



**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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The Abatement of N<sub>2</sub>O Emissions from Nitric Acid Production at CJSC “Severodonetsk Azot Association” (Ukraine)

Sectoral scopes to which the project pertains is chemical industry (5); Group III

Version 3

12 January 2010

**A.2. Description of the project:**

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Close Joint Stock Company (CJSC) “Severodonetsk Azot Association” (hereafter called “Severodonetsk Azot”) mainly products mineral fertilizers, ammonia and nonconcentrated nitric acid, methanol, acetic acid, products of organic synthesis.

Currently CJSC “Severodonetsk Azot Association” has four UKL-7 units of nitric acid production operated as medium pressure combustion nitric acid plants. The total design capacity is 480,000 tonnes/yr (120,000 tonnes/yr\*4 units)<sup>1</sup> based on 100% HNO<sub>3</sub>.

Nitrous oxide (N<sub>2</sub>O) 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 rest participates in undesirable side reactions that lead to the production of nitrous oxide, among other compounds.

Waste N<sub>2</sub>O 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<sub>2</sub>O 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<sub>2</sub>O inside the reactor once it is formed. The project activity aims at the catalytic destruction of most of the nitrous oxide (N<sub>2</sub>O) produced in the nitric acid plant.

The baseline scenario is determined to be the release of N<sub>2</sub>O emissions to the atmosphere at the currently measured rate, in the absence of regulations to restrict N<sub>2</sub>O emissions (currently there is no legislation requiring the limitation of N<sub>2</sub>O emissions associated with nitric acid production in Ukraine). If regulations on N<sub>2</sub>O 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<sub>2</sub>O emission factor (kg N<sub>2</sub>O/tonne HNO<sub>3</sub>) during a *complete* production campaign before project implementation. To ensure that the data obtained during the initial N<sub>2</sub>O 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<sub>2</sub>O generation and under the control of the plant operator will be monitored and compared with 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<sub>2</sub>O emissions will be monitored directly in real

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<sup>1</sup> The annual capacity specified in the technical design documents assumes 8000 operational hours per year. If 365 days of operation are assumed as suggested in AM0034, the calculated hours of operation per year will be 8760. 8000 operational hours per year refers to 330 days of operation, and this gives 480,000 tonnes per annum.



time. Additional N<sub>2</sub>O monitoring and recording facilities will be installed to measure the amount of N<sub>2</sub>O emitted by the project activity.

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

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

Severodonetsk Azot nitrous oxide abatement project has the potential to be replicated by other nitric acid plants in the country.

Starting date of a JI project on the abatement of N<sub>2</sub>O emissions at Severodonetsk Azot was 30.05.2008, when was signed the financial agreement between CJSC “Severodonetsk Azot Association” from one side and “MGM WORLDWIDE LLC” from another side on PDD development and JI project assistance according to JISC rules . In 2008 a contract for supply of the monitoring system was concluded,, MGM developed PDD and made historical verification of the project. In March 2009 AMS (ABB, Germany) was installed. In April 2009 the project baseline monitoring was started. In June 2009 QAL2 works were performed.

Crediting period of a JI project starts on 10.11.2009.

### 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)
Ukraine (host)	CJSC “Severodonetsk Azot Association” (Ukraine)	No
United Kingdom (Investor)	CGT CHEMICAL GENERAL TRADING LIMITED	No

CJSC “SEVERODONETSK AZOT ASSOCIATION” is a joint Ukrainian-American enterprise which was created in 2004 and registered (incorporated) on December 24, 2004 by Reg. # 1383121000000337, with the following purposes: investing in production modernization, increase of product output volumes, and growth in foreign trade, especially the export of fertilizers for agriculture.

The foreign trade activity was taken over from the majority shareholder, the mother company “Worldwide Chemical LLC”, a privately owned American company, founded in 1991.

Severodonetsk Azot is specializing in production and export of ammonia, mineral fertilizers, methanol, acetic acid, products of organic synthesis.

CGT CHEMICAL GENERAL TRADING LIMITED (hereinafter called CGT), is a limited liability company located and registered in the UK on 17.06.2003 (the Companies Act 1985, Company No. 4802141), under UK law. CGT will take part in financing and technical project development. The company is an experienced financing and investment company specializing as chemical product trader and supplier of new technologies.

**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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Ukraine is located in South-Eastern Europe.



Figure 1. Map of Ukraine showing project location.

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

The Luganska oblast (province) is located in the eastern part of Ukraine. It extends for 130 km from the west to the east and for 210 km from the north to the south. It borders Kharkivska and Donetsk oblasts, Ukrainian provinces; and Belgorodskaya, Voronezhskaya and Rostovskaya oblasts, Russian provinces.

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

The project is located in the city of Severodonetsk, Luganska oblast, postal code 93403. Severodonetsk is an industrial town in south-eastern Ukraine. The town is designated as a separate district within the oblast, and is located on the Seversky Donets River, approximately 110 km (72 miles) to the north-north-west from the oblast's capital, Lugansk. The estimated population is around 156,000 (as of 2006). Severodonetsk contains many factories and is also an important chemical production center. The town also has an airport.

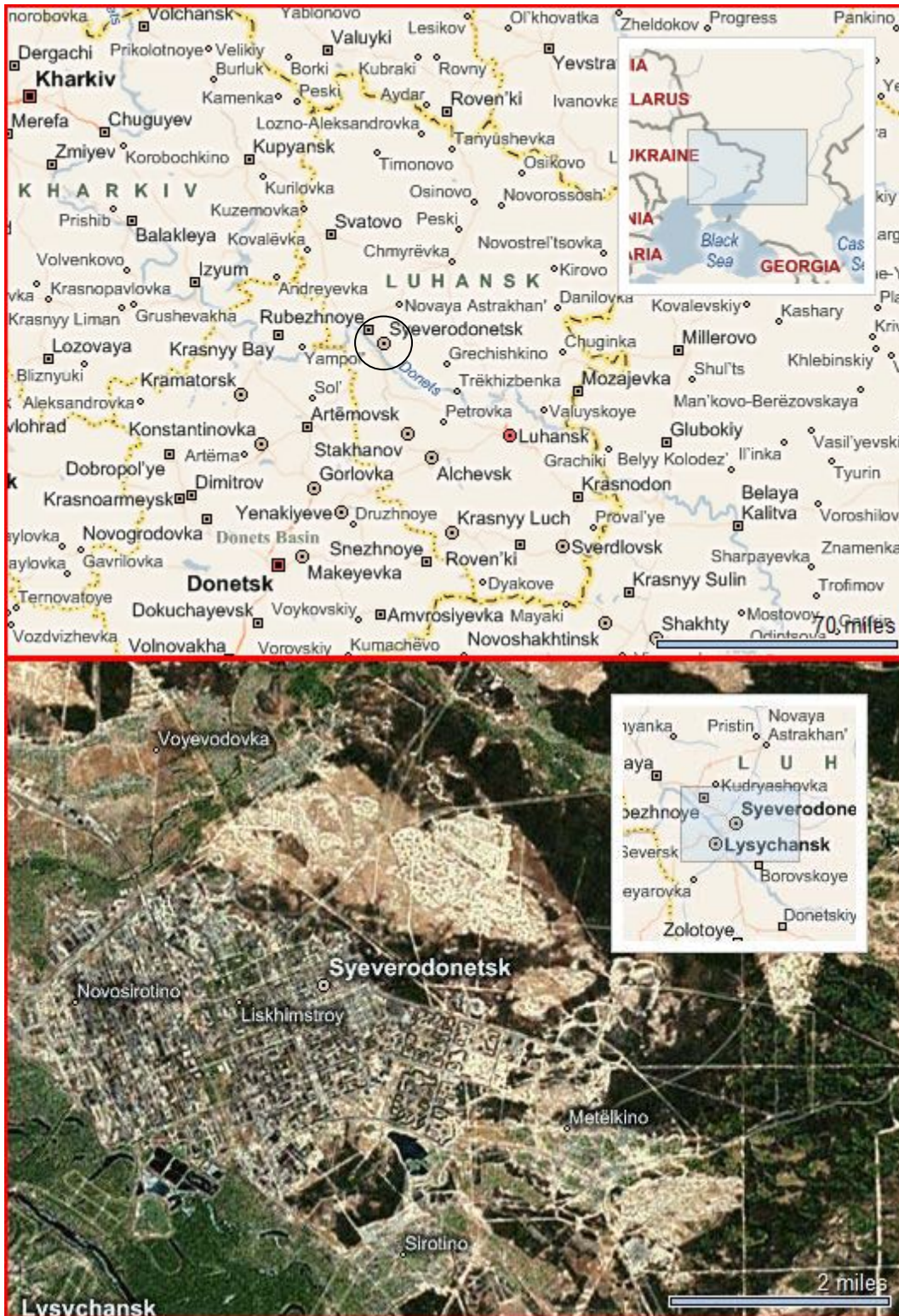


Figure 2. Map of the Lugansk oblast showing project location.

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

The GPS coordinates of the plant are:

48°56'50" north latitude

38°27'32" east longitude

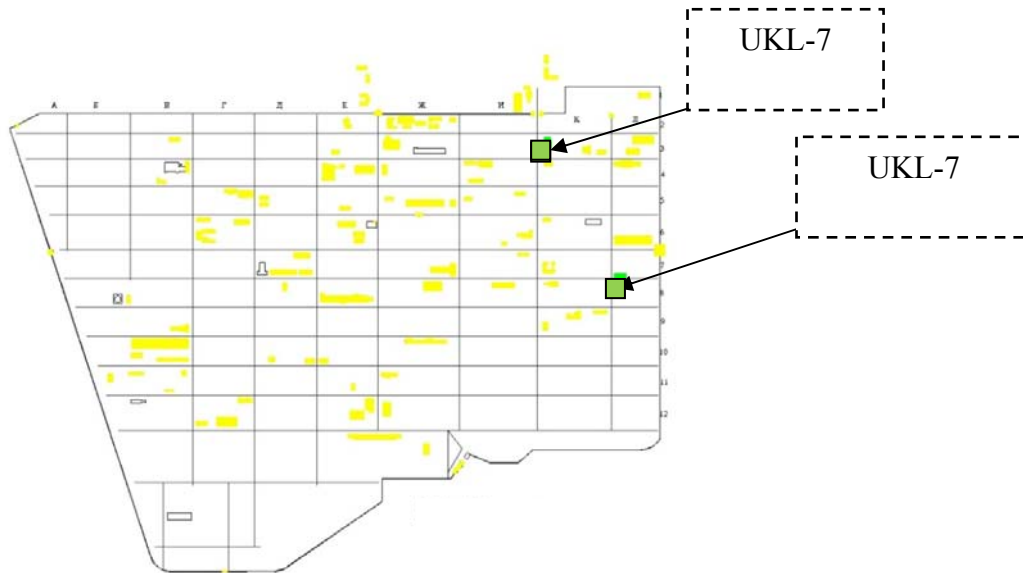


Figure 3. Severodonetsk Azot's plant locations (UKL-7).

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

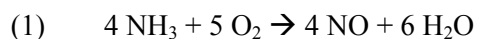
The nitric acid production facility consists of 4 lines grouped into two sets, each of them with two lines. Each set includes 2 reactors, 2 absorption towers, 2 DeNO<sub>x</sub> units, 2 tail turbines and a common stack.

**The Ostwald process**

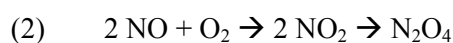
Nowadays, all commercial nitric acid is produced by the oxidation of ammonia, and subsequent reaction of the oxidation products with water, through the Ostwald process.

The basic Ostwald process involves 3 chemical steps:

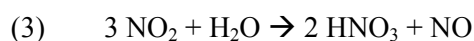
A) Catalytic oxidation of ammonia with atmospheric oxygen, to yield nitrogen monoxide (or nitric oxide).



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



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



Reaction 1 is favored by lower pressure and higher temperature. However, 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 4)<sup>2</sup>. Reactions 2 and 3 are favored by higher pressure and lower temperatures.

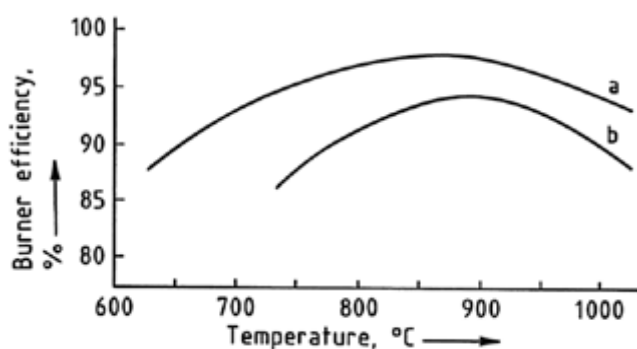


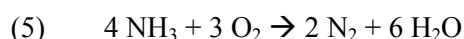
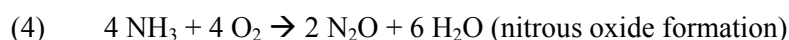
Figure 4. Conversion of ammonia to nitrogen monoxide on platinum gauze as a function of temperature at (a) 100 kPa; (b) 400 kPa.

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 rest participates in undesirable side reactions that lead to nitrous oxide (N<sub>2</sub>O), among other compounds.

Side reactions during oxidation of ammonia:



### N<sub>2</sub>O abatement technology classification

<sup>2</sup> 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.

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

Primary:  $N_2O$  is prevented from forming in the oxidation gauzes.

Secondary:  $N_2O$  once formed is eliminated anywhere between the outlet of the ammonia oxidation gauzes and the inlet of the absorption tower.

Tertiary:  $N_2O$  is removed at the tail gas, after the absorption tower and before the expansion turbine.

Quaternary:  $N_2O$  is removed following the expansion turbine and before the stack.

### Selected technology for the project activity

#### *General description*

The current project activity involves the installation of a new (not previously installed) catalyst below the oxidation gauzes, inside the reactor (a “secondary catalyst”) ( Figure 5), whose sole purpose is the decomposition of  $N_2O$ .

To reduce the  $N_2O$  formed a catalytic abatement system will be installed. In order to monitor the emission reductions generated by the project an uninterrupted automatic emission monitoring system (AMS) will be installed.

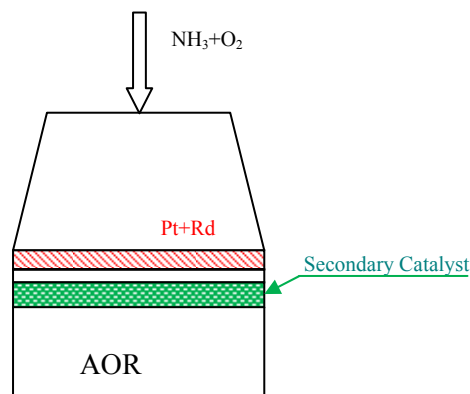


Figure 5. Location of “secondary catalyst” inside the ammonia oxidation reactor (AOR).

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.
- Capital cost is considerably lower when compared to other approaches.
- Secondary catalyst does not affect  $NO$  yield.
- Secondary catalyst does not increase  $NO_x$  emissions.

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.





Severodonetsk Azot will ensure that the N<sub>2</sub>O abatement catalyst is returned to the supplier at the end of its useful life and refine, recycle or dispose of it according to the prevailing EU standards.

The following secondary catalyst installation works will be coordinated among the catalyst supplier, CGT CHEMICAL GENERAL TRADING LIMITED team and Severodonetsk Azot staff, and will be carried out by plant technical personnel. Design and installation of a new catalyst support system or modification of the existing one, for secondary catalyst installation including choice of material, strength property, fitting scheme, and all other related documentation will be done according to prevailing rules and norms in Ukraine. Timing of the installation will be correlated with the plant and maintenance schedule.

Once installed, the catalyst itself and the automated measuring system (AMS) will be operated by the local Severodonetsk Azot employees. All project participants will work together on training Severodonetsk Azot staff 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.

Severodonetsk Azot Association” has the following JI project schedule:

- September 2008 - March 2009: installation of ABB AMS.
- 23.04.2009: the project baseline monitoring started.
- June 2009: QAL2.
- November 2009: completion of the project determination by AIE.
- December 2009: completion of the baseline monitoring.
- 10.11.2009: start of the project campaigns.
- January 2010: DFP project registration.
- 2010: first verification of the report on GHG emission reduction.

**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<sub>2</sub>O emissions, inside the ammonia burner, and beneath the primary catalyst.

Due to high temperature and the presence of the secondary catalyst, the N<sub>2</sub>O previously formed is converted into N<sub>2</sub> and O<sub>2</sub>.

N<sub>2</sub>O 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 Ukraine concerning N<sub>2</sub>O emissions. It is unlikely that any such limits on N<sub>2</sub>O emissions will be imposed in the near future.

The abatement of N<sub>2</sub>O involves significant investment. Without the project activity as a JI project activity, the N<sub>2</sub>O formed would be emitted to the atmosphere, as there are neither economic incentives nor regulatory requirements to abate N<sub>2</sub>O emissions.

From what was said earlier, it is concluded that N<sub>2</sub>O 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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Estimates of baseline emission over the crediting period are calculated taking into account the following factors:



1. The plant produced in 2008 480,000 t of nitric acid. In this PDD HNO<sub>3</sub> production after 2009 will be estimated as the same as in 2008 – 480 000 t, in 2009-80 000t
2. For baseline emission estimation the conservative IPCC default N<sub>2</sub>O emission factor for nitric acid plants which have not installed N<sub>2</sub>O destruction measures (4.5 kg N<sub>2</sub>O/t HNO<sub>3</sub>) will be used. The estimated accuracy of the monitoring system is not taken into account in the calculations. The preliminary emission factor is below the lower end of the 10-19 kg N<sub>2</sub>O/tonne HNO<sub>3</sub> range shown in the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (Chapter 3, Industrial Processes, Table 3.8, page 3.35. J Penman, D Kruger, I Galbally, T Hiraishi, B Nyenzi, S Emmanul, L Buendia, R Hoppaus, T Martinsen, J Meijer, K Miwa and K Tanabe (Eds). IPCC National Greenhouse Gas Inventories Programme. Published for the IPCC by the Institute for Global Environmental Strategies, Japan).
3. Emission reduction efficiency of the N<sub>2</sub>O catalyst is 75 % (guaranteed reduction level offered by the catalyst manufacturer - Umicore). “Severodonetsk Azot Association” reserves the right to use during project activities the most efficient N<sub>2</sub>O decomposition secondary catalyst available at the time.
4. Project campaigns are planned to start up in 10.11. 2009.

**Table 1. Estimation of expected emission reductions.**

Year	Estimate of annual emission reductions in tonnes of CO <sub>2</sub> equivalent
<b>Length of the crediting period 2009-2012</b>	4 years
2009	83 700
2010	502 200
2011	502 200
2012	502 200
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e)</b>	1 590 300
<b>Annual average over the crediting period of estimated reductions (tonnes of CO<sub>2</sub>e)</b>	489 323

<b>Length of the crediting period 2013-2018</b>	6 years
2013	502 200
2014	502 200
2015	502 200
2016	502 200
2017	502 200
2018	502 200
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e)</b>	3 013 200
<b>Annual average over the crediting period of estimated reductions (tonnes of CO<sub>2</sub>e)</b>	502 200

<b>Total number of crediting years</b>	10 years
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e) for 10 years</b>	4 603 500

The crediting period can extend beyond 2012 subject to the approval by the host Party, Ukraine.

**A.5. Project approval by the Parties involved:**

Letter of Endorsement (LoE) was issued to Severodonetsk Azot N<sub>2</sub>O abatement JI project by the Ministry of Environmental Protection on July 8<sup>th</sup>, 2007, by communication No. 7515/10/3-10. Also, the assent from the National Agency of Ecological Investments of Ukraine was taken into consideration in the decision making procedure.

## Project approval by the Parties involved

Host Party: Ukraine

Letter of Endorsement was issued by the Ukrainian Government. The Letter of Approval will be applied for.

Other Parties: United Kingdom

Letter of Authorization and Letter of Approval, with CGT CHEMICAL GENERAL TRADING LIMITED as Authorized Participant, will be applied for.

**SECTION B. Baseline****B.1. Description and justification of the baseline chosen:**

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

AM0034 Catalytic reduction of N<sub>2</sub>O inside the ammonia burner of nitric acid plant, version 03.2 (EB 41) was used as the basis to develop the baseline and monitoring methodology for the project. 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:

- Severodonetsk Azot's plant limits the application of this project activity to existing nitric acid production lines installed no later than December 31, 2005. Two lines were installed in 1976 and 2 lines were installed in 1985.
- The project activity will not result in the shutdown of any existing N<sub>2</sub>O 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<sub>2</sub>O emissions from nitric acid plants in Ukraine.
- The project activity will not increase NO<sub>x</sub> emissions.
- Severodonetsk Azot's plant has a selective catalytic reduction (SCR) DeNO<sub>x</sub> abatement system installed.
- Operation of the secondary N<sub>2</sub>O abatement catalyst installed under the project activity will not lead to any process emissions of greenhouse gases, directly or indirectly.
- Continuous real-time measurements of N<sub>2</sub>O concentration and total gas volume flow will be carried out in the stack:
  - Before the installation of the secondary catalyst for one campaign, and



- After the installation of the secondary catalyst throughout the chosen crediting period of the project activity.

The baseline methodology application first involves an identification of possible baseline scenarios, and eliminating those that would not qualify. The procedures followed for baseline scenario selection correspond to AM0028 “Catalytic N<sub>2</sub>O destruction in the tail gas of Nitric Acid and Caprolactam Production Plants” version 4.2 (EB 41) as is specified in the selected AM0034 version 03.2; for more details see the following link at the UNFCCC website:

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

The analysis of baseline scenarios involves five steps:

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

The baseline scenario alternatives should include all technically feasible options which are realistic and credible.

The first step in determining the baseline scenario is to analyze all options available to project participants. 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<sub>2</sub>O emissions. These options include:

1. 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<sub>2</sub>O.
2. Switch to an alternative production method not involving the ammonia oxidation process.
3. Alternative use of N<sub>2</sub>O, such as:
  - a) Recycling N<sub>2</sub>O as a feedstock;
  - b) Use of N<sub>2</sub>O for external purposes.
4. Installation of a non-selective catalytic reduction (NSCR) DeNO<sub>x</sub> unit<sup>3</sup>.
5. The installation of an N<sub>2</sub>O destruction or abatement technology:
  - a) Primary measure for N<sub>2</sub>O destruction;
  - b) Secondary measure for N<sub>2</sub>O destruction (the project activity);
  - c) Tertiary or Quaternary measure for N<sub>2</sub>O destruction.

For now, alternative use of N<sub>2</sub>O is not technically feasible either, due to the following reason;

First, the use of N<sub>2</sub>O for external purposes, the quantity of the tail gas to be treated is enormous compared to the amount of nitrous oxide that could be recovered.

(The N<sub>2</sub>O concentration of the tail gas for each of four units in Severodonetsk Azot’s plant is around 0.04-0.10 volume %.)

Following, as for recycling of N<sub>2</sub>O as a feedstock for the plant, nitrous oxide is not a feedstock for nitric acid production.

Therefore, these technologies have not been commercially proven and there are no markets or technologies to utilize N<sub>2</sub>O directly or indirectly in Ukraine or others country.

Next, switch to alternative production method excluding ammonia oxidation process is not prevailing and is not available to Severodonetsk Azot’s plant. Currently the method using ammonia oxidation process (Ostwald process) is predominant for manufacturing nitric acid although here had been other production methods in history.

Therefore, neither option 2. nor option 3. is a baseline scenario alternative.

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

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<sup>3</sup> A NSCR DeNO<sub>x</sub> unit will reduce N<sub>2</sub>O emissions as a side reaction to the NO<sub>x</sub> reduction, consequently, new NSCR installation can be seen as an alternative N<sub>2</sub>O reduction technology.



**Sub-step 1b:** In addition to the baseline scenario alternatives of Sub-step 1a, all possible options that are technically feasible to handle NO<sub>x</sub> emissions should be considered, since some NO<sub>x</sub> technical solutions could also have an effect on N<sub>2</sub>O emissions. The alternatives include:

6. The continuation of the current situation, where a DeNO<sub>x</sub> unit is installed;
7. Installation of a new Selective Catalytic Reduction (SCR) DeNO<sub>x</sub> unit;
8. Installation of a new non-selective catalytic reduction (NSCR) DeNO<sub>x</sub> unit;
9. Installation of a new tertiary measure that combines NO<sub>x</sub> and N<sub>2</sub>O emission reduction.

Option 8. is not accepted because it is the same as baseline scenario alternative 4. of Sub-step 1a. And currently, the NO<sub>x</sub> emissions for each of four units (with a DeNO<sub>x</sub>-unit) in Severodonetsk Azot's plant meet the NO<sub>x</sub> regulation (please see Step 2 of this section). Therefore, neither option 7. nor option 9. is a baseline scenario alternative.

As above, option 1., 4., 5. and 6. are baseline scenario alternatives.

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

Currently, there are no national regulations or legal obligations in Ukraine concerning N<sub>2</sub>O emissions. It is unlikely that any such limits on N<sub>2</sub>O emissions will be imposed in the near future. In fact, given the cost and complexity of suitable N<sub>2</sub>O destruction and abatement technologies, it is unlikely that a limit would be introduced in Ukraine considering it has ratified the Kyoto Protocol and actively participates in JI.

In accordance with Resolution № 90009 of December 27, 2007 which was issued by State Environmental authorities of Lugansk region (letter of State Environmental authorities of Lugansk №6438 of August 21, 2009), the limit for NO<sub>x</sub> emissions is set as 125 mg/m<sup>3</sup>. As Severodonetsk Azot plant has installed a SCR DeNO<sub>x</sub> unit to reduce NO<sub>x</sub> emissions the actual emissions of NO<sub>x</sub> do not exceed 100 mg/m<sup>3</sup>.

All mentioned baseline alternatives are in compliance with all relevant legal and regulatory requirements on N<sub>2</sub>O and NO<sub>x</sub> emissions. Therefore no baseline alternatives (baseline scenario alternatives 1., 4., 5. and 6.) are eliminated at step 2.

### **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 alternatives to occur 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<sub>2</sub>O destruction/abatement rate);



- Skilled and/or properly trained labor to operate and maintain the technology is not available and no education/training institution in the host country provides the needed skill, leading to equipment disrepair and malfunctioning;
- Lack of infrastructure for implementation of the technology.
- Barriers due to prevailing practice, inter alia:
  - The project activity is the “first of its kind”: no project activity of this type is currently operational in the host country or region

Sub-Step 3b: We will show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed 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<sub>2</sub>O 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), which require considerable additional costs; the investment on this system installation and the increase in operating expenses for a plant like Severodonetsk are not justifiable, because a low temperature SCR system is already in place at the plant, and effectively works with a minimum of operating costs. Recently, new catalysts for the heterogeneous decomposition of N<sub>2</sub>O at tertiary conditions have been made available on the market. At present, these alternatives lack extensive plant-scale experience; furthermore, these options require high tail gas temperatures (operational at temperatures > 450°C), hence their application at facilities that do not meet this requirement (like Severodonetsk) generates considerable fuel consumption and indirect GHG emissions.
- 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<sub>2</sub>O for external purposes: This is technically not feasible at Severodonetsk Azot’s plant, as the quantity of gas to be treated is extremely high, compared to the amount of nitrous oxide that could be recovered. The use of N<sub>2</sub>O for external purposes is practiced neither in Ukraine nor anywhere else.
- Recycling N<sub>2</sub>O as a feedstock: We may discard recycling N<sub>2</sub>O 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 in Ukraine or anywhere else.

Therefore, baseline scenario alternative 4. and 5. are excluded. It can be concluded that the continuation of current practice (baseline scenario alternatives 1. and 6..) would be a unique baseline scenario, since it does not face any barriers, while others face such barriers as described in Sub-step 3a.

#### **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 in the barrier analysis stage, involve: the continuation of the *status quo*, the installation of a new selective catalytic reduction (SCR) DeNO<sub>x</sub> unit and the installation of some form of secondary DeN<sub>2</sub>O system.

The installation of a secondary DeN<sub>2</sub>O system involves substantial investment and operational costs, and would need to provide benefits (other than JI revenue) in order to qualify as a valid baseline. 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<sub>2</sub>O.

Severodonetsk Azot's plant has currently installed a selective catalytic reduction DeNO<sub>x</sub> unit in accordance with Ukrainian and EU standards. This unit does not consume natural gas for heating the tail gas in the process of NO<sub>x</sub> decomposition and has low operational costs. Therefore, the installation of a new selective catalytic reduction DeNO<sub>x</sub> unit is not necessary.

As a result of the analysis the only feasible baseline is a continuation of the *status quo*, which meets current regulations, and requires neither additional investments nor additional running costs.

**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<sub>x</sub> or N<sub>2</sub>O emission regulations in Ukraine will be executed as follows.

**Sub-step 5a:** New or modified NO<sub>x</sub> emission regulations:

If new or modified NO<sub>x</sub> emission regulations are introduced after the project start, determination 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<sub>2</sub>O and NO<sub>x</sub> emissions;
- Continuation of baseline scenario.

For the determination of the adjusted baseline scenario the project participant should re-assess the baseline scenario and shall apply baseline determination process as stipulated above (Steps 1 – 4).

**Sub-step 5b:** New or modified N<sub>2</sub>O regulations:

If legal regulations on N<sub>2</sub>O emissions are introduced or changed during the crediting period, the baseline emissions will be adjusted at the time the legislation is legally implemented.

***In the event of re-assessment of the baseline scenario as a consequence of new NOX regulations over***



*the course of the crediting period of the proposed project activity, the re-assessment of the baseline scenario shall be undertaken using the same 5-Step process mentioned above. In such a case the additionality of the project must be re-demonstrated.*

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<sub>2</sub>O emission to the atmosphere, without the installation of N<sub>2</sub>O destruction or abatement technologies, including technologies that indirectly reduce N<sub>2</sub>O emissions (e.g., NSCR DeNO<sub>x</sub> units).

Summary:

Table 2 below shows the results of the checks of the applicability conditions of baseline methodology AM0034 against the proposed Severodonetsk Azot project activity, the object of this PDD.

Table 2: Checks of applicability conditions of baseline methodology AM0034

Applicability condition (methodology)	Concordance
1. This baseline methodology is applicable to project activities that install a secondary N <sub>2</sub> O abatement catalyst inside the ammonia burner of a nitric acid plant, underneath the precious metal gauze pack.	Condition satisfied
2. The applicability is limited to existing nitric acid production facilities installed no later than 31 December 2005.	Condition satisfied
3. The project activity shall not affect the level of nitric acid production.	Condition satisfied
4. The project activity will not result in the shutdown of any existing N <sub>2</sub> O destruction or abatement facility or equipment in the plant.	Condition satisfied
5. There are currently no regulatory requirements or incentives to reduce levels of N <sub>2</sub> O emissions from nitric acid plants in the host country.	Condition satisfied
6. No N <sub>2</sub> O abatement technology is currently installed in the plant.	Condition satisfied
7. The project activity will not increase NO <sub>x</sub> emissions.	Condition satisfied
8. NO <sub>x</sub> abatement catalyst installed, if any, before the start of the project activity is not a non-selective catalytic reduction (NSCR) DeNO <sub>x</sub> unit.	Condition satisfied
9. Operation of the secondary N <sub>2</sub> O abatement catalyst installed under the project activity does not lead to any process emissions of greenhouse gases, directly or indirectly.	Condition satisfied





<p>10. Continuous real-time measurements of N<sub>2</sub>O concentration and total gas volume flow can be carried out in the stack:</p> <ul style="list-style-type: none"> <li>• Before the installation of the secondary catalyst for one campaign, and</li> <li>• After the installation of the secondary catalyst throughout the chosen crediting period of the project activity.</li> </ul>	Condition satisfied
---	---------------------

### B.1.1. Possible variations of methodology AM0034/Version 03.2 for application to this project

In accordance with methodology AM0034 “Catalytic reduction of N<sub>2</sub>O inside the ammonia burner of nitric acid plants”/Version 03.2, the baseline emission factor should be determined directly by measuring emissions over the period of a full campaign. This methodology is developed for and applicable to nitric acid production with one reactor, one absorption tower, one turbine, one DeNO<sub>x</sub> plant and one monitoring system. But in the case of the joint-stock company “Severodonetsk Association Azot” we have four separate lines, and each of these lines includes AOR, absorption tower, turbine, DeNO<sub>x</sub> plant and monitoring system. The estimated times of the start and end of campaigns for all 4 lines do not coincide and the difference between them can be close to 3-4 months. A baseline monitoring postponement will result in a delay in project implementation, losing the possibility of reducing a considerable amount of GHG emissions. Hence, for this project, a minor modified variant of the procedure for baseline monitoring and emission factor estimation in accordance with methodology AM0034 ver.03 is proposed.

#### B 1.1.1. Overlapping of consecutive campaigns

Baseline emission measurement starts immediately after AMS installation simultaneously on each production line. The situation at the moment is as follows: on some lines baseline monitoring starts simultaneously with installation of the new catalyst gauze, on other lines it starts some time after start of run of the reduced catalyst gauze (fig. 7). In this case for some lines baseline monitoring campaign will continue during one single campaign from installation to replacement of the gauze (No. 1, fig. 7). For other lines – as summary of two successive campaigns (the first and the second) (No. 2, No.3, fig.7). Thus, overlapping of the two campaigns takes place. In this case the total (cumulative) period of the baseline monitoring will be completed as soon as the total length of the two campaigns ( $CL_{BL}$ ) will be equal to the average length of the campaign in the past ( $CL_{normal}$ ).

Thus, in order to calculate the baseline emission factor received from two separate and consecutive campaigns with identical operating modes, data will be received in the following way:

(i) Monitored data for the last “x” hours of the first campaign. (During this period, at the end of the campaign, NO production is lower and N<sub>2</sub>O emission is higher.)

plus

(ii) Monitored data for the first “y” hours of the subsequent campaign. (During this period, in the beginning of the campaign, NO production is higher and N<sub>2</sub>O emission is lower).

The baseline emission factor identifying by the shrme shown down in case of baseline monitoring by the procedure mention above.

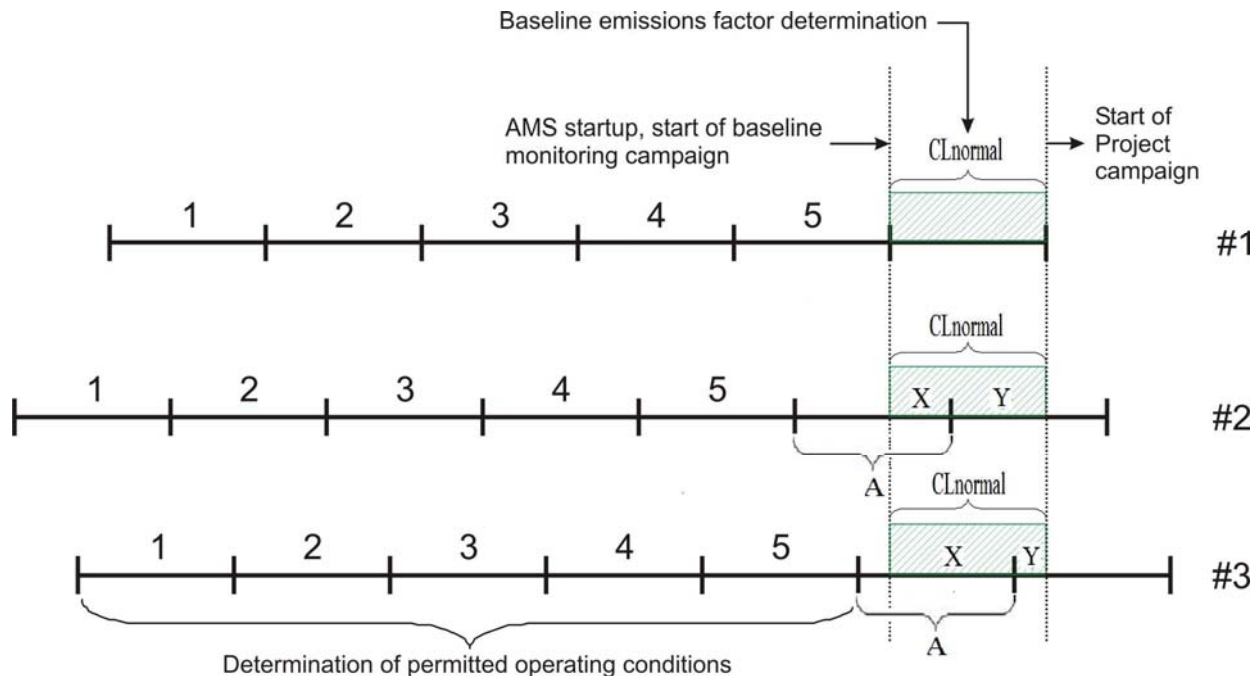


Figure 6. Determination of baseline emission factor.

In order not to overstate baseline emissions and adapt the AM0034 measures to ensure conservativeness of this approach, the following conditions shall apply:

- Limit campaign A to the average historic campaign length and
- limit the baseline measurement period to the average historic campaign length.
- Only in case campaign A does exceed the average historic campaign length, N<sub>2</sub>O values at the end of campaign A shall be eliminated.

This shall prevent the inclusion of the higher emission levels at the end of a campaign into the baseline emission factor.

#### B.1.1.2. Determination of total emission from the project

The nitric acid production plant at Severodonetsk Azot consists of four separate lines, each line has its separate monitoring system, which allows calculations all the parameters of the baseline and project campaigns. Thus, baseline and project emissions are measured separately for each production line with implementation of methodology modification. The baseline and project emission factor subject to one of the abovementioned variations should also be calculated for each line separately, and total baseline and project emission for the plant should be calculated as the sum of baseline and project emissions for each line.

The total reduction emission of project activity is the sum of project emissions for each independent line.

### B 1.1.3. Emission reduction verification

Considering that each production line is a completely independent unit that has got an individual start/stop schedule for the campaigns, emission reduction for each line will be reported separately with an individual monitoring report. Project campaigns will be executed in full accordance with methodology AM0034 ver. 03.2. All reports will be joined into one verification report over plant and will be given for whole verification audit. In case of possible overlapping of monitoring periods all reports will be executed referring to the JISC 13 “CLARIFICATION REGARDING OVERLAPPING MONITORING PERIODS UNDER THE VERIFICATION PROCEDURE UNDER THE JOINT IMPLEMENTATION SUPERVISORY COMMITTEE”, Version 01.

Any production line which has a campaign available for verification at the time of the audit will be included in the single verification report.

#### B.1.1.4. Tail gas flow measurement ( $VSG_i$ )

Assuming that as per the existing project for construction of gas ducts for the tail gas emission into the air (A.4.2. ), the tail gas from two lines shall be emitted via one stack, therefore the devices for the tail gas measurement were installed as shown on fig. 6-a, where F1 - gas volume flow meter for line №1 (line №4); F total - gas volume flow meter for lines №1+№2 (lines №3+№4). So, the tail gas volume from lines №1 and №4 is directly measured by the flowmeters. And the tail gas volume from line №2 is calculated as a difference between total tail gas volume from lines №1 and №2 minus the tail gas volume from line №1. And the tail gas volume from line №3 is calculated as a difference between total tail gas volume from lines №3 and №4 minus the tail gas volume from line №4. The automated monitoring system software (EMI3000) supports the above calculation procedure for  $VSG_i$  and all further calculations are made in compliance with the requirements of AM0034.

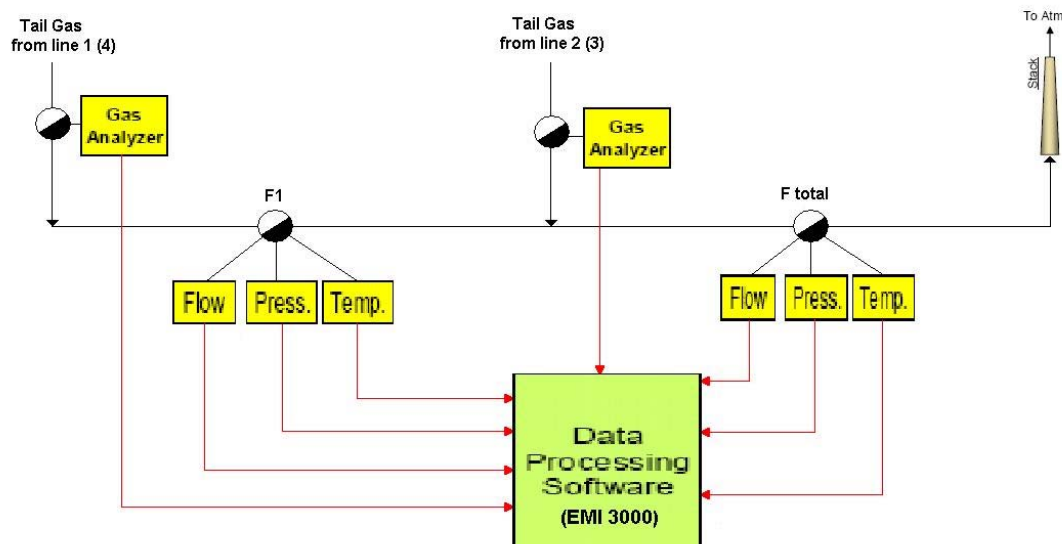


Figure 6-a. Flow meter and N<sub>2</sub>O analyzer installation scheme

**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:**

&gt;&gt;

Severodonetsk Azot's Nitrous Oxide Abatement Project involves the installation of secondary catalysts whose only purpose and effect is the decomposition of nitrous oxide once it is formed.

Following the selected methodology, project emissions are determined from N<sub>2</sub>O measurements in the stack gas of the nitric acid plant.

Baseline emissions are calculated from the baseline emission factor, which is measured before project start-up (before the secondary catalyst installation). After that, the baseline will be determined by measuring the N<sub>2</sub>O baseline emission factor (t N<sub>2</sub>O/t HNO<sub>3</sub>) before project start-up during a *complete* production campaign, (named "initial N<sub>2</sub>O measurement campaign for baseline determination"). This production campaign will be monitored by the abovementioned variant of baseline monitoring procedure.

To ensure that data obtained during such initial campaign are representative of the actual GHG emissions from the source plant, a set of process parameters known to affect N<sub>2</sub>O 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 is established considering specific control capabilities of Severodonetsk Azot's nitric acid plant. In order to properly characterize baseline emission rates, operation during such initial campaign is controlled within the specified limits.

Only those N<sub>2</sub>O 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<sub>2</sub>O 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 "Tool for demonstration and assessment of additionality" version 05.2 (EB39). We shall demonstrate that the baseline scenario is the continuation of the current situation.

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<sub>2</sub>O 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 and 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 measurement 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 “The continuation of the current situation” will require neither any additional investments costs nor any additional running costs.

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

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

#### **Step 4. Common practice analysis:**

The proposed project activity (or any other form of nitrous oxide abatement technology) is unique practice since any similar project at nitric acid plants is not implemented in Ukraine. At present time for the such projects in JSC “Azot «Cherkassy and JSC “RivneAzot” are only developed PDDs The nitric acid industry typically releases into the atmosphere the N<sub>2</sub>O generated as a by-product, as it does not have any economic value or toxicity at typical emission levels. N<sub>2</sub>O emission through the stack gas can be considered the business-as-usual activity as it is a widespread practice for all plants in Ukraine. No nitric acid plant in Ukraine has a secondary catalyst (or any other type of N<sub>2</sub>O abatement technology) currently installed. But all the projects can be provided only in case of JI components implementation because of this project is not observed as common practice, that is why proposed project considers as additional.

#### **Conclusion:**

Currently, there are no national regulations or legal obligations in Ukraine concerning N<sub>2</sub>O emissions. It is unlikely that any such limits on N<sub>2</sub>O emissions will be imposed in the near future. In fact, given the cost and complexity of suitable N<sub>2</sub>O destruction and abatement technologies, it is unlikely that a limit would be introduced by Ukraine, which has ratified the Kyoto Protocol and actively participates in JI.

Severodonetsk Azot has no need to invest in any N<sub>2</sub>O destruction or abatement another technology than it choose for project activity. 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 up to 75 % below what they would otherwise be without the catalyst technology installed.

The proposed JI project activity is undoubtedly additional, since it passes all the steps of the “Tool for demonstration and assessment of additionality (Version 5.2)”, 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<sub>2</sub>O 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 Severodonetsk Azot 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:**

&gt;&gt;

The project boundary encompasses the physical, geographical site of Severodonetsk Azot's 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<sub>2</sub>O contained in the waste stream exiting the stack. The abatement of N<sub>2</sub>O 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
<b>Baseline</b>	Nitric Acid Plant (Burner Inlet to Stack)	CO <sub>2</sub>	Excluded	The project does not lead to any change in CO <sub>2</sub> or CH <sub>4</sub> emissions, and, therefore, these are not included.
		CH <sub>4</sub>	Excluded	
		N <sub>2</sub> O	Included	
<b>Project Activity</b>	Nitric Acid Plant (Burner Inlet to Stack)	CO <sub>2</sub>	Excluded	The project does not lead to any change in CO <sub>2</sub> or CH <sub>4</sub> emissions.
		CH <sub>4</sub>	Excluded	
		N <sub>2</sub> O	Included	
	Leakage emissions from production, transport, operation and decommissioning of the catalyst	CO <sub>2</sub>	Excluded	No leakage emissions are expected.
		CH <sub>4</sub>	Excluded	
		N <sub>2</sub> O	Excluded	

Figure 7 represents the principles of nitric acid production in the production line UKL-7.

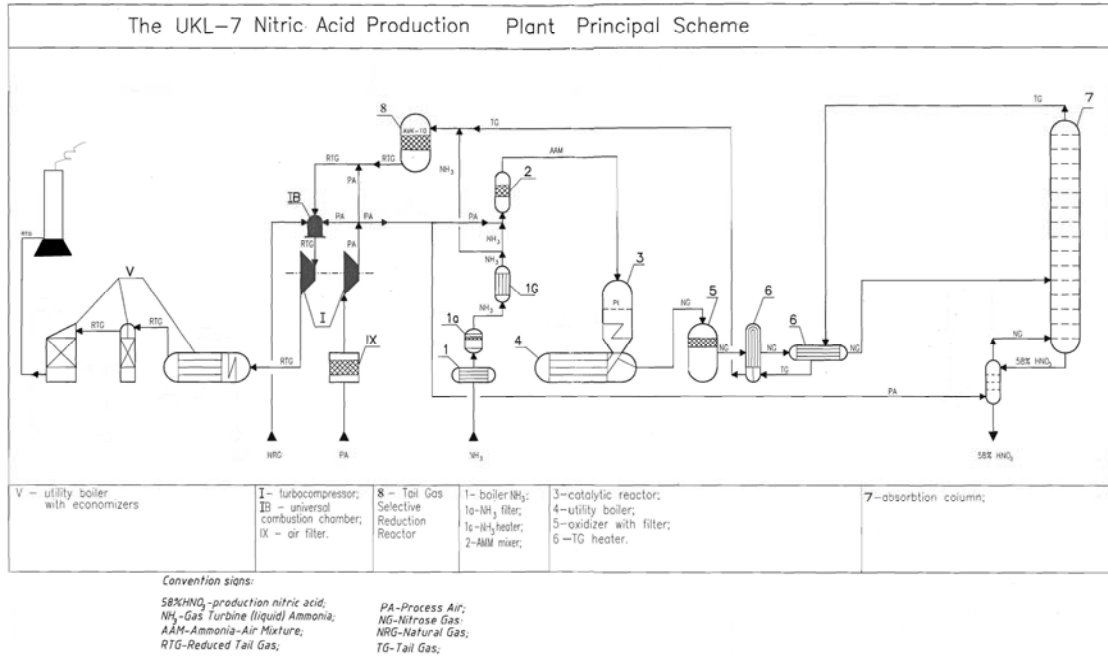


Figure 7. Project boundary.

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

Date of baseline setting: 17/12/ 2008  
 The baseline methodology has been applied by:

CJSC “Severodonetsk Azot Association” (Project Participant)  
 Dr. Kazakov Valentin V. (Kazakov@azot.lg.ua)

MGM International Group LLC (MGM International Group LLC is not a project participant)  
 Mr. Vladymyr Ivashchenko (ivladymyr @mgminter.com)  
 Mr. Walter Hügler (whugler\_@mgminter.com)  
 Ms. María Inés Hidalgo (ihidalgo\_@mgminter.com )

**SECTION C. Duration of the project/crediting period****C.1. Starting date of the project:**

30 May, 2008

**C.2. Expected operational lifetime of the project:**

21 years

**C.3. Length of the crediting period:**

&gt;&gt;10 years. Starting date of the crediting period: 10/11/2009

The first period for crediting of ERUs is from 10st November 2009 to 31st December 2012.  
Emissions Reductions Units generated for the period after the first commitment period (2008-2012) are pending any relevant agreement under the UNFCCC and approval by Ukraine.



**SECTION D. Monitoring plan****D.1. Description of monitoring plan chosen:**

&gt;&gt;

The monitoring plan follows the guidance provided in the approved monitoring methodology AM0034.

Severodonetsk Azot's plant is a large producer of mineral fertilizers and products of organic synthesis. The plant is operated by highly skilled personnel with great experience. The nitric acid production plant is equipped with an automated control system of technological process (ACS TP), destruction unit NO<sub>x</sub> and NO<sub>x</sub> online analyzer, which is maintained by highly skilled operators, providing a high standard of work quality. Technical supervision of the production process is provided by the specialized mechanical and electric automation divisions, central laboratory, and project design department.

Development of the project activity involves installation of a continuous automated monitoring system (AMS) supplied by ABB. The system is manufactured in accordance with DIN EN ISO 14956 and EN 14181 and is certified in compliance with methodology AM0034.

**The ABB AMS includes:**

1. Gas analyzer system with an Infrared Analyzer Module Uras 26. This uses non-dispersive infrared (NDIR) absorption (including probes, pipes and sample conditioning system) which will continuously measure the concentration of N<sub>2</sub>O in the stack gas of the nitric acid plant. A probe extracts the homogeneously mixed gas directly from the tail gas stream from the point in the stack at which it is pumped through gas lines to the analyzer. The probes are extracted continuously, using the pipe specially optimized to the width and height of the stack for sampling at different points.
2. Gaseous volume flow meters. These are dynamic pressure probes (model SDF flow measuring system, manufactured by Systec Controls) that use the pressure differential technique to continuously monitor the gas volume flow, temperature and pressure in the stack of the nitric acid plant. Sampling shall be carried out continuously using a multiple point sampling tube that is optimized to the specific width and height of the pipe, and the expected gas velocities near the probing point. Temperature and pressure in the stack will also be measured continuously and used to calculate the gas volume flow at the prescribed temperature and pressure. This calculation of gas volume flow at standard conditions will be carried out automatically..
3. Emission evaluation system. This presents an integrated computer system for collection, storage and processing of data. In addition to measurements of N<sub>2</sub>O concentration and normalized volumetric flow of stack gases (every 2 sec.), it includes acquisition, processing and digital transformation and automated registration of temperature and oxidation pressure in AOR (hourly), ammonia flow (continuously) and ammonia-air ratio (hourly) in accordance with methodology AM0034. Recording of the daily data of operation time of the plant and nitric acid production input is also envisaged. ACS TP flow and density meters, which are installed in each UKL-7 line, provide data for weak nitric acid (57-58%) production, which is recalculated into 100% HNO<sub>3</sub> by the ACS processing system. These data calculated and transmitted to ACS where it is digital recorded and recorded by the operator in production log.

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Measuring points for the NDIR analyzers will be placed after the recovery boiler and heat of each line before the stack gas release in atmosphere, at points with easy access. The ASM service staff of Severodonetsk Azot plant was trained in the monitoring procedures by the ABB representatives during the commissioning phase and a reliable ASM technical support infrastructure is established.

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

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

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

ID number (Please use numbers to ease cross-referencing to D.2.)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P.1	NCSG <sub>n,i</sub> N <sub>2</sub> O concentration in the stack gas in campaign <i>n</i> of line <i>i</i>	N <sub>2</sub> O analyzer	mg N <sub>2</sub> O/m <sup>3</sup> at normal conditions (101.325 kPa, 0 deg C). (converted from ppm if necessary)	m	Every 2 seconds	100%	Electronic and paper for at least 2 years	The data output from the analyzer will be processed using appropriate software
P.2	VSG <sub>n,i</sub> Volume flow rate of the stack gas in campaign <i>n</i>	Gas volume flow meter	m <sup>3</sup> /hour at normal conditions (101.325 kPa, 0 deg C).	m c	Every 2 seconds	100%	Electronic and paper for at least 2 years	The data output from the stack flow meter will be processed using

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	of line <i>i</i>							appropriate software.
<i>P.3</i>	PE <sub>n,i</sub> N <sub>2</sub> O emission <i>n</i> th project campaign of line <i>i</i>	Calculated from measured data	t N <sub>2</sub> O	c	At least once after each campaign	100%	Electronic and paper for at least 2 years	
<i>P.4</i>	OH <sub>n,i</sub> Operating hours in campaign <i>n</i> of line <i>i</i>	Production log	Hours	m	Daily, compiled for the entire campaign	100%	Electronic and paper for at least 2 years	Plant manager records the hours of full operation of the plant during a campaign.
<i>P.5</i>	NAP <sub>n,i</sub> Nitric Acid production (100% concentrate) in campaign <i>n</i> of line <i>i</i>	Production log	t HNO <sub>3</sub>	m	Daily, compiled for the entire campaign	100%	Electronic and paper for at least 2 years	Total production over project campaign
<i>P.6</i>	TSG <sub>i</sub> Temperature of the stack gas of line <i>i</i>	Probe (part of gas volume flow meter)	°C	m	Every 2 seconds	100%	Electronic and paper for at least 2 years	
<i>P.7</i>	PSG <sub>i</sub> Pressure of the stack gas of line <i>i</i>	Probe (part of gas volume flow meter)	Pa	m	Every 2 seconds	100%	Electronic and paper for at least 2 years	
<i>P.8</i>	AFR <sub>i</sub> Ammonia gas flow rate to the	Monitored	kgNH <sub>3</sub> /h	m	Continuously		Electronic records and paper for at	To be obtained from the operating

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	AOR of line <i>i</i>						least 2 years	condition campaign
<i>P.9</i>	AIFR <sub><i>i</i></sub> Ammonia to air ratio of line <i>i</i>	Monitored	%	mc	Every hour		Electronic and paper for at least 2 years	To be obtained from the operating condition campaign
<i>P.10</i>	OT <sub><i>h,i</i></sub> Oxidation temperature for each hour of line <i>i</i>	Monitored	°C	m	Every hour		Electronic records and paper for at least 2 years.	To be obtained from the operating condition campaign
<i>P.11</i>	OP <sub><i>h,i</i></sub> Oxidation Pressure for each hour of line <i>i</i>	Monitored	Pa	m	Every hour		Electronic records and paper for at least 2 years.	To be obtained from the operating condition campaign
<i>P.12</i>	EF <sub><i>n,i</i></sub> Emissions factor calculated for <i>n</i> th campaign of line <i>i</i>	Calculated from measured data	tN <sub>2</sub> O/t HNO <sub>3</sub>	c	After end of each campaign			
<i>P.13</i>	EF <sub>ma,<i>n,i</i></sub> Moving average emissions factor after campaign <i>n</i> of line <i>i</i>	Calculated from campaign emissions factors for each line	tN <sub>2</sub> O/tHNO <sub>3</sub>	c	After end of each campaign			For the first campaign EF and EF <sub>x</sub> will be equal

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<i>P.14</i>	CL <sub>n,i</sub> Campaign length of line <i>i</i>	Calculated from nitric acid production data	t HNO <sub>3</sub>	c	After end of each campaign		Electronic and paper for at least 2 years	
<i>P.15</i>	EF <sub>P,n,i</sub> Emission factor use to determine emission reductions of campaign <i>n</i> in line <i>i</i>	Determined from campaign emissions factors	tN <sub>2</sub> O/t HNO <sub>3</sub>	c	After end of each campaign			Determined from campaign emission factors
<i>P.16</i>	EF <sub>min,i</sub> Minimum emissions factor after 10 campaigns for line <i>i</i>	Determined from campaign emissions factors	tN <sub>2</sub> O/tHNO <sub>3</sub>	c	After end of 10th campaign			Determined from campaign emissions factors
<i>P.17</i>	GS <sub>project,i</sub> Gauze supplier for the project campaigns of line <i>i</i>	Monitored		m	Each campaign		Electronic records and paper for the crediting period	To be obtained during the project campaign
<i>P.18</i>	GC <sub>project,i</sub> Gauze composition during project campaigns of line <i>i</i>	Monitored		m			Electronic records and paper for the crediting period	To be obtained during the project campaign

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**D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO<sub>2</sub> equivalent):**

>>  
Actual project emissions will be determined during the project activity from continuous measurements of N<sub>2</sub>O 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<sub>2</sub>O 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 will be 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 ( $\bar{x}$ );
- 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<sub>2</sub>O concentration and total flow rate are used in the following formula (Eq. 3 from AM0034) to calculate project emissions:

$$PE_{n,i} = VSG_{n,i} \cdot NCSG_{n,i} \cdot 10^{-9} \cdot OH_{n,i} \quad (\text{Eq. 1})$$

Where

$PE_{n,i}$	Total project emissions of the $n$ th campaign on $i$ lines, tN <sub>2</sub> O
$VSG_{n,i}$	Mean stack gas volume flow rate for the $n$ th project campaign on $i$ lines, m <sup>3</sup> /h
$NCSG_{n,i}$	Mean concentration of N <sub>2</sub> O in the stack gas for the project campaign on $i$ lines, mgN <sub>2</sub> O/m <sup>3</sup>
$OH_{n,i}$	Number of operating hours in the project campaign, h

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Total project emissions of the verification or crediting period of the whole JI project calculate by the finished project campaigns for all units for this term (Eq. 2):

$$PE_{total} = \sum_{i=1}^{i=4} PE_{n,i} \quad (\text{Eq. 2})$$

Where

$PE_{total}$  Total project emissions of the Verification / Crediting period of the whole JI project, tN<sub>2</sub>O  
 $PE_{n,i}$  Total project emissions of the *n*th campaign on *i* lines, tN<sub>2</sub>O

### 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<sub>2</sub>O emissions during that campaign by the total production of 100% concentrated nitric acid during that same campaign.

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

$$EF_{n,i} = \frac{PE_{n,i}}{NAP_{n,i}} \quad (\text{Eq. 3})$$

Where

$EF_{n,i}$  Emission factor calculated for the *n*th campaign on *i* lines, t N<sub>2</sub>O/t HNO<sub>3</sub>  
 $PE_{n,i}$  Total project emissions of the *n*th campaign on *i* lines, tN<sub>2</sub>O  
 $NAP_{n,i}$  Nitric acid production in the *n*th campaign on *i* lines, t HNO<sub>3</sub>

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

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$$EF_{ma,n,i} = (EF_{1,i} + EF_{2,i} + \dots + EF_{n,i}) / n_i \quad (\text{Eq. 4})$$

Where

$EF_{ma,n,i}$  Moving average (ma) emission factor of after  $n$ th campaigns, including the current campaign on  $i$  lines, tN<sub>2</sub>O/tHNO<sub>3</sub>

$EF_{n,i}$  Emission factor calculated for a specific project campaign on  $i$  lines, tN<sub>2</sub>O/tHNO<sub>3</sub>

$n_i$  Number of campaigns to date on  $i$  lines

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  $n$ th campaign on  $i$  lines, the higher of the two values  $EF_{ma,n,i}$  and  $EF_{n,i}$  shall be applied as the emission factor relevant for that particular campaign on  $i$  lines ( $EF_{p,i}$ ).

If  $EF_{ma,n,i} > EF_{n,i}$ , then  $EF_{p,i} = EF_{ma,n,i}$  (Eq. 5)

If  $EF_{ma,n,i} < EF_{n,i}$ , then  $EF_{p,i} = EF_{n,i}$  (Eq. 6)

### Minimum project emission factor

A campaign-specific emission factor on  $i$  lines will be used to cap any potential long-term trend towards decreasing N<sub>2</sub>O 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  $EF_{n,i}$  observed during those campaigns will be adopted as a minimum ( $EF_{min,i}$ ). If any of the later project campaigns results in an  $EF_{n,i}$  that is lower than  $EF_{min,i}$ , the calculation of the emission reductions for that particular campaign will use  $EF_{min,i}$  and not  $EF_{n,i}$ .

### Project campaign length

#### a. Longer project campaign

If the length of any individual project campaign  $CL_n$  is greater than or equal to the average historical campaign length  $CL_{normal}$ , then all N<sub>2</sub>O 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).

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## 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 the  $CL_n$  (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:								
ID number (Please use numbers to ease cross-referencing to D.2.)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
B.1	NCSG <sub>BCi</sub> N <sub>2</sub> O concentration in the stack gas in baseline campaign of line <i>i</i>	N <sub>2</sub> O analyzer	mg N <sub>2</sub> O/m <sup>3</sup> at normal conditions (101.325 kPa, 0 deg C). (converted from ppm if necessary)	m	Every 2 seconds	100%	Electronic and paper for the entire crediting period	The data output from the analyzer will be processed using the appropriate software
B.2	VSG <sub>BCi</sub> Volume flow rate of the stack gas in baseline campaign of line <i>i</i>	Gas volume flow meter	m <sup>3</sup> /hour at normal conditions (101.325 kPa, 0 deg C).	m c	Every 2 seconds	100%	Electronic and paper for the entire crediting period	The data output from the stack flow meter will be processed using appropriate software
B.3	BE <sub>BCi</sub> Total emissions N <sub>2</sub> O for baseline	Calculated from measured data	tN <sub>2</sub> O	c	At least once after baseline campaign	100%	Electronic and paper for the entire crediting period	

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	campaign of line <i>i</i>							
<i>B.4</i>	OH <sub>BC i</sub> Operating hours in baseline campaign of line <i>i</i>	Production log	Hours	m	Daily, compiled for the entire campaign	100%	Electronic and paper for the entire crediting period	Plant manager records the hours of full operation of the plant during a campaign.
<i>B.5</i>	NAP <sub>BC i</sub> Nitric acid (100% concentrated) in baseline campaign of line <i>i</i>	Production log	t HNO <sub>3</sub>	m	Daily, compiled for entire campaign	100%	Electronic and paper for the entire crediting period	
<i>B.6</i>	TSG <sub>i</sub> Temperature of the stack gas of line <i>i</i>	Probe (part of gas volume flow meter)	°C	m	Every 2 seconds	100%	Electronic and paper for the entire crediting period	
<i>B.7</i>	PSG <sub>i</sub> Pressure of the stack gas of line <i>i</i>	Probe (part of gas volume flow meter)	Pa	m	Every 2 seconds	100%	Electronic and paper for the entire crediting period	
<i>B.8</i>	EF <sub>BL i</sub> Baseline emission factor of line <i>i</i>	Calculated from measured data	t N <sub>2</sub> O/t HNO <sub>3</sub>	c	At the end of the baseline campaign		Electronic and paper for the entire crediting period	
<i>B.9</i>	UNC <sub>i</sub> Overall	Calculation of the combined	%	c	Once, after the monitoring		Electronic and paper for the	

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	measurement uncertainty of the monitoring system of line <i>i</i>	uncertainty of the applied monitoring equipment			system is commissioned		duration of the project activity	
<i>B.10</i>	AFR <sub><i>i</i></sub> Ammonia gas flow rate to the AOR of line <i>i</i>	Monitored	kg NH <sub>3</sub> /h	m	Continuously	100%	Electronic and paper for at least 2 years	To be obtained from the operating condition campaign
<i>B.11</i>	AFR <sub>max <i>i</i></sub> Maximum ammonia flow rate of line <i>i</i>	Plant records	kgNH <sub>3</sub> /h	m	Once	100%	Electronic and paper for at least 2 years	
<i>B.12</i>	AIFR <sub>BC <i>i</i></sub> Ammonia to air flow ratio of line <i>i</i>	Calculated from monitored data	%	mc	Every hour	100%	Electronic and paper for at least 2 years	To be obtained from the operating condition campaign
<i>B.13</i>	CL <sub>BC <i>i</i></sub> Length of the baseline campaign of line <i>i</i>	Calculated from nitric acid production data	tHNO <sub>3</sub>	c	After end of each campaign	100%	Electronic and paper for at least 2 years	
<i>B.14</i>	CL <sub>normal <i>i</i></sub> Normal campaign length of line <i>i</i>	Calculated from nitric acid production data	t HNO <sub>3</sub>	c	Prior to end of baseline campaign			Average historical campaign length during the operating

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								conditions campaign
<i>B.15</i>	AIFR <sub>max i</sub> Maximum ammonia to air ratio of line <i>i</i>	Calculated	%	mc	Once	100%	Electronic and paper for at least 2 years	
<i>B.16</i>	OT <sub>h i</sub> Oxidation temperature for each hour of line <i>i</i>	Monitored	°C	m	Every hour	100%	Electronic and paper for at least 2 years	To be obtained from the operating condition campaign
<i>B.17</i>	OT <sub>normal i</sub> Normal operating temperature of line <i>i</i>	Historical monitoring	°C	m	Once	100%	Electronic and paper for at least 2 years	
<i>B.18</i>	OP <sub>h i</sub> Oxidation Pressure for each hour of line <i>i</i>	Monitored	Pa	m	Every hour	100%	Electronic and paper for at least 2 years	To be obtained from the operating condition campaign
<i>B.19</i>	OP <sub>normal i</sub> Normal operating pressure of line <i>i</i>	Historical monitoring	Pa	m	Once	100%	Electronic and paper for at least 2 years	
<i>B.20</i>	GS <sub>normal i</sub> Normal gauze supplier for the operation	Monitored		m	Each campaign	100%	For project crediting period	To be obtained during the operating condition

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	condition campaigns of campaign $n$ of line $i$							campaign
B.21	GS <sub>BL,i</sub> Gauze supplier for the baseline campaign of line $i$	Monitored		m	Once	100%	Electronic records and paper for the crediting period	. To be obtained during the baseline campaign
B.22	GC <sub>normal,i</sub> Gauze composition during the operation campaign of line $i$	Monitored		m	Each campaign	100%	For project crediting period	To be obtained during the operating condition campaign
B.23	GC <sub>BL,i</sub> Gauze composition during baseline campaign of line $i$	Monitored		m	Once	100%	For project crediting period	To be obtained during the baseline campaign
B.24	EF <sub>reg</sub> Emissions level set by incoming policies or regulations	Monitored					Updated when new regulations comes into force	

**D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO<sub>2</sub> equivalent):**

>>

**Baseline emission procedure**

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Following AM0034 (Section B1.1) the baseline shall be established through continuous monitoring of both N<sub>2</sub>O concentration and gas flow volume in the stack of the nitric acid plant for *one complete* campaign before project implementation.

The scheme of baseline emission factor determination is in accordance with the variant mentioned in B 1.1.1.

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

*Oxidation temperature and pressure*

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

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

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

For this project, the permitted range of operating temperature and pressure were determined on the historical operating data for the previous five campaigns

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

The upper limits for ammonia flow and ammonia-to-air ratio are determined using historical maximum operating data for hourly ammonia gas and ammonia-to-air ratio for the previous five campaigns.

If no data is available, the maximum permitted ammonia gas flow rate and ammonia-to-air ratio are calculated as specified by the ammonia oxidation catalyst manufacturer or for typical catalyst loadings.

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

For this project, maximum ammonia gas flow rate and maximum ammonia to air ratio were determined on the historical operating data for the previous five campaigns

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2. Determination of baseline emission factor: measurement procedure for N<sub>2</sub>O concentration and gas volume flow

The baseline emission factor N<sub>2</sub>O concentration and gas volume flow will be determined according to the approach selected in Section B.1. Error readings (e.g., downtime or malfunction) and extreme values will be eliminated from the output data series. A complete baseline campaign will be determined either on the basis of the term of use of a primary catalyst starting from its loading and until unloading or it could be calculated on the basis of nitric acid production in accordance with historical data and can pass from the end of one campaign to the beginning of the following campaign.

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<sub>2</sub>O 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 ( $\bar{x}$ );
- 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<sub>2</sub>O concentration of stack gas (NCSG)).

Then, the average mass of N<sub>2</sub>O emissions per hour is estimated as the product of NCSG and VSG. The N<sub>2</sub>O emissions on  $i$ -lines per campaign are estimated as the product of N<sub>2</sub>O emissions per hour and the total number of complete hours of operation of the campaign using the following Eq. 6 from AM0034:

$$BE_{BC,i} = VSG_{BC,i} \cdot NCSG_{BC,i} \cdot 10^{-9} \cdot OH_{BC,i} \quad (\text{Eq. 7})$$

Where

$BE_{BC,i}$	Total baseline emissions in the baseline measurement period on $i$ -lines, tN <sub>2</sub> O
$VSG_{BC,i}$	Mean stack gas volume flow rate in the baseline measurement period on $i$ -lines, m <sup>3</sup> /h
$NCSG_{BC,i}$	Mean concentration of N <sub>2</sub> O in the stack gas in the baseline measurement period on $i$ -lines, mg N <sub>2</sub> O/m <sup>3</sup>
$OH_{BC,i}$	Number of operating hours in the baseline measurement period on $i$ -lines, h

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The plant-specific baseline emission factor representing the average N<sub>2</sub>O emission per tonne of nitric acid is derived by dividing the total mass of N<sub>2</sub>O emissions by the total output nitric acid according to Section B.1.

The overall measurement uncertainty of the monitoring system, expressed as a percentage (*UNC*), will be used to reduce the N<sub>2</sub>O emission factor per tonne of nitric acid produced in the baseline period (*EF<sub>BL</sub>*) as follows:

$$EF_{BL,i} = \frac{BE_{BC,i}}{NAP_{BC,i}} \left(1 - \frac{UNC_i}{100}\right) \quad (\text{Eq. 8})$$

Where

<i>EF<sub>BL,i</sub></i>	Baseline emission factor on <i>i</i> -lines, tN <sub>2</sub> O/tHNO <sub>3</sub>
<i>NAP<sub>BC,i</sub></i>	Nitric acid production during the baseline campaign on <i>i</i> -lines, tHNO <sub>3</sub>
<i>UNC<sub>i</sub></i>	Overall measurement uncertainty of the monitoring system on <i>i</i> -lines, in %, calculated as the combined uncertainty of the applied monitoring equipment

### Impact of regulations

Should N<sub>2</sub>O emission regulations that apply to nitric acid plants be introduced in Ukraine or the jurisdiction covering the location of the nitric acid plant, such regulations shall be compared to the calculated baseline emission factor (*EF<sub>BL</sub>*), regardless of whether the regulatory level is expressed as:

- An absolute cap on the total volume of N<sub>2</sub>O emissions for a set period;
- A relative limit on N<sub>2</sub>O emissions expressed as a quantity per unit of output; or
- A threshold value for specific N<sub>2</sub>O mass flow in the stack.

In this case, a corresponding plant-specific emission factor cap (maximum allowed tN<sub>2</sub>O/tHNO<sub>3</sub>) 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:

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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 Severodonetsk Azot 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, then there shall be no limitations on N<sub>2</sub>O baseline emissions.

If Severodonetsk Azot has changed the composition of the ammonia oxidation catalyst in a project campaign to a composition not used in the baseline campaign, it will be act in full accordance with methodology AM0034 version 03.2:

- (i) Repeat the baseline campaign to determine a new baseline emissions factor (tN<sub>2</sub>O/tHNO<sub>3</sub>), compare it to the previous baseline emissions factor and adopt the lower figure as EF<sub>BL</sub>; or
- (ii) Set the baseline emissions factor to the conservative IPCC default emission factor for N<sub>2</sub>O from nitric acid plants which have not installed N<sub>2</sub>O destruction measures (4.5 kg-N<sub>2</sub>O/t HNO<sub>3</sub>).

Parameters to be monitored for composition of the catalyst are as follows:

- GS<sub>normal</sub> Gauze supplier for the operating condition campaigns
- GS<sub>BC</sub> Gauze supplier for the baseline campaign
- GS<sub>project</sub> Gauze supplier for the project campaign
- GC<sub>normal</sub> Gauze composition for the operating condition campaigns
- GC<sub>BC</sub> Gauze composition for the baseline campaign
- GC<sub>project</sub> Gauze composition for the project campaign

For the initial project campaign, Severodonetsk Azot has decided to install a secondary catalyst system from Umicore (Germany).. The N<sub>2</sub>O abatement catalyst will be returned to the supplier at the end of its useful life to be refined, recycled or disposed of, according to the prevailing standards.. Severodonetsk Azot plant keep the right during project activity use the most effective N<sub>2</sub>O abatement secondary catalyst which will exist in future time. Nevertheless, this decision will not affect in any way the project activity as described in this PDD.

### Campaign length

In order to take into account variations in campaign length and their influence on N<sub>2</sub>O emission levels, the historical 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%

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concentration produced with one set of gauzes or two identical sets of gauzes for two consecutive campaigns at the different stages of their life (the end - the beginning).

#### Historical campaign length

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

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

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

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

Not applicable

#### **D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:**

ID number (Please use numbers to ease cross-referencing to D.2.)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

#### **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<sub>2</sub> equivalent):**

>>

The emission reductions of the project activity,  $ER$ , expressed in tonnes of CO<sub>2</sub> equivalent per year (tCO<sub>2</sub>e/yr), are given by Eq. 7 (Eq. 7 from AM0034):

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$$ER_{n,i} = (EF_{BL,i} - EF_{p,i}) \cdot NAP_{n,i} \cdot GWP_{N_2O} \quad (\text{Eq. 9})$$

Where

$ER_{n,i}$  Emission reductions of the project for the specific campaign on  $i$ -lines, tCO<sub>2</sub>e

$EF_{BL,i}$  Baseline emission factor on  $i$ -lines, tN<sub>2</sub>O/tHNO<sub>3</sub>

$EF_{p,i}$  Project emission factor on  $i$ -lines, tN<sub>2</sub>O/tHNO<sub>3</sub>

$NAP_{n,i}$  Nitric acid production for the project campaign on  $i$ -lines, tHNO<sub>3</sub>. The maximum value of NAP shall not exceed the design capacity

$GWP_{N_2O}$  Global warming potential for the N<sub>2</sub>O as per IPCC default value

Calculations of total emissions reduction for the project

Total project emissions of the verification / crediting period of the whole JI project calculate by the finished project campaigns for all units for this term (Eq. 10):

$$ER_{total} = \sum_{i=1}^{i=4} ER_{n,i} \quad (\text{Eq. 10})$$

Where

$ER_{total}$  Total project emissions of the verification /crediting period of the whole JI project, tCO<sub>2</sub>e

$ER_{n,i}$  Total project emissions of the nth campaign on  $i$  lines, tCO<sub>2</sub>e

Note. The nitric acid production used to calculate emission reductions should not exceed the design capacity (nameplate) of the nitric acid plant. Documentation to prove design capacity (nameplate) of the nitric acid plant should be available for the determination process of the project activity.<sup>4</sup>

<sup>4</sup> Nameplate (design) means the total yearly capacity (considering 365 days of operation per year) according to the documentation of the plant technology provider (such as the Operation Manual). If the plant has been modified to increase production, and such de-bottleneck or expansion projects were completed before December 2005, then the new capacity is considered nameplate, provided This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



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

No leakage calculation is required

**D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:**

ID number <i>(Please use numbers to ease cross-referencing to D.2.)</i>	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

**D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO<sub>2</sub> equivalent):**

>>

No leakage calculation is required.

**D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO<sub>2</sub> equivalent):**

>>

Ex-ante estimation of emission reductions

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

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proper documentation of the projects is available (such as, but not limited to: properly dated engineering plans or blueprints, engineering, materials and/or equipment expenses, or third party construction services).

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- Nitric acid production is assumed to be constant, so that project emissions do not vary from year to year. In 2008 480,000 t of nitric acid were produced on 4 lines (120 000 t/y 100% HNO<sub>3</sub> x 4 lines). In this PDD was set up that the production of HNO<sub>3</sub> after 2008 will have the same capacity as in 2008 year - 480,000 t HNO<sub>3</sub> per year.
- An N<sub>2</sub>O emission factor set to the conservative IPCC default emission factor for N<sub>2</sub>O from nitric acid plants which have not installed N<sub>2</sub>O destruction measures (4.5 kg N<sub>2</sub>O/t HNO<sub>3</sub>) is used to estimate project emissions.
- The potential technology providers (Umicore) indicate that the estimated reduction efficiency to be achieved as a consequence of project implementation is 75%. Thus, in order to present estimated values in this PDD, we consider the project emission factor to be equal to 25% of the baseline emission factor ( $EF_p = 0.25 * EF_{BL}$ ).

Then, *ex-ante* estimation of emission reduction is done using the following formula:

$$ER_y = (EF_{BL} - EF_p) \cdot NAP_y \cdot GWP_{N_2O} \quad (\text{Eq. 11})$$

Where

$ER_y$	Emission reductions in year $y$ for the crediting period, tCO <sub>2</sub> e
$EF_{BL}$	Baseline emission factor, tN <sub>2</sub> O/tHNO <sub>3</sub>
$EF_p$	Project emission factor, tN <sub>2</sub> O/tHNO <sub>3</sub>
$NAP_y$	Nitric acid production on 4 lines during a year $y$ for the crediting period campaign of the project activity, tHNO <sub>3</sub>
$GWP_{N_2O}$	Global warming potential for the N <sub>2</sub> O as per IPCC default value

The assumption parameters are specified in the following table:

Estimated values	
$NAP, tHNO_3/yr^5$	480,000
$EF_{BL}, tN_2O/tHNO_3$	0.0045
$EF_p, tN_2O/tHNO_3$	0.001125
$GWP_{N_2O} tCO_2e/tN_2O$	310

<sup>5</sup> This NAP corresponds to the total capacity of all plant reactors.



Then,

$$ER_n = (0,0045 - 0,001125) \times 480,000 \times 310 = 502\,200 \text{ tCO}_2\text{e/year}$$

The ex-ante estimates of project emission reductions are summarized in the table below:

Table 3. Estimation of expected emission reductions.

Year	Estimate of project activity emissions (tonnes of CO <sub>2</sub> e)	Estimate of baseline emissions (tonnes of CO <sub>2</sub> e)	Estimate of leakage (tonnes of CO <sub>2</sub> e)	Estimate of emission reduction (tonnes of CO <sub>2</sub> e)
<b>Length of the crediting period 2009-2012</b>				
2009	27 900	111 600	-	83 700
2010	167 400	669,600	-	502 200
2011	167 400	669,600	-	502 200
2012	167 400	669,600	-	502 200
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e)</b>	530 100	2 120 400		1 590 300

<b>Length of the crediting period 2013-2018</b>				
2013	167 400	669,600	-	502 200
2014	167 400	669,600	-	502 200
2015	167 400	669,600	-	502 200
2016	167 400	669,600	-	502 200
2017	167 400	669,600	-	502 200
2018	167 400	669,600	-	502 200
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e)</b>	1 004 400	4 017 600		3 013 200

<b>Total estimated reductions (tonnes of CO<sub>2</sub>e) for 10 years</b>	1 534 500	6 138 000		4 603 500
--	-----------	-----------	--	-----------

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**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:**

>>

<b>D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:</b>		
Data (Indicate table and ID number)	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
<i>P.1; B.1; P.2; B.2; P.6; B.6; P.7; B.7</i>	<i>Low</i>	Regular calibrations according to vendor specifications and recognized industry standards. Staff will be trained in monitoring procedures and a reliable technical support infrastructure will be set up.
Automated monitoring system	<i>Low</i>	See Monitoring Plan.
<i>P.4; P.5, P.8, P.9, B.4, B.5, B.8, B.9, B.10</i>	<i>Low</i>	Included in evaluation by third party validator
Measuring points	<i>Low</i>	In the selection of downstream measuring points the following issues are considered: temperature of the gas below 300°C (N <sub>2</sub> O inert), assurance of homogeneity of the volume gas flow at the measuring points throughout the diameter in terms of velocity of flow and mass composition of gas flow, possible turbulences in the gas flow stream (e.g., at the stack walls). If inhomogeneities exist, measuring of the gas flow is conducted with specific measuring equipment that minimizes uncertainties and inhomogeneities (e.g., multiple probe measuring units that allow for a representative coverage of the gas flow across the stack diameter). The measuring points will be points of the plant with easy access behind the gas expander turbine where the gas flow streams are consistent.



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

>>

In order to ensure the successful operation of the project and the creditability and verifiability of the ERUs achieved, the project will have a well-defined management and operational system.

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

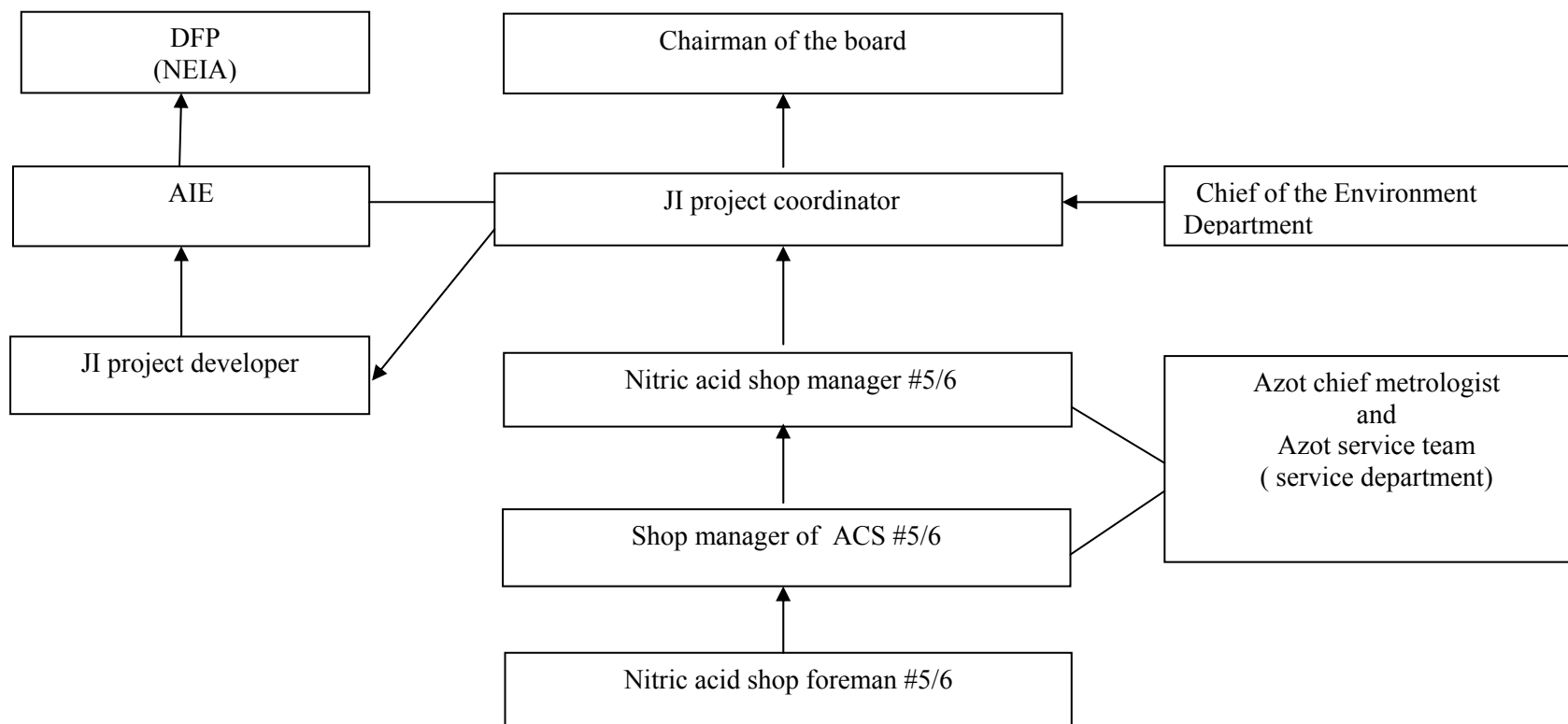


Figure 8. The scheme of the operational and management structure

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Severodonetsk Azot is a major producer of mineral fertilizers and organic synthesis products operated by highly qualified and experienced personnel. Automatic process control system (ACS), NO<sub>x</sub> abatement system and NO<sub>x</sub> online analyzer were installed at the nitric acid plant. These systems are attended by highly qualified operators ensuring high quality standards of operation. Technical services are provided by the company's specialized departments for mechanical, electrical, instrumentation maintenance, central laboratory of the enterprise and by the engineering design department.

Furthermore, before starting the baseline monitoring campaigns the whole operating personnel of the AMS received training on how to work with the new installed technology which is the basis for the project activities. To ensure high quality AMS maintenance in accordance with EN 14 181, ISO 14 956 there was developed "Manual of procedures for JI project monitoring" which determines JI project management structure, scope of work and responsibilities of the operating personnel and their relations. This manual of procedures was available during the determination site visit.

The proposed JI project will be closely monitored, metered and recorded. Management of the project for reduction of N<sub>2</sub>O emissions from nitric acid production will be the responsibility of the enterprise. Emission reduction will be verified on an annual basis (or campaign wise) by an independent organization which will be AIE. Periodic reports on emission reduction generated by the project will be issued by the emission owner in accordance with AIE verification report.

Relations between operational and management structures of the project and other participants in JI project activities are shown below:

- Nitric acid shop foreman #5/6 (the Plant Operator) will bear responsibility for monitoring data acquisition from AMS and automatic process control system which allow to have records of data on the line operating parameters. In case of AMS malfunction the plant shift supervisor is to inform the Shop manager of ACS #5/6 (the Monitoring Engineer) about it.
- Shop manager of ACS #5/6 (the Monitoring Engineer) monitors normal functioning of the AMS and accuracy of records made by the monitoring system. Shop manager of ACS #5/6 gets major data from the Plant Operator and provides technical servicing of the system at the plant level. Shop manager of ACS #5/6 personally carries out technical servicing of the AMS, including QAL3 and AST, and data acquisition system (DAS); eliminates malfunctions in the monitoring system operation at the plant level.
- Nitric acid shop manager #5/6 (the Plant Manager) is responsible for ensuring JI project execution at the plant level in accordance with PDD and other important standards. Nitric acid shop manager #5/6 will routinely inform the enterprise JI Project Coordinator about the general progress in the JI project activities. Occasionally, when Nitric acid shop manager #5/6 needs to start the next stage JI project implementation, he requests the previous report from the

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Monitoring Engineer. Nitric acid shop manager #5/6 provides the enterprise JI Project Coordinator with a report (in the form of a monitoring plan spreadsheet) for each period of one vintage year. Nitric acid shop manager #5/6 is responsible for failsafe AMS operation and timely technical servicing of the N<sub>2</sub>O monitoring system, including QAL3 activities. Besides, he is to make sure the subordinate personnel is trained to work with the AMS and operates the AMS in accordance with the quality and safety standards. ISO 9001-2008 quality control system was introduced at the enterprise in June 2009.

- Chief Metrologist of the Azot and Azot service team ( service department) can have support and assistance nitric acid shop manager #5/6 with regard to technical servicing, troubleshooting and supporting AMS in operational condition. Nitric acid shop manager #5/6 also uses services provided by Azot Chief Metrologist and Service Department as a support resource in case of need. The enterprise Service department is also responsible for servicing N<sub>2</sub>O monitoring system and maintenance of the system at the enterprise level, including carrying out AST. Operation, maintenance, technical servicing and calibration intervals are established in accordance with the manufacturer's specification and the international standards (see section *QA/QC* hereinafter). These intervals are included in the management structure in accordance with ISO 9001-2008 procedures.
- JI Project Coordinator ensures that JI procedures and monitoring plan are complied with during the project activities. Based on reports from Nitric acid shop manager #5/6 for the relevant period for the completed campaigns the Project Coordinator and the JI project developer prepare verification report for AIE in accordance with AIE requirements. The Project Coordinator provides the Chairman of the Board with information about the progress in JI project activities and with ERU generation reports.
- Chief of the Environment Department is monitoring regulatory acts issued by the Government with regard to changes in requirements to NO<sub>x</sub> and N<sub>2</sub>O emissions and informs JI Project Coordinator accordingly.
- JI Project Developer provides the project monitoring and support in accordance with the JI procedures.
- AIE carries our verification of the GHG emission report and will submit the respective verification report to the DFP where the report will be analyzed and ERU transfer will be made possible.



Azot Chairman of the Board will be receiving verification reports from the Project Coordinator on annual basis and similar reports will be submitted to the shareholders.

Taking into account the arguments and the above shown illustrative scheme, compliance with the monitoring methodology and monitoring plan will be fully guaranteed.

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

>>

The baseline and monitoring methodology has been applied by:

CJSC “Severodonetsk Azot Association” (Project Participant)

Dr. Kazakov Valentin V. (Kazakov@azot.lg.ua)

MGM International Group LLC (MGM International Group LLC is not a project participant)

Mr. Vladymyr Ivashchenko (ivladymyr@mgminter.com)

Mr. Walter Hügler (whugler@mgminter.com)

Ms. María Inés Hidalgo (ihidalgo@mgminter.com)

**SECTION E. Estimation of greenhouse gas emission reductions****E.1. Estimated project emissions:**

&gt;&gt;

Project emissions are estimated according the following assumptions:

- Nitric acid production is assumed to be constant, so that project emissions do not vary from year to year. In 2008 480,000 t of nitric acid were produced on 4 lines (120 000 t/y 100% HNO<sub>3</sub> x 4 lines). In this PDD the same capacity on 4 lines are 480,000 t per year.
- An N<sub>2</sub>O emission factor set to the conservative IPCC default emission factor for N<sub>2</sub>O from nitric acid plants which have not installed N<sub>2</sub>O destruction measures (4.5 kg N<sub>2</sub>O/t HNO<sub>3</sub>) is used to estimate project emissions.
- The potential technology providers (Umicore) indicate that the estimated reduction efficiency to be achieved as a consequence of project implementation is 75%. Thus, in order to present estimated values in this PDD, we consider the project emission factor to be equal to the 25% of the baseline emission factor ( $EF_p = 0.25 * EF_{BL}$ ).

Then, the estimated project emissions are:

$$PE_y = EF_p \cdot NAP_y \cdot GWP_{N_2O} \quad (\text{Eq. 12})$$

Where

$PE_y$	Project emissions during year $y$ for the crediting period of the project activity, tCO <sub>2</sub>
$EF_p$	Project emission factor, tN <sub>2</sub> O/tHNO <sub>3</sub>
$NAP_y$	Nitric acid production during year $y$ for the crediting period of the project activity, tHNO <sub>3</sub>
$GWP_{N_2O}$	N <sub>2</sub> O global warming potential

Then,

$$PE_y = 0,001125 \cdot 480,000 \cdot 310 = 167\,400 \text{ tCO}_2 \text{ e/year} \quad (\text{Eq. 12})$$

**E.2. Estimated leakage:**

&gt;&gt;

Not applicable

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

&gt;&gt;

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

**E.4. Estimated baseline emissions:**

&gt;&gt;

Baseline emissions are estimated according the following assumptions:

- Nitric acid production is assumed to be constant, so that baseline emissions do not vary from year to year. In 2008 480,000 t of nitric acid were produced on 4 lines (120 000 t/y 100% HNO<sub>3</sub> x 4 lines). In this PDD the same capacity on 4 lines are 480,000 t per year.
- An N<sub>2</sub>O emission factor set to the conservative IPCC default emission factor for N<sub>2</sub>O from nitric acid plants which have not installed N<sub>2</sub>O destruction measures (4.5 kg N<sub>2</sub>O/t HNO<sub>3</sub>) is

used to estimate baseline emissions. The final baseline emission factor will be calculated after the completion of baseline campaign measurements.

$$BE_y = EF_{BL} \cdot NAP_y \cdot GWP_{N_2O} \quad (\text{Eq. 13})$$

Where

$BE_y$  Baseline emissions during year  $y$  of the project activity, tCO<sub>2</sub>  
 $EF_{BL}$  Baseline emission factor, tN<sub>2</sub>O/tHNO<sub>3</sub>  
 $NAP_y$  Nitric acid production during year  $y$  of the project activity, tHNO<sub>3</sub>  
 $GWP_{N_2O}$  N<sub>2</sub>O global warming potential

Then

$$BE_y = 0,0045 \cdot 480,000 \cdot 310 = 669,600 \text{ tCO}_2\text{e/year} \quad (\text{Eq. 13})$$

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

>>

$$ER_y = (EF_{BL} - EF_p) \cdot NAP_y \cdot GWP_{N_2O} \quad (\text{Eq. 14})$$

Where

$ER_y$  Emission reductions during year  $y$ , tCO<sub>2</sub>e  
 $EF_{BL}$  Baseline emission factor, tN<sub>2</sub>O/tHNO<sub>3</sub>  
 $EF_p$  Project emission factor, tN<sub>2</sub>O/tHNO<sub>3</sub>  
 $NAP_y$  Nitric acid production on 4 lines during year  $y$  of the project activity, tHNO<sub>3</sub>  
 $GWP_{N_2O}$  N<sub>2</sub>O global warming potential

Then

$$ER_y = (0,0045 - 0,001125) \cdot 480,000 \cdot 310 = 502\,200 \text{ tCO}_2\text{e/year} \quad (\text{Eq. 14})$$

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

>>

Table 4. Estimation of expected emission reductions.

Year	Estimate of project activity emissions (tonnes of CO <sub>2</sub> e)	Estimate of baseline emissions (tonnes of CO <sub>2</sub> e)	Estimate of leakage (tonnes of CO <sub>2</sub> e)	Estimate of emission reduction (tonnes of CO <sub>2</sub> e)
<b>Length of the crediting period 2009-2012</b>				
2009	27 900	111 600	-	83 700
2010	167 400	669,600	-	502 200
2011	167 400	669,600	-	502 200
2012	167 400	669,600	-	502 200
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e)</b>	<b>530 100</b>	<b>2 120 400</b>		<b>1 590 300</b>



<b>Length of the crediting period 2013-2018</b>				
2013	167 400	669,600	-	502 200
2014	167 400	669,600	-	502 200
2015	167 400	669,600	-	502 200
2016	167 400	669,600	-	502 200
2017	167 400	669,600	-	502 200
2018	167 400	669,600	-	502 200
<b>Total estimated reductions</b> (tonnes of CO <sub>2</sub> e)	1 004 400	4 017 600		3 013 200

<b>Total estimated reductions</b> (tonnes of CO <sub>2</sub> e) for 10 years	1 534 500	6 138 000		4 603 500
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## 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:

>>

The law of Ukraine “On Atmospheric Environment Protection” No. 2556-III regulates responsibilities of the enterprises with regard to atmospheric environment protection. According to this law, pollutant emissions into atmosphere from stationary sources may take place after obtaining a permit given by a local agency of a specially authorized central executive authority in charge of ecology and natural resources. Procedure for issuing such permits is regulated by the Order of the Cabinet of Ministers of Ukraine No. 1598 of November 29, 2001 “On the approval of the list of the most common and hazardous pollutants the emission of which into atmosphere is subject to regulation” and by the Order of the Cabinet of Ministers of Ukraine No. 302 of March 13, 2002 “On approval of the procedure for performance and payment for works related to issue of permits for pollutant emissions into atmosphere from stationary sources, recording of enterprises, institutions, organizations and sole proprietors that were given such permits”.

Since this project does not result in growth of NO<sub>x</sub> and other hazardous gas emissions, State environmental authorities in Lugansk region have informed Severodonetsk Azot by Letter № 38-OOC/Д-59 26.01.2009, that this project is outside the scope of state environmental control rules; hence it is not necessary to develop an EIA in this case.

### 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:

>>

Since this project does not result in growth of NO<sub>x</sub> and other hazardous gas emissions, State environmental authorities in Lugansk region have informed Severodonetsk Azot by Letter № 38-OOC/Д-59 26.01.2009, that this project is outside the scope of state environmental control rules; hence it is not necessary to develop an EIA in this case.

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

&gt;&gt;

According to the order of the Ukrainian National Agency for Environmental Investments No.33 of June 25, 2008 "On Approval of JI Project Preparation Requirements" the following information is provided in the comments of the parties concerned:

- brief description of the ways for obtaining comments from the concerned parties
- summary of received comments
- report on responses to received comments.

**G.1.1 Brief description of collection of the concerned parties' comments.**

CJSC "Severodonetsk Azot Association" has adopted the following transparent methodology for carrying out concerned parties consultations:

- Publications in mass media (in newspapers and local and regional information editions) on the project with proposals to express one's opinion about the JI Project at CJSC "Severodonetsk Azot Association"
- Submission of the information about the project to the trade union organization and obtaining their approval for the project implementation
- CJSC "Severodonetsk Azot Association" informed the State administration of environmental protection in Lugansk region that the project implementation will not violate any environmental protection requirements of the State administration of environmental protection in Lugansk region.

**G.1.2. Summary of the received comments.**

On November 14, 2008 CJSC "Severodonetsk Azot Association" published an article (notification) in local newspapers about the project activities. The article was published in "Severodonetsky Khimik" newspaper (weekly newspaper in Russian) and in local newspaper "... " (daily newspaper in Ukrainian). The article contained information about the contact person at CJSC "Severodonetsk Azot Association", who would consider opinions and comments of the residents. Comments were accepted by post, e-mail, phone, and fax. People had enough time to comment. In reply to the publication two comments were received: one from the residents and the other from the Head of the trade union of CJSC "Severodonetsk Azot Association". Both comments highly appreciated efforts of CJSC "Severodonetsk Azot Association" on improvement of environmental conditions.

On November 13, 2008 CJSC "Severodonetsk Azot Association" held a meeting with the employees to inform them about the JI project and its impact on improvement of environmental conditions. This meeting promoted understanding of the plans of the enterprise to register the project activity as a JI project according to Kyoto Protocol.

Summary of this meeting and received comments are given below.

Question No. 1. What is the purpose of the JI project?

Answer No.1: This mechanism (project) was developed with the purpose of reducing greenhouse gas emissions.



Question No. 2. When does implementation of the project start?

Answer No.2: We plan to complete installation of AMS before March 2009 and start generation of emission reduction units in autumn. In spite of the economic crisis we are making efforts to finance the project.

Question No. 3. Where will funds for implementation of the project be obtained from?

Answer No. 3: During implementation of the project reduction of N<sub>2</sub>O emission will be achieved. Taking into account that N<sub>2</sub>O to CO<sub>2</sub> conversion coefficient (GWP) is 310, the project will generate sufficiently large amount of emission reduction units (ERUs) out of proceeds of the sale of which not only funds invested into the project will be returned but also fair profit will be secured.

Question No.4. Are there any buyers of ERUs?

Answer No. 4: Developed countries, which have obligations under Kyoto protocol to reduce GHG emissions by 5-8% and are not able to do that in their own countries willingly buy ERUs.

Question No. 5. Why developed countries do not implement similar projects?

Answer No. 5: Developed countries also implement many JI projects but that is not enough for them to fulfill obligations under Kyoto protocol.

Question No. 6. What will be the impact of the secondary catalyst on production? Will there be any adverse impact?

Answer No. 6: The secondary catalyst does not produce any adverse impact on production.

Question No. 7. What is the secondary catalyst?

Answer No. 7: It is a cordierite- based (metal oxides-based) honeycomb substrate catalyst. The catalyst is placed in the burner just under the platinum gauze and decomposes N<sub>2</sub>O into nitrogen and oxygen.

#### G.1.3. Report on responses to received comments.

The management of the enterprise took into consideration the questions that were asked at the meeting regarding implementation of JI project.





## Annex 1

**CONTACT INFORMATION ON PROJECT PARTICIPANTS**

Organisation:	CJSC "Severodonetsk Azot Association"
Street/P.O.Box:	Pivovarova Street
Building:	5
City:	Severodonetsk
State/Region:	Luganskaja oblast (region)
Postal code:	93403
Country:	Ukraine
Phone:	+ 380 6452 4 43 42
Fax:	+ 380 6452 2 30 30
E-mail:	zao@azot.lg.ua; taratuta@azot.lg.ua
URL:	<a href="http://www.azot.lg.ua/">http://www.azot.lg.ua/</a>
Represented by:	Valentin V. Kazakov
Title:	Chairman of board of CJSC "Severodonetsk Azot Association"
Salutation:	Dr.
Last name:	Kazakov
First name:	Valentin
Middle name:	Vasiljevich
Phone (direct):	+ 380 645 71 23 24
Fax (direct):	+ 380 645 22 99 69
Personal e-mail:	<a href="mailto:zao@azot.lg.ua">zao@azot.lg.ua</a>

Organisation:	CGT CHEMICAL GENERAL TRADING LIMITED
Street/P.O.Box:	6 <sup>th</sup> Floor, Wigmore Street
Building:	94
City:	London
State/Region:	
Postal code:	W1U 3RF
Country:	United Kingdom
Phone:	+41 22 789 7110
Fax:	+41 22 789 7160
E-mail:	sabine@chmetz.ch
URL:	
Represented by:	Sabine Chmetz-Maximov
Title:	Director
Salutation:	Ms.
Last name:	Chmetz-Maximov
First name:	Sabine
Middle name:	
Phone (direct):	+41 22 789 7110
Fax (direct):	+41 22 789 7160
Personal e-mail:	<a href="mailto:sabine@chmetz.ch">sabine@chmetz.ch</a>



## Annex 2

**BASELINE INFORMATION**

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

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

<hr/>	
Parameter	
Typical nitric acid production for 4 lines ,t HNO <sub>3</sub> /year	480,000
Maximum historic nitric acid production on 1 line, t HNO <sub>3</sub> /day	432
The conservative IPCC default emission factor, kgN <sub>2</sub> O/t HNO <sub>3</sub>	4,5
N <sub>2</sub> O destruction factor (%)	75
UNC(%)*	
Operating days	330

\*Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment. By the QAL2 results calculates UNC for whole AMS for each line separately and these data will be present during first verification.



### Annex 3

## MONITORING PLAN

The current JI project “Nitrous Oxide Abatement Project at Severodonetsk Azot plant” will measure on a quasi-continuous basis (uninterrupted sampling of flue gases with concentration and normalized flow analysis for short, discrete time periods) the N<sub>2</sub>O mass flow leaving the nitric acid plant through an automated measuring system (AMS<sup>6</sup>) using technologies and procedures in accordance with AM0034 “Catalytic reduction of N<sub>2</sub>O inside the ammonia burner of nitric acid plants”.

There is ISO 9001-2008 on plant. The monitoring procedures (deployed according to the current monitoring plan and being an integral part of it) will be fully integrated into Severodonetsk Azot’s quality and environmental management system.

There is “JI project monitoring manual” on plant.

The shop ACM foreman, Chef metrologyst and service department will be responsible for the ongoing operation and maintenance of the N<sub>2</sub>O 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 9001-2008 standard procedures. In case of any emergency, any measuring equipment failure the plant can be supported by the ASM supplier.

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

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 baseline campaign and (future) project campaigns. Furthermore, the baseline methodology requires that certain process parameters are monitored (to be compared vs. the permitted operating conditions) during the baseline campaign; such process parameters are also described in those tables. Only those N<sub>2</sub>O measurements taken when the plant is operating within the permitted range will be considered during the calculation of baseline emissions.

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

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<sup>6</sup> According to “terms and definitions” of EN 14181:2004 (E), the definition of AMS is: measuring system permanently installed on site for continuous monitoring of emissions. An AMS is a method that 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.



All parameters measured during the baseline campaign will be archived in electronic format during the entire crediting period.

All parameters measured during project campaigns will be archived in electronic format for at least two years.

### Emission reduction calculations

Emission reductions are calculated separately for each production line. The mass (in tonnes) of N<sub>2</sub>O that the project actually avoids being vented to the atmosphere during each production campaign, expressed in tonnes of carbon dioxide equivalent (or tCO<sub>2</sub>e), will be calculated by applying the following formulas:

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

Where

$BE_{BC,i}$	Total baseline emissions in the baseline measurement period on $i$ lines, tN <sub>2</sub> O
$VSG_{BC,i}$	Mean stack gas volume flow rate in the baseline measurement period on $i$ lines, Nm <sup>3</sup> /h
$NCSG_{BC,i}$	Mean concentration of N <sub>2</sub> O in the stack gas in the baseline measurement period on $i$ lines, mg N <sub>2</sub> O/Nm <sup>3</sup>
$OH_{BC,i}$	Number of operating hours in the baseline measurement period on $i$ lines, h

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

Where

$EF_{BL,i}$	Baseline emission factor on $i$ lines, tN <sub>2</sub> O/tHNO <sub>3</sub>
$NAP_{BC,i}$	Nitric acid production during the baseline campaign on $i$ lines, tHNO <sub>3</sub>
$UNC_i$	Overall measurement uncertainty of the monitoring system on $i$ lines, in %, calculated as the combined uncertainty of the applied monitoring equipment

Project emissions are calculated from mean values of N<sub>2</sub>O concentration and total flow rate:

$$PE_{n,i} = VSG_{n,i} \cdot NCSG_{n,i} \cdot 10^{-9} \cdot OH_{n,i}$$

Where

$PE_{n,i}$	Total project emissions of the $n$ th campaign on $i$ lines, tN <sub>2</sub> O
$VSG_{n,i}$	Mean stack gas volume flow rate for the $n$ th project campaign on $i$ lines, Nm <sup>3</sup> /h
$NCSG_{n,i}$	Mean concentration of N <sub>2</sub> O in the stack gas for the project campaign on $i$ lines, mg N <sub>2</sub> O/Nm <sup>3</sup>
$OH_{n,i}$	Number of operating hours in the project campaign on $i$ lines, h

For the  $n$ th campaign, the campaign specific emission factor would be:

$$EF_{n,i} = \frac{PE_{n,i}}{NAP_{n,i}}$$

Where



$EF_{n,i}$	Emission factor calculated for the $n$ th campaign on $i$ lines, kg N <sub>2</sub> O/t HNO <sub>3</sub>
$PE_{n,i}$	Total project emissions of the $n$ th campaign on $i$ lines, tN <sub>2</sub> O
$NAP_{n,i}$	Nitric acid production in the $n$ th campaign on $i$ lines, t 100% HNO <sub>3</sub>

Then,

$$ER_{n,i} = (EF_{BL,i} - EF_{p,i}) \cdot NAP_{n,i} \cdot GWP_{N_2O}$$

Where

$ER_{n,i}$	Emission reductions for the $n$ th campaign on $i$ lines, tCO <sub>2</sub> e
$EF_{BL,i}$	Baseline emission factor, tN <sub>2</sub> O/tHNO <sub>3</sub>
$EF_{p,i}$	Project emission factor, applicable to the $n$ th campaign on $i$ lines, tN <sub>2</sub> O/tHNO <sub>3</sub>
$NAP_{n,i}$	Nitric acid production during the $n$ th campaign of the project activity on $i$ lines, tHNO <sub>3</sub>
$GWP_{N_2O}$	Global warming potential of N <sub>2</sub> O, set as 310 tCO <sub>2</sub> e/tN <sub>2</sub> O for the 1 <sup>st</sup> commitment period

Calculations of total emissions reduction for the project

Total project emissions for the verification / crediting period of the whole JI project calculates by the finished project campaigns for all units for this term:

$$ER_{total} = \sum_{i=1}^{i=A} ER_{n,i}$$

Where

$ER_{total}$	Total project emissions for the verification / crediting period of the whole JI project, tCO <sub>2</sub> e
$ER_{n,i}$	Total project emissions of the $n$ <sup>th</sup> campaign on $i$ lines, tCO <sub>2</sub> e

Following AM0034, several restrictions and adjustments will be applied to the formulas above, among others:

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

The monitoring system will provide separate reading for N<sub>2</sub>O 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 ( $\bar{x}$ );
- 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 factor ( $EF_{ma}$ ) 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 of the emission factors generated in the previous campaigns ( $EF_{ma,n}$ ).

To calculate the total emission reductions achieved in the  $n$ th 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 abovementioned moving average and the specific campaign emission factor (and not lower than the minimum emission factor, after 10 campaigns).

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

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

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

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

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

The production during a given campaign will be compared to normal campaign length ( $CL_{normal}$ ). If the length of any individual project campaign  $CL_n$  is shorter than the average historic campaign length, then  $EF_{BL}$  will be re-calculated 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  $EF_n$ .

### Quality control and quality assurance

Severodonetsk Azot has a monitoring system which conforms to EN 14181. In accordance with the system detailed in the methodology AM0034. Three levels of quality assurance are planned. These three levels are QAL1, QAL2, QAL3 and AST.

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



The evaluation of the suitability of the measuring procedure is 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<sub>2</sub>O 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<sub>x</sub>, SO<sub>2</sub>) 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<sub>2</sub>O, for the purpose of expanded uncertainty calculations. The specific performance characteristics of the monitoring system chosen for the project are listed in the Project Design Document, in accordance with AM0034

The complete EN 14181: 2004 QAL1 reports are provided by the equipment manufacturers considering the performance characteristics as measured by a qualified Technical Inspection Authority (such as the German TÜV) and the specific installation characteristics and site conditions at the plant. The QAL1 report confirms that the N<sub>2</sub>O analyzer is suitable for performing the indicated analysis (N<sub>2</sub>O concentration), and provides a conservative estimate for expanded uncertainty. Severodonetsk Azot has received the QAL 1 report from ABB. The complete QAL1 report is available for auditing purposes. QAL1 is snow down.

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,  $UNC = ((N_2O \text{ analyzer uncertainty})^2 + (\text{flow meter uncertainty})^2)^{1/2}$ ). The overall measurement uncertainty is available for the determination of the project activity. QAL1 is snow down.



Description of evaluated measurement procedure

Automated Measuring System (AMS) based on	AO2000-Uras26 N2O
Analyzer module serial number (optional)	33524458
Quotation or order number	
Intended for monitoring of	Nitric acid plant
Applicable EU directive	2003/87/EC
Name of plant	SevAzot Line1
Gas to be measured	N2O
Smallest range of AMS	300 ppm
Largest range of AMS (optional)	3000 ppm
Smallest certified range for AMS	100 mg/m <sup>3</sup>
Smallest certified range for AMS	51 ppm

Test value and required quality at that value

Test concentration (Emission Limit Value, ELV)	2400 ppm
Required measurement quality as 95% confidence interval	20 % of ELV
Shortest averaging time of measured values	30 minutes
Required response time	25 % of shortest averaging time

Field conditions of operation used in the uncertainty assessment

	Min. value	Max. value	
Ambient temperature range	5	36	°C
Ambient pressure range	970	1030	hPa
Flow range	30	90	l/h
Voltage range	190	260	V

Internal diameter of sample gas line	4 mm
Length of sample gas line	13 m
Average flow of sample gas	60 l/h

Time between (automatic) span calibration	7 days
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Ranges of chemical interferents for

Nitric acid plant		Min. value	Max. value	
Component				
O2		3	3	Vol.%
H2O		1	2	Vol.%
CO		0	0	mg/m <sup>3</sup>
CO2		0	0	Vol.%
CH4		0	0	mg/m <sup>3</sup>
N2O		0	6000	mg/m <sup>3</sup>
NO		0	0	mg/m <sup>3</sup>
NO2		0	0	mg/m <sup>3</sup>
NH3		0	0	mg/m <sup>3</sup>
HCl		0	0	mg/m <sup>3</sup>
SO2		0	0	mg/m <sup>3</sup>





Contributing partial standard uncertainties and reference to their origins

Selectivity H2O	0,00	ppm
Selectivity others (largest sum)	0,04	ppm
Lack of fit	0,47	ppm
Drift	10,82	ppm
Pressure dependence	0,00	ppm
Temperature dependence	49,88	ppm
Flow dependence	0,15	ppm
Voltage dependence	0,09	ppm
Repeatability	0,10	ppm
Uncertainty of response factors	0,00	ppm
Uncertainty of converter efficiency (SCC-K NOx converter)	0,00	ppm
Response time	44	seconds
Origin of data	TÜV-Report no. 821029 (2006)	
Long-term drift of calibration cell	4,18	ppm
Origin of data	Article in UmweltMagazin, 2001	
Uncertainty of SRM	15,49	ppm
Standard Reference Method (SRM), Reference	Gas Chromatography, VDI 2469	
Uncertainty of cylinder gas	24,00	ppm
Origin of data	Datasheet of gas supplier	

Determination and assessment of expanded uncertainty

Expanded uncertainty	114,87	ppm
Required measurement quality as 95% confidence interval	480,00	ppm
Confidence interval met	YES	
Total response time	54	seconds
Required response time	450	seconds
Response time met	YES	
Conclusion	The AMS is ACCEPTABLE	

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 a certain number of parallel measurements (meaning simultaneously with the AMS), performed with a standard reference method (SRM) (which should be a proven and accurate<sup>7</sup> analytical protocol according to 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 norms 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 will have an accredited quality assurance system according to EN ISO/IEC 17025 or relevant (national) standards.

AIRTEC (Germany) made a preliminary evaluation of project documentation of the ABB monitoring system installation in the Severodonetsk Azot plant (preliminary testing of QAL2 conformity) and has issued a positive opinion letter. AIRTEC performed the final testing of AMS QAL2 conformity after completion of the monitoring system installation.

QAL3: A procedure to maintain and demonstrate the required quality of the AMS during its normal operation by checking the zero and span readings.

<sup>7</sup> Considering that 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<sub>2</sub>O, 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.



Severodonetsk Azot will be responsible for QAL 3 and for maintenance and assurance of the required quality of the AMS during its normal operation by weekly checking and calibration of zero and span.

The calibration of the NDIR is done on a weekly basis automatically with special cell which is filling of special gas with N<sub>2</sub>O concentration 80% of measuring limit, which is recorded in protocol, digital and in maintenance log.

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 the QAL2, it also requires a limited number of parallel measurements using an appropriate standard reference method. An AST should be performed at least once every year, considering that the total expected uncertainty of the AMS is well below the selected required uncertainty, provided ongoing quality assurance (QAL3) and equipment maintenance is proven to be well implemented (according to the current monitoring plan) during the verification audits.

#### Downtime of Automated Measuring System

In the event that the monitoring system is down, the lowest between the conservative IPCC (4.5 kg N<sub>2</sub>O/tHNO<sub>3</sub>) 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.

### Description of the AMS installed at Severodonetsk Azot Nitric Acid Plant

#### 1. Components of AMS

Severodonetsk Azot has installed in its nitric acid plant an automated monitoring system (AMS) from ABB:

AMS ABB comprising an automated monitoring system for N<sub>2</sub>O concentration of stack gas, sample probe, sample conditioning system, SDF flow sensor (for stack gas flow measurement), Data Acquisition System: ITBK EMI3000

#### 2. Selection of sample points

Severodonetsk Azot proposes sample points for collection of samples to meet the requirements of EN 14181. The sample points have been selected as advised by the supplier, ensuring their correctness.

Stack gas sample probe are doing automatically every 2 seconds.

#### 3. Analyzer system

The ABB AO2000 URAS 26 is capable of analyzing N<sub>2</sub>O concentration in gas mixtures on continuous basis.

The URAS 26 is a continuous NDIR industrial photometer that can selectively measure concentrations of up to four sample components. In this case it is equipped for the measurement of N<sub>2</sub>O only. The analyzer features gas-filled opto-pneumatic detectors. The detector is filled with the corresponding gas with N<sub>2</sub>O concentration 80% of measuring limit being measured.

This means that the detector provides optimum sensitivity and high selectivity compared with the other gas components in the sample. Gas-filled calibration cells are used for automatic calibration. The analyzer is QAL1 tested for the measurement of N<sub>2</sub>O.

#### 4. Sample conditioning system

The gas sample is extracted at the sampling point, particles are removed by the heated filter unit and the clean sample gas is delivered through a heated sampling line to the analyzer cabinet. Before being fed to the analyzer, moisture is removed by the sample gas cooler and sample gas feed 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 and efficiently separates the moisture from the sampling gas. 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.

### **5. Flow meter**

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

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

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

The signal resulting from the differential pressure is proportional to the velocity of the exhaust flow gas. ABB's differential pressure transmitter produces a signal in proportion to the flow, provided as a 4-20 mA signal to the Beckhoff DATA Logger. The stack gas pressure and temperature are also measured separately by transmitters and the corresponding 4-20 mA signal generated is fed to the DATA Logger as input for further converting the stack flow from operating to standard conditions. This is done by EMI3000 by compensating the flow for pressure and temperature and correcting the volume flow.

### **6. Downtime of Automated Measuring System**

In the event that the monitoring system is down, the lowest between the conservative IPCC (4.5 kg N<sub>2</sub>O/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.

### **7. Frequency of Monitoring and storage of the data**

Data storage and data security are considered to be one of the most important part of the monitoring plan ("MP"). The system is designed to be operated automatically. No operator is required for the daily operation of the system. However, monitoring engineer will ensure that the system is in normal operation and take necessary action to follow the MP.

N<sub>2</sub>O concentration in the stack gas is measured continuously by NDIR. Data will be recorded every 2 second. Data will be compiled into hourly and daily data and stored in the electronic media.

Volume Flow Rate of Stack Gas is measured continuously by the pressure-differential type flow meter. Data will be recorded every 2 second. Data will be compiled into hourly and daily data and stored in electronic media. Data will be compiled into hourly and daily and stored in electronic media.

Other parameters are monitored periodically and recorded into electronic media to suite the requirement of the JI monitoring activity.

### **8. The data acquisition system**

AMS has data transfer unit which transfer data to storage device and to the register system appointed to the project. Data processing system programmed by AFRISO in accordance with AM0034 version 3.

EMI3000 CDM system can easy configured in accordance with unit demand or operator desire.

The system includes: a specially adapted personal computer; 2 hard disks with capacity of 500 GB with the system of auto backup of information called RAID 1; operating system Microsoft® Windows® SERVER™ 2003; Ethernet; MYSQL- information bases licensed control system; PCAnywhere software; operator interface, including a remote management and software for EN14181-QAL3-monitoring.

In the EMI3000 PC all data evaluation and storage takes place. The data is stored simultaneously on different hard disks to prevent the loss of data in case one hard disk fails.



The EMI3000 CDM 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 functionality, the correct calculations and the correct statistical evaluation of the EMI3000 CDM software are tested and certified by TÜV NORD.

The measured values are transferred to the newly installed data recorder and the newly installed logging system dedicated for the project.

The logging system which is programmed by AFRISO according to AM0034/Version 2, displays, calculates, evaluates, prints out and stores the measured data.

The system EMI3000 CDM can be freely configured according to the needs of the plant and the wishes of the operator.

EMI3000 CDM for the statistics evaluation according to AM0034 Methodology

Data retention period

The logging data and all reports printed out from the system are kept for the period required by AM0034/Version 2.

- Main project emissions parameters: Electronic and paper for at least 2 years
- Main baseline emissions parameters: Electronic and paper for the entire crediting period
- AOR operation parameters related to baseline emissions: Electronic and paper for at least 2 years
- Ammonia oxidation gauze's parameters related to baseline emissions: For project crediting period