical instruments are checked on a routine basis according to the plant's maintenance program.
Any comment:	Total production over project campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**AFR (Ammonia Flow Rate to the Oxidation Reactor)**
Data unit:	kg NH_3/hour
Description:	Ammonia flow rate to the ammonia oxidation reactor
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Monitored by plant automated control system. Recorded every hour.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied: :	The flow is measured by a differential pressure type Honeywell transmitter with square root extraction.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project Monitored continuously.

Data/Parameter:	**UNC (Overall Uncertainty of the Monitoring System)**
Data unit:	%
Description:	Overall measurement uncertainty of the monitoring system
Time of determination/monitoring	Defined on the basis of the report of the QAL2 test performed during the baseline campaign and uncertainty of float-type level indicator used in nitric acid production calculations. The report will be verified during the verification visit.
Source of data to be used:	Calculation of the combined uncertainty of the applied monitoring equipment Calculated once after the monitoring system is commissioned.
Value of data applied (for ex ante calculations/determination)	4.94%
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	The overall uncertainty is calculated as the combined uncertainty of the flow meter, the uncertainty of the N_2O concentration measurements, and the uncertainty of the nitric acid flow measurement, using the law of propagation of uncertainty.
QA/QC procedures to be applied:	QAL2 was performed by an ISO 1705 accredited lab.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**AIFR (Ammonia to Air Ratio)**
Data unit:	kg HNO_3/kg air
Description:	Ammonia to air ratio
Time of determination/monitoring	Recorded every hour over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	The ammonia to air ratio is calculated on the basis of the actual flow analysis from the individual streams (ammonia and air). Air flow to the oxidation reactor is measured by a Honeywell differential pressure type transmitter with square root extraction.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**CL_{BL} (Baseline Campaign Length)**
Data unit:	$tHNO_3$
Description:	Campaign length is defined as the total number of tonnes of nitric acid at 100% concentration produced with one set of gauzes.
Time of determination/monitoring	Production recorded daily over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Calculated from nitric acid production data
Value of data applied (for ex ante calculations/determination)	88,516 tonnes of nitric acid. (The normal campaign length has been set as 92,293 tonnes 100% HNO_3. Since the baseline campaign length is lower than normal (CL_{Normal}), all N_2O values measured during the baseline campaign can be used for the baseline emission factor calculation.)

Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Daily production is measured by a float-type level indicator.
QA/QC procedures to be applied:	Not applied
Any comment:	Baseline campaign length is calculated once at the end of the baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**OT_h (Oxidation Temperature for Each Hour)**
Data unit:	ºC
Description:	Oxidation temperature for each hour
Time of determination/monitoring	Recorded every hour over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Reactor temperature is measured by measuring loops in each factor consisting of thermocouple (Cr-Al) and analog (4-20 mA) output Honeywell transmitter's type STT 173-BS. For determination of normal range of OT the median of four measurements in each reactor is applied
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**OP_h (Oxidation Pressure for Each Hour)**
Data unit:	Pa
Description:	Oxidation pressure for each hour
Time of determination/monitoring	Recorded every hour during the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Since air pressure was used to determine OP_{normal} Air pressure in the point after compressor and before the mixer is used to determine **OP_h**. Pressure is measured by an in-line Honeywell smart pressure transmitter model ST3000 with measuring range 0-4 bar.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. Air pressure is available to compare with OP_{normal} too and it is processed the same way as OP_h.

Data/Parameter:	**GS_{BL} (Gauze Supplier)**
Data unit:	Name of gauze supplier
Description:	Gauze supplier for the baseline campaign
Time of determination/monitoring	Once for the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Umicore. We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets methodology requirements. Recorded once.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Cover of supply contract or bill for gauzes for baseline campaign, or equivalent document to prove commercial transaction.
QA/QC procedures to be applied:	None
Any comment	The information will be stored in electronic records and on paper for the crediting period.

Data/Parameter:	**GC_{BL} (Gauze Composition)**
Data unit:	% precious metals
Description:	Gauze composition for the baseline campaign
Time of determination/monitoring	Once for the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Pt 95%, Rh 5%. We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets methodology requirements.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Section of supply contract for gauzes that specifies the technical characteristics agreed during the baseline campaign.
QA/QC procedures to be applied:	None
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

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DonauChem Nitrous Oxide Abatement Project involves the installation of secondary catalysts which only purpose and effect is the decomposition of nitrous oxide once it is formed.

Following the selected methodology, project emissions are determined from N_2O measurements in the stack gas of the nitric acid plant.

Baseline emissions are calculated from an emission factor measured before the implementation of the project activity (the installation of a secondary catalyst). Then, the baseline will be determined by measuring the N_2O baseline emission factor (kg N_2O/tonne HNO_3) during a *complete* production campaign, called "initial N_2O measurement campaign for baseline determination", before project implementation.

To ensure that data obtained during such initial campaign are representative of the actual GHG emissions from the source plant, a set of process parameters known to affect N_2O generation and which are (to some extent) under the control of the plant operator are monitored and compared to limits or ranges called "normal operating conditions".

Normal operating conditions are defined on the basis of plant historical operating conditions and plant design data. A range or maximum value for any given parameter has been established considering specific control capabilities of DonauChem's nitric acid plant. In order to properly characterize baseline emission rates, operation during such initial campaign is controlled within the specified limit (a maximum or range has been established for each parameter). Only those N_2O measurements taken when the plant is operating within the permitted range will be considered in the calculation of baseline emissions. The level of uncertainty determined for the N_2O monitoring equipment will be deducted from the baseline emission factor.

The emission factor determined during the baseline campaign will be presented for crediting of emission reductions.

The additionality of the project activity is demonstrated and assessed using the latest version of the "Tool for demonstration and assessment of additionality" ver 5.2 (EB39). We will demonstrate that the baseline scenario is installation of a selective catalytic reduction (SCR) $DeNO_x$ unit.

Step 1 of the tool can be avoided since the selection of alternative scenarios was already covered in the analysis carried out in Section B.1 above.

Step 2. Investment analysis.

Sub-step 2a. Determine appropriate analysis method:

As catalytic N_2O destruction facilities generate no financial or economical benefits other than JI-related income, a simple cost analysis is applied.

Sub-step 2b. Apply simple cost analysis:

Project scenario: No income from any kind of potential product or by-product except ERUs is able to pay back investment costs as well as running costs for the installation of the secondary catalyst as no marketable product or by-product exists.

The investment (excluding potential financing costs) consists of the engineering, construction, shipping, installation and commissioning of the secondary catalyst and the monitoring equipment. The running costs consist of the regular change of the catalysts, personnel costs for the supervision and cost of the measurement equipment.

Baseline scenario: The baseline scenario "Installation of a selective catalytic reduction (SCR) $DeNO_x$ unit" will require lower investment and running costs than the implementation of the project activity.

Therefore, the proposed JI project activity is, without the revenues from the sale of ERUs, obviously less economically and financially attractive than the baseline scenario.

Step 3. Barrier analysis is not used for demonstrating additionality in this project.

Step 4. Common practice analysis.

Sub-step 4a: Analyze other activities similar to the proposed project activity:

The proposed project activity (or any other form of nitrous oxide abatement technology) is not common practice since no similar project (on the base of data that come from open sources), at nitric acid plants is identified in Romania. (Now 5 projects together with DonauChem project are on the process of development by InterAgro Group. Similar projects are implemented in other Romanian plants; Asomures and Doljchim, all of them are developed under the aegis of Kyoto Protocol and recieved LoEs from Romanian DFP).
The nitric acid industry typically releases into the atmosphere the N_2O generated as a by-product, as it does not have any economic value or toxicity at typical emission levels. N_2O emissions through the stack gas can be considered the business-as-usual activity as it is a widespread practice around the country. No nitric acid plant in Romania has a secondary catalyst (or any other type of N_2O abatement technology) currently installed.

Sub-step 4b: Discuss any similar options that are occurring:

No similar projects are operating in Romania.

Since similar project activities are not observed the proposed project activity is additional.

Conclusion:

Currently, there are no national regulations or legal obligations in Romania concerning N_2O emissions. It is unlikely that any such limits on N_2O emissions will be imposed in the near future. In fact, given the cost and complexity of suitable N_2O destruction and abatement technologies, it is unlikely that a limit would be introduced by Romania, which has ratified the Kyoto Protocol and actively participates in JI.

DonauChem has no need to invest in any N_2O destruction or abatement technology. Nor are there any national incentives or sectoral policies to promote similar project activities.

Without the sale of the ERUs generated by the project activity the net present value (NPV) and internal rate of return (IRR) of the project would be negative, no revenue would be generated and the technology would not be installed. The secondary catalyst technology when installed will reduce nitrous oxide emissions by up to 90% below what they would otherwise be without the catalyst technology installed.

The proposed JI project activity is undoubtedly additional, since it passes all the steps of the "tool for demonstration and assessment of additionality (Version 05.2)", approved by the CDM Executive Board.

The approval and registration of the project activity as a JI activity, and the attendant benefits and incentives derived from the project activity, will offset the substantial cost of the secondary catalyst, and any plant modifications and will enable the project activity to be undertaken.

On the basis of the *ex-ante* estimation of N_2O emission reductions, it is expected that the income from selling of ERUs of the determined JI project activity is at least as high as the investment, financing and running costs. Therefore DonauChem is willing to finance the project activity under the condition of its determination as a JI project activity.

B.3. Description of how the definition of the project boundary is applied to the project:

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The project boundary encompasses the physical, geographical site of the DonauChem nitric acid plant and equipment for the complete nitric acid production process from the inlet to the ammonia burner to the stack. The only GHG emission relevant to the project activity is N_2O contained in the waste stream exiting the stack. The abatement of N_2O is the only GHG emission under the control of the project participant.

The secondary catalyst utilizes the heat liberated by the highly exothermal oxidation reaction (which occurs on the precious metal gauzes of the primary catalyst) to reach its effective operating temperature. Once the operating temperature is reached, no incremental energy is necessary to sustain the reaction.

	Source	Gas	Included?	Justification/Explanation
Baseline	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	Excluded	The project does not lead to any change in CO_2 or CH_4 emissions, and, therefore, these are not included.
		CH_4	Excluded	
		N_2O	Included	
Project Activity	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	Excluded	The project does not lead to any change in CO_2 or CH_4 emissions.
		CH_4	Excluded	
		N_2O	Included	
	Leakage emissions from production, transport, operation and decommissioning of the catalyst	CO_2	Excluded	No leakage emissions are expected.
		CH_4	Excluded	
		N_2O	Excluded	

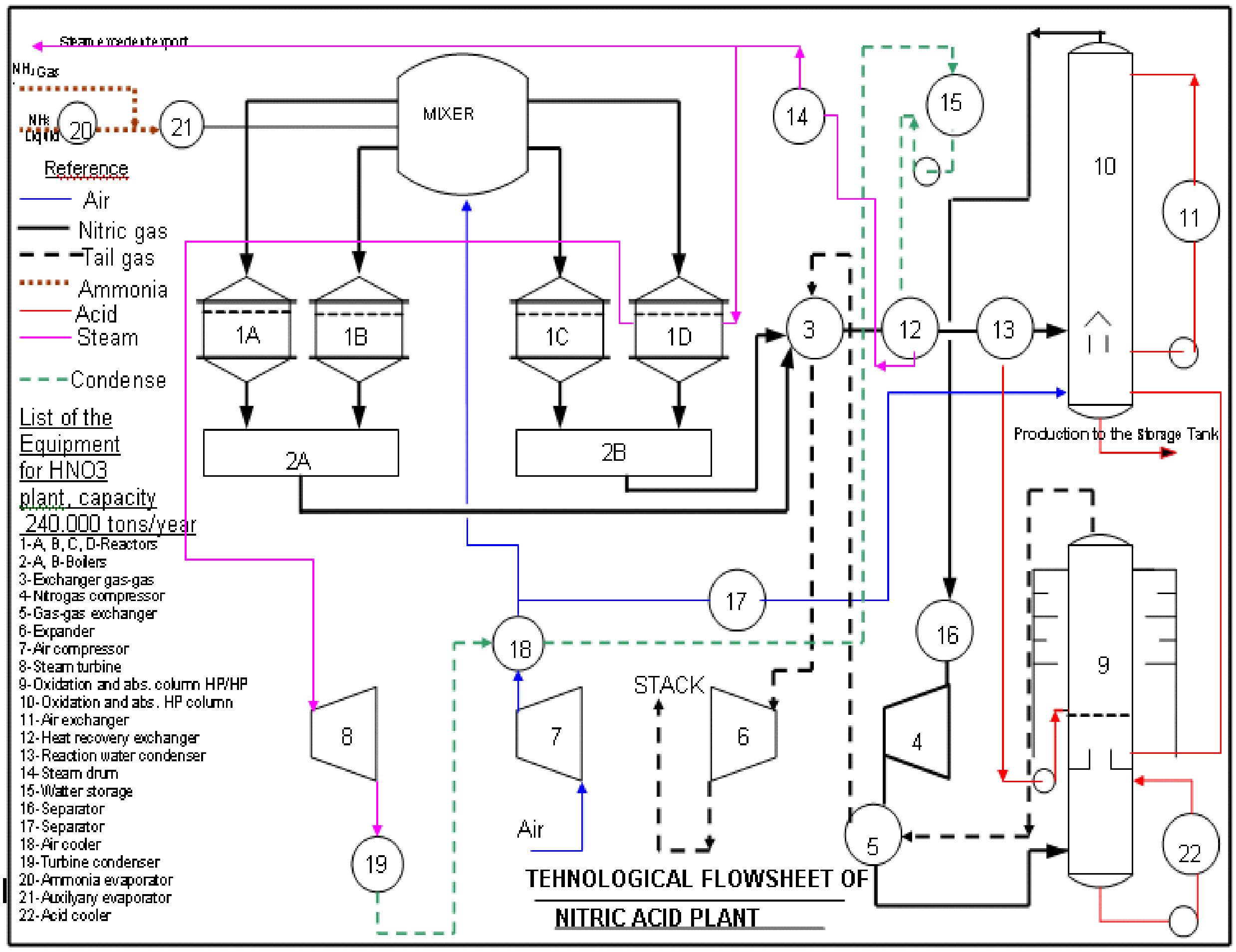

Figure 4: Project boundary

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

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Date of baseline setting: September 2007

The baseline and monitoring methodology has been applied by:

Walter Hügler, Nuria Zanzottera, and María Inés Hidalgo, MGM International Group LLC (not project participant).

Tel: +54-11-5219-1230

e-mail: whugler@mgminter.com; nzanzottera@mgminter.com; ihidalgo@mgminter.com.

SECTION C. Duration of the project/crediting period

C.1. Starting date of the project:

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6/02/2007. Date of the signature of the contract with the project developer.

C.2. Expected operational lifetime of the project:

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10 years.

C.3. Length of the crediting period:

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10 years, starting date of the crediting period: 17 July 2009

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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The DonauChem site is a large fertilizer complex having 8 plants currently in operation. Many of the plants' activities and services are performed by common/shared staff, so personnel have qualifications and experience beyond any specific plant or operation. The nitric acid plant is operated by a centralized automated control system[4]; thus, operators are qualified and experienced in operating technical equipment to a high level of quality standards. The plant has access to specialized technical services from the central MEA (mechanical, electrical and automation) department.

The plant manager will be responsible for the ongoing operation and maintenance of the N_2O monitoring system. Operation, maintenance, calibration and service intervals will be according to the manufacturer's specifications and international standards (see QA/QC section below), and incorporated into the management structure of ISO 9000 standard procedures. The DonauChem meets the requirements of ISO 9001 quality system. It is confirmed by certificate #1728 of 15.01.2008 issued by AEROQ S.A. certified organisation and valid till 14.01.2011

The proposed JI project will be closely monitored, metered and recorded in accordance with methodology AM0034 ver.3.2. The management and operation of the proposed nitrous oxide abatement project will be the responsibility of DonauChem's plant. The emission reductions will be verified at least annually by an independent entity, which will be an Accredited Independent Entity (AIE). A regular (annual) reporting of the emission reductions generated by the project will be sent to the owner of the ERUs, coincidentally with the AIE determination.

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

Data/Parameter:	**NCSG (N_2O Concentration in the Stack Gas)**
Data unit:	mgN_2O/m^3 at normal conditions (101.325 kPa, 0 deg C).(converted from ppm if necessary)
Description:	N_2O concentration in the stack gas during a project campaign
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit. The values are scanned continuously and used for calculation of one minute averages.

[4] Currently the nitric acid plant is migrating from pneumatic to electronic controls.

Source of data to be used:	N_2O analyzer. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	The values are scanned continuously and used for calculation of one minute averages.
Justification of the choice of data or description of measurement methods and procedures actually applied:	N_2O concentration is measured by a Sidor on-line analyzer (non dispersive infrared principle). A gas stream is continuously drawn from the stack by the sampling system under proper conditions (the line is heat traced to avoid condensation), and driven to the infrared cell.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program.

Data/Parameter:	**VSG (Volume Flow of the Stack Gas)**
Data unit:	m^3/h
Description:	Volume flow rate of the stack gas during a project campaign. AMS automatically normalizes values that are received from sensors and represents normalized value in report. It should be stated for normal conditions (101.325 kPa, 0 deg C)
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit.
Source of data to be used:	Gas volume flow meter. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	The values are scanned continuously and used for calculation of one minute averages.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Ultra-sound Flowsick FLSE 100 gas volume flow meter measurements are applied.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**TSG (Temperature of the Stack Gas)**
Data unit:	ºC
Description:	Temperature of the stack gas during a project campaign

Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit.
Source of data to be used:	Temperature probe. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for $VSG_{project}$ normalization.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Platinum temperature sensors (PTS) model P100 produced by Jumo which use variation of the electrical resistance of metals with temperature are applied.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**PSG (Pressure of the Stack Gas)**
Data unit:	Pa
Description:	Pressure of the stack gas during the baseline and project campaigns
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit.
Source of data to be used:	Probe (part of gas volume flow meter). The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for VSG normalization.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Stack pressure is measured by the pressure transmitter of P121type made by Bourdon Haenni with dry ceramic sensor, analog output and pressure measuring range 0.8-1.2 bar.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**OH (Operating Hours)**

Data unit:	Hours
Description:	Operating hours during a project campaign
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit.
Source of data to be used:	Plant automated control system and production log. Monitored daily.
Value of data applied (for ex ante calculations/determination)	Will be calculated for each project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Plant operating status is determined on the basis of present thresholds for oxidation temperature.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	Compiled for each entire campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**NAP (Nitric Acid Production)**
Data unit:	$tHNO_3$
Description:	Nitric acid production (100% concentrated) during each project campaign or vintage year
Time of determination/monitoring	Monitored daily over the period of the project campaigns and will be verified during the verification visit. Completed for each entire campaign.
Source of data to be used:	Production log
Value of data applied (for ex ante calculations/determination)	For the vintage years: 2009 – 168,000 tonnes, 2010 – 216,000 tonnes,2011-2018 – 235,000 tonnes. For the project campaigns - 92,293 tonnes (CL_{normal}). The final figure will be calculated for each project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Daily production is measured by a float-type level indicator.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	Compiled for each entire campaign. Total production over project campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**$GS_{project}$ (Project Gauze Supplier)**
Data unit:	Name of gauze supplier
Description:	Normal gauze supplier for the project campaigns
Time of determination/monitoring	To be obtained during the operating condition campaigns and will be verified during the verification visit
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Umicore (to be confirmed during project campaigns). We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets methodology requirements.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Cover of supply contract or bill for gauzes for operating condition campaigns, or equivalent document to prove commercial transaction
QA/QC procedures to be applied:	None
Any comment:	To be obtained during the operating condition campaigns. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**$GC_{project}$ (Project Gauze Composition)**
Data unit:	% precious metals
Description:	Normal gauze composition for the operation condition campaigns
Time of determination/monitoring	During project campaigns and will be verified during the verification visit
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Pt 95%, Rh 5% (to be confirmed during project campaigns). We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets methodology requirements
Justification of the choice of data or description of measurement methods and procedures actually applied:	Section of supply contract for gauzes that specifies the technical characteristics agreed during the baseline campaign

QA/QC procedures to be applied:	None
Any comment:	To be obtained during the operating condition campaigns. The information will be stored in electronic records and on paper for the crediting period.

Data/Parameter:	**PE_n (N_2O Emission of nth Project Campaign)**
Data unit:	t N_2O
Description:	N_2O emission for a project campaign
Time of determination/monitoring	Calculated at least once after each campaign
Source of data to be used:	Calculated from monitored data
Value of data applied (for ex ante calculations/determination)	126.51 t N_2O. Estimated amount which is calculated using the estimated value of N_2O baseline emissions, considering an N_2O abatement efficiency of 85% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from monitored data
QA/QC procedures to be applied:	No QA/QC procedure is needed.
Any comment:	N_2O project emission will be calculated on the basis of measurements of stack gas flow rate, N_2O concentration, and the operating hours. All parameters will be measured during a complete project campaign to properly characterize N_2O project emissions.

Data/Parameter:	**EF_n (Project Emission Factor)**
Data unit:	t N_2O/t 100% HNO_3
Description:	Project emission factor calculated from monitored data for each project campaign
Time of determination/monitoring	Calculated at least once after each project campaign
Source of data to be used:	Calculated from monitoring data

Value of data applied (for ex ante calculations/determination)	0.001371 t N_2O/t 100% HNO_3 Estimated amount which is calculated using the estimated value of N_2O baseline emission, considering an N_2O abatement efficiency of 85% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from monitored data on the basis of methodology
QA/QC procedures to be applied:	No QA/QC procedure is needed.
Any comment:	Project emission factor will be calculated on the basis of measurements of the nitric acid production, stack gas flow rate and N_2O concentration.

Data/Parameter:	**EF_{reg} (Emission Factor set by Regulation)**
Data unit:	Not applicable
Description:	Emission level set by incoming policies or regulations
Time of determination/monitoring	During the whole project duration
Source of data to be used:	Monitored
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions.
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has personnel that verify changes in the relevant Romanian legislation.
QA/QC procedures to be applied:	None
Any comment:	Updated when new regulation comes into force

Data/Parameter:	**$EF_{ma,n}$ (Moving Average Emission factor)**
Data unit:	tonne N_2O / tonne 100% HNO_3
Description:	Moving average of emission factor calculated as the average of the emission factors of all previous project campaigns
Time of	Calculated at the end of each project campaign

determination/monitoring	
Source of data to be used:	Calculated from campaign emissions factors
Value of data applied (for ex ante calculations/determination)	0.001371 t N_2O/t 100% HNO_3. Estimated amount which is calculated using the estimated value of N_2O baseline emission, considering an N_2O abatement efficiency of 85% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated as the average of the emission factors of each project campaign.
QA/QC procedures to be applied:	None
Any comment:	None

Data/Parameter:	**EF_p (Emission factor used to determine emission reductions)**
Data unit:	tonne N_2O / tonne 100% HNO_3
Description:	Emission factor used to calculate the emission from the particular campaign.
Time of determination/monitoring	Calculated at the end of each project campaign
Source of data to be used:	Calculated using campaign emission factors.
Value of data applied (for ex ante calculations/determination)	0.001371 t N_2O/t 100% HNO_3. Estimated amount which is calculated using the estimated value of N_2O baseline emission, considering an N_2O abatement efficiency of 85% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated using campaign emission factors. EF_p will be determined as the higher of $EF_{ma,n}$ and EF_n.
QA/QC procedures to be applied:	None

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

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Actual project emissions will be determined during the project activity from continuous measurements of N_2O concentration and total flow rate in the stack gas of the nitric acid plant.

Project measurements are subjected to exactly the same procedure as the baseline measurements in order to be coherent.

Estimation of campaign-specific project emissions

The monitoring system will provide separate readings for N_2O concentration and gas flow for a given period of time (e.g., every hour of operation, i.e., an average of the measured values of the past 60 minutes). Error readings (e.g., downtime or malfunction) and extreme values are eliminated from the output data series. Next, the same statistical evaluation that was applied to the baseline data series has to be applied to the project data series:

a) Calculate the sample mean (x);
b) Calculate the sample standard deviation (s);
c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation);
d) Eliminate all data that lie outside the 95% confidence interval;
e) Calculate the new sample mean from the remaining values.

The mean values of N_2O concentration and total flow rate are used in the following formula (Eq. 3 from AM0034) to calculate project emissions:

$$PE_n = VSG_n \cdot NCSG_n \cdot 10^{-9} \cdot OH_n$$

Where

PE_n	Total project emissions of the nth campaign, in tN_2O
VSG_n	Mean stack gas volume flow rate for the nth project campaign, in Nm^3/h
$NCSG_n$	Mean concentration of N_2O in the stack gas for the project campaign, in mgN_2O/Nm^3
OH_n	Number of operating hours in the project campaign, in h

Derivation of a moving average emission factor

In order to take into account possible long-term emission trends over the duration of the project activity and to take a conservative approach a moving average emission factor is estimated as follows:

Step 1. Estimate the campaign-specific emission factor for each campaign during the project's crediting period by dividing the total mass of N_2O emissions during that campaign by the total production of 100% concentrated nitric acid during that same campaign.

For example, for the *nth* campaign the campaign-specific emission factor would be:

$$EF_n = \frac{PE_n}{NAP_n}$$

Where

EF_n	Emission factor calculated for the *nth* campaign, in kg N_2O/t HNO_3
PE_n	Total project emissions of the *nth* campaign, in tN_2O
NAP_n	Nitric acid production in the *nth* campaign, in t 100% HNO_3

Step 2: Estimate a moving average emission factor calculated at the end of the *nth* project campaign as follows:

$$EF_{ma,n} = \frac{\sum_n EF_n}{n}$$

This process will be repeated for each campaign such that a moving average, $EF_{ma,n}$, is established over time, becoming more representative and precise with each additional campaign.

To calculate the total emission reductions achieved in the *nth* campaign, the higher of the two values $EF_{ma,n}$ and EF_n shall be applied as the emission factor relevant for that particular campaign (EF_p).

If $EF_{ma,n} > EF_n$, then $EF_p = EF_{ma,n}$

If $EF_{ma,n} < EF_n$, then $EF_p = EF_n$

<u>Minimum project emission factor</u>

A campaign-specific emission factor will be used to cap any potential long-term trend towards decreasing N_2O emissions that may result from a potential build-up of platinum deposits. After the first ten campaigns of the crediting period of the project, the lowest EF_n observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in an EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign will use EF_{min} and not EF_n.

Project campaign length

a. Longer project campaign

If the length of each individual project campaign CL_n is greater than or equal to the average historic campaign length CL_{normal}, then all N_2O values measured during the baseline campaign can be used for the calculation of EF_n (subject to the elimination of data from the ammonia/air analysis).

b. Shorter project campaign

If $CL_n < CL_{normal}$, recalculate EF_{BL} by eliminating those N_2O values that were obtained during the production of tonnes of nitric acid beyond CL_n (i.e., the last tonnes produced) from the calculation of EF_n.

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

Data/Parameter:	**OT_{normal} (Normal Operating Temperature)**
Data unit:	ºC
Description:	Normal range of oxidation temperature of the ammonia reactor
Time of determination/monitoring	Operating temperature was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data (to be) used:	Historical data was used. Calculated on the basis of operating temperature during operating condition campaigns.
Value applied (for ex ante calculations/determinations) :	806ºC-838ºC

Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal oxidation temperature. Reactor temperature is measured by measuring loops in each factor consisting of thermocouple (Cr-Al) and analog (4-20 mA) output Honeywell transmitter's type STT 173-BS. For determination of normal range of OT the median of four measurements in each reactor is applied
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**OP_{normal} (Normal Operating Pressure)**
Data unit:	Pa
Description:	Normal range of oxidation pressure of the ammonia reactor
Time of determination/monitoring	The parameter was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data (to be) used:	Historical data were used. Pressure at the oxidation reactors is not a process control parameter and isn't monitored on a routine basis. Air pressure is available, and represent an accurate parallel parameter (pressure drop between compressor and reactors is constant at 0.1 bar); then air pressure in the point after compressor and before the mixer is used to determine OP_{normal}.
Value applied (for ex ante calculations/determinations):	2.5-2.9 bar
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal oxidation pressure on the basis of air pressure data figures. Pressure is measured by an in-line Honeywell smart pressure transmitter model ST3000 with measuring range 0-4 bar.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**AFR_{max} (Maximum Ammonia Flow Rate)**
Data unit:	kg NH_3/hour

Description:	Maximum value of ammonia flow rate to the ammonia oxidation reactor
Time of determination/monitoring	The parameter was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data used:	Historical data was used.
Value applied (for ex ante calculations/determinations):	10,500 kg NH_3/hour
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine maximum ammonia flow rate. The flow is measured by a Honeywell differential pressure type transmitter with square root extraction.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**$AIFR_{max}$ (Maximum Ammonia to Air Flow Ratio)**
Data unit:	kg NH_3/kg air
Description:	Maximum ammonia to air ratio
Time of determination/monitoring	Monitored during operating condition campaigns and will be verified during the verification visit.
Source of data used:	Historical data was used. Calculated on the basis of ammonia and air flow to the oxidation reactor.
Value applied (for ex ante calculations/determinations):	0.0868 kg NH_3/kg air
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine the maximum ammonia to air flow ratio. Air flow to the oxidation reactor is measured by a differential pressure type Honeywell transmitter with square root extraction. The ammonia to air ratio is calculated on the basis of the actual flow analysis from the individual streams (ammonia and air).
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**CL_{normal} (Normal Campaign Length)**
Data unit:	tonne 100% HNO_3
Description:	Total number of tonnes of nitric acid at 100% concentration produced between two consecutive gauze changes.
Time of determination/monitoring	Monitored during operating condition campaigns and will be verified during the verification visit.
Source of data used:	Historical data was used. Calculated from nitric acid production data as the average of operating condition campaign lengths.
Value applied (for ex ante calculations/determinations):	92,293 tonnes 100% HNO_3
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal campaign length. (One of the consecutive historical campaigns was eliminated from processed historical data as untypical because of being an abnormal campaign, much shorter than a standard one (56,453 ton), because of gauzes contamination with oil drops).
QA/QC procedures (to be) applied	Not necessary
Any comment:	Calculated once, before the end of the baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**GS_{normal} (Normal Gauze Supplier)**
Data unit:	Umicore
Description:	Gauze supplier during normal operating condition campaigns (the previous five campaigns)
Time of determination/monitoring	The parameter was monitored during historical campaigns and will be verified during the verification visit.
Source of data used:	Historical data of nitric acid plant procurement office was used.
Value applied (for ex ante calculations/determinations):	Umicore
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine the normal gauze supplier.
QA/QC procedures (to be)	Not necessary

applied	
Any comment:	The information will be stored in electronic records and on paper for the crediting period.

Data/Parameter:	**Normal Gauze Composition, GC_{normal}**
Data unit:	%
Description:	Gauze composition during normal operation condition campaigns (the previous five campaigns).
Time of determination/monitoring	The parameter was monitored during historical campaigns and will be verified during the verification visit.
Source of data used:	Historical process data from nitric acid plant procurement office was used.
Value applied (for ex ante calculations/determinations):	Pt 95% Rh 5%
Justification of the choice of data or description of measurement methods and procedures actually applied:	DonauChem has adequate historical registers for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal gauze composition. The composition of the ammonia oxidation catalyst to operate during the baseline campaign will be the same as the one used for the previous 5 historical campaigns.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**$NCSG_{BC}$ (Baseline N_2O Concentration in the Stack Gas)**
Data unit:	mgN_2O/m^3 under normal conditions (101.325 kPa, 0 deg C) (converted from ppm if necessary)
Description:	Mean concentration of N_2O in the stack gas during the baseline campaign
Time of determination/monitoring	Over the period of the baseline campaign and will be verified the during verification visit.
Source of data to be used:	N_2O analyzer. The values for **$NCSG_{BC}$ calculation** are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	2,843 mgN_2O/m^3
Justification of the choice of data or description of measurement methods and procedures actually	N_2O concentration is measured by a Sidor on-line analyzer (non dispersive infrared principle). A gas stream is continuously drawn from the stack by the sampling system under proper conditions (the line is heat traced to avoid condensation), and driven to the infrared cell.

applied:	
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**VSG_{BC} (Baseline Volume Flow of the Stack Gas)**
Data unit:	m^3/h
Description:	Mean gas volume flow rate at the stack in the baseline measurement period. AMS automatically normalizes values that are received from sensors and represents normalized value in report. Should be stated for normal conditions (101.325 kPa, 0 deg C).
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Flow meter. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	88,238 Nm^3/h
Justification of the choice of data or description of measurement methods and procedures actually applied:	Ultra-sound Flowsick FLSE 100 gas volume flow meter
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**TSG (Temperature of the Stack Gas)**
Data unit:	ºC
Description:	Temperature of the stack gas
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Temperature probe. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for VSG_{BC} and VSG

ante calculations/determination)	normalization.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Platinum temperature sensors (PTS) model P100 produced by Jumo which use variation of the electrical resistance of metals with temperature.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. The values are scanned each second and used for calculation of one minute averages.

Data/Parameter:	**PSG (Pressure of the Stack Gas)**
Data unit:	Pa
Description:	Pressure of the stack gas
Time of determination/monitoring	Over the period of the baseline and project campaigns and will be verified during the verification visit.
Source of data to be used:	Pressure probe. The values are scanned continuously and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for **VSG_{BC}** and **VSG** normalization
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Stack pressure is measured by the pressure transmitter of P121type made by Bourdon Haenni with dry ceramic sensor, analog output and pressure measuring range 0.8-1.2 bar.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. The values are scanned each second and used for calculation of one minute averages.

Data/Parameter:	**OH_{BC} (Baseline Operating Hours)**
Data unit:	Hour
Description:	Total operating hours during the baseline campaign

Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Plant automated control system and production log. Recorded daily, compiled for the entire campaign.
Value of data applied (for ex ante calculations/determination)	3,225 hours.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Plant operating status is determined on the basis of present thresholds for oxidation temperature.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**NAP_{BC} (Nitric Acid Production)**
Data unit:	$tHNO_3$
Description:	Total nitric acid production (100% concentrated) during the baseline campaign
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Production log. Calculated on the basis of recorded daily values, compiled for the entire campaign.
Value of data applied (for ex ante calculations/determination)	88,516 $tHNO_3$
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Daily production is measured by a float-type level indicator.
QA/QC procedures to be applied:	Critical instruments are checked on a routine basis according to the plant's maintenance program.
Any comment:	Total production over the baseline campaign. This information will be available in electronic and paper format for at least two years

	after the last transfer of ERUs for the project.

Data/Parameter:	**AFR (Ammonia Flow Rate to the Oxidation Reactor)**
Data unit:	kg NH_3/hour
Description:	Ammonia flow rate to the ammonia oxidation reactor
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Monitored by plant automated control system. Recorded every hour.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied: :	The flow is measured by a differential pressure type Honeywell transmitter with square root extraction.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. Monitored continuously.

Data/Parameter:	**UNC (Overall Uncertainty of the Monitoring System)**
Data unit:	%
Description:	Overall measurement uncertainty of the monitoring system
Time of determination/monitoring	Defined on the basis of the report of QAL2 performed during the baseline campaign and uncertainty of the float-type level indicator used in nitric acid production calculations. The report will be verified during the verification visit.
Source of data to be used:	Calculation of the combined uncertainty of the applied monitoring equipment. Calculated once after monitoring system is commissioned.
Value of data applied (for ex ante calculations/determination)	4.94%
Justification of the choice	The overall uncertainty is calculated as the combined uncertainty of the flow meter, the uncertainty of the N_2O concentration

of data or description of measurement methods and procedures (to be) applied:	measurements, and the uncertainty of the nitric acid flow measurement, using the law of propagation of uncertainty.
QA/QC procedures to be applied:	QAL2 was performed by an ISO 1705 accredited lab.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**AIFR (Ammonia to Air Ratio)**
Data unit:	kg HNO_3/kg air
Description:	Ammonia to air ratio
Time of determination/monitoring	Recorded every hour over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	The ammonia to air ratio is calculated on the basis of the actual flow analysis from the individual streams (ammonia and air). Air flow to the oxidation reactor is measured by a Honeywell differential pressure type transmitter with square root extraction.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**CL_{BL} (Baseline Campaign Length)**
Data unit:	$tHNO_3$
Description:	Campaign length is defined as the total number of tonnes of nitric acid at 100% concentration produced with one set of gauzes.
Time of determination/monitoring	Production recorded daily over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Calculated from nitric acid production data

Value of data applied (for ex ante calculations/determination)	88,516 tonnes of nitric acid. (The normal campaign length has been set as 92,293 tonnes 100% HNO_3. Since the baseline campaign length is lower than normal (CL_{Normal}), all N_2O values measured during the baseline campaign can be used for the baseline emission factor calculation.)
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Daily production is measured by a float-type level indicator.
QA/QC procedures to be applied:	Not applied
Any comment:	Baseline campaign length calculated once at the end of the baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**OT_h (Oxidation Temperature for Each Hour)**
Data unit:	ºC
Description:	Oxidation temperature for each hour
Time of determination/monitoring	Recorded every hour over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Reactor temperature is measured by measuring loops in each factor consisting of thermocouple (Cr-Al) and analog (4-20 mA) output Honeywell transmitter's type STT 173-BS.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**OP_h (Oxidation Pressure for Each hour)**
Data unit:	Pa
Description:	Oxidation pressure for each hour

Time of determination/monitoring	Recorded every hour during the baseline campaign and will be verified during the verification visit
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Since air pressure was used to determine OP_{normal} Air pressure in the point after compressor ad before the mixer is used to determine $\mathbf{OP_h}$. Pressure is measured by an in-line Honeywell smart pressure transmitter model ST3000 with measuring range 0-4 bar.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. Air pressure is available to compare with $OP_{norma\,l}$ too and it is processed the same way as OP_h.

Data/Parameter:	**GS_{BL} (Gauze Supplier)**
Data unit:	Name of gauze supplier
Description:	Gauze supplier for the baseline campaign
Time of determination/monitoring	Once for the baseline campaign and will be verified during the verification visit
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Umicore. We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets methodology requirements. Recorded once.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Cover of supply contract or bill for gauzes for the baseline campaign, or equivalent document to prove commercial transaction
QA/QC procedures to be applied:	None
Any comment	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**GC_{BL} (Gauze Composition)**
Data unit:	% precious metals
Description:	Gauze composition for the baseline campaign
Time of determination/monitoring	Once for the baseline campaign and will be verified during the verification visit
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Pt 95% Rh 5%. We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets methodology requirements.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Section of supply contract for gauzes that specifies the technical characteristics agreed during the baseline campaign.
QA/QC procedures to be applied:	None
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**BE_{BC} (N_2O Emission of Baseline Campaign)**
Data unit:	t N_2O
Description:	N_2O emission for the baseline campaign
Time of determination/monitoring	Calculated at least once after the baseline campaign
Source of data to be used:	Calculated from baseline monitored data
Value of data applied (for ex ante calculations/determination)	808.9 t N_2O
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from monitored data
QA/QC procedures to be applied:	No QA/QC procedure is needed.

Any comment:	N_2O baseline emissions will be calculated on the basis of measurements of stack gas flow rate, N_2O concentration, and the operating hours. All parameters will be measured during the complete baseline campaign to properly characterize N_2O baseline emissions.

Data/Parameter:	**EF_{BL} (Baseline Emission Factor)**
Data unit:	t N_2O/t 100% HNO_3
Description:	Baseline emission factor calculated from monitored data for the baseline campaign
Time of determination/monitoring	Calculated at least once after the baseline campaign
Source of data to be used:	Calculated from monitoring data
Value of data applied (for ex ante calculations/determination)	0.00868 t N_2O/t 100% HNO_3
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from monitored data on the basis of the methodology
QA/QC procedures to be applied:	No QA/QC procedure is needed.
Any comment:	Baseline emission factor will be calculated on the basis of measurements of the nitric acid production, stack gas flow rate, N_2O concentration, and the operating hours.

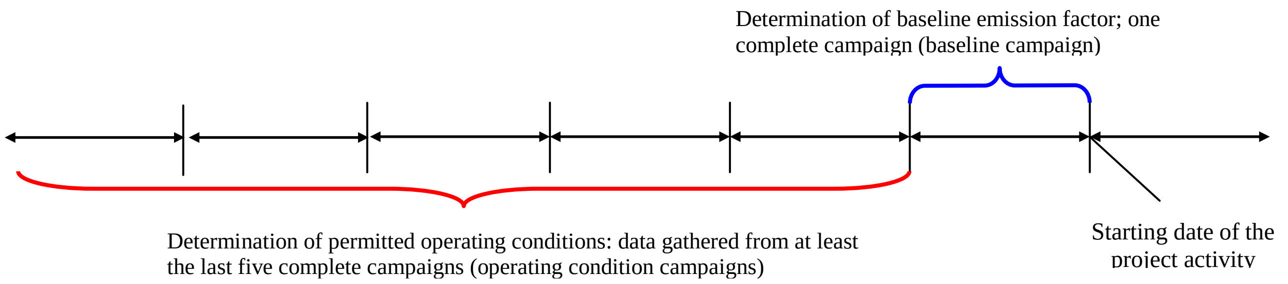
D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

>>

Baseline emission procedure

Following AM0034, the baseline shall be established through continuous monitoring of both N_2O concentration and gas flow volume in the stack of the nitric acid plant for *one complete* campaign before project implementation.

The schematic of the procedure is as follows:



1. Determination of the permitted operating conditions of the nitric acid plant to avoid overestimation of baseline emissions:

Oxidation temperature and pressure

When historical data is used to calculate the "permitted range of operating conditions", this range is determined through a statistical analysis in which the time series data is to be interpreted as a sample for a stochastic variable. All data that falls within the upper and lower 2.5% percentiles of the sample distribution is defined as abnormal and will be eliminated. The permitted range of operating temperature and pressure is then assigned as the historical minimum (value of parameter below which 2.5% of the observations lie) and maximum operating conditions (value of parameter exceeded by 2.5% of observations).

If historical data is not available the "permitted range of operating conditions" will be determined using design data.

If design data is not available the "permitted range of operating conditions" will be determined using adequate literature sources.

Information used to define "normal operating temperature" and "normal operating pressure" will be available for auditing purposes during the determination visit.

Ammonia gas flow rate and ammonia-to-air ratio input into the ammonia oxidation reactor

The upper limits for ammonia flow rate and ammonia-to-air ratio are determined using historical maximum operating data for hourly ammonia gas and ammonia-to-air ratio for the previous five campaigns.
If no data is available, the maximum permitted ammonia gas flow rate and ammonia-to-air ratio are calculated as specified by the ammonia oxidation catalyst manufacturer or for typical catalyst loadings.

If the information stated above is not available, the maximum ammonia gas flow rate and the maximum ammonia-to-air ratio will be calculated on the basis of a relevant technical literature source.

Information used to determine maximum ammonia gas flow rate and maximum ammonia-to-air ratio will be available for auditing purposes during the determination visit.

2. Determination of baseline emission factor: measurement procedure for N_2O concentration and gas volume flow

For the determination of the baseline emission factor N_2O concentration and gas volume flow will be monitored throughout the baseline campaign. Separate readings for N_2O concentration and gas flow volume for a defined period of time (e.g., every hour of operation, it provides an average of the measured values for the previous 60 minutes) will be taken. Error readings (e.g., downtime or malfunction) and extreme values will be eliminated from the output data series.

Measurement results can be distorted before and after periods of downtime or malfunction of the monitoring system and can lead to maverick data. To eliminate such extremes and to ensure a conservative approach, the following statistical evaluation is to be applied to the complete data series of N_2O concentration and the data series for gas volume flow. The statistical procedure will be applied to data obtained after eliminating data measured for periods when the plant operated outside the permitted ranges:

a) Calculate the sample mean (x);
b) Calculate the sample standard deviation (s);
c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation);
d) Eliminate all data that lie outside the 95% confidence interval;
e) Calculate the new sample mean from the remaining values (volume of stack gas (VSG) and N_2O concentration of stack gas (NCSG)).

Then, the average mass of N_2O emissions per hour is estimated as the product of NCSG and VSG. The N_2O emissions per campaign are estimated as the product of N_2O emission per hour and the total number of complete hours of operation of the campaign using the following equation from AM0034:

$$BE_{BC} = VSG_{BC} \cdot NCSG_{BC} \cdot 10^{-9} \cdot OH_{BC}$$

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
OH_{BC}	Number of operating hours in the baseline measurement period, in h

The plant-specific baseline emission factor representing the average N_2O emissions per tonne of nitric acid over *one full campaign* is derived by dividing the total mass of N_2O emissions by the total output of 100% concentrated nitric acid for that period for baseline emission factor determination.

The overall measurement uncertainty of the monitoring system, expressed as a percentage (*UNC*), will be used to reduce the N_2O emission factor per tonne of nitric acid produced in the baseline period (EF_{BL}) as follows:

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}\left(1 - \frac{UNC}{100}\right)$$

Where

EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
NAP_{BC}	Nitric acid production during the baseline campaign, in $tHNO_3$
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

<u>Impact of regulations</u>

Should N_2O emission regulations that apply to nitric acid plants be introduced in Romania or the jurisdiction covering the location of the nitric acid plant, such regulations shall be compared to the calculated baseline emission factor (EF_{BL}), regardless of whether the regulatory level is expressed as:

- An absolute cap on the total volume of N_2O emissions for a set period;
- A relative limit on N_2O emissions expressed as a quantity per unit of output; or
- A threshold value for specific N_2O mass flow in the stack.

In this case, a corresponding plant-specific emission factor cap (maximum allowed $tN_2O/tHNO_3$) is to be derived from the regulatory level. If the regulatory limit is lower than the baseline factor determined for the project activity, the regulatory limit will become the new baseline emission factor, that is:

If $EF_{BL} > EF_{reg}$, then $EF_{BL} = EF_{reg}$ for all the calculations.

<u>Composition of the ammonia oxidation catalyst</u>

In the case that in the DonauChem plant the composition of the ammonia oxidation catalyst used for the baseline campaign and after the implementation of the project is identical to that used in the campaigns for setting the operating conditions (the previous five campaigns), there shall be no limitations on N_2O baseline emissions.

<u>Campaign length</u>

In order to take into account variations in campaign length and their influence on N_2O emission levels, the historic campaign lengths and the baseline campaign length are to be determined and compared to the project campaign length. Campaign length is defined as the total number of tonnes of nitric acid at 100% concentration produced with one set of gauzes.

<u>Historic campaign length</u>

The average historic campaign length (CL_{normal}), defined as the average campaign length for the historic campaigns used to define operating conditions (the previous five campaigns), will be used as a cap on the length of the baseline campaign.

If the baseline campaign length *(CL_{BL}) is lower than or equal to* CL_{normal}, all N_2O values measured during the baseline campaign can be used for the calculation of EF_{BL} (subject to the elimination of data that was monitored during times when the plant was operating outside of the “permitted range”).

If the baseline campaign length (CL_{BL}) is higher than CL_{normal}, all N_2O values that were measured beyond the length of CL_{normal} during the production of the quantity of nitric acid (i.e., the final tonnes produced) will be eliminated from the calculation of EF_{BL}.

Parameters to be monitored for composition of the catalyst are as follows:
GS_{normal} Gauze supplier for the operating condition campaigns
GS_{BC} Gauze supplier for the baseline campaign
$GS_{project}$ Gauze supplier for the project campaign
GC_{normal} Gauze composition for the operating condition campaigns
GC_{BC} Gauze composition for the baseline campaign
$GC_{project}$ Gauze composition for the project campaign

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in Section E):

>>
Not applicable

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

>>
The emission reductions of the project activity, *ER*, expressed in tonnes of CO_2 equivalent per year (tCO_2e/yr), are given by the following equation (Eq. 7 from AM0034):

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O}$$

Where

ER_n	Emission reductions for the *nth* campaign , tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
EF_p	Project emission factor, in $tN_2O/tHNO_3$
NAP_n	Nitric acid production during the *nth* campaign of the project activity, in $tHNO_3$
GWP_{N_2O}	Global warming potential of N_2O, set as 310 tCO_2e/tN_2O for the 1st commitment period

Note. The nitric acid production used to calculate emission reductions should not exceed the design capacity (nameplate) of the nitric acid plant.

Documentation to prove design capacity (nameplate) of the nitric acid plant should be available for the validation process of the project activity.[5]

D.1.3. Treatment of leakage in the monitoring plan:

>>
No leakage calculation is required.

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

>>
No leakage calculation is required.

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

>>

To calculate EF_{BL} firstly we calculate

$$BE_{BC} = VSG_{BC} \cdot NCSG_{BC} \cdot 10^{-9} \cdot OH_{BC}$$

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3

[5] Nameplate (design) implies the total yearly capacity (considering 365 days of operation per year) according to the documentation of the plant technology provider (such as the Operation Manual). If the plant has been modified to increase production, and such de-bottleneck or expansion projects were completed before December 2005, then the new capacity is considered nameplate, provided proper documentation of the projects is available (such as, but not limited to: properly dated engineering plans or blueprints, engineering, materials and/or equipment expenses, or third party construction services, etc.).

OH_{BC}	Number of operating hours in the baseline measurement period, in h

and after that

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}(1 - \frac{UNC}{100})$$

Where

EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
NAP_{BC}	Nitric acid production during the baseline campaign, in $tHNO_3$
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

<u>To calculate EF_p</u> firstly we calculate

$$PE_n = (VSG_{BC} \cdot NCSG_{BC}) * (1 - R_{Eff}) / 100 \cdot 10^{-9} \cdot OH$$

Where

PE_n	Estimated N_2O emission for the project campaign, tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
R_{Eff}	Secondary catalyst efficiency, %
OH	Estimated number of operating hours in the project campaign, in h

and after that

$$EF_p = \frac{PE_n}{Cl_{normal}}$$

Where

EF_p	Estimated project emission factor, in $tN_2O/tHNO_3$
PE_n	Estimated N_2O emission for the project campaign, in tN_2O
Cl_{normal}	Project campaign length, in $tHNO_3$

Then we can calculate ER_n:

$$ER_n = (EF_{BL} - EF_p) \cdot NAP \cdot GWP_{N_2O}$$

Where

ER_n	Emission reductions for the *nth* campaign, in tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
EF_p	Estimated project emission factor, in $tN_2O/tHNO_3$
NAP_n	Estimated nitric acid production during the *nth* project campaign
GWP_{N2O}	Global warming potential of N_2O, set as 310 tCO_2e/tN_2O for the 1^{st} commitment period

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

>>

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

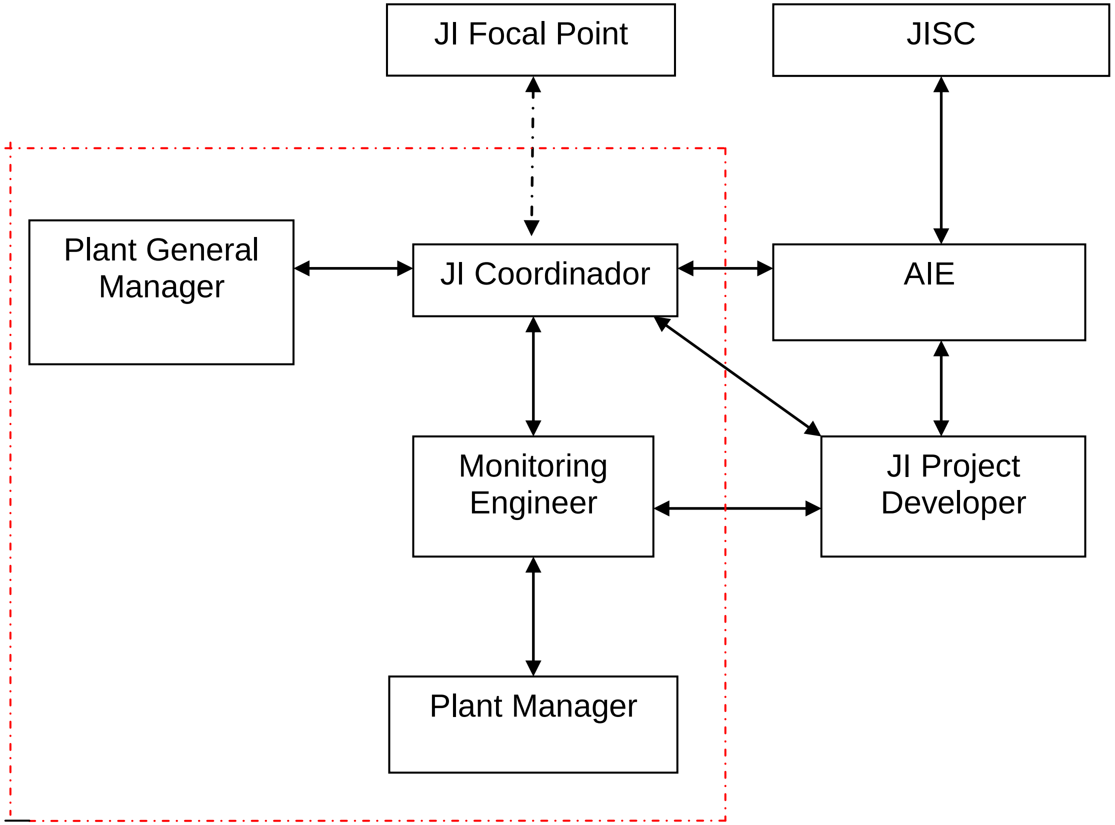
>>

Not applied. QC/QA procedures are described directly in the tables for each data and parameter.

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

>>

An illustrative scheme of the operational and management structure that will monitor the proposed JI project activity is depicted in the scheme below.



Note: the dashed line shows the operational and management structure boundaries of the proposed project.

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

>>

The baseline and monitoring methodology has been applied by:

Walter Hügler, Nuria Zanzottera, and María Inés Hidalgo, MGM International Group LLC (not project participant).
Tel: +54-11-5219-1230
e-mail: whugler@mgminter.com; nzanzottera@mgminter.com; ihidalgo@mgminter.com

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

>>

Ex-ante estimation of emission reductions

For completing this PDD with the estimation of project emissions the following assumptions are used:

- It is assumed that nitric acid production varies from year to year in accordance with DonauChem production plan. 2009 – 168,000 tonnes, 2010 – 216,000 tonnes, 2011-2018 – 235,000 tonnes. .
- The potential technology providers (BASF, Heraeus) indicate that the estimated reduction efficiency to be achieved as a consequence of project implementation is 85%.
- All other conditions were measured and calculated in accordance with the methodology on the basis of historical and baseline campaign data.

On the basis of the baseline data from Annex 1 of this PDD we can calculate:

1) $BE_{BC} = VSG_{BC} \cdot NCSG_{BC} \cdot 10^{-9} \cdot OH_{BC}$

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
OH_{BC}	Number of operating hours in the baseline measurement period, in h

$$BE_{BC} = 88{,}238 \cdot 2{,}843 \cdot 10^{-9} \cdot 3{,}225 = 808.9 tN_2O$$

2) $EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}(1 - \frac{UNC}{100})$

Where

EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
NAP_{BC}	Nitric acid production during the baseline campaign, in $tHNO_3$
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

$$EF_{BL} = \frac{808.9}{88{,}516}(1 - \frac{4.94}{100}) = 0.00868 t N_2O / tHNO_3$$

3) $PE_n = (VSG_{BC} \cdot NCSG_{BC}) * (1 - R_{Eff}) / 100 \cdot 10^{-9} \cdot OH$

Where

PE_n	Estimated N_2O emission for the project campaign, tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
R_{Eff}	Secondary catalyst efficiency, %
OH	Estimated number of operating hours in the project campaign, in h

$$PE_n = 88{,}238 \cdot 2{,}843 \cdot (1-0.85)/100 \cdot 10^{-9} \cdot 3{,}363 = 126.51 t N_2O$$

4) $EF_p = \dfrac{PE_n}{Cl_{normal}}$

Where

EF_p	Estimated project emission factor, in $tN_2O/tHNO_3$
PE_n	Estimated N_2O emission for the *nth* project campaign, tN_2O
Cl_{normal}	Normal campaign length, in $tHNO_3$

$$EF_p = \frac{126.51}{92{,}293} = 0.001371 tN_2O/tHNO_3$$

5) $PE_{annual} = EF_p \cdot NAP_{annual} \cdot GWP_{N_2O}$

Where

PE_{annual}	Estimated annual N_2O emissions for the vintage year, tN_2O
EF_p	Estimated project emission factor, in $tN_2O/tHNO_3$
NAP_{annual}	Nitric acid production during the *nth* year of the project activity, in $tHNO_3$
GWP_{N2O}	Global warming potential of N_2O, set as 310 tCO_2e/tN_2O for the 1st commitment period

$$PE_{annual} = 0.001371 \cdot 235{,}000 \cdot 310 = 99{,}861 tCO_2e/year$$

E.2. Estimated leakage:

>>

Not applicable

E.3. The sum of E.1. and E.2.:

>>

As there is no leakage the sum of E.1 and E.2 is equal to E.1.

E.4. Estimated baseline emissions:

>>

Baseline emissions are estimated according to the following assumptions:

- Nitric acid production is assumed to be constant, so that project emissions do not vary from year to year.
- An N_2O emission factor (EF_{BL}) is calculated from monitored data available at the moment of submitting this PDD. The final baseline emission factor will be calculated after the completion of baseline campaign measurements.

$$BE_n = EF_{BL} \cdot NAP_n \cdot GWP_{N_2O}$$

Where

BE_{annual}	Baseline emissions during the vintage year of the project activity, tCO_2
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
NAP_{annual}	Nitric acid production during the vintage year of the project activity, in $tHNO_3$

GWP_{N_2O} Global warming potential of N_2O

$$BE_n = 0.00867 \cdot 235{,}000 \cdot 310 = 632{,}083 tCO_2e / year$$

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

>>

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O}$$

Where

ER_{annual}	Emission reductions for the *nth* year , tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
EF_p	Project emission factor, in $tN_2O/tHNO_3$
NAP_{annual}	Nitric acid production during the vintage year of the project activity, in $tHNO_3$
GWP_{N_2O}	Global warming potential of N_2O

$$ER_{annual} = (0.00868 - 0.001371) \cdot 235{,}000 \cdot 310 = 532{,}477 tCO_2e / year$$

E.6. Table providing values obtained when applying formulae above:

>>

Years	Estimated project activity emissions (tonnes of CO2 equivalent)	Estimated leakage (tonnes of CO2 e equivalent)	Estimated baseline emissions (tonnes of CO2 equivalent)	Estimated emission reductions (tonnes of CO2 equivalent)
2009	32 720	-	207 192	174 472
2010	91 787	-	581 213	488 426
2011	99 861	-	632 338	532 477
2012	99 861	-	632 338	532 477
2013	99 861	-	632 338	532 477
2014	99 861	-	632 338	532 477
2015	99 861	-	632 338	532 477
2016	99 861	-	632 338	532 477
2017	99 861	-	632 338	532 477
2018	54 091	-	342 516	288 425
Total	877 625	-	5 557 287	4 679 662

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

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The Environmental Protection Law sets out the EIA requirements and principles: the GD 918/2002 sets out the procedures, while the OM 860/2002 and 863/2002 present in detail the procedures for EIA and for issuing the environmental license.

In accordance with these documents, any development of a new facility or modification of an existing one requires the approval of an EIA before the Environmental License (Environmental Agreement).

The GD 918/2002 presents the requirement for a physical or legal certified person to prepare the impact studies. In DonauChem this report on environmental impact study was elaborated by SC IPROCHIM SA Bucharest (DonauChem Project Design Developer) and had been submitted to the regional Teleoran Environmental Protection Agency to apply for the Environmental Agreement.

In accordance with the above mentioned environmental impact study, the effects on the environment produced by the functioning of the refurbished ammonia plant are the following:

- ➔ WATER – no effect, because the ammonium content in the plant waste water was not modified after the unit modernization.
- ➔ AIR –no effect, because NOx concentration in the emissions is estimated to be below the legal limits, Ord. 462/93.
- ➔ SOIL – no effect, because the products and waste materials are stored in a controlled way at the plant location so as to reduce the risk of soil pollution.

As a general conclusion, following the analysis of the evaluation report on the impact on the environment based on the data provided by the company, places the impact at an insignificant level.

Due to Donau Chem plant modernization the air quality in the area will improve, which will bring forth a positive impact on the staff health and safety as well as on the environmental factors water, soil and subsoil.

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

As was mentioned in paragraph F.1, in Romania any development of a new facility or modification of an existing one requires the approval of an EIA before the environmental license (environmental agreement).

In DonauChem in accordance with Romanian legislation this approval has been confirmed by the corresponding Environmental Agreement No. 1 dated 20.02.2009 between DonauChem and Teleoran Environmental Protection Agency.

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SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

>>

DonauChem has carried out a stakeholders' comment process in accordance with Romanian requirements. According to Art. 14 (3) of GD 1213/2006 the EIA documentation was made available to the public concerned for comments. No comments from stakeholders were received.16 January 2009 at the meeting held for the public discussion of the project. Following the public debates there were no complaints or concerns voiced by the public.

If comments had been received they would have been taken into consideration in the review stage. The EIA documentation was available for consultation at the competent environmental authority's headquarters. The information about this project has been also published on the DonauChem website (www.donauchem.ro) and is available in Turnu Magurele City Hall.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Represented by:	
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Salutation:	Mr.
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E-Mail:	administration@mgminter.com
Represented by:	Maria Pia Iannariello
Title:	President
Salutation:	Ms.
Last Name:	Iannariello
Middle Name:	Pia
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ANNEX 2

BASELINE INFORMATION

Baseline emissions will be calculated from an emission factor measured during a complete campaign before the implementation of the project activity, under normal operating conditions.

Ex-ante estimates of the key baseline parameters are listed in the following table:

Parameter	Estimated value for DonauChem Plant
Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h (VSG_{BC})	88,238
Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3 ($NCSG_{BC}$)	2,843
Baseline emission factor, in $tN_2O/tHNO_3$ (EF_{BL})	0.00868
Nitric acid production during the baseline campaign, in $tHNO_3$ (NAP_{BC} $tHNO_3$)	88,516
Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment, % (UNC)	4.94
Number of operating hours in the baseline measurement period, in h (OH GWP_{N_2O})	3,225
Estimated number of operating hours in the project campaign, in h (OH)	3,363
Project campaign length, in $tHNO_3$ (estimated to be CL_{normal})	92,293
Nitric acid production during the vintage year of the project activity, th. tHNO3/year (NAP_{annual})	168 (2009), 216 (2010), 235(2011-2018)
Secondary catalyst efficiency, % (R_{Eff})	85
N_2O global warming potential tCO_2e/tN_2O (GWP_{N_2O})	310

Annex 3

MONITORING PLAN

The current JI project "Nitrous Oxide Abatement Project at DonauChem plant" measures on a quasi-continuous basis (uninterrupted sampling of flue gases with concentration and normalized flow analysis for short, discrete time periods) the N_2O mass flow leaving the nitric acid plant through an automated measuring system (AMS[6]) using technologies and procedures in accordance with AM0034: "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants".

The plant is currently certified ISO 9001/2000. The monitoring working procedures (deployed according to the current monitoring plan and being an integral part of it) are fully integrated into DonauChem's quality and environmental management system.

The plant manager is responsible for the ongoing operation and maintenance of the N_2O monitoring system. Operation, maintenance, calibration and service intervals are according to the manufacturer's specifications and international standards, and incorporated into the management structure of ISO 9000 standard procedures. Measuring equipment that is involved in the monitoring process is properly checked and calibrated. Procedures of maintenance, calibration routines, and checking for availability of spare parts are clearly described in "Working procedure for monitoring data regarding the greenhouse gas emissions (N_2O) of the nitric acid plant" (P.Ld –o5-01/ edition 1/2008) and other corresponding ISO 9001/2000 documents.

The proposed JI project is closely monitored, metered and recorded. The management and operation of the nitrous oxide abatement project is the responsibility of the plant. The emission reductions will be verified at least annually by an Accredited Independent Entity (AIE). A regular (annual) reporting of the emission reductions generated by the project will be sent to the owner of the ERUs, coincidentally with the AIE determination.

Training required as a consequence of the JI project implementation has been developed and included as part of the JI project manual. Monitoring of the national regulations related to NO_x and N_2O (as required by AM0034) is also established as a written procedure and integrated into the project's JI manual.

Tables in Sections D.1.1.1 and D.1.1.3 of the PDD describe the parameters to be acquired and recorded according to the current monitoring plan, for both the baseline campaign and (future) project campaigns. Furthermore, the baseline methodology requires that certain process parameters are monitored (to be compared with the permitted operating conditions) during the baseline campaign; such process parameters are also described in those tables. Only those N_2O measurements taken when the plant is operating within the permitted range are considered during the calculation of baseline emissions.

In the selection of downstream measuring points the following issues were considered: temperature of the gas below 300ºC (N_2O inert), assurance of homogeneity of the volume gas flow at the measuring points throughout the diameter in terms of velocity of flow and mass composition of gas flow; possible turbulences in the gas flow stream (e.g., at the stack walls); if inhomogeneities exist, measuring of the gas flow is conducted with specific measuring equipment that minimizes uncertainties and inhomogeneities (e.g., multiple probe measuring units that allow for a representative coverage of the gas flow across the stack diameter). The measuring points will be points of the plant with easy access behind the gas expander turbine where the gas flow streams are consistent.

All the relevant instrumentation to measure process parameters is calibrated on a routine basis. The signals generated by these instruments are acquired and logged by the control system of the plant. The specific data generated by the AMS will be stored on a dedicated data acquisition system (DAS) at specified time intervals. The DAS automatically provides an hourly average, which is then transferred onto a common spreadsheet (Excel) for further analysis/calculations and reporting purposes. Actual emission reduction calculation will use values from such spreadsheet. Due to space constraints on the DAS hard drive, from time to time, historical data is archived on a separate hard drive or CDs, to be safeguarded for at least 2 years.

[6] According to "terms and definitions" of EN 14181:2004 (E), an AMS is: a measuring system permanently installed on site for continuous monitoring of emissions. An AMS is a method which is traceable to a reference method. Apart from the analyzer, an AMS includes facilities for taking samples and for sample conditioning. This definition also includes testing and adjusting devices that are required for regular functional checks.

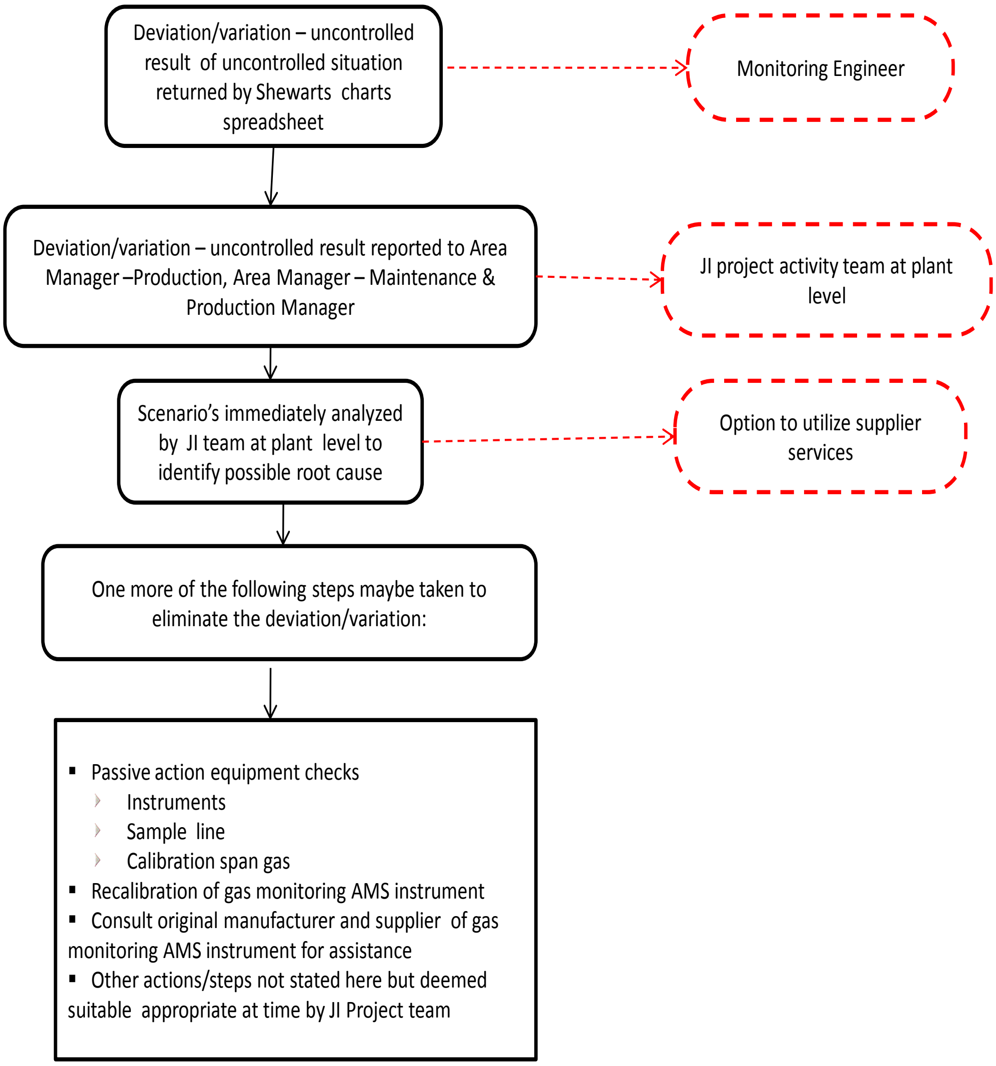
The data acquisition and processing system is protected by the processing security system without any possibility of interference with any parameter. The safety of the system is ensured by a program (software) furnished by the analyzer supplier.

Every day the data are visually displayed by the monitoring engineer and plant manager. The internal storage memory of the computer which serves the DAS can store the acquired data for a minimum of 10 years (and stores it for 2 years after crediting period in accordance with methodology AM0034). Daily, printers generate a paper report which is sent to the personnel responsible for data storage in the IT department.

Weekly, the data is gathered, stored and transmitted to the operator responsible for storing the data. The operator generates, on the basis of the program received from the JI developer, a report which is submitted to the JI developer too.

Such a program is also stored in the IT department on two independent CDs and separately maintained.
The data gathered monthly on CDs from the DAS is also separately stored and maintained.

In case of any malfunction (as for example malfunction of measuring equipment, no signal etc.) the personnel acts in accordance with an illustrative scheme of the basic operational procedure that will identify and eliminate any possible malfunctions (deviations, variations, etc.) of the gas monitoring AMS instrument as part of the JI project activities at the DonauChem



plant:

Emission reduction calculations

The mass (in tonnes) of N_2O that the project actually avoids being vented to the atmosphere during each production campaign, expressed in tonnes of carbon dioxide equivalent (or tCO_2e), will be calculated by applying the following formulas:

$$BE_{BC} = VSG_{BC} \cdot NCSG_{BC} \cdot 10^{-9} \cdot OH_{BC}$$

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
OH_{BC}	Number of operating hours in the baseline measurement period, in h

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}\left(1 - \frac{UNC}{100}\right)$$

Where

EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
NAP_{BC}	Nitric acid production during the baseline campaign, in $tHNO_3$
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

Project emissions are calculated from mean values of N_2O concentration and total flow rate:

$$PE_n = VSG_n \cdot NCSG_n \cdot 10^{-9} \cdot OH_n$$

Where

PE_n	Total project emissions of the nth campaign, in tN_2O
VSG_n	Mean stack gas volume flow rate for the nth project campaign, in Nm^3/h
$NCSG_n$	Mean concentration of N_2O in the stack gas for the project campaign, in mg N_2O/Nm^3
OH_n	Number of operating hours in the project campaign, in h

For the *nth* campaign, the campaign specific emission factor would be:

$$EF_n = \frac{PE_n}{NAP_n}$$

Where

EF_n	Emission factor calculated for the *nth* campaign, in kg N_2O/t HNO_3
PE_n	Total project emissions of the *nth* campaign, in tN_2O
NAP_n	Nitric acid production in the *nth* campaign, in t 100% HNO_3

Then

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O}$$

Where

ER_n	Emission reductions of the project for the *nth* campaign, tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
EF_p	Project emission factor, applicable to the *nth* campaign, in $tN_2O/tHNO_3$
NAP_n	Nitric acid production during the *nth* campaign of the project activity, in $tHNO_3$
GWP_{N_2O}	Global warming potential of N_2O, set as 310 tCO_2e/tN_2O for the 1^{st} commitment period

Following AM0034, several restrictions and adjustments will be applied to the formulas above, including the following:

1. All data series are filtered to eliminate mavericks and outliers.

   The monitoring system will provide separate readings for N_2O concentration and gas flow for a defined period of time (e.g., every hour of operation, i.e., an average of the measured values of the past 60 minutes). Error readings (e.g., downtime or malfunction) and extreme values are eliminated from the output data series. Next, the same statistical evaluation that was applied to the baseline data series will be applied to the project data series:

   a) Calculate the sample mean (x);

b) Calculate the sample standard deviation (s);
c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation);
d) Eliminate all data that lie outside the 95% confidence interval;
e) Calculate the new sample mean from the remaining values.

2. NAP (nitric acid production) cannot exceed nameplate capacity of the plant.

Nitric acid production will be compared to nameplate capacity. If nitric acid production in a given campaign is larger than nameplate, then emission reductions will be calculated ignoring data generated after production exceeds nameplate.

3. A moving average of the emission factors (EF_{ma}) must be calculated.

The campaign specific emission factor (EF_n) for each campaign during the project's crediting period is compared to a moving average emission factor calculated as the average emission factor of the factors generated in the previous campaigns ($EF_{ma,n}$).

To calculate the total emission reductions achieved in the *nth* campaign, the higher of the two values $EF_{ma,n}$ and EF_n shall be applied as the emission factor relevant for that particular campaign (EF_p).

4. A minimum project emission factor should also be determined (EF_{min}), defined as the lowest among the emission factors of the first 10 campaigns.

After the first ten campaigns of the crediting period of the project, the lowest emission factor (EF_n) observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in an EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign will use EF_{min} and not EF_n.

5. The emission factor to be applied for a particular campaign calculation (EF_p) must be the higher between the above-mentioned moving average and the specific campaign emission factor (and not lower than minimum emission factor, after 10 campaigns).

This will be checked according to procedures detailed in Steps 4 and 5 above.

6. The level of uncertainty (*UNC*) determined for the AMS installed must be deducted from the baseline emission factor.

The overall measurement uncertainty (*UNC*), calculated by summing in an appropriate manner (using Gauss's law of error propagation) all the relevant uncertainties arising from the individual performance characteristics of the AMS components, will be used to reduce the baseline emission factor. The following formula will be applied:

$$EF_{BL} = EF_{BC} * (1 - \frac{UNC}{100})$$

7. If production during a given campaign is lower than normal (CL_{normal}), then the baseline is recalculated by ignoring the data generated after production exceeds normal campaign length.

The production during a given campaign will be compared to normal campaign length (CL_{normal}). If the length of any individual project campaign CL_n is shorter than the average historic campaign length, then EF_{BL} will be recalculated by eliminating those N_2O values that were obtained during the production of tonnes of nitric acid beyond CL_n (i.e., the last tonnes produced) from the calculation of EF_n.

Description of the AMS

DonauChem has installed a continuous gas analyzer from the supplier Sick Maihak, model SIDOR-A6, while the specific module to measure N_2O is of the non-dispersive infrared type.

Technical data SIDOR			
Instrument data	SIDOR	OXOR-P	OXOR-E
Detection limit % of range:	1%[2]	≤ 0.5%	≤ 1%
Non-linearity % of range:	≤ 1%[2]	≤ 1%	≤ 1.5%
Repeatability % of FS	≤ 1% [3]	≤ 1% [3]	≤ 1% [3]
Zero point drift % of lowest FS range	≤ 2%/¼ year[1]	≤ 2%/ ¼ year[1]	≤ 2%/¼ year[1]
Span (sensitivity) drift	≤ 2%/¼ year	≤ 2%/ ¼ year	≤ 2%/¼ year[1]
Response time:	Typically 3 sec	≤ 4 sec.	typically 20 sec
Warm-up time:	120 min	120 min	none
Sample contacted parts:	viton B, PVDF, glass, 316ti stst, aluminum	same as SIDOR + platinum & nickel	viton B, PVDF 316 ti stst
Sample gas flow:	0.5 ... 1 liter/min [4] for all analysis modules		
Maximum sample pressure:	4.2 psi (300 mbar) for all analysis modules		
Sample gas temperature range	32 ... 122 °F for all analysis modules		
Enclosure:	General purpose, 19" rack		
Weight	20 – 26 lbs depending on the configuration		
Power supply	100, 115 or 230 V AC (+10,-15%) 48...62 Hz, max. 150 W, typically 50 Watts		
Interfaces and signals			
Digital interface	via RS 232 C uni or bi-directional interface with modified AK protocol or Modbus protocol		
Analog outputs	qty. 4, linear, isolated 4-20 mA outputs, max. load 500 Ω		
Digital outputs	8 relay contacts, 48 V DC/50 mA, 24 V DC/200 mA or 18 V DC/0.5A, logic (open or close) is user selectable, 8 transistor outputs		
Digital inputs	8 inputs, isolated with opto-couplers		

1) with routine single point adjustments
2) double values for ranges < 2 x smallest measuring range
3) at constant temperature and pressure
4) flow dependancy for OXOR P < 0.2 vol % O_2 in specified range
5) highest measuring range is 100% except for NO and SO_2 max 3 vol%

For stack flow measurement, the DonauChem plant installed an ultrasound principle unit, model Flowsick 100 manufactured by Sick AG (Germany). The Flowsick series are also TÜV certified and comply with relevant regulations in Germany such as 13th and 17th BlmSchV.

Device Data	UHD	UMD	USD PR	UMA
Measured quantity	Gas velocity, volume flow s.s./o.s., gas temperature			
Measuring range	v: ±40 m/s; freely selectable			
Accuracy emission measur. [10]	±0.1 m/s			
Reproducibility process control	±1% for v > 2 m/s; ±0.02 m/s for v < 2 m/s			
Signals	1 analog output: 0/2/4...20 mA; 750 Ω load 4 relay outputs f. status signals: 48 V/1 A (el. isolated)			
Interfaces	RS 232			
Response time (T_{90})	1...300 s; freely selectable			
Mounting angle	45°...60°		45°	45°...60°
Options	2 analog modules max. 0...20 mA, 1 pulse output 1 interface module RS 232/422/485			1 analog module 1 pulse output
Purge-air supply	–			
Power supply	90...140 V AC/ 180...240 V AC; 50/60 Hz; ca. 20 W			
Protection class	IP 65			

Good monitoring practice and performance characteristics

Regarding QA/QC, the European Norm EN 14181:2004, which is recommended as guidance regarding the selection, installation and operation of the AMS under Monitoring Methodology AM0034, stipulates the Quality Assurance Levels (QAL), and one Annual Surveillance Test (AST):

QAL1: Suitability of the AMS for the specific measuring task.

The evaluation of the suitability of the AMS and its measuring procedure are described in ISO 14956:2002 “Air quality – Evaluation of the suitability of a measurement procedure by comparison with a required measuring uncertainty”. Using this standard, it will be proven that the total uncertainty of the results obtained from the AMS meets the specification for uncertainty stated in the applicable regulations (e.g., EU Directives 2000/76/EU or 2001/80/EU). Since European regulations do not yet cover the measurement of N_2O at nitric acid plants, there is no official specification for uncertainty available. Hence, considering official specification of uncertainties defined for equivalent pollutants (e.g., NO_x, SO_2) according to EU regulations, 20% of the ELV (emission limit value) has been considered by the equipment manufacturer as the required measurement quality for N_2O, for the purpose of expanded uncertainty calculations. The specific performance characteristics of the monitoring system chosen by the project will be listed in the Project Design Document, in accordance with AM0034. The tables below indicate such characteristics in accordance with the corresponding QAL 1 report.

Specific performance characteristics for N_2O analyzer (SIDOR-A6)

Performance characteristics from suitability test:

Response time 3)	2,18 min	
Lack of fit (Non-Linearity) 2) 1)	58,9 mg/m³	
Uncertainty of reproducibility 3)	28,7 mg/m³	at 3928 mg/m³ N2O
Sensitivity to supply voltage 3)	23,6 mg/m³	at 3928 mg/m³ N2O
Sensitivity to sample volume flow 3)	27,5 mg/m³	at 3928 mg/m³ N2O
Uncertainty of reference gas 1)	78,6 mg/m³	at 3928 mg/m³ N2O
Detection limit 3)	59,0 mg/m³	
Maintenance intervall 3)	4 weeks	

	Zero	Span
Drift within Maintenance intervall 3)	82,5 mg/m³	64,8 mg/m³
Influence of readjustment 3)	0,0 mg/m³	15,7 mg/m³
Sensitivity to ambient temperature 3)	70,7 mg/m³	62,8 mg/m³

Cross Sensitivities :

Interfering Component	Concentration	Influence to the N2O Concentration	
		Zero Point	Reference Point
O2 2)	21,0 Vol%	0,0 mg/m³	0,0 mg/m³
H2O 2) 1)	30,0 Vol%	-5,9 mg/m³	-5,9 mg/m³
CO 2) 1)	300,0 mg/m³	5,9 mg/m³	5,9 mg/m³
CO2 2) 1)	15,0 Vol%	-61,0 mg/m³	-88,4 mg/m³
CH4 2) 1)	50,0 mg/m³	5,9 mg/m³	5,9 mg/m³
N2O	100,0 mg/m³	0,0 mg/m³	0,0 mg/m³
NO 2) 1)	300,0 mg/m³	3,5 mg/m³	3,5 mg/m³
NO2 2) 1)	30,0 mg/m³	4,4 mg/m³	4,4 mg/m³
NH3 2) 1)	20,0 mg/m³	0,0 mg/m³	0,0 mg/m³
SO2 2) 1)	200,0 mg/m³	5,9 mg/m³	5,9 mg/m³
HCL 2) 1)	200,0 mg/m³	0,0 mg/m³	0,0 mg/m³

The following performance characteristics do not influence the measurement or just non-essential:
Relative humidity, vibrations 3)

Requirements:

Test value of CO Concentration	3928 mg/m³
Averaging time of the measuring values	30 min
95% Confidence intervall of measuring values	20 %

Requirements regarding response time:

Requirements for response time	25 % von 30 min; this corresponds to 7,5 min
Measured response time	2,18 min
Result	**Requirements for response time fulfilled**

Uncertainty of the performance characteristics from suitability test:

Uncertainty of Non-linearity	34,0 mg/m³
Uncertainty of Reproducibility	28,7 mg/m³
Uncertainty of Power Line Variations	13,6 mg/m³
Uncertainty of Gas Flow	15,9 mg/m³
Uncertainty of Span Gas	45,4 mg/m³

	Zero Point	**Reference Point**
Uncertainty of Instability / Drift	47,6 mg/m³	37,4 mg/m³
Uncertainty of Readjustment	0,0 mg/m³	9,1 mg/m³
Uncertainty of Ambient Temperature	40,8 mg/m³	36,3 mg/m³
Uncertainty from cross sensitivity O2	0,0 mg/m³	0,0 mg/m³
Uncertainty from cross sensitivity H2O	3,4 mg/m³	3,4 mg/m³
Uncertainty from cross sensitivity CO	3,4 mg/m³	3,4 mg/m³
Uncertainty from cross sensitivity CO2	35,2 mg/m³	51,0 mg/m³
Uncertainty from cross sensitivity CH4	3,4 mg/m³	3,4 mg/m³
Uncertainty from cross sensitivity N2O	0,0 mg/m³	0,0 mg/m³
Uncertainty from cross sensitivity NO	2,0 mg/m³	2,0 mg/m³
Uncertainty from cross sensitivity NO2	2,6 mg/m³	2,6 mg/m³
Uncertainty from cross sensitivity NH3	0,0 mg/m³	0,0 mg/m³
Uncertainty from cross sensitivity SO2	3,4 mg/m³	3,4 mg/m³
Uncertainty from cross sensitivity HCl	0,0 mg/m³	0,0 mg/m³

Result:

	Zero Point	**Reference Point**
Estimate of combined Standard uncertainty s_{AMS} =	98,5	99,7

Measurement uncertainty related to the emissions limit

Estimate of the extended Measurement uncertainty	199,3 at 3928 mg/m³ N2O
Estimate of the relative extended Measurement uncertainty	5,1 %
Result	**Requirements of QAL 1 acc. to EN 14181 fulfilled**

The complete EN 14181: 2004 QAL1 reports are provided by the equipment manufacturers considering the performance characteristics as measured by a qualified Technical Inspection Authority (such as the German TÜV) and the specific installation characteristics and site conditions at the plant. The QAL1 report confirms the N_2O analyzer is suitable for performing the indicated analysis (N_2O concentration), and provides a conservative estimate for expanded uncertainty. The complete QAL1 report is available for verification.

The overall measurement uncertainty (*UNC*) is calculated by summing (using Gauss's law of error propagation) all the relevant uncertainties arising from the individual performance characteristics of the AMS components (thus UNC = ((N_2O analyzer uncertainty)^2 + (flow meter uncertainty)^2)$^{1/2}$). The overall measurement uncertainty is available for the determination of the project activity.

QAL2: Validation of the AMS following its installation.

The next level of quality assurance prescribed in EN14181:2004 (QAL2) describes a procedure for the determination of the calibration function and its variability, by means of certain number of parallel measurements (meaning simultaneously with the AMS), performed with a standard reference method (SRM) (which should be a proven and accurate[7] analytical protocol in accordance with relevant norms or legislation). The variability of the measured values obtained with the AMS is then compared with the uncertainty given by the applicable legislation. If the measured variability is lower than the permitted uncertainty, it is concluded that the AMS has passed the variability test. Since (as explained above), official uncertainty is not available, an appropriate level is determined on the basis of those that do exist for similar pollutants and techniques (in this case 20% of ELV).

The testing laboratories performing the measurements with the standard reference method should have an accredited quality assurance system according to EN ISO/IEC 17025 or relevant (national) standards.

As condition precedent for a QAL2 test, it is required that the AMS has been correctly installed and commissioned, considering (for example) that the AMS is readily accessible for regular maintenance and other necessary activities and that the working platform to access the AMS allows for parallel sampling.
The AMS unit was installed by qualified contractors under the direct supervision of the equipment manufacturers, considering both relevant Romanian and international standards. The plant technical director, as well as other members of DonauChem´s technical team, actively supervised all phases of installation, from system design to commissioning.

The QAL2 test in DonauChem was performed in October of 2008 by the certified organization SGS Nederland B.V. Environmental Services.

All data collected before the receipt of the QAL2 lab report was corrected through proper application of the calibration function.

The relevant extract from the QAL2 report with main conclusions is mentioned below:

[7] Considering EN 14181 does not specify what SRM to use for each specific compound, there is controversy as to which method is suitable as SRM for N_2O, since the best available technology (and hence the most accurate instrument) is the actual online instrument which is the subject of calibration by this method.

Based on the executed measurements the following conclusions can be made:

- As far as possible measured the used Sidor Sick Maihak N_2O emission measurement analyser coops with the QAL 1 and QAL 2 demands of the European standard EN 14181;
- The QA/QC system of the plant coops with the demands of EN 14181 QAL3 (see recommendations);
- Before the 8th of October 2008 the deviation of the calibration line is:
  N_2O : $y = 1.023 \times N_2O$ [ppm] + 0.00
- Flue gas flow rate : $y = 1.047 \times$ Flow $[m_0^3/h]$ + 0.00
- After the 8th of October 2008 the deviation of the calibration line is:
  N_2O : $y = 1.008 \times N_2O$ [ppm] + 0.00
  Flue gas flow rate : $y = 1.047 \times$ Flow $[m_0^3/h]$ + 0.00
- The linearity test is passed;
- The overall uncertainty of the used measurement system before the 8th of October 2008 is calculated as ± 5.43%.
- The overall expanded uncertainty (95% CI) of the used measurement system before 8th of October 2008 is calculated as ± 10.64%.
- The overall uncertainty of the used measurement system after the 8th of October 2008 is calculated as ± 4.39%.
- The overall expanded uncertainty (95% CI) of the used measurement system after 8th of October 2008 is calculated as ± 8.61%.

QAL3: Ongoing quality assurance during operation.

Procedures described under QAL3 of EN 14181: 2004 checks for drift and precision, in order to demonstrate that the AMS is in control during its operations so that it continues to function within the required specification for uncertainty. This is achieved by conducting periodic zero and span checks on the AMS, and evaluating results obtained using control charts. Zero and span adjustments or maintenance of the AMS may be implemented as a result of such evaluation. The implementation and performance of the QAL3 procedures given in this standard are the responsibility of the plant operating team.

The standard deviation according to QAL3 has been calculated by the equipment manufacturer on the basis of equipment performance characteristics and field conditions for DonauChem's nitric acid plant. Calculation spreadsheets from the suppliers are available for verification. The data is used to monitor that the difference between measured values and true values of zero and span reference materials are equal to or smaller than the combined drift and precision value of the AMS multiplied by a coverage factor of 2 (2 times the standard deviation of the AMS, as described in the QAL3 section of EN14181) on a scheduled basis, with the aid of Shewart charts. The documented calibration procedure for the zero and span checks and the resulting Shewart charts will be available on site for future verification.

All monitoring equipment is serviced and maintained according to the manufacturer's instructions and international standards by qualified personnel. Maintenance and service logs will be well kept at DonauChem's plant and available for auditing purposes.

AST: Annual Surveillance Test (ongoing quality assurance).

The AST is a procedure to evaluate whether the measured values obtained from the AMS still meet the required uncertainty criteria, as evaluated during the QAL2 test. Like QAL2, it also requires a limited number of parallel measurements using an appropriate Standard Reference Method. Although the total expected uncertainty of the AMS is well below the selected required uncertainty, an AST will be performed on the AMS once a year. If at a later time, the DOE (Designated Operational Entity) agrees that the AST is not required on a yearly basis (considering the consistent performance of the AMS), the frequency will be modified accordingly.