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

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

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Reduction of N_2O Emissions from Nitric Acid Production at OJSC “AZOT”, Cherkasy, Ukraine

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

Version 1
25 May 2009

A.2. Description of the project:

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Open Joint Stock Company (OJSC) “AZOT” (hereafter called “Cherkasy AZOT”) mainly products mineral fertilizers, ammonia and weak nitric acid, caprolactam.

Cherkasy AZOT has ten lines of nitric acid production of UKL-7 type, which are operated at high pressure. The total design capacity is 1,200,000 tonne per year (120,000 tonne[1]/yr*10 units) based on 100% HNO_3.

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

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

The project activity involves the installation of a secondary catalyst for catalytic destruction of most of the nitrous oxide (N2O) produced in the nitric acid plant. The abatement is expected to be approximately 80% of the N2O produced.

The baseline scenario is determined to be the release of N_2O emissions to the atmosphere at the currently measured rate, in the absence of regulations to restrict N_2O emissions (currently there is no legislation requiring the limitation of N2O emissions associated with nitric acid production in Ukraine). If regulations on N_2O emissions are introduced during the crediting period, the baseline scenario shall be adjusted accordingly.

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

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[1] In accordance with AM0034, annual production shall be calculated on the basis of 365 days of operation. On plant design documentation, annual production is calculated on the basis of 8000 operational hours (330 days) per year. 1,200,000 tones per year – is the production capacity, which is calculated for 10 lines on the basis of 330 operational days per year in accordance with the operating manual of the production units.

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

Project additionality is determined using the "Tool for the demonstration and assessment of additionality", version 05.2 approved at the 39th meeting of 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 Cherkasy AZOT plant.

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

A.3. Project participants:

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Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (host)	OJSC "AZOT" (Ukraine).	No
Investor	ERU purchaser is yet to be determined and shall be named before the first verification at the latest	No

Cherkasy AZOT is Ukrainian Open Joint Stock Company enterprise which was created in 1994 and registered (incorporated) on July 14th , 1994 by Reg. # 1 026 120 0000 000004 , with the following main activities: fertilizers and nitric compounds production, raw plastics production, chemicals for industrial purposes and wholesale of chemicals.

During 2005-2010 the strategic program of energy consumption reduction in ammonia and mineral fertilizer production is under developed by the company. To develop this program more than 21.14 million USD were spent in 2007. It gave the possibility of reducing the consumption of natural gas by 5.24% and electricity by 20%. In 2007 nitric acid production grew almost 2 fold compared to previous year (2006). The % of ammonium nitrate export in 2007 has grown by 3 times more than in 2006. Currently the Complex produces ammonia, weak nitric acid, ammonium nitrate, urea, caprolactam among other products.

The ammonia results from the chemical synthesis of nitrogen and hydrogen which is obtained from natural gas in a facility that uses the Kellogg process at 270 bar. Ammonia is the starting material for nitric acid, ammonium nitrate, urea and complex fertilizers. Urea is obtained in two facilities under the license of Stamicarbon using ammonia and carbon dioxide as raw materials. Ammonium nitrate is obtained in a plant under the license of GIAP through the neutralization of nitric acid with ammonia that leads to a granulated product.

This project design document (PDD) has been developed by MGM WORLDWIDE LLC, an affiliated company of MGM International Inc. MGM is an experienced Clean Development Mechanism (CDM) and Joint Implementation (JI) project developer. MGM International was established in the year 2000 as a project development, investment and commercialization firm whose objectives are the identification, design, negotiation, execution, and monitoring of CDM, JI and Voluntary Market (VM) projects that contribute to reducing anthropogenic GHG emissions.

A.4. Technical description of the project:

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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

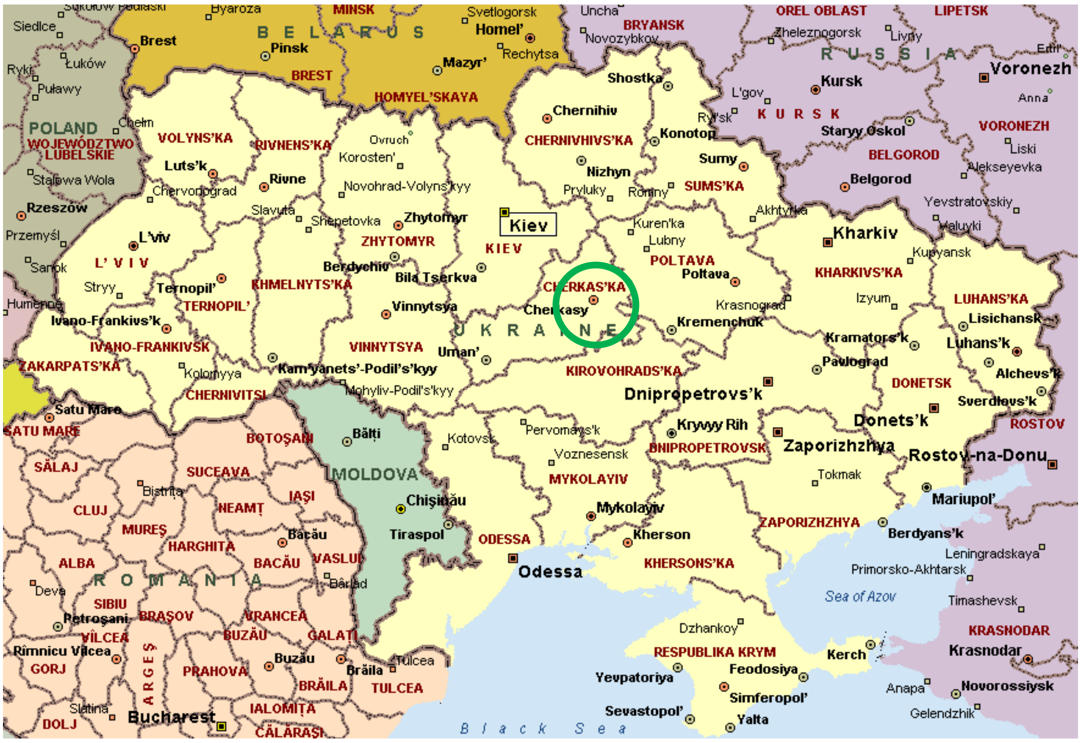

Figure 1. Map of Ukraine showing project location.

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

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Cherkas'ka oblast (region) is situated in the central part of Ukraine; it extends for 238 km from the west to the east and for 200 km from the north to the south. It borders with Kyivs'ka, Poltavs'ka, Kirovohrads'ka and Vinnyts'ka oblasts.

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

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The project is located in the City of Cherkasy, postal code 18014. Cherkasy is a regional centre of Cherkas'ka oblast. The city is located on the Dnieper River, approximately 186 km (122 miles) to the south-west from Kyiv. The estimated population is more than 300,000 people. Cherkasy has many factories and is also an important chemical production center. The city has a local airport.

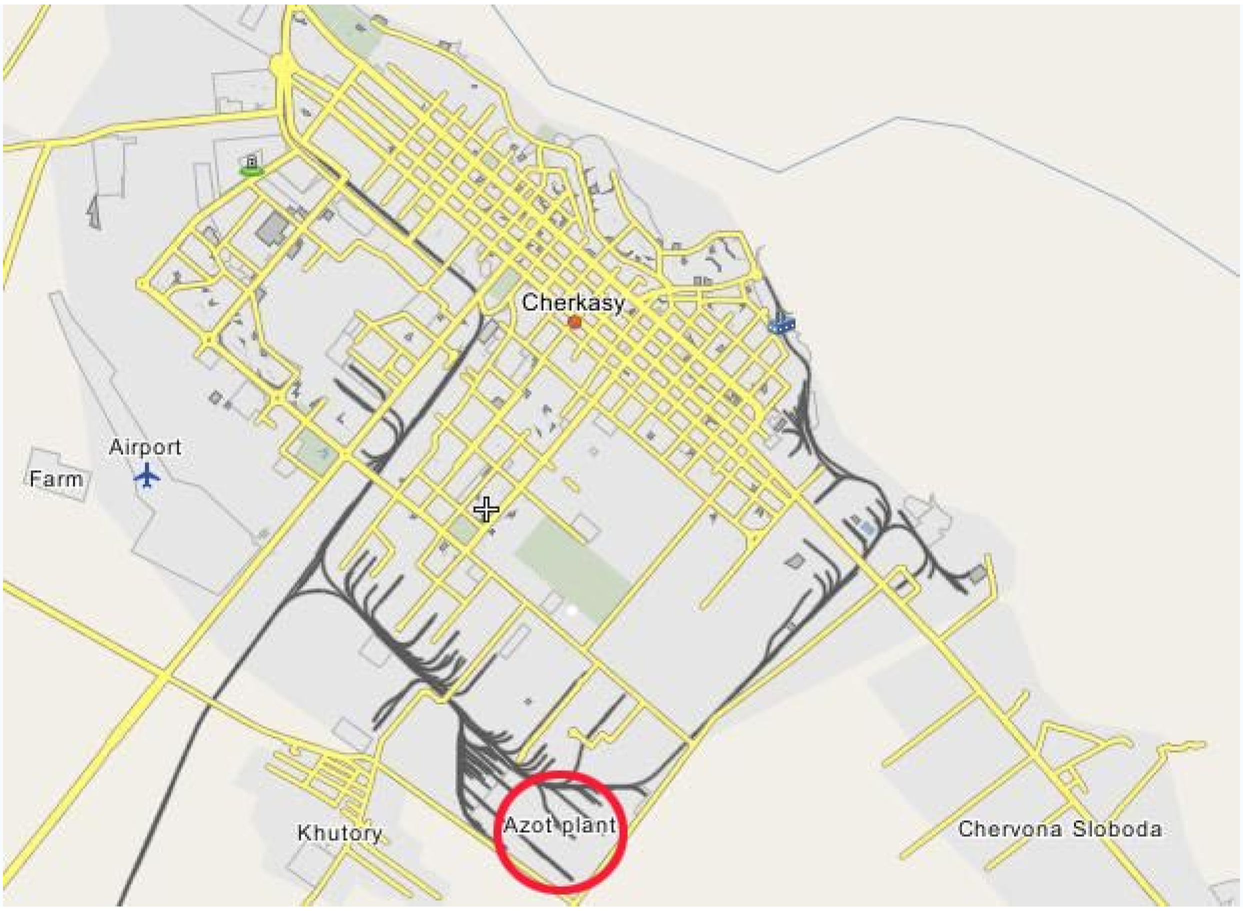

Figure 2. Map of Cherkasy city showing project location.

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

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The GPS coordinates of the plant are:

49°27'53"northern latitude and
32°11'25"eastern longitude.

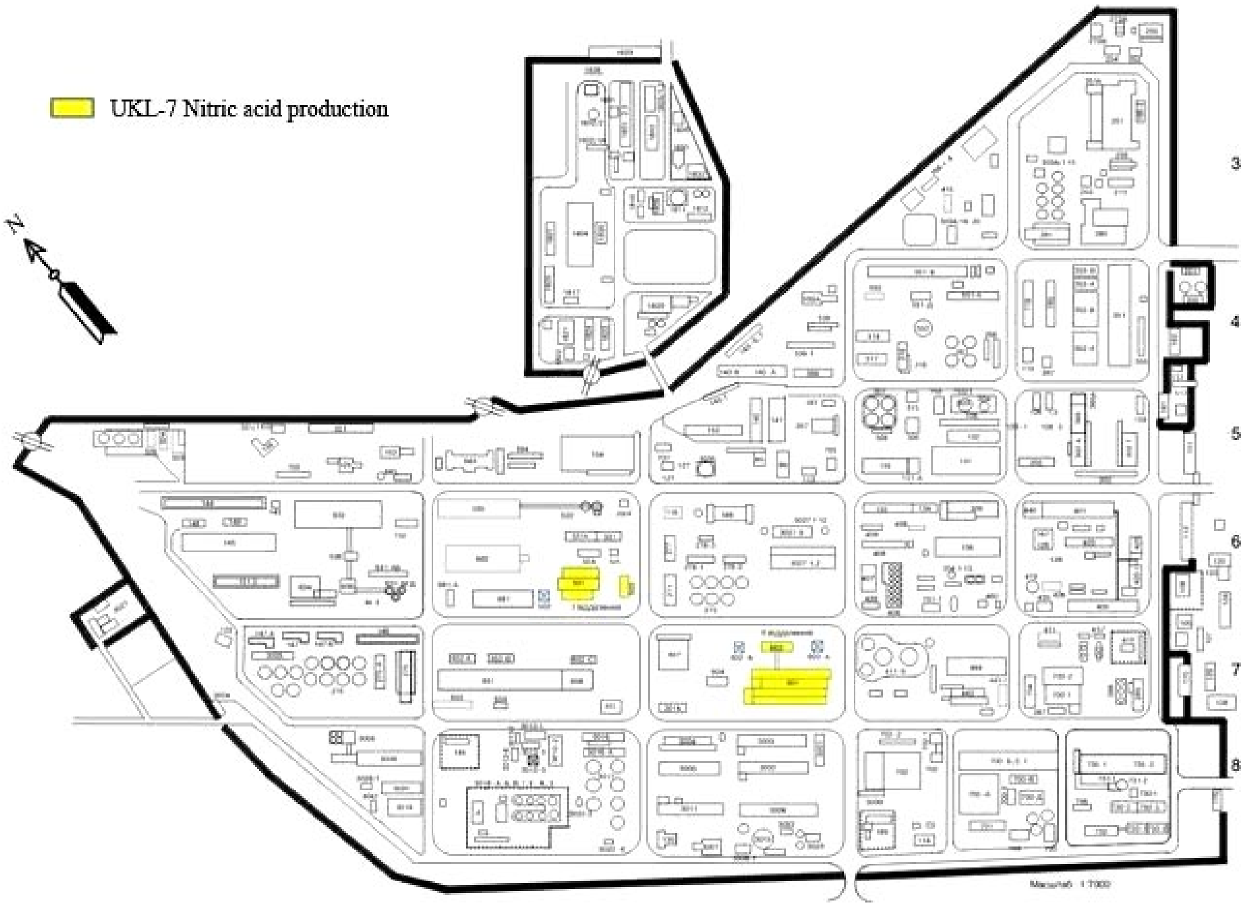

Figure 3. The location of UKL-7 ammonia oxidation reactors at Cherkasy AZOT.

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

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The Ostwald process

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

The basic Ostwald process involves 3 chemical steps:

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

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

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

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

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

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

Reaction 1 is favoured by lower pressure and higher temperature. Nevertheless, at too 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)[2]. Reactions 2 and 3 are favoured by higher pressure and lower temperatures.

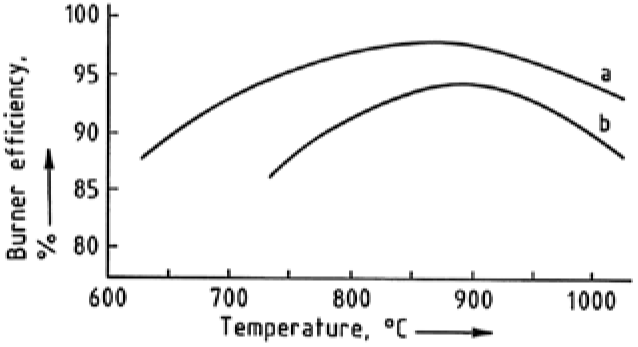

Figure 4. Conversion of ammonia to nitrogen monoxide on platinum gauze as a function of temperature at (a) 100 kPa; (b) 400 kPa[2] above.

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 fed ammonia is converted to nitric oxide (NO) according to reaction (1) above. The remainder participates in undesirable side reactions that lead to nitrous oxide (N_2O), among other compounds.
Side reactions during oxidation of ammonia:

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

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

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

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

Nitric acid production in Cherkasy AZOT

At Cherkasy AZOT the nitric acid production facility consists of 10 lines UKL-7 which are situated in two shops - nº1 and nº2, shop nº1 consists of 3 lines and shop nº2 consists of 7 lines. Each line consists of 1 reactor, 1 absorption towers, 1 DeNOx unit, 1 tail turbine. N_20 as the part of stack gases after turbine from 10 lines is emitted into the atmosphere through 3 common stacks: one stack in shop nº1 and 2 stacks in shop nº2 – 1st for 3 lines and 2nd for 4 lines.

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[2] 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.

N_2O abatement technology classification

The potential technologies (proven and under development) to treat N_2O emissions at nitric acid plants have been classified as follows, on the basis of the process location of the control device:
Primary: N_2O is prevented from forming in the oxidation gauzes.
Secondary: N_2O once formed is eliminated anywhere between the outlet of the ammonia oxidation gauzes and the inlet of the absorption tower.
Tertiary: N_2O is removed at the tail gas, after the absorption tower and before the expansion turbine.
Quaternary: N_2O is removed following the expansion turbine and before the stack.

Selected technology for the project activity

General description
The current project activity involves the installation of a new (not previously installed) catalyst below the oxidation gauzes, inside the reactor (a "secondary catalyst") (Figure 5), whose sole purpose is the decomposition of N_2O.
To reduce the N2O formed a catalytic abatement system will be installed. In order to monitor the emission reductions generated by the project an uninterrupted automatic emissions monitoring system (AMS) will be installed.
There are several potential vendors, which could become suppliers of Secondary Catalyst for this project.

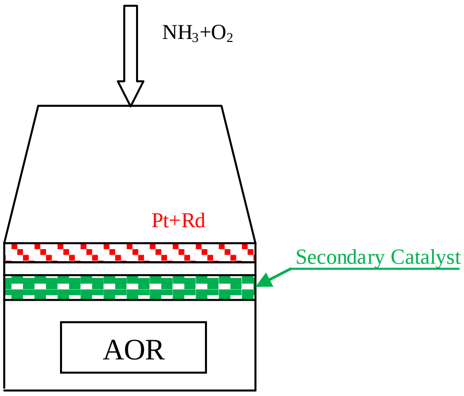

Figure 5. Location of "secondary catalyst" inside the ammonia oxidation reactor (AOR).

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.
- Considerably lower capital cost when compared to other approaches.
- Secondary catalyst does not affect NO yield.
- Secondary catalyst does not increase NO_X emissions.

Cherkasy AZOT is in the process of selecting the secondary catalyst supplier. 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.

Cherkasy AZOT will ensure that the N_2O abatement catalyst is returned to the supplier at the end of its useful life to be refined, recycled or dispose of according to the prevailing EU standards.

The corresponding secondary catalyst installation works will be coordinated among the catalyst supplier's team and Cherkasy AZOT staff, and will be performed by plant technical personnel. Design and installation of a new catalyst support system or modification, for secondary catalyst installation including choice of material, their strength properties, mounting of equipment and all other related documentation will be done according to acting rules and norms in Ukraine by secondary catalyst supplier. 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 Cherkasy AZOT employees. All project participants will work together on training Cherkasy AZOT staff to reliably supervise the effective operation of the catalyst technology, operate the installed monitoring system to measure the emission levels and collect the data in a manner that allows the successful completion of each verification procedure.

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

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The project activity consists of the installation of a secondary catalyst inside the ammonia burner beneath the primary catalyst, whose sole purpose is to reduce the N_2O emissions.
Due to high temperature and the presence of the secondary catalyst, the N_2O previously formed is converted into N_2 and O_2.

N_2O is typically released into the atmosphere as common practice in the industry, since it does not have any economic value or toxicity at typical emission levels.

Currently, there are no national regulations or legal obligations in Ukraine concerning N_2O emissions. It is unlikely that any such limits on N_2O emissions will be imposed in the near future.

The abatement of N2O involves significant investment. Without the project activity as a JI project activity, the N2O formed would be emitted to the atmosphere, as there are neither economic incentives nor regulatory requirements to abate N2O emissions.

From what was said earlier, it is concluded that N_2O would not be removed in the absence of the proposed project activity.

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

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Estimates of emission reductions over the crediting period are calculated taking into account the following factors:

- Annual production of nitric acid is based on the Plan for Production of Nitric Acid for the Years 2009-1015 approved by the plant management. For the period of 2010-2012 a conservative value of 590,000 tonnes of nitric acid per year was used. For the period of 2013-2022 an average of 800,000 tonnes HNO_3 per year was applied.

- For baseline emission estimation an emission factor equal to 3,48 kg N_2O/t HNO_3 is assumed for all UKL-7 lines, taking in consideration actual N_2O concentration measurements taken by certified organization "Airtec" from 27.01.2009 to 30.01.2009.
- The potential technology providers (BASF, Umicore, Johnson Matthey) indicate that the estimated reduction efficiency to be achieved is 80% or higher. Thus, in order to present estimated values in this PDD, we consider the project emission factor to be equal to 20% of baseline emission factor ($EF_P = 0.20 * EF_{BL}$)
- Project campaigns start in November 2010.

Estimated amount of emission reductions over the first crediting period of the Kyoto Protocol:

	Years
Length of the crediting period	3 years
Year	Estimate of annual emission reductions in tones of CO_2 equivalent
2010	84,866
2011	509,194
2012	509,194
Total estimated reductions	1,103,254
Annual average over the crediting period of estimated reductions	509,194

Estimated amount of emission reductions after the end of the first crediting period of the Kyoto Protocol, subject to approval by the host country:

	Years
Length of the crediting period	10 years
Year	Estimate of annual emission reductions
	in tones of CO_2 equivalent
2013	690,432
2014	690,432
2015	690,432
2016	690,432
2017	690,432
2018	690,432
2019	690,432
2020	690,432
2021	690,432
2022	690,432
Total estimated reductions	6,904,320

Total estimated reductions (for 13 years)	8,007,574

A.5. Project approval by the Parties involved:

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Letter of Endorsement (LoE) was issued to Cherkasy AZOT N_2O abatement JI project by the Ministry of Environmental Protection on August 21th, 2006, by communication No. 7064/09-10.

In the process of PDD development it was taken into account the assent nº33 "About improvement of requirements for preparation of joint implementation projects", from the National Agency of ecological investments of Ukraine of June 25th, 2008

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.
Investor Party:	Letter of Approval and Letter of Authorization of an ERU purchaser will be applied for.

SECTION B. Baseline

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

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Following JI criteria for baseline setting and monitoring methodologies adopted during the fourth meeting of the Joint Implementation Supervisory Committee (JISC) that took place in Bonn, Germany, on September 13-15, 2006; an approved methodology for CDM project activities can be applicable for JI project activities.
AM0034 version 03.4 (EB 50) is the baseline and monitoring methodology chosen to develop the project activity. Thus, the baseline scenario will be chosen following the procedures stated in AM0034.

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

- Cherkasy AZOT's lines limit the application of this project activity to existing nitric acid production installed no later than December 31, 2005. One line was installed in 1970, two lines in 1971, 3 lines in 1972, 3 lines in 1973 and 1 line was installed in 1980.
- The project activity will not result in the shutdown of any existing N_2O destruction or abatement facility or equipment in the plant.
- The project activity will not affect the level of nitric acid production.
- There are currently no regulatory requirements or incentives to reduce levels of N_2O emissions from nitric acid plants in Ukraine.
- The project activity will not increase NO_x emissions.
- Cherkasy AZOT's plant has selective catalytic reduction (SCR) $DeNO_x$ abatement system installed.
- Operation of the secondary N_2O abatement catalyst installed under the project activity does not lead to any process emissions of greenhouse gases, directly or indirectly.
- Continuous real-time measurements of N_2O concentration and total gas volume flow will be carried out in the stack:
    - Before the installation of the secondary catalyst, and
    - After the installation of the secondary catalyst throughout the chosen crediting period of the project activity.

The baseline methodology application first involves an identification of possible baseline scenarios, and eliminating those that would not qualify. The procedures followed for baseline scenario selection correspond to AM0028 "Catalytic N_2O destruction in the tail gas of Nitric Acid and Caprolactam Production Plants" version 4.2 (EB 41) as it is specified in the selected AM0034 version 03.4; for more details see the following link at the UNFCCC website:

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

The analysis of baseline scenarios involves five steps:

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

The first step in determining the baseline scenario is to analyze all options available to project participants. This *first step* can be further broken down into two sub-steps:

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

- Continuation of *status quo*. The continuation of the current situation, where there will be no installation of technology for the destruction or abatement of N_2O.
- Switch to an alternative production method not involving the ammonia oxidation process.
- Alternative use of N_2O, such as:
    - Recycling N_2O as a feedstock
    - Use of N_2O for external purposes.
- Installation of a Non-Selective Catalytic Reduction (NSCR) DeNOx unit[3];
- The installation of an N_2O destruction or abatement technology:
    - Primary measure for N_2O destruction.
    - Secondary measure for N_2O destruction
    - Tertiary measure for N_2O destruction

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

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

- The continuation of the current situation, where a $DeNO_X$ unit is installed
- Installation of a new non-selective catalytic reduction (NSCR) $DeNO_X$ unit
- Installation of a new tertiary measure that combines NO_X and N_2O emission reduction

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

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

In accordance with Resolution № 710296 of December 30th, 2005 and Letter from State Department of Environmental Protection in Cherkasy, region №1247/05 26.03.07 the limit for NOx emissions in 2008 is set as 103 mg/m^3. As Cherkasy AZOT plant has installed SCR $DeNO_X$ units to reduce NO_X emissions, the actual emissions of NOx do not exceed the above mentioned limit.

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

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

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[3] A NSCR $DeNO_X$-unit will reduce N_2O emissions as a side reaction to the NO_X--reduction, consequently, new NSCR installation can be seen as an alternative N_2O reduction technology.

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

The identified barriers are:

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

- Technological barriers, inter alia:
  - Technical and operational risks of alternatives;
  - Technical efficiency of alternatives (e.g., N_2O destruction, abatement rate);
  - Skilled and/or properly trained labour 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 CDM project activity):

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

- Tertiary abatement technology. Application of 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 on operating expenses for a plant like Cherkasy are not justifiable, because a of low temperature SCR system is already installed at the plant, which effectively works with minimum operating costs. Additional natural gas consumption for heating the tail gases from temperatures below 100ºC to the reaction temperature (about 350 ºC) leads to raised operational costs.

- Switch to an alternative production method not involving the ammonia oxidation process: This is not an option because there is no other commercially viable alternative to produce nitric acid.

- The use of N_2O for external purposes: This is technically not feasible at Cherkasy 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_2O for external purposes is practiced neither in Ukraine nor anywhere else.

- Recycling N_2O as a feedstock: We may discard recycling N_2O as a feedstock for the nitric acid plant. This is because nitrous oxide is not a feedstock for nitric acid production. Nitrous oxide is not recycled at nitric acid plants in Ukraine, nor anywhere else.

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

- Installation of a secondary catalytic DeN_2O;
- Continuation of the *status quo*;
- Installation of a new Selective Catalytic Reduction (SCR) $DeNO_X$ unit.

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

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

Sub-step 4a: Determine appropriate analysis method:

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

Sub-step 4b: Apply simple cost analysis:

The possible alternatives listed in Sub-step 1a above, and not discarded in the barrier analysis stage, include: the continuation of the *status quo*, the installation of new Selective Catalytic Reduction (SCR) $DeNO_X$ unit and the installation of some form of secondary DeN_2O system

The installation of a secondary DeN_2O system involve substantial investment and operational costs, and would need to provide benefits (other than JI revenue) in order to qualify as valid baseline. No income from any kind of potential product or by-product except Emission Reduction Units (ERUs) are able to pay back investment costs and running costs for the installation of any such abatement systems as no marketable products or by-products are generated by these treatment methods. Thus, there is no incentive to install a secondary catalyst for the abatement of N_2O.

Cherkasy AZOT’s plant has currently installed a Selective Catalytic Reduction $DeNO_X$ unit in accordance with Ukraine's and EU standards. This unit does not consume natural gas for heating the tail gas in the process of NO_X decomposition and has low operational costs. Therefore, the installation of a new Selective Catalytic Reduction $DeNO_X$ unit is not necessary.

According to the baseline methodology, “If all alternatives do not generate any financial or economic benefits, then the least costly alternative among these alternatives is pre-selected as the most plausible baseline scenario candidate.”

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_X or N_2O emission regulations in Ukraine will be executed as follows:

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

If new or modified NO_X emission regulations are introduced after the project start, the baseline scenario will be re-assessed at the start of a crediting period. Baseline scenario alternatives to be analyzed will include, inter alia:

- Selective catalytic reduction (SCR);
- Non-selective catalytic reduction (NSCR);
- Tertiary measures incorporating a selective catalyst for destroying N_2O and NO_x emissions;
- Continuation of baseline scenario

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

Sub-step 5b: New or modified N_2O regulations
If legal regulations on N_2O emissions are introduced or changed during the crediting period, the baseline emissions will be adjusted at the time the legislation is legally implemented.
The methodology is applicable if the procedure to identify the baseline scenario results in that the most likely baseline scenario is the continuation of N_2O emission to the atmosphere, without the installation of N_2O destruction or abatement technologies, including technologies that indirectly reduce N_2O emissions (e.g., NSCR $DeNO_X$ units).

Resume:

Table below shows results of applicability condition analysis for the current proposed Cherkasy AZOT's project activity (object of this PDD) as per baseline methodology AM0034 requirements.

Table 1. Checks of applicability conditions of baseline methodology AM0034

Applicability condition (methodology)	**Conclusion**
1. This baseline methodology is applicable to project activities that install a secondary N_2O 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_2O 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_2O emissions from nitric acid plants in the host country.	Condition satisfied
6. No N_2O abatement technology is currently installed in the plant.	Condition satisfied
7. The project activity will not increase NO_X emissions	Condition satisfied
8. NO_X abatement catalyst installed, if any, prior to the start of the project activity is not a Non-Selective Catalytic Reduction (NSCR) $DeNO_X$ unit	Condition satisfied
9. Operation of the secondary N_2O abatement catalyst installed under the project activity does not lead to any process emissions of greenhouse gases, directly or indirectly	Condition satisfied
10. Continuous real-time measurements of N_2O concentration and total	Condition satisfied

gas volume flow can be carried out in the stack; • Prior to 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.	

B.1.1. Variation of methodology AM0034, version 03.4, applicable to the current project activity.

Overlap of data of two consecutive campaigns for baseline determination.

AM0034 requires monitoring one full campaign before secondary catalyst installation, in order to determine baseline emission factor. In case of Cherkasy AZOT plant campaigns at each production line start and end at different points in time, then, baseline will be measured according to the campaign stage at each line at the moment of installing the AMS.

Baseline emissions will be monitored immediately after AMS installation for active campaigns, and during next campaign (for each independent production line), up to the date when cumulative nitric acid production during both (partial) campaign periods will be equal to the average historic campaign length (CL_{normal}).

Thus, raw data for emission factor calculation may be obtained from the data of two separate consecutive campaigns with equal operating conditions as follows:

(i) Monitored data for the last "*x*" hours of the first campaign (during this period, closer to the end of campaign. Normally ammonia conversion efficiency is lower and N_2O formation is higher at the end of a campaign.

(ii) Monitored data for the first "*y*" hours of the next campaign (during this period, at the beginning of campaign. Normally ammonia conversion efficiency is slightly higher and N_2O formation is lower at the beginning of a campaign.

This is illustrated at the figure below, where three production lines are monitored at different stages of campaigns.

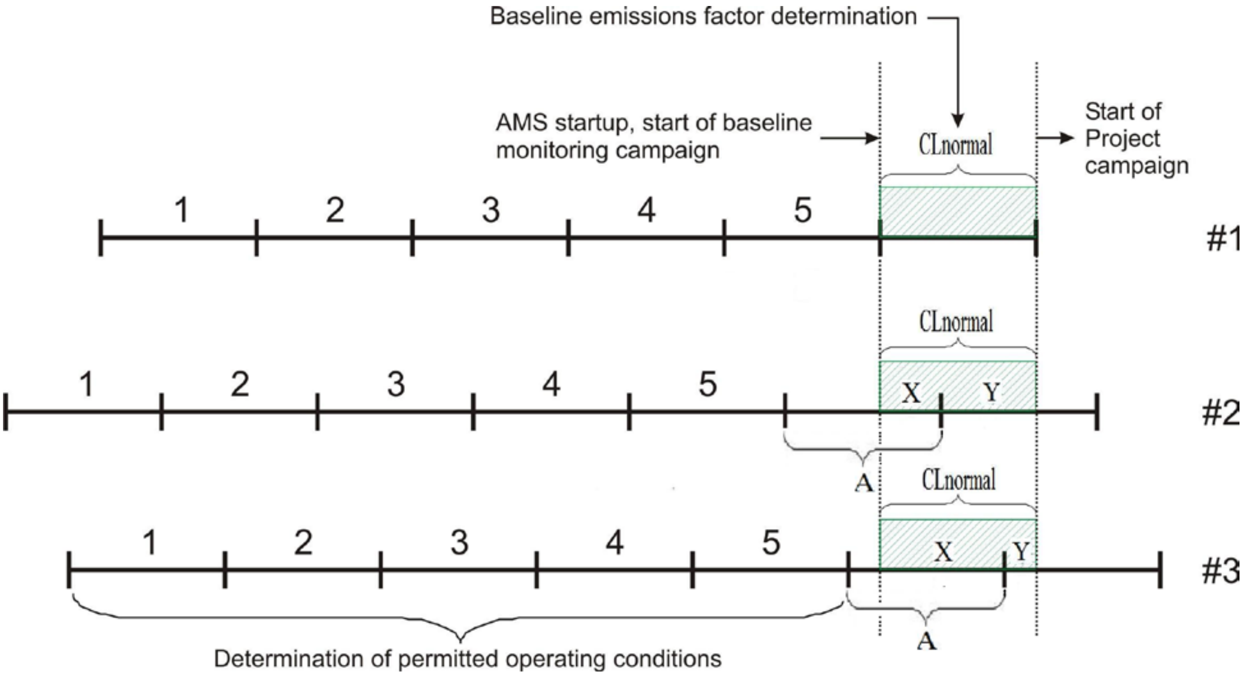

Figure 6. **Determination of baseline emission factor.**

For the lines where full campaign was monitored, baseline emissions factor should be calculated in accordance with below mentioned formula 2 of methodology AM0034. For other lines, in which baseline has been monitored during partial periods of consecutive campaigns, the average N_2O emissions ($NCSG_{BC}$) of the two consecutive campaigns will be used for calculation of baseline emission factor (EF_{BL}).

Total project emissions calculation.

For the nitric acid production lines emission factor calculates separately for each line, using mentioned above modification of methodology. Total baseline emission of the project is the sum of emissions at each line. Project emissions will be calculated in the same way, separately for each line. Emissions reduction of the project is the sum of emission reductions of each line.

Emission reduction verification.

Considering that each production line is a completely independent unit which has individual start/stop schedules for the production campaigns, emission reduction for each line will be reported separately within an individual monitoring report, meaning that multiple verification periods (one per line) will be provided during any single verification audit. Any production line which has a campaign available for verification at the time of the audit will be included on the single verification report.

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:

>>

Cherkasy AZOT’s Nitrous Oxide Abatement Project involves the installation of several secondary catalysts which only purpose and effect is the decomposition of nitrous oxide once it is formed.

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

Baseline will be determined by calculating N_2O baseline emission factor (kg N_2O/tonne HNO_3) before project implementation during a complete production campaign , called "baseline monitoring campaign", which will be conducted under variant described above (end of section B.1)..

To ensure that data obtained during such initial campaign represent actual GHG emissions from the source plant, a number of process parameters that could affect N_2O emission and which could be (to a certain degree) 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/or plant design data. A range or maximum value for any given parameter has been established considering the specific control capabilities of Cherkasy AZOT. In order to properly characterize baseline emission rates, operation during the initial campaign is controlled within the specified range (a maximum or range has been established for each parameter).

Only N_2O emissions that are obtained under permitted ranges will be considered in the calculation of baseline emissions. The level of uncertainty determined for the N_2O monitoring equipment will be deducted from the baseline emission factor.

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

The additionality of the project activity is demonstrated and assessed using the "Tool for demonstration and assessment of additionality" version 5.2 (EB39). We will 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_2O destruction facilities generate no financial or economical benefits other than JI-related income, a simple cost analysis is applied.

Sub-step 2b. Apply simple cost analysis

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

The investment (excluding potential financing costs) consists of the engineering, construction, shipping, installation and commissioning of the secondary catalyst and the 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 neither require 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 less economically and financially attractive than the baseline scenario.

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

Step 4. Common practice analysis

The proposed project activity (or any other form of nitrous oxide abatement technology) is not common practice since no similar project at nitric acid plants is identified in Ukraine. The nitric acid industry typically releases into the atmosphere the N_2O generated as a by-product, as it does not have any economic value or toxicity at typical emission levels. N_2O emissions through the stack gas can be considered the business-as-usual activity as it is a widespread practice around the country. No nitric acid plant in Ukraine has a secondary catalyst (or any other type of N_2O abatement technology) currently installed.

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

Conclusion:

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

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

Without the sale of the ERUs generated by the project activity the net present value (NPV) and internal rate of return (IRR) of the project would be negative, no revenue would be generated and the technology would not be installed. The secondary catalyst technology when installed will reduce nitrous oxide emissions by up to 80 % 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_2O emission reductions, it is expected that the income from selling of ERUs of the determined JI project activity is at least as high as the investment, financing and running costs. Therefore Cherkasy AZOT is willing to finance the project activity under the condition of the determination of the JI project activity.

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

>>
The project boundary encompasses the physical, geographical site of Cherkasy 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_2O contained in the waste stream exiting the stack. The abatement of N_2O is the only GHG emission under the control of the project participant.

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

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

The figure below shows the scheme of nitric acid production process at UKL-7 lines, which corresponds to the project boundary.

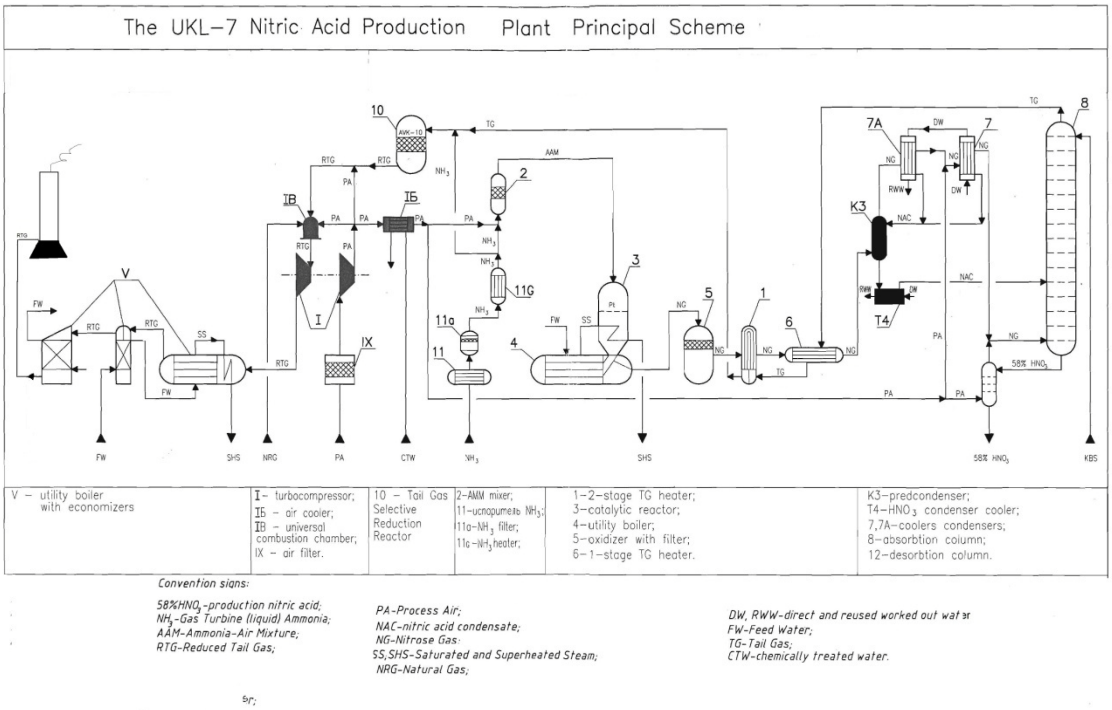

Figure 7. Project boundary.

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

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The baseline for the project activity has not been set yet. This PDD presents preliminary estimates of the baseline and project emissions.

The baseline and monitoring methodology has been applied by:
Vladymyr Ivashchenko, María Inés Hidalgo and Walter Hügler, MGM International Group LLC. (not project participant).
Tel: +380-44-221-66 55; +54-11-5219-1230
e-mails: ivladymyr@mgminter.com, ihidalgo@mgminter.com, whugler@mgminter.com.

SECTION C. Duration of the project / crediting period

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C.1. Starting date of the project:

>>
June 20th , 2008 (contract signature date with MGM)

C.2. Expected operational lifetime of the project:

>>
21 years.

C.3. Length of the crediting period:

>>
The crediting period of the project shall be 13 years. The status of the emission reductions after the end of the first commitment period of the Kyoto Protocol will be determined by any relevant agreement under the UNFCCC and is subject to the approval by the host Party. Currently, the host Party can acknowledge emission reductions for the period up to 2022, or later according to project's lifetime (Decree of the Cabinet of Ministers of Ukraine N 1313 dated 25 November 2009).

The starting date of the crediting period is November 1st , 2010. The end date of the crediting period is 31 December 2022.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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

Cherkasy AZOT's plant is a large producer of mineral fertilizers and products of organic synthesis, over 6 multitonnage highly technological productions operate on an enterprise. Production activity of these productions is served by skilled personnel with a vast experience. A Distrsbuted Control System of technological process (DCS TP) operates at the weak nitric acid production, which is served by skilled operators, providing a high standard level of work quality. Technical service of production is provided by the specialized services/divisions of enterprise on mechanical and electric part, automations, central factory laboratory.

The Shop foreman (AMS TP) and technical divisions of the plant will be responsible for the ongoing operation and maintenance of the N_2O monitoring system. Operation, maintenance, calibration and service intervals will be according to the manufacturer's specifications and international standards (see QA/QC section below), and incorporated into the management structure of ISO 9001-2000 standard procedures. Cherkasy AZOT follows the next international standards: ISO 9001-2000, ISO 14001-2004, BSI-OHSAS 18001:1999.

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 Cherkasy 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) reporting of the emission reductions generated by the project will be sent to the owner of the ERUs, coincidently with the AIE determination.

Project activity includes installation of a continuous automated monitoring system (AMS) which is supplied by Invensys. The system is manufactured in accordance with DIN EN ISO 14956 and EN 14181.
The AMS includes:

Gas analyzer system with an Infrared Analyzer Module. This uses non-dispersive infrared (NDIR) absorption (including probes, pipes and sample conditioning system) which will continuously measure the concentration of N_2O 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.
Flow meters, using the principle of pressure difference for continuous monitoring of gas flow, temperature and pressure in the plant pipe line and according to expected speed of gas flow near sampling point.

This system gives the possibility of monitoring:

- N2O concentration in stack gas for each of production line;
- Stack gas flow rate at each production line;
- Stack temperature for each of production line;
- Stack gas pressure for each of production line.

In addition: AMS TP mass flow meters are installed at each UKL-7 line, providing data on weak nitric acid production (57-58%), which is recalculated at 100% HNO_3 .

Measuring points will be placed after the Recovery boiler of each line prior to gas release, at points with easy access. The staff of Cherkasy AZOT's plant will be trained in the monitoring procedures during the commissioning phase, and a reliable technical support infrastructure will be established.

The plant manager will be responsible for the ongoing operation and maintenance of the N_2O monitoring system. Operation, maintenance, calibration and service intervals will be according to the manufacturer's specifications and international standards (see QA/QC section below), and incorporated into the management structure of ISO 9001:2000 standard procedures.

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 Cherkasy 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 reporting of the emission reductions generated by the project will be sent to the owner of the ERUs, coincidently 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-*	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/	Comment

referencing to D.2.)							paper)	
P.1	$NCSG_{project}$ Project N_2O Concentration in the Stack Gas	AMS (infrared gas analyzer)	mg N_2O/m^3 (converted from ppmv if necessary)	m	Every 2 seconds	100%	Electronically and on paper for at least 2 years	The data output from the analyser will be processed using appropriate software.
P.2	$VSG_{project}$ Project Volume Flow in the Stack Gas	AMS (flow meter)	Nm^3/hour	m	Every 2 seconds	100%	Electronically and on paper for at least 2 years	The data output from the stack flow meter will be processed using appropriate software.
P.3	PE_n N_2O emission of nth project campaign	Calculated from measured data	t N_2O	c	At least once at the end of each campaign	100%	Electronically and on paper for at least 2 years	None
P.4	$OH_{project}$ Project Operating Hours	Process control system	Hours	m	Daily, compiled for the entire campaign	100%	Electronically and on paper for at least 2 years	Shop foreman (DCS TP) and technical devisions of the plant record the hours of full operation of the plant during a campaign
P.5	$NAP_{project}$ Project Nitric Acid Production	Production logs	t 100% HNO_3	m	Daily, compiled for the entire campaign	100%	Electronically and on paper for at least 2 years	Total production over project campaign
P.6	$TSG_{project}$ Project Temperature of the Stack Gas	AMS (flow meter)	ºC	m	Every 2 seconds	100%	Electronically and on paper for at least 2 years	
P.7	$PSG_{project}$ Project	AMS (flow	Bar	m	Every 2 seconds	100%	Electronically	

	Pressure of the Stack Gas	meter)					and on paper for at least 2 years	
P.8	EF_n Project Emission Factor	Calculated from monitoring data	$tN_2O/t100\%\ HNO_3$	c	At the end of each project campaign			See [4]
P.9	$EF_{ma.n}$ Mean emission factor after n campaigns	Calculated from campaign emission factors	$tN_2O/t100\%\ HNO_3$	c	At the end of each project campaign			For the first campaign EF and EFx will be equal
P.10	CL_n Project Campaign Length	Calculated from nitric acid production data	$t100\%\ HNO_3$	c	At the end of each project campaign	100%	Electronically and on paper for at least 2 years	
P.11	EF_P Emission factor used to determine emission reductions	Determined from campaign emissions factors	$tN_2O/t100\%\ HNO_3$	c	After end of each campaign			Determined from campaign emission factor
P.12	EF_{min} Minimum emission factor after 10 campaigns	Determined from campaign emissions factors	$tN_2O/t100\%\ HNO_3$	c	After the end of 10 campaigns			Determined from campaign emission factor
P. 13	GS_n Project Gauze Supplier	Procurement offices	Company name			Once	On paper	

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

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

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[4] Project emission factor per unit of nitric acid produced will be calculated on the basis of measurements of the nitric acid production, stack gas flow rate, N_2O concentration, and the operating hours

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

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

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

$$PE_n = VSG_n \cdot NCSG_n \cdot 10^{-9} \cdot OH_n \qquad \text{(Eq. 1)}$$

where:

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

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

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

$$EF_n = \frac{PE_n}{NAP_n} \qquad \text{(Eq. 2)}$$

where:

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

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

$$EF_{ma,n} = \frac{\sum_n EF_n}{n} \qquad \text{(Eq. 3)}$$

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

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

If $EF_{ma,n} > EF_n$, then $EF_p = EF_{ma,n}$
If $EF_{ma,n} < EF_n$, then $EF_p = EF_n$ (Eq. 4)

Minimum project emission factor

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

Project Campaign Length

a. Longer Project Campaign

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

b. Shorter Project Campaign

If $CL_n < CL_{normal}$, recalculate EF_{BL} by eliminating those N_2O values that were obtained during the production of tonnes of nitric acid beyond 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	$NCSG_{BC}$ Baseline N_2O Concentration in the Stack Gas	AMS (Infrared gas analyzer)	mg N_2O/m^3 (converted from ppmv if necessary)	m	Every 2 seconds	100%	Electronically and on paper for the entire crediting period	The data output from the analyser will be processed using appropriate software program
B.2	VSG_{BC} Baseline Volume Flow in the Stack Gas	AMS (flow meter)	Nm^3/hour	m	Every 2 seconds	100%	Electronically and on paper for the entire crediting period	The data output from the analyser will be processed using

								appropriate software program.
B.3	BE_{BC} Total baseline emissions	Calculated from measured data	tN_2O	c	At least once after baseline campaign	100%	Electronically and on paper for the entire crediting period	
B.4	OH_{BC} Operating hours	Production logs	Hours	m	Daily compiled for the entire campaign	100%	Electronically and on paper for the entire crediting period	Technical divisions of the plant record the hours of full operation of the plant during a campaign
B.5	NAP_{BC} Nitric Acid Production	Production logs	t100% HNO_3	m	Daily compiled for the entire campaign	100%	Electronically and on paper for the entire crediting period	
B.6	TSG_{BC} Baseline Temperature of the Stack Gas	AMS (probe of flow meter)	ºC	m	Every 2 seconds	100%	Electronically and on paper for the entire crediting period	
B.7	PSG_{BC} Baseline Pressure of the Stack Gas	AMS (probe of flow meter)	Bar	m	Every 2 seconds	100%	Electronically and on paper for the entire crediting period	
B.8	EF_{BL} Baseline Emission Factor	Calculated from monitored data	$t N_2O/t HNO_3$	c	Once, at the end of the baseline campaign		Electronically and on paper for the entire crediting period	
B.9	UNC Overall measurement uncertainty of the monitoring system	Calculation of the combined uncertainty of the applied monitoring equipment	%	c	Once after monitoring system is commissioned		Electronically and on paper for the duration of the project	

B.10	AFR_{BC} Ammonia gas flow rate to the AOR	Monitored	kg NH_3/hour	m	Continuously	100%	Electronically and on paper for at least 2 years	To be obtained from the operating condition campaign
B.11	AFR_{max} Maximum Ammonia Flow Rate	Plant records	kg NH_3/hour	c	Once, before baseline campaign	100%	Electronically and on paper for at least 2 years	
B.12	$AIFR_{BC}$ Baseline Ammonia to Air Flow Rate	Monitored	%	mc	Once per hour	100%	Electronically and on paper for at least 2 years	To be obtained from the operating condition campaign
B.13	CL_{BL} Baseline Campaign Length	Calculated from nitric acid production data	t HNO_3	c	After end of each campaign	100%	Electronically and on paper for at least 2 years	
B.14	CL_{normal} Normal Campaign Length	Calculated from nitric acid production data	t HNO_3	c	Before baseline campaign			Average historical campaign length during the operating conditions campaign
B.15	$AIFR_{max}$ Maximum Ammonia to Air Flow Rate	Calculated from historical process data	%	mc	Once	100%	Electronically and on paper for at least 2 years	
B.16	OTh Oxidation temperature for each hour	Monitored	ºC	m	Every hour	100%	Electronically and on paper for at least 2 years	To be obtained from the operating condition campaign
B.17	OT_{normal} Normal	Monitored	ºC	m	Once	100%	Electronically and on paper for	

	Operating Temperature						at least 2 years	
B.18	OPh Oxidation Pressure for each hour	Monitored	Pa	m	Every hour	100%	Electronically and on paper for at least 2 years	To be obtained from the operating condition campaign
B.19	OP_{normal} Normal Operating Pressure	Monitored	Pa	m	Once	100%	Electronically and on paper for at least 2 years	
B.20	GS_{normal} Normal Gauze Supplier	Monitored		m		100%	For project crediting period	To be obtained from the operating condition campaign
B.21	GS_{BL} Baseline Gauze Supplier	Monitored		m	Once	100%	For project crediting period	To be obtained during the baseline campaign
B.22	GSproject Gauze supplier for the project campaigns	Monitored		m	Each campaign	100%	For project crediting period	To be obtained during the project campaign
B.23	GC_{normal} Normal Gauze Composition	Monitored		m	Each campaign	100%	For project crediting period	To be obtained from the operating condition campaign
B.24	GC_{BL} Baseline Gauze Composition	Monitored		m	Once	100%	For project crediting period	To be obtained during the baseline campaign

B.25	GCproject Gauze composition during baseline campaign	Monitored		m	Each campaign	100%	For project crediting period	To be obtained during the project campaign
B.26	EF_{reg} Emission Factor Set by Regulation	Local and national regulations			At date of introducing or change of regulation			

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

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Baseline emission procedure

The baseline emissions will be established through monitoring of N_2O concentration and gas flow volume in the stack of the nitric acid plant for one campaign before project implementation. Where possible, baseline emissions will be monitored continuously over one complete campaign as described in AM0034. At those production lines where the installation of the monitoring system took place in the middle of a campaign, baseline emissions will be monitored during two consecutive periods of two different campaigns, as described in B 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.

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

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

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

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

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

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

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

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

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

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

e) Calculate the new sample mean from the remaining values (volume of stack gas (VSG) and N_2O concentration of stack gas (NCSG))

Then, the average mass of N_2O emissions per hour is estimated as product of NCSG and VSG. The N_2O emissions per campaign are estimated as the product of N_2O emission per hour and the total number of complete hours of operation of the campaign using the following Eq. 5 from AM0034:

$$BE_{BC} = VSG_{BC} \cdot NCSG_{BC} \cdot 10^{-9} \cdot OH_{BC} \qquad \text{(Eq. 5)}$$

where:

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

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

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

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}(1 - \frac{UNC}{100}) \qquad \text{(Eq. 6)}$$

Where:

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

Impact of regulations

Should N_2O 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_{BL}), regardless of whether the regulatory level is expressed as:

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

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

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

Composition of the ammonia oxidation catalyst

In the case that in the Cherkasy 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 (previous five campaigns), then there shall be no limitations on N_2O baseline emissions.

Campaign length

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

Historic campaign length

The average historic campaign length (CL_{normal}) defined as the average campaign length for the historic campaigns used to define operating conditions (the previous 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 where the plant was operating outside of the “permitted range”).

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

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

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

>>
Not applicable

D.1.2.1. 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_2 equivalent):

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

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O} \qquad \text{(Eq. 7)}$$

where:

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

Calculations of total emissions reductions for the project

Total emission reductions for the project over the verification period are calculated as a sum of emission reductions at individual lines with completed project campaigns. (Eq. 2):

$$ER_{total} = \sum_{i=1}^{i=10} ER_n \quad \text{(Eq. 2)}$$

where

ER_{total}	Total emission reductions for the project over the verification period, tCO_2e
ER_n	Total project emissions of the n^{th} campaign on i line, tCO_2e

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

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

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

>>

No leakage calculation is required

---

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

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

>>

No leakage calculation is required.

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

>>

Ex ante estimation of emission reductions

For completing this PDD the following assumptions were used for estimation of project emissions:

- Annual production of nitric acid is based on the Plan for Production of Nitric Acid for the Years 2009-1015 approved by the plant management. For the period of 2010-2012 a conservative value of 590,000 tonnes of nitric acid per year was used. For the period of 2013-2022 an average of 800,000 tonnes HNO_3 per year was applied.
- For baseline emission estimation an emission factor equal to 3,48 kg N_2O/t HNO_3 is assumed for all UKL-7 lines, taking in consideration actual N_2O concentration measurements taken by certified organization “Airtec” from 27.01.2009 to 30.01.2009.
- The potential technology providers (BASF, Umicore, Johnson Matthey) indicate that the estimated reduction efficiency to be achieved is 80% or higher. Thus, in order to present estimated values in this PDD, we consider the project emission factor to be equal to 20% of baseline emission factor ($EF_P = 0.20 * EF_{BL}$)
- Project campaigns start in November 2010.

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

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O} \qquad \text{(Eq. 8)}$$

Where:

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

The assumption parameters are specified in the following tables.

For the period 2010-2012:

Estimated values	
NAP, $tHNO_3/yr$[6]	590,000
EF_{BL} , $tN_2O/tHNO_3$	0.00348
EF_p , $tN_2O/tHNO_3$	0.000696
GWP_{N_2O} tCO_2e/tN_2O	310

For the period 2013-2022:

Estimated values	
NAP, $tHNO_3/yr$[7]	800,000
EF_{BL} , $tN_2O/tHNO_3$	0.00348
EF_p , $tN_2O/tHNO_3$	0.000696
GWP_{N_2O} tCO_2e/tN_2O	310

---

[6] This NAP corresponds to the total capacity of all plant reactors.

[7] This NAP corresponds to the total capacity of all plant reactors.

Then,

For the period 2010-2012

ER_n = (0,00348- 0,000696) x 590,000 x 310 = 509,194 tCO_2 *e/year* (Eq.9)

For the period 2013-2022

ER_n = (0,00348-0,000696) x 800,000 x 310 = 690,432 tCO_2 *e/year* (Eq.10)

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

>>

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

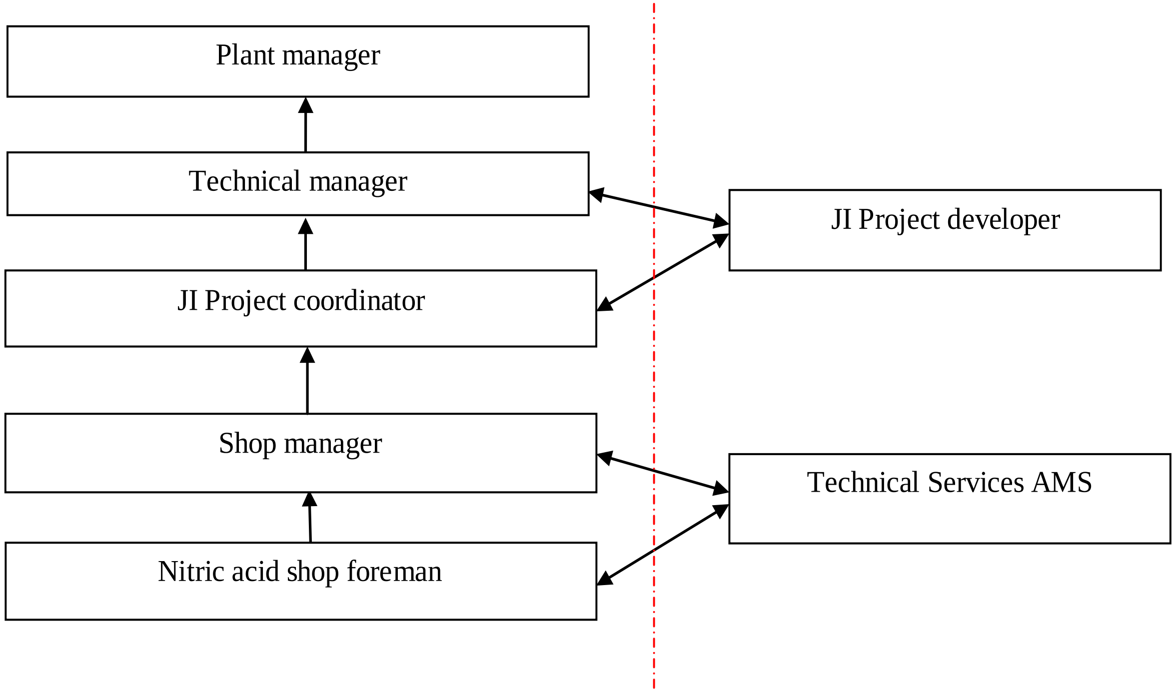
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
P.1; B.1; P.2; B.2; P.6; B.6; P.7; B.7	*Low*	Regular calibrations according to vendor specifications and recognised industry standards. Staff will be trained in monitoring procedures and a reliable technical support infrastructure will be set up.
Automated Monitoring System	*Low*	See Monitoring Plan
P.4; P.5, P.8, P.9, B.4, B.5, B.8, B.9, B.10	*Low*	Included in evaluation by third party validator

Measuring points	*Low*	In the selection of downstream measuring points the following issues are considered: temperature of the gas below 300°C (N_2O inert), assurance of homogeneity of the volume gas flow at the measuring points throughout the diameter in terms of velocity of flow and mass composition of gas flow, possible turbulences in the gas flow stream (e.g., at the stack walls), if inhomogeneities exist, measuring of the gas flow is conducted with specific measuring equipment that minimizes uncertainties and inhomogeneities to a minimum (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:

>>

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



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

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

>>

The baseline and monitoring methodology has been applied by:
Volodymyr Ivashchenko, Walter Hügler, and María Inés Hidalgo, MGM International Group LLC (not project participant).
Tel: : +380-44-221-6655; +54-11-5219-1230
e-mails: ivladymyr@ mgminter.com, ihidalgo@mgminter.com, whugler@mgminter.com..

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

>>

Project emissions are estimated according to the following assumptions:
For completing this PDD the following assumptions were used for estimation of project emissions:

- Annual production of nitric acid is based on the Plan for Production of Nitric Acid for the Years 2009-1015 approved by the plant management. For the period of 2010-2012 a conservative value of 590,000 tonnes of nitric acid per year was used. For the period of 2013-2022 an average of 800,000 tonnes HNO_3 per year was applied.
- For baseline emission estimation an emission factor equal to 3,48 kg N_2O/t HNO_3 is assumed for all UKL-7 lines, taking in consideration actual N_2O concentration measurements taken by certified organization "Airtec" from 27.01.2009 to 30.01.2009.
- The potential technology providers (BASF, Umicore, Johnson Matthey) indicate that the estimated reduction efficiency to be achieved is 80% or higher. Thus, in order to present estimated values in this PDD, we consider the project emission factor to be equal to 20% of baseline emission factor (EF_P = 0.20 * EF_{BL})
- Project campaigns start in November 2010.

Then, the estimated project emissions are:

$$PE_n = EF_p \cdot NAP_n \cdot GWP_{N_2O} \qquad \text{(Eq. 10)}$$

Where:

PE_n	Project emissions during the *nth* campaign of the project activity, tCO_2
EF_p	Project emission factor, in $tN_2O/tHNO_3$
NAP	Nitric acid production during the *nth* campaign of the project activity, in, $tHNO_3$
GWP_{N_2O}	N_2O global warming potential

For the period 2010-2012

$$PE_n = 0.000696 \cdot 590{,}000 \cdot 310 = 127{,}298 tCO_2e / year$$

For the period 2013-2022

$$PE_n = 0.000696 \cdot 800{,}000 \cdot 310 = 172{,}608 tCO_2e / year$$

E.2. Estimated leakage:

>>

Not applicable

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

>>

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

E.4. Estimated baseline emissions:

>>

Baseline emissions are estimated according the following assumptions:

- Annual production of nitric acid is based on the Plan for Production of Nitric Acid for the Years 2009-1015 approved by the plant management. For the period of 2010-2012 a conservative value of 590,000 tonnes of nitric acid per year was used. For the period of 2013-2022 an average of 800,000 tonnes HNO_3 per year was applied.
- For baseline emission estimation an emission factor equal to 3,48 kg N_2O/t HNO_3 is assumed for all UKL-7 lines, taking in consideration actual N_2O concentration measurements taken by certified organization “Airtec” from 27.01.2009 to 30.01.2009.
- The potential technology providers (BASF, Umicore, Johnson Matthey) indicate that the estimated reduction efficiency to be achieved is 80% or higher. Thus, in order to present estimated values in this PDD, we consider the project emission factor to be equal to 20% of baseline emission factor ($EF_P = 0.20 * EF_{BL}$).
- Project campaigns start in November 2010.

$$BE_n = EF_{BL} \cdot NAP_n \cdot GWP_{N_2O} \qquad \text{(Eq. 11)}$$

where

BE_n	Baseline emissions during the *nth* campaign of the project activity, tCO_2
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
NAP	Nitric acid production during the *nth* campaign of the project activity, in $tHNO_3$
GWP_{N_2O}	N_2O global warming potential

For the period 2010-2012

$$BE_n = 0.00348 \cdot 590{,}000 \cdot 310 = 636{,}492\, tCO_2e / year$$

For the period 2013-2022

$$BE_n = 0.00348 \cdot 800{,}000 \cdot 310 = 863{,}040\, tCO_2e / year$$

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

\>>

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O} \qquad \text{(Eq. 12)}$$

where

ER_n	Emission reductions for the *nth* campaign , tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
EF_p	Project emission factor, in $tN_2O/tHNO_3$
NAP	Nitric acid production during the *nth* campaign of the project activity, in $tHNO_3$
GWP_{N_2O}	N_2O global warming potential

For the period 2010-2012

$$ER_n = (0.00348 - 0.000696) \cdot 590{,}000 \cdot 310 = 509{,}194\, tCO_2e / year$$

For the period 2013-2022

$$ER_n = (0.00348 - 0.000696) \cdot 800{,}000 \cdot 310 = 690{,}432\, tCO_2e / year$$

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

\>>

For the first crediting period of the Kyoto Protocol:

Years	Estimation of project activity emissions (tones of CO_2e)	Estimation of baseline emissions (tones of CO_2e)	Estimation of leakage (tones of CO_2e)	Estimation of emission reduction (tones of CO_2e)
2010	21,216	106,082	0	84,866
2011	127,298	636,492	0	509,194
2012	127,298	636,492	0	509,194
Total	275,812	1,379,066	0	1,103,254

For the period after the end of the first crediting period of the Kyoto Protocol, subject to approval by the host country:

Years	Estimation of project activity emissions (tones of CO2e)	Estimation of baseline emissions (tones of CO2e)	Estimation of leakage (tones of CO_2e)	Estimation of emission reduction (tones of CO2e)
2013	172,608	863,040	0	690,432
2014	172,608	863,040	0	690,432
2015	172,608	863,040	0	690,432
2016	172,608	863,040	0	690,432
2017	172,608	863,040	0	690,432
2018	172,608	863,040	0	690,432
2019	172,608	863,040	0	690,432
2020	172,608	863,040	0	690,432
2021	172,608	863,040	0	690,432
2022	172,608	863,040	0	690,432
Total	1,726,080	8,630,400	0	6,904,320

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 project is not expected to have any significant impact on the environment other than reduction of N_2O emissions. The installation of the monitoring system and secondary catalyst does not affect the production process, and emissions of NO_x will remain at the same level as before the implementation of the project. Cherkasy AZOT is considering the need for the Environmental Impact Assessment (EIA), which will be determined based on the national legislation and the decision of the State Administration on Environmental Protection in Cherkas'ka oblast. If EIA is required, its summary will be included in this section.

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:

>>

This section will be completed upon decision regarding EIA.

SECTION G. Stakeholders' comments

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

>>

Cherkasy AZOT is planning to carry out a stakeholder's assessment during the first half of 2010. The stakeholder's consultations will be carried out in accordance to the Requirements to the Preparation of Joint Implementation Projects (Order of the National Environmental Investment Agency N 33, dated June 25 2008.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	Open Joint Stock Company "AZOT",
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Represented by:	Andriy A. Koval
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Salutation:	Mr.
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Mobile:	

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 estimations of the key baseline parameters are listed in the following table:

Parameter	2010-2012	2013-2022
Tail gas N_2O concentration (ppm)		
Typical nitric acid production output (t 100% HNO_3/year)	590,000	800,000
Maximum historic nitric acid production for 1 line (t 100% HNO_3/day)	360	360
N_2O baseline emission factor (kg N_2O/t 100% HNO_3)	3,48	3,48
N_2O destruction factor (%)	80	80
UNC(%)*	4%	4%
Operating days	330	330

* Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment. Before QAL1 and QAL2 certification preliminary typical figure for AMS is used.

Annex 3

MONITORING PLAN

The current JI project "Nitrous Oxide Abatement Project at Cherkasy AZOT will measure on a quasi-continuous basis (uninterrupted sampling of flue gases with concentration and normalized flow analysis on short, discrete time periods) the N_2O mass flow leaving the nitric acid plant through an automated measuring system (AMS[8]) using technologies and procedures in accordance with AM0034: "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants". Monitoring procedures (which are the integral part of monitoring plan) will be fully integrated in Quality control and Environment protection systems.

The plant is currently ISO 9001-2000, ISO 14001-2004 certified; certification documents will be available on site during determination for their review.

The Shop Foreman (AMS TP) and technical divisions of the plant will be responsible for the ongoing operation and maintenance of the N_2O monitoring system. Operation, maintenance, calibration and service intervals will be according to the manufacturer's specifications and international standards (see QA/QC section below), and incorporated into the management structure of ISO 9001-2000 standard procedures.

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 reporting of the emission reductions generated by the project will be sent to the ERUs' owner, coincidently with the AIE determination.

Tables in Sections D.1.1.1 and D.1.1.3 of the PDD describe the parameters to be acquired and recorded as per 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_2O 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 ACM. 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.

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.

1. Emission reduction calculations

---

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

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

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

where:

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

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

where:

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

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

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

where:

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

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

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

where:

EF_n	Emission factor calculated for the n^{th} campaign on *i* line, in kg N_2O/t HNO_3
PE_n	Total project emissions of the n^{th} campaign, in tN_2O
NAP_n	Nitric acid production in the n^{th} campaign, in t 100% HNO_3

Then,

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

where

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

Calculation of total emissions reduction for the project:

Total emission reductions for the project over the verification period are calculated as a sum of emission reductions at individual lines with completed project campaigns. (Eq. 2):

$$ER_{total} = \sum_{i=1}^{i=10} ER_n \quad \text{(Eq. 2)}$$

where

ER_{total}	Total emission reductions for the project over the verification period, tCO_2e
ER_n	Total project emissions of the n^{th} campaign on *i* line, tCO_2e

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_2O concentration and gas flow for a defined period of time (e.g., every hour of operation, i.e., an average of the measured values of the past 60 minutes). Error readings (e.g., downtime or malfunction) and extreme values are eliminated from the output data series. Next, the same statistical evaluation that was applied to the baseline data series will be applied to the project data series:
a) Calculate the sample mean (x)
b) Calculate the sample standard deviation (s)
c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation)
d) Eliminate all data that lie outside the 95% confidence interval
e) Calculate the new sample mean from the remaining values

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

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

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

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

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

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

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

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

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

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

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

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

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

The production during a given campaign will be compared to normal campaign length (CL_{normal}). If the length of each 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 tones of nitric acid beyond the CL_n (i.e., the last tonnes produced) from the calculation of EF_n.

Quality Control and Quality Assurance

Cherkasy AZOT plans to install monitoring system which complies with EN 14181. As per the system detailed out in the methodology AM0034, three levels of quality assurance are planned. These levels are QAL1, QAL2, QAL3 and AST.

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

The suitability evaluation and its measuring procedure are described in ISO 14956:2002 "Air quality – Evaluation of the suitability of a measurement procedure by comparison with a required measuring uncertainty". Using this standard, it will be proven that the total uncertainty of the results obtained from the AMS meets the specification for uncertainty stated in the applicable regulations (e.g., EU Directives 2000/76/EU or 2001/80/EU). Since European regulations do not yet cover the measurement of N_2O at nitric acid plants, there is no official specification for uncertainty available. Then, considering official specification of uncertainties defined for equivalent pollutants (e.g., NO_x, SO_2) as per EU regulations, 20% of the ELV (emission limit value) has been considered by the equipment manufacturer as the required measurement quality for N_2O, for the purpose of expanded uncertainty calculations. The specific performance characteristics of the monitoring system chosen by the project will be listed in the Project Design Document, as per 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 the N_2O analyzer is suitable to perform the indicated analysis (N_2O concentration), and provides a conservative estimate for expanded uncertainty. The complete QAL1 report will be available for determination audit.

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.

QAL2: Validation of the AMS following its installation.

The next level of quality assurance prescribed on EN14181:2004 (QAL2) describes a procedure for the determination of the calibration function and its variability, by means of certain number of parallel measurements (meaning simultaneously with the AMS), performed with a standard reference method (SRM) (which should be a proven and accurate[9] analytical protocol as per relevant norms or legislation). The variability of the measured values obtained with the AMS is then compared with the uncertainty given by the applicable legislation. If the measured variability is lower than the permitted uncertainty, it is concluded that the AMS has passed the variability test. Since (as explained above), official uncertainty is not available, an appropriate level is determined on the basis of those that do exist for similar pollutants and techniques (in this case 20% of ELV). The testing laboratories performing the measurements with the standard reference method will have an accredited quality assurance system according to EN ISO/IEC 17025 or relevant (national) standards.

TUV SUD conducted a preliminary consideration of project documentation on monitoring system installation at the Cherkasy AZOT plant (preliminary testing on QAL2 conformity) and expressed a positive conclusion. TUV SUD will conduct the final testing of AMS on QAL2 conformity after completion of monitoring system installation.

The monitored data will be corrected through proper application of the resulting calibration functions. The UNC as determined during the QAL2 test will be deducted from the baseline emission factor according to the equations provided by the methodology.

QAL3: Ongoing quality assurance during operation

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

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

All monitoring equipment will be serviced and maintained according to the manufacturer's instructions and international standards by qualified personnel (both Cherkasy AZOT's resources and any third parties that

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

may be involved during such activities). Maintenance and service logs will be well kept at Cherkasy AZOT plant and available for auditing purposes.

AST: Annual Surveillance Test (ongoing quality assurance).

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