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

CONTENTS

A. General description of the project

B. Baseline

C. Duration of the project/crediting period

D. Monitoring plan

E. Estimation of greenhouse gas emission reductions

F. Environmental impacts

G. Stakeholders' comments

Annexes

Annex 1: Contact information on project participants

Annex 2: Baseline information

Annex 3: Monitoring plan

SECTION A. General description of the project

A.1. Title of the project:

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Chemgas Nitrous Oxide Abatement Project
Sectoral Scope: 5 (Chemical industry)
Version 2.2
26 January 2012

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.

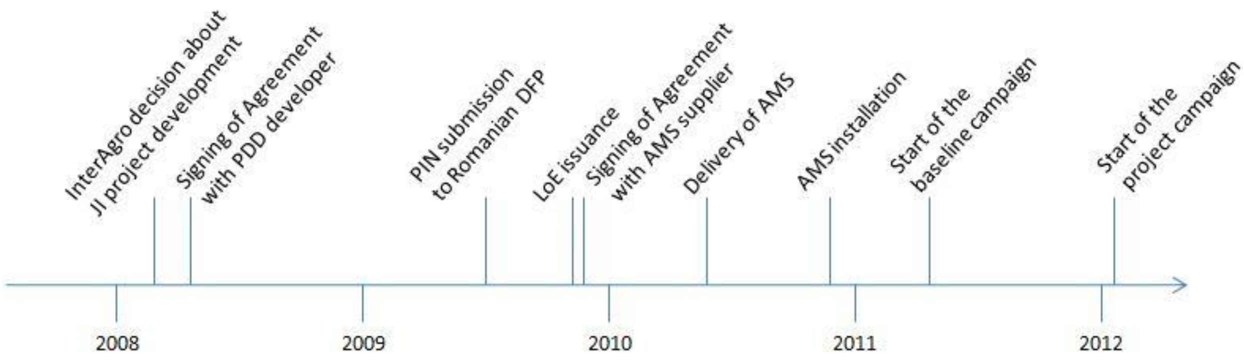
The baseline scenario is determined to be the release of N_2O emissions to the atmosphere at the currently measured rate, in the absence of regulations to restrict N_2O emissions. If regulations on N_2O emissions are introduced during the crediting period, the baseline scenario shall be adjusted accordingly.

The baseline emission rate will be determined by measuring the N_2O emission factor (kg N_2O/tonne HNO_3) during a 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 main milestones of the project are described in Table 1:



Date	Description
April 18, 2008	Decision to proceed with JI project development and signature of the contract with PDD developer
April 21, 2008	Contract signature with PDD developer MGM International (MGM Worldwide LLC)
January 18, 2009	Decision on secondary catalyst supplier
June 1, 2009	Contract signature with Chemgas and Interagro, allocating duties of the Parties in terms of Project development
June, 2009	PIN submission to Romanian DFP
June 17, 2009	Contract signature with AMS supplier (ABB)
September 29, 2009	Issuance of LoE (#8334)
April 28, 2010	Delivery of AMS (delay in delivery due to technical and financial issues)
November 27, 2010	AMS start up
April, 2011	Start of baseline campaign
March, 2012	Start of first project campaign

Table 1. Timeline of the project.

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 Chemgas' plant.

Chemgas 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. Chemgas Holding Corporation S.R.L.	No

	Private entity	
Sweden	MGM Carbon Portfolio , S.a.r.l. Private entity	No

CHEMGAS was established in 1969 as Chemical Fertilizers Plant (Cich Slobozia) and by 1983 was the largest producer of urea in Romania. Then Joint stock company with private capital SC Amonil SA was established in 1990 on the basis of Chemical Fertilizers Plant. After that the Amonil plant was purchased by S.C. Chemgas Holding Corporation S.R.L. in October 2009.

Chemgas produces and markets urea, ammonium nitrate and UAN liquid fertilizers. The nitric acid plant (capacity 725 tonnes/day) has been in operation since 1974. It is a part of InterAgro Group of Companies, a Romanian – British joint venture. The plant is single line dual pressure plant (medium pressure in AOR 2,7 – 3,5bars (P_{abs}), high pressure in Absorption tower –8,0-9,0 bars (P_{abs}). The line consists of 4 AORs (1 is out of operation), 1 compressor, 1 absorption tower and 1 stack. The holding company of this group is S.C. InterAgro S.A. that is a privately owned Romanian-English company founded in 1994 and mainly involved in growing cereals and in foreign trade, especially the export of fertilizers for agriculture.

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

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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Ialomita Slobozia

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

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Slobozia

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 Slobozia, County of Ialomita. Slobozia lies roughly in the middle of the county, on the banks of Ialomita River, at ca. 120 km (75 miles) east of Bucharest and 150 km (93 miles) west of Constanța, an important port of the Black Sea. The City is within 30 km of the Bucharest-Constanta A2 Motorway (Autostrada Soarelui).

The GPS coordinates of the plant are:

44°31'54.8034" North latitude
27°23'05.9274" East longitude.

Figure 2: Chemgas 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.

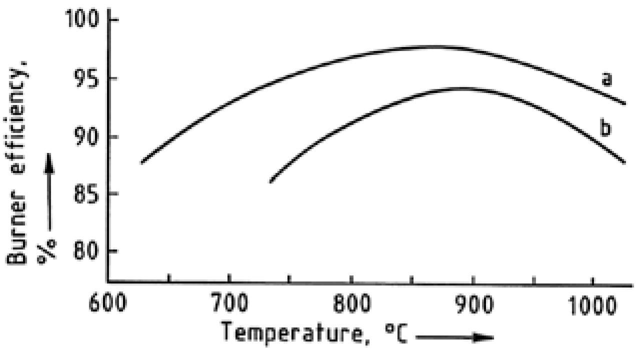

Figure 3: Conversion of ammonia to nitrogen monoxide on platinum gauze as a function of temperature at (a) 100 kPa; (b) 400 kPa

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 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:

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

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 costs (summarized in Annex 4) as compared to other approaches.

Chemgas has decided that, given successful baseline monitoring implementation and registration as a JI project, it shall install a secondary catalyst system and has selected BASF as the 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 minimum expected removal efficiency is 83%). Besides 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 no increase in NO_x emissions.

There are several secondary catalyst suppliers who offer essentially the same technical approach (high temperature N_2O heterogeneous decomposition). At the moment of purchase, Chemgas will re-evaluate performance and cost advantages of the BASF system vis-à-vis others available at that moment 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.
Chemgas and BASF (or other selected supplier) will ensure that the N_2O abatement catalyst is returned to the supplier at the end of its useful life and refined, recycled or disposed of according to the prevailing EU standards.

Once installed, the catalyst itself and the automated measuring system (AMS) will be operated by the local Chemgas employees. All project participants will work together in training Chemgas 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 whose sole purpose is to reduce the N_2O emissions inside the ammonia burner, and beneath the primary catalyst..

Due to the 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 is stated 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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Based on the above, the estimated amount of emission reductions over the first crediting period of the Kyoto Protocol is the following:

	Years
Length of the crediting period	1 year 1 months
Year	Annual estimated emission reduction in tonnes of CO_2e
Year 2012	538,014
Total estimated reductions (tonnes of CO_2e)	538,014
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	645,617

Subject to approval by the host country, the crediting period may be extended beyond the first crediting period of the Kyoto Protocol. Estimated amount of emission reductions for the 8-year period after 2012 is the following:

	Years
Length of the crediting period	8 years
Year	Annual estimated emission reduction in tonnes of CO2e
Year 2013	627,683
Year 2014	645,617
Year 2015	645,617
Year 2016	627,683
Year 2017	627,683
Year 2018	627,683
Year 2019	627,683
Year 2020	627,683
Total estimated reductions (tonnes of CO_2e)	5,057,334
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	632,167

These estimated amounts are calculated on the basis of Chemgas plant road map figures: 2012 – 180,000 t/year, 2013 –175,000 t/year, 2014 – 180,000 t/year, 2015 – 180,000 t/year, 2016-2020 – 175,000 t/year, and preliminary calculations of EF_{BL} on the base of available monitoring data that resulted in emission factor equal to 13,94 kg $N_2O/tHNO_3$, taking in account that project campaign will start in March 2012.

A.5. Project approval by the Parties involved:

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LoE Ref.no. Reg. No.: 8334 / N.N./ Sep 29, 2009 of the host country DFP was issued. This section will be completed after receiving the LoA.

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 applied for JI project activities.

AM0034 version 05.1.0 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:

- Chemgas' plant limits the application of this project activity to existing nitric acid production;
- 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;
- Chemgas' 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.

Explanation and Justification for deviations from AM0034

The following aspects of the approved CDM baseline & monitoring methodology AM0034, version 05.1.0 "Catalytic reduction of N2O inside the ammonia burner of nitric acid plants" are either not applied or applied in a modified manner:

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Project Implementation Aspect	AM0034	Adjustment in JI project specific context
Determination of the permitted operating conditions	"The average historical campaign length (CL_{normal}) defined as the average campaign length for the historical campaigns used to define operating condition (the immediately previous five campaigns) (or fewer, if the plant has not been operating for five campaigns). It is used as a cap on the length of the baseline campaign. The "permitted range" for oxidation	CL_{normal} is defined on the base of the periods between the stops for partial gauze replacement. It is calculated as an average of five such periods before the start of baseline measurements. See D 1.1.4

	temperature and pressure, ammonia flow rate and ammonia to air flow ratio is to be determined using one of the following sources: Historical data for the operating range of temperature and pressure from the immediately previous five campaigns. (or fewer, if the plant has not been operating for five campaigns). In case there are abnormal campaigns identified by the project participants among these five campaigns, a request for deviation from this methodology should be submitted…".	
Cap on HNO_3 production for which ERUs can be earned	The maximum value of NAP eligible for ERU issuance shall not exceed the design capacity. "By nameplate (design) implies the total yearly capacity (considering 365 days of operation per year) as per the documentation of the plant technology provider".	The plant operates with 3 reactors instead of 4, which is different from the original design. For this reason the annual design capacity - 240000 t/year, that is established by Reception Certificate cannot be applied in this project, it is established based on the daily design capacity of the plant with dismounted reactor 1B, which is multiplied by the number of operating days per year. The updated plant design diagram show that after dismounting of reactor 1B the design capacity is 640 metric tonnes of HNO_3 per day. To ensure the conservativeness of the approach it is assumed that the plant operates 306 days per year (the longest observed period of annual activity), instead of 365 days as suggested in the methodology. This gives the annual capacity of 195,840t.

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 05.1.0; for more details please 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;
- Installation of a Non-Selective Catalytic Reduction (NSCR) DeNOx unit;
- The installation of an N_2O destruction or abatement technology:
  - Tertiary measure for N_2O destruction
  - Primary or secondary measures for N_2O destruction or abatement.

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. The installation of a NSCR DeNOx unit could also cause N_2O emission reduction. Therefore NO_X emission regulations are taken into account in determining the baseline scenario. The respective options are, inter alia
:

- The continuation of the current situation, whether a $DeNO_x$ unit is installed or not;
- Installation of a new selective catalytic reduction (SCR) $DeNO_x$ unit;
- Installation of a new non-selective catalytic reduction (NSCR) $DeNO_x$ unit;
- Installation of a new tertiary measure that combines NO_x and N_2O emission reduction.

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 #160 from 30.10.2007 the plant has a voluntary plan to implement the JI Project to reduce N2O emissions by 31.12.2014 to 150 mg/m^3. The Integrated Environmental Permit #160 from 30.10.2007 was issued for S.C. Amonil S.R.L. and has been transfered to the new holder S.C. Chemgas Holding Corporation S.R.L. with the earlier validity term and obligations by Decree No 187 from 29 March 2010.

The plant now ensures N2O reductions according to this schedule. The secondary catalyst should be installed in the terms that are stipulated by the Permit (to the end of year 2012).

In 2005, and as a consequence of Romania's negotiations to become a member of the European Union, Chemgas was granted a grace (or transition) period before having to comply with EU regulations on NO_x. This period for the implementation of NOx reduction measures ends on December 31, 2012. Chemgas plans to take corrective actions (the installation of a $DeNO_x$ system). This plan of action is included in the Integrated Environmental Permit which is valid until 31.12.2014. In accordance with this document Chemgas should reduce NOx emissions to 300 mg/m^3

Since Chemgas' 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 with the exception "continuation of the status quo" which is not 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);

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 JI 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 act over acidic species (NO_x). Although Uhde' process is more efficient than the traditional NSCR system, both technologies have significant requirements regarding space that is highly limited in Ghemgas..
- 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 the Chemgas 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 not carried out either in Romania or 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 involves substantial investment costs (summarized in Annex 4),, 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."*

Therefore 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:

See paragraph D 1.1.3

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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Chemgas Nitrous Oxide Abatement Project involves the installation of secondary catalysts the only purpose and effect of which 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 production campaign, called "initial N_2O measurement campaign for baseline determination", before project implementation.

To ensure that data obtained during the said 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 Chemgas' 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 at nitric acid plants is identified in Romania. (three projects in addition to the Chemgas project are currently being developed by InterAgro Group. Similar projects that are implemented in other Romanian nitric acid production plants: DonauChem (InterAgro Group), Asomures and Doljchim, have all been developed under the aegis of Kyoto Protocol and received LoEs from the Romanian DFP).
The nitric acid industry typically releases the N_2O generated as a by-product into the atmosphere, 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 without concurrent JI project implementation.

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

No similar projects are operating in Romania without concurrent JI project implementation.

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.

Chemgas 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 no revenue would be generated and the technology would not be installed. The secondary catalyst technology when installed will reduce nitrous oxide emissions by minimum 83% of 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 Chemgas 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 Chemgas 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	

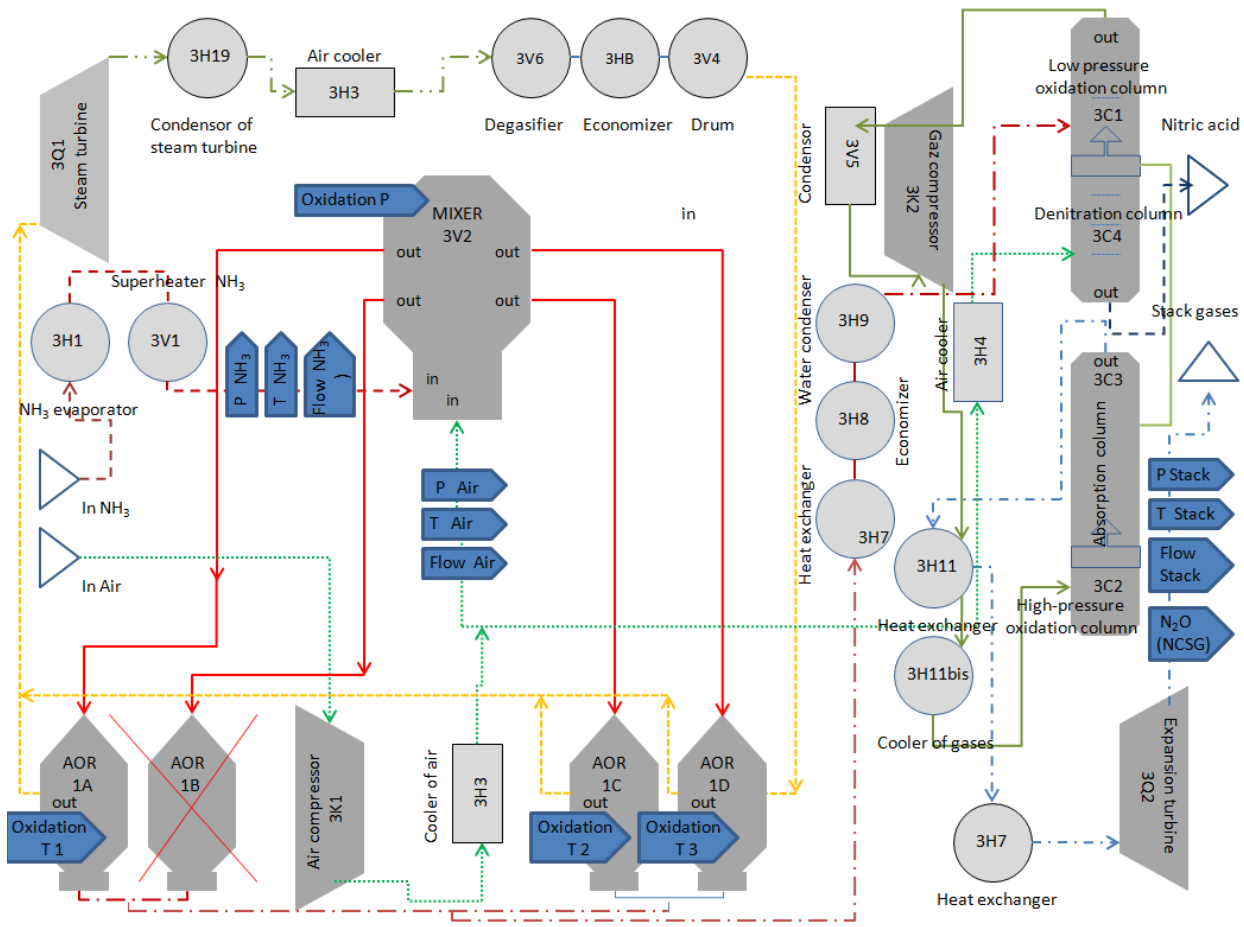

Figure 4: Project boundary

The plant currently operates with 3 AORs and reactor 1B is not applied for Nitric Acid production (and the heat exchanger of AOR has been dismounted). The plant shall not use this reactor for production to the end of crediting period.

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: 27/11/2010 (AMS startup date)
The baseline and monitoring methodology has been applied by:
Sergii Klibus, Nuria Zanzottera, and María Inés Hidalgo, MGM International (MGM Worldwide LLC,).
Tel: +380-50-221-66-55
e-mail: sklibus@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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21/04/2008. 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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The crediting period of the project shall be 8 years 10 month, of which 10 month will be within the first commitment period of the Kyoto Protocol. The status of the emission reductions after the end of the first commitment period of the Kyoto Protocol will be determined by any relevant agreement under the UNFCCC and is subject to the approval by the host Party.

Starting date of the crediting period: is March 2012, when the secondary catalyst is planned to be installed and the project is expected to start generating emission reductions.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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The Chemgas site is a large fertilizer complex. 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 production facility consists of 1 line. It includes 4 reactors (but 1 has been out of operation as from 1985, so it could be treated as normal practice), 1 compressor, 1 absorption tower, 1 stack. The plant is dual pressure plant (medium pressure in AOR 2,7 – 3,5bars (P_{abs}), high pressure in Absorption tower –8,0-9,0 bars (P_{abs})).The nitric acid plant is operated by a centralized automated control system[2]; 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 9001 standard procedures. Chemgas meets the requirements of the ISO 9001 quality system. It is confirmed by certificate #1859 of 21.12.2009 issued by AEROQ S.A. certified organisation and valid till 02.11.2011. This certificate was issued for Amonil, the legal successor of which is Chemgas. The certificate is currently in the process of reissuance to Chemgas.

The proposed JI project will be closely monitored, metered and recorded in accordance with methodology AM0034 ver.3.4. The management and operation of the proposed nitrous oxide abatement project will be the responsibility of Chemgas' plant. The emission reductions will be verified at least annually by an independent entity, which will be an Accredited Independent Entity (AIE) and the national technical authority (NEPA), through its subordinated units (county agencies for environmental protection-EPAs). The reports will be submitted to the Romanian DFP (Ministry of Environment and Sustainable Development) and processed in accordance with National JI Track I Procedure.

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

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

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 on 1 second basis and used for calculation of one hour averages.
Source of data to be used:	N_2O analyzer. The values are scanned every 1 second 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 ABB online analyzers URAS 2000 type that include URAS 26 on-line analyzer module (non dispersive infrared principle) on dry basis. A gas stream is continuously drawn from the stack by the sampling system under proper conditions, 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:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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. The values are scanned every 1 second and used for calculation of one minute averages.
Source of data to be used:	Gas volume flow meter.
Value of data applied (for ex ante calculations/determination)	
Justification of the choice of data or description of measurement methods and	Differential Pressure flow sensor SDF-22 with pressure transmitter Model 265DS. The values are scanned on 1 second basis and used for calculation of one minute averages. The values are measured under wet conditions. At the same time, preliminary measurements show that moisture content in the

procedures actually applied:	stack is negligibly small. If this statement is confirmed by QAL2 results, the conditions will be considered as dry. Otherwise values will be recalculated by methodology recommended in QAL2 report.
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 records and on paper for at least 2 years after the end of the project activity.

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:	Pressure transmitters with thermoresistance PT100 range 0-150^{o}C 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 records and on paper for at least 2 years after the end of the project activity.

Data/Parameter:	**PSG (Pressure of the Stack Gas)**
Data unit:	Pa
Description:	Pressure of the stack gas during 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 every 2 seconds 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:	Type DMU01ST pressure transmitter, range 0-0,16 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 records and on paper for at least 2 years after the end of the project activity.

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 a relay that controls electromagnetic valves of ammonia input before the mixer. If the plant valve is opened the plant status is ON, otherwise plant status is OFF. Since plant does not keep the records of valve status, the oxidation temperature is used during emission factor and emission reductions calculations for crosscheck of plant status. If hourly oxidation temperature value is lower than 750^{o}C, plant status is treated like OFF for such monitored hour..
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 records and on paper for at least 2 years after the end of the project activity.

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)	1) Production on the base of production road map: 2012 – 180000 t/year, 2013 – 175000 t/year, 2014 – 2015 - 180000 t/year, 2016 - 2020 – 175,000 t/year. The plant design diagram states that after dismounting reactor 1B the design capacity is equal to 640 metric tonnes of HNO_3. To ensure the conservativeness of the approach it is assumed that the plant operates 306 (the longest observed period of annual activity) days per year, instead of 365 days as suggested in the methodology. This gives an annual capacity of 195,840t.
Justification of the choice of data or description of measurement methods and procedures actually applied:	The determination of diluted nitric acid production by shift is made by means of a float-type level sensor, installed on each nitric acid tank. At the same time, production HNO_3 concentration is determined on an hourly basis in the laboratory. Production acid temperature is continuously measured and recorded by the control panel instruments. Acid density is determined from the Grand Paroise tables, depending on concentration and temperature. The foreman calculates the quantity of acid, expressed in 100%, produced during that shift and records it in the Daily Production report. In order to control these figures, the Crosschecking calculation of the nitric acid production amount is performed at the end of each month. Information that specifies month-end stock, incoming quantities, outgoing quantities and month-end stock is accumulated by the Production Department. On the basis of this information and information on daily production, the Production Department generates a “Production report” Based on this report, this same Department carries out the calculations and completes the “Nitric Acid production Crosscheck table” correlating the production of nitric acid with ammonia consumption. The calculated value of ammonia consumption is compared to the value measured by the flow meters and finally with nitric acid production registered by the main method. If production deviation, calculated by means of both methods, is below 5%, then it is considered that the nitric acid production measured by float and level gauge system is confirmed. Otherwise, an additional internal inquiry should be performed.
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 records and on paper for at least 2 years after the end of the project activity.

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. 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:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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 before 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. This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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)	124,992 t N_2O. Estimated amount which is calculated using the estimated value of N_2O baseline emissions, considering an N_2O abatement efficiency of 83% 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 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)	0.00237 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 83% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of	Calculated from monitored data on the basis of methodology

measurement methods and procedures actually applied:	
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:	Chemgas 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 determination/monitoring	Calculated at the end of each project campaign
Source of data to be used:	Calculated from campaign emissions factors
Value of data applied (for ex	We do not use this parameter for ex-ante calculations.

ante calculations/determination)	
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)	0.00237 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 83% 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 $EF_p = EF_n$

Minimum project emission factor

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 were used. Calculated on the basis of operating temperature during operating condition periods using OT values of 3

	reactors separately. During the baseline period, control of OT parameters will be performed for each of 3 reactors separately.
Value applied (for ex ante calculations/determinations):	AOR 1A-799ºC-844ºC, AOR 1C – 779 -821, AOR 1D - 791 -840 (on the basis of the historical data before the date of AMS installation, and will be updated after the start of baseline campaign for the verification purposes).
Justification of the choice of data or description of measurement methods and procedures actually applied:	Chemgas has adequate historical registers for operating parameters; thus, historical data from date of installation of the first gauze that is used for CL_{normal} determination to the date dismounting of the last (fifth) gauze are used to determine normal oxidation temperature. Reactor temperature is measured by measuring loops in each reactor consisting of: PtRh-PT thermocouple type S ITDR Pascani and Temperature transmitter type S. Value in PDD is calculated on the basis of the data until the date of AMS installation, and will be updated after the start of baseline campaign for verification purposes.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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:	Values from plant design diagram and internal production manual are applied.
Value applied (for ex ante calculations/determinations):	170,000-250,000 Pa
Justification of the choice of data or description of measurement methods and procedures actually applied:	Pressure at the oxidation reactors is not a process control parameter, therefore values from plant design diagram and internal production manual are applied. Pressure is measured by an in-line Honeywell smart pressure transmitter model ST3000 with 0-4 bar measuring range.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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):	8,553 kg NH_3/hour (on the basis of the historical data before the date of AMS installation, and will be updated after the start of baseline campaign for the verification purposes).
Justification of the choice of data or description of measurement methods and procedures actually applied:	Chemgas has adequate historical registers for operating parameters; thus, historical data from date of installation of the first gauze that is used for CL_{normal} determination to the date dismounting of the last fifth gauze are historical data from date of installation of the first gauze that is used for CL_{normal} determination to the date dismounting of the last (fifth) gauze used to determine the maximum ammonia flow rate. Value in PDD is calculated on the basis of the data until the date of AMS installation, and will be updated after the start of baseline campaign for verification purposes. The flow is measured by Honeywell ST 3000 smart pressure transmitter model STG94L
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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):	8,6732 % (kgNH3/(kgNH3+kgAir) (on the basis of the historical data before the date of AMS installation, and will be updated after the start of baseline campaign for the verification purposes).
Justification of the choice of data or description of measurement methods and	Chemgas has adequate historical registers for operating parameters; thus historical data from date of installation of the first gauze that is used for CL_{normal} determination to the date dismounting of the last (fifth) gauze are used to determine maximum ammonia to air flow ratio. Air flow to the oxidation reactor is measured by Honeywell ST 3000 smart pressure transmitter model STG94L.

procedures actually applied:	The ammonia to air ratio is calculated on the basis of the actual flow analysis from the individual streams (ammonia and air). Value in PDD is calculated on the basis of the data until the date of AMS installation, and will be updated after the start of baseline campaign for verification purposes.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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):	61,082 tonnes 100% HNO_3 (on the basis of the historical data before the date of AMS installation, and will be updated after the start of baseline campaign for the verification purposes).
Justification of the choice of data or description of measurement methods and procedures actually applied:	Chemgas has adequate historical registers for operating parameters. CL_{normal} is defined on the base of the periods between the stops for partial gauze replacement. It is calculated as an average of five such periods before the start of baseline measurements
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 records and on paper for at least 2 years after the end of the project activity.

Data/Parameter:	**GS_{normal}(Normal Gauze Supplier)**
Data unit:	
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, AMCO Otopeni
Justification of the choice of data or description of measurement methods and procedures actually applied:	Chemgas has adequate historical registers for operating parameters; thus gauzes that were used during the period of determination of permitted operating conditions are used to determine the normal gauze supplier.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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
Value applied (for ex ante calculations/determinations):	Pt 90 - 95% Rh 10- 5 %
Justification of the choice of data or description of measurement methods and procedures actually applied:	Chemgas has adequate historical registers for operating parameters; thus, gauzes that were used during the period of determination of permitted operating conditions are used to determine normal gauze composition.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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.
Value of data applied (for ex ante calculations/determination)	Will be defined during baseline campaign
Justification of the choice of data or description of measurement methods and procedures actually applied:	N_2O concentration is measured by ABB online analyzers URAS 2000 type which include URAS 26 on-line analyzer module (non dispersive infrared principle) on dry basis. A gas stream is continuously drawn from the stack by the sampling system under proper conditions, and driven to the infrared cell.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) are performed automatically. Staff will be trained to control this procedure.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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)	Will be defined during baseline campaign
Justification of the choice of data or description of measurement methods and procedures actually applied:	Differential Pressure flow sensor SDF-22 with pressure transmitter Model 265DS. The values are scanned on 1 second basis and used for calculation of one minute averages. The values are measured under wet conditions. At the same time, preliminary measurements show that moisture content in the stack is negligibly small. If this statement is confirmed by QAL2 results, the conditions will be considered as dry. Otherwise values will be recalculated by methodology recommended in QAL2 report.

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 records and on paper for at least 2 years after the end of the project activity.

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 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:	Pressure transmitters with thermoresistance PT100 range 0-150^{o}C 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 records and on paper for at least 2 years after the end of the project activity. 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 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 pressure transmitter Type DMU01ST, range 0-0,16 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 records and on paper for at least 2 years after the end of the project activity. The values are scanned every 2 seconds and used for calculation of one minute averages.

Data/Parameter:	**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)	Will be defined during baseline campaign.
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 records and on paper for at least 2 years after the end of the project activity.

Data/Parameter:	**NAP_{BC} (Nitric Acid Production)**
Data unit:	$tHNO_3$
Description:	Total nitric acid production (100% concentrated) during the baseline campaign
Time of	Over the period of the baseline campaign and will be verified during the verification visit.

determination/monitoring	
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)	Will be defined during baseline campaign.
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:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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 are 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 Honeywell T3000 controller transmitter type STD964
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 records and on paper for at least 2 years after the end of the project activity.

Data/Parameter:	**UNC (Overall Uncertainty of the Monitoring System)**
Data unit:	4,37 %
Description:	Overall measurement uncertainty of the monitoring system
Time of determination/monitoring	Will be defined on the basis of the report of the QAL2 test performed during the baseline. 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)	Will be defined on the base of QAL2 test
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 and N_2O analyzer.
QA/QC procedures to be applied:	QAL2 performed by an ISO 17025 accredited lab.
Any comment:	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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 are measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of	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 Honeywell T3000 controller transmitter type STD964

measurement methods and procedures (to be) 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 records and on paper for at least 2 years after the end of the project activity.

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 between two maintenance stops when one or several new catalytic gauze(s) layer is(are) installed.
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:	Production log. Calculated on the basis of recorded daily values, compiled for the entire period.
Value of data applied (for ex ante calculations/determination)	Will be defined during baseline campaign.
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 records and on paper for at least 2 years after the end of the project activity.

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 are 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 in each reactor by PtRh-PT thermocouple type S ITDR Pascani and Temperature transmitter type S. The plant has 3 active reactors with one thermocouple each, the OT parameter is controlled for each reactor separately .
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 records and on paper for at least 2 years after the end of the project activity.

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 are 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:	Air pressure is used to determine OP_h. Pressure is measured by an in-line Honeywell ST 3000 smart pressure transmitter model STG94L with measuring range 0-4 bar.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant' maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic records and on paper for at least 2 years after the end of the project activity.

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.
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	This information will be available in electronic records and on paper for at least 2 years after the end of the project activity. Recorded once.

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 records and on paper for at least 2 years after the end of the project activity.

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)	756,245-777,852 t N_2O (for a complete year). The final value will be calculated for baseline and each 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 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)	0.01394 t N_2O/t 100% HNO_3. The final value will be calculated for baseline and each project campaign.
Justification of the choice of data or description of	Calculated from monitored data on the basis of the methodology

measurement methods and procedures actually applied:	
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):

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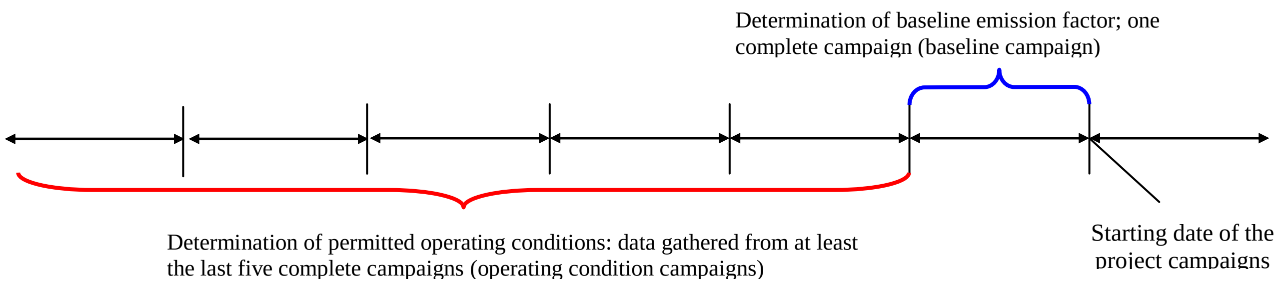
Baseline emission procedure

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:



Ammonia oxidation catalysts at Chemgas plant consist of 3 platinum gauze layers. During historical operation of the plant the gauzes were periodically replaced, one or two gauze layers at a time, in the following way. One or two of the oldest gauze layers (at the end of the operational lifetime) were removed from the bottom of the gauze pack, while one or two new gauze layers were added on the top of the pack. The other gauze layer(s) remained in the reactor but moved down to a lower position (see Fig. #5). The same procedure was performed on all 3 reactors simultaneously, so 3 to 6 gauze layers were replaced during one maintenance stop (1 or 2 gauze layers in each reactor).

Thus, the definition of a campaign as provided in AM0034 is not applicable to the historic operation of the plant.

CL_{normal} is defined on the base of the periods between the stops for partial gauze replacement. It is calculated as an average of five such periods before the start of baseline measurements.

Permitted operating conditions for oxidation temperature, ammonia flow rate and ammonia to air flow ratio in this project are determined on the base of historical data for the corresponding operational parameters over the period that is used for CL_{normal} determination.

Oxidation pressure was not a process control parameter and was not monitored on a routine basis. The permitted operating range for oxidation pressure is determined based on the plant design data.

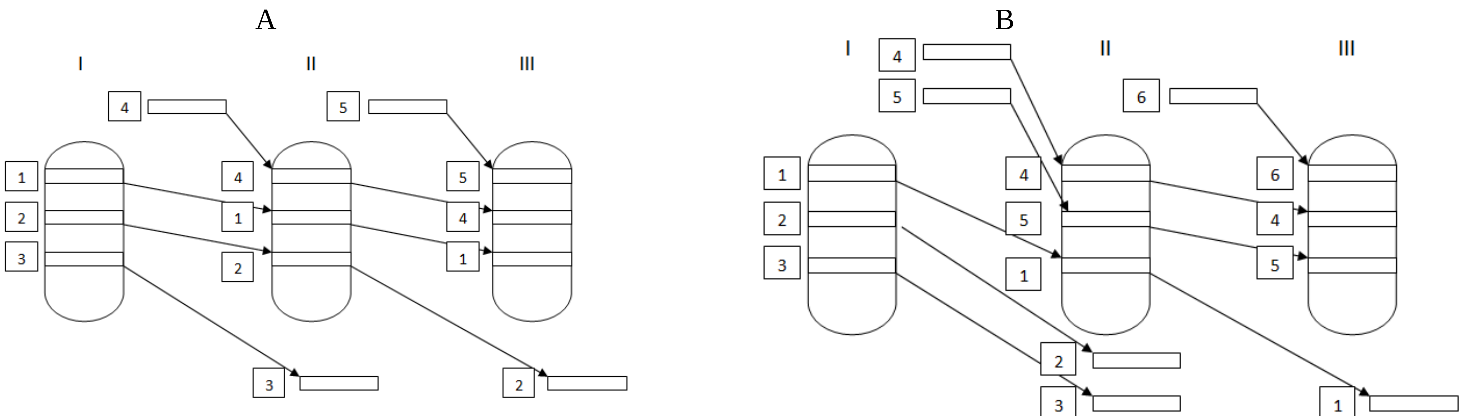


Figure 5: Gauze replacement diagram

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

Oxidation temperature

Historical data are used to calculate the "permitted range of operating conditions", this range is determined through a statistical analysis in which the time series data are to be interpreted as a sample for a stochastic variable. All data that fall within the upper and lower 2.5% percentiles of the sample distribution are 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).
Historical data is calculated on the basis of operating temperature during operating condition periods using OT values of 3 reactors separately. During the baseline period, control of OT parameters will be performed for each of 3 reactors separately.

Oxidation pressure
Pressure at the oxidation reactors is not a process control parameter, therefore values from plant design diagram and internal production manual are applied.

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

Chemgas has adequate historical registers for operating parameters to determine the upper limits for ammonia flow rate and ammonia-to-air ratio; thus, historical data from date of installation of the first gauze that is used for CL_{normal} determination to the date dismounting of the last (fifth) gauze are used to determine the maximum ammonia flow rate. Value in PDD is calculated on the basis of the data until the date of AMS installation, and will be updated after the start of baseline campaign for verification purposes.

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.

Composition of the ammonia oxidation catalyst

In the case that in the Chemgas 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.

Campaign length

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 between two maintenance stops when one or several new catalytic gauze(s) layer is(are) installed, the oldest gauze layer(s) is(are) removed .

Historic campaign length

The average historic campaign length (CL_{normal}) is defined in accordance with rule mentioned in section D1.1.4 of the PDD.

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 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):

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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):

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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.[3]

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

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No leakage calculation is required.

[3] The plant design diagram states that after dismounting reactor 1B the design capacity is equal to 640 metric tonnes of HNO_3. To ensure the conservativeness of the approach it is assumed that the plant operates 306 (the longest observed period of annual activity) days per year, instead of 365 days as suggested in the methodology. This gives an annual capacity of 195,840t.

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

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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):

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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
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

To estimate EF_p 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

$$EF_p = \frac{PE_n}{Cl_n}$$

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_n	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:

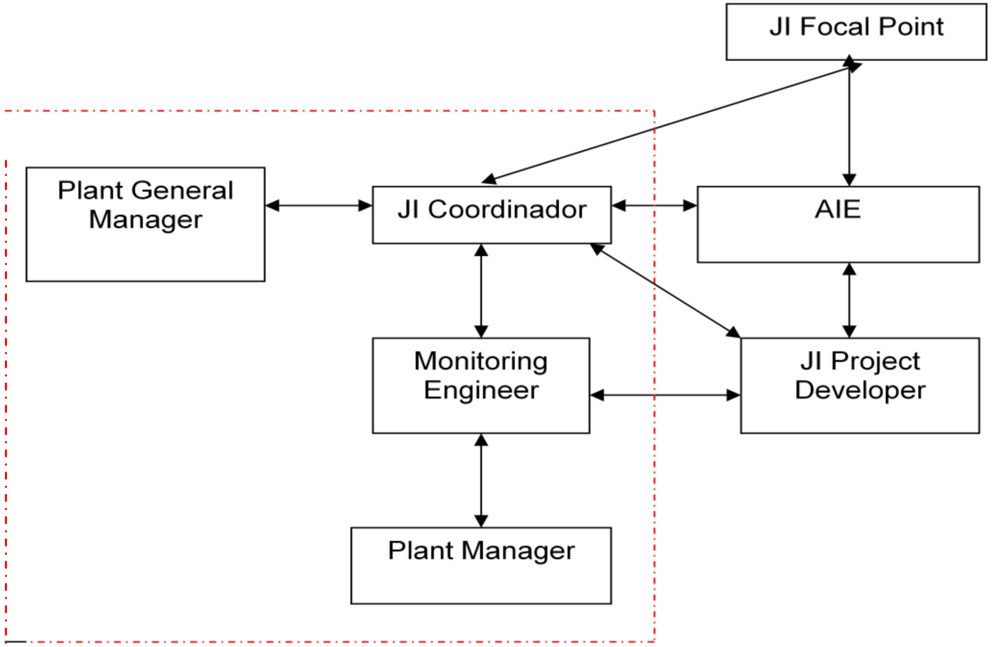
>>

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:

Sergii Klibus, Nuria Zanzottera, and María Inés Hidalgo, MGM International (MGM Worldwide LLC).
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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:

a) The estimated amounts are equal to Chemgas plant road map figures: 2012 – 180,000 t/year, 2013 – 175,000 t/year, 2014 – 180,000 t/year, 2015 – 180,000 t/year, 2016-2020 – 175,000 t/year;

b) The potential technology provider (BASF) indicates that the estimated reduction efficiency to be achieved as a consequence of project implementation is 83%. (EFP = 0.17* EFBL);

c) EF_{BL} (on the base of available monitoring data) is equal to 13,94 kg $N_2O/tHNO_3$and preliminary calculations of EF_{BL} on the base of available monitoring data that resulted in emission factor equal to 13,94 kg $N_2O/tHNO_3$

$$PE_n = EF_{BL} \cdot 0{,}17 \cdot NAP_n \cdot GWP_{N_2O}$$

Where

PE_{annual}	Project emissions during the vintage year of th$_e$ project activity, tCO_2
EF_{BL}	Baseline campaign 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

For example, for years 2016-2020:

$$PE_n = 0.01394 \cdot 0{,}17 * 175{,}000 \cdot 310 = 128{,}562\, tCO_2e / year$$

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 ex ante emission factor (EF_{BL})

$$BE_{annual} = EF_{BL} \cdot NAP_{annual} \cdot GWP_{N_2O}$$

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

For example, for years 2016-2020:

$$BE_{annual} = 0.01394 \cdot 175{,}000 \cdot 310 = 756{,}245 tCO_2e / year$$

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

For example, for years 2016-2020:

$$ER_{annual} = (0.01394 - 0.00237) \cdot 175{,}000 \cdot 310 = 627{,}683 tCO_2e / year$$

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

>>

Years	**Estimated project activity emissions (tonnes of CO_2 equivalent)**	**Estimated leakage (tonnes of CO_{2e} equivalent)**	**Estimated baseline emissions (tonnes of CO_2 equivalent)**	**Estimated emission reductions (tonnes of CO_2 equivalent)**
2012	110,196	-	648,210	538,014
2013	128,562	-	756,245	627,683
2014	132,235	-	777,852	645,617
2015	132,235	-	777,852	645,617
2016	128,562	-	756,245	627,683
2017	128,562	-	756,245	627,683
2018	128,562	-	756,245	627,683
2019	128,562	-	756,245	627,683
2020	128,562	-	756,245	627,683
Total	1,146,035	**-**	6,741,384	**5,595,349**

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:

>>

In accordance with Government Decision no. 445/2009 on the environmental impact assessment of certain public and private projects, it is not necessary to perform an EIA for this JI project. This is confirmed by

Ialomita Regional environmental agency decision N1377/09.03.2011 regarding the Environmental Impact Assessment of the project.

Nevertheless, for Chemgas an environmental impact study was voluntarily carried out by SC IPROCHIM SA Bucharest in September 2010 (Nr of project MD 1002.02).

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, the impact is placed at an insignificant level.

Due to Chemgas plant modernization, the air quality in the area will improve. This will have a positive impact on 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:

>>
.

SECTION G. Stakeholders' comments

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

>>
In accordance with Romanian legislation it is not necessary for Chemgas to carry out a stakeholders' comment process. Nevertheless, information on this project was published in the local newspaper, Tribuna Ialomitei (04 March 2011). No comments have been received on these articles.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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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 on the base of available monitoring data are listed in the following table:

Parameter	Estimated value for Chemgas Plant
Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h (VSG_{BC})	94,984
Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3 ($NCSG_{BC}$)	4,047
Baseline emission factor, in $tN_2O/tHNO_3$ (EF_{BL})	0.0139
Nitric acid production during the available baseline measurement period, in $tHNO_3$ (NAP_{BC} $tHNO_3$)	30,430
Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment, % (UNC, QAL2 results)	4.37
Number of operating hours in the available baseline measurement period, in h (OH GWP_{N_2O})	1,151
Nitric acid production during the vintage year of the project activity, th. tHNO3/year (NAP_{annual})	180 (2012), 175 (2013), 180 (2014-2015), 175 (2016-2020)
Secondary catalyst efficiency, % (R_{Eff})	83
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 Chemgas 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[4]) using technologies and procedures in accordance with AM0034: "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants".

[4] 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 plant is currently ISO 9001/2000 certified. The monitoring working procedures (deployed according to the current monitoring plan and being an integral part of it) are fully integrated into Chemgas' 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 are the points of the plant with easy access behind the gas expander turbine where the gas flow streams are consistent. To secure proper correct selection of the sample points, in Chemgas they have been determined by an accredited institution SGS Nederland BV.

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 hourly averages, which are stored in the electronic media.

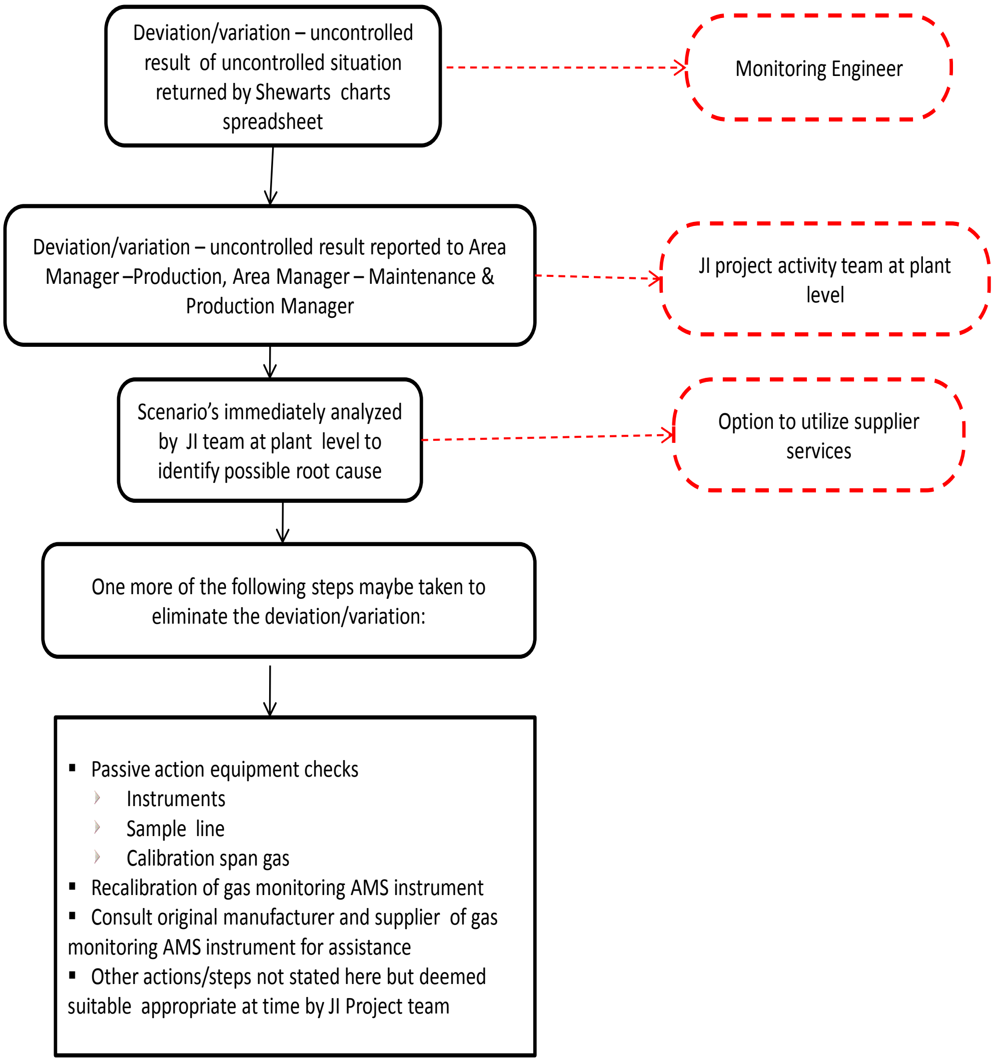
The system is designed to be operated automatically and for the daily operation of the system an operator is not required. However, the monitoring engineer will ensure that the system is in normal operation and take necessary action to follow the MP. The data acquisition and processing system is protected 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.
The monitoring data are stored simultaneously on several hard disks to prevent the loss of data in case one hard disk fails. The 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 the end of the 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 are 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.

In the event that the monitoring system is down, the lowest between the conservative IPCC (4.5 kg N_2O / ton nitric acid) or the last measured value will be valid and applied for the downtime period for the baseline emission factor, and the highest measured value in the campaign will be applied for the downtime period for the campaign emission factor.

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 Chemgas 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

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

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 1st 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.

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

Chemgas has installed ABB automated monitoring system (AMS)

ABB AMS consist of N_2O analyzer, sample probe, sample conditioning system, SDF flow sensor (for stack gas flow measurement) and Data Acquisition System: ITBK EMI3000

1. Analyzer system

The ABB AO2000 URAS 26 analyzes N_2O concentration in gas mixes continuously on dry basis

The URAS 26 is a continuous NDIR industrial photometer that can selectively measure concentrations of up to four compounds. In this system it is equipped for the measurement of N_2O only. The analyzer quipped with gas-filled opto-pneumatic cell. The cell is filled by gas mixture with defined N2O concentration. Gas-filled calibration cells are used for automatic calibration. The analyzer has QAL1 certificate.

2. Sample conditioning system

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

3. Flow meter

The SDF flow measuring system allows continuous determination of the flow rate of stack gas on wet basis. It is performance tested according to 17.BlmSchG and "TA Luft" (test report No. 936/802015, TUV Rheinland 1993) for plants.

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

Thereby the differential pressure is continuously measured and the signal is fed to the Beckhoff DATA logger and ITBK EMI3000 – JI Data acquisition and data evaluation system.

The signal resulting from the differential pressure is proportional to the velocity of the exhaust flow gas.

The stack gas pressure and temperature are also measured separately by transmitters and fed to the DATA Logger input for further conversion of flow to normal conditions by EMI3000.

4. The data acquisition system

AMS transfers data to storage device and to the register system appointed to the project. Data aquisition and processing system are programmed by AFRISO in accordance with AM0034 version 3.

EMI3000 system can be easily configured in accordance with unit demand or operator desire. The EMI3000 software is designed to conduct all the statistical analyses and calculations required by the methodology in order to derive the baseline and project emission factors and to calculate the amount of emission reductions resulting from the project activity.
The system includes: a specially adapted personal computer; 2 hard disks with capacity of 500 GB with RAID 1 the storage scheme for auto backup of information; operating system Microsoft® Windows® SERVERTM 2003; Ethernet; MYSQL- information bases licensed control system; PCAnywhere software; operator interface, including a remote management and software for EN14181-QAL3- monitoring. The DAS displays, calculates, evaluates, prints out and stores the measured data.

The data are stored simultaneously on several hard disks to prevent the lost of data in case one hard disk fails. The functionality, the correct calculations and statistical evaluation of the EMI3000 CDM software are tested and certified by TÜV NORD.

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.

The complete EN 14181: 2004 QAL1 reports will be provided by the equipment manufacturers considering the performance characteristics as measured by a qualified Technical Inspection Authority 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 will be 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[5] 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 will be 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 Chemgas´ technical team, actively supervised all phases of installation, from system design to commissioning.

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

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 will be calculated by the equipment manufacturer on the basis of equipment performance characteristics and field conditions for Chemgas' nitric acid plant. Calculation spreadsheets from the suppliers will be available for verification. The data are 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

[5] 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.

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 Chemgas' 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.

AST will be performed on the AMS once a year. If at a later time, the DFP (Designated Focal Point) agrees that the AST is not required on a yearly basis (considering the consistent performance of the AMS), the frequency will be modified accordingly.

Annex 4

EXPECTED PROJECT COSTS

Estimated costs of the main equipment that is required for the project implementation are presented in the table below.

Equipment	Estimated cost, Euro
Automatic Monitoring System (AMS) (equipment, installation, software, etc.)	120 000
Secondary catalyst for N_2O destruction	350 000