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:

"Catalytic N_2O destruction project in the tail gas of two nitric acid plants at Novomoskovsky Azot"

Version 1

Date of Completion: 08/03/2008

A.2. Description of the project:

General Introduction:

Nitrous oxide (N_2O) is an unwanted, invisible and previously neglected by-product of the manufacture of nitric acid. It is formed alongside the main, desired product nitric oxide (NO) during the catalytic oxidation of ammonia in air over noble metal gauzes. The production of nitric acid takes place in three main process steps as indicated by the following reactions:

1. Ammonia (NH_3) combustion to form nitric oxide (NO):

   Ammonia is reacted with air on noble metal catalyst in the oxidation section of nitric acid plants. Nitric oxide and water are formed in this process according to the following equation:

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

   Simultaneously, nitrous oxide (N_2O), nitrogen (N) and water (H_2O) are formed as well, in accordance with the following equations:

   $4\ NH_3 + 3\ O_2 \rightarrow 2\ N_2 + 6\ H_2O$ (side reaction 1) **(2)**

   $4\ NH_3 + 4\ O_2 \rightarrow 2\ N_2O + 6\ H_2O$ (side reaction 2) **(3)**

   NO yield depends mainly on pressure and temperature in the ammonia oxidation process and usually is in a range of 95% to 97%.

2. NO is oxidised to nitrogen dioxide (NO_2):

   $2\ NO + O_2 \rightarrow 2\ NO_2$ (main reaction 2) **(4)**

3. (According to the technical process) Absorption of NO_2 in water to form nitric acid (HNO_3):

   $3\ NO_2 + H_2O \rightarrow 2\ HNO_3 + NO$ (main reaction 3) **(5)**

   (NO is oxidised to NO_2 according to main reaction 2)

Nitric acid plants are, in the vast majority of cases, part of a chemical complex and are built and operated to supply acid for consumption in downstream process units. The most common use for nitric acid is for fertilisers, with smaller quantities going into the manufacture of organic compounds and mining explosives.

In the proposed project activity nitric acid production is part of a chemical fertilizer production complex of EUROCHEM Mineral and Chemical Company in Novomoskovsk, Russia. EUROCHEM is the major agrochemical Company in Russia, one of top ten global fertilizer producers.

EUROCHEM Mineral and Chemical Company in Novomoskovsk produce nitric acid in UKL 7-71 plants. N_2O is a chemical by product of the production process and emitted through the tail gas to the atmosphere. On leaving the ammonia oxidation reactor (AOR) some of the N_2O may be destroyed in the part of the plant upstream of the absorption tower by high temperature homogeneous gas phase decomposition and by catalytic decomposition on platinum deposits formed from metal lost from the ammonia oxidation catalyst. Since platinum dust carryover into the tail gas section of the plant is prevented by the absorption tower, which acts as a very efficient scrubber, and the temperatures encountered in the tail gas section of the plant are lower than those leading to homogeneous gas phase N_2O decomposition there is no relevant loss of N_2O in the tail gas section unless a N_2O destruction facility is installed. N_2O that has reached the tail gas section is thus discharged to atmosphere in the tail gas, and has no economic value.

Depending on technical parameters (e.g. tail gas temperature) the project applicant has to decide either to install a catalytic decomposition process or catalytic reduction process for the proposed project activity.

Description of catalytic decomposition process:

Catalytic decomposition of N_2O occurs when the N_2O is split into its constituent elements by contact with a catalyst. A catalyst is a material which accelerates the speed of the reaction without itself being transformed or consumed by the reaction.

Overall reaction:

$$2\ N_2O \rightarrow 2\ N_2 + O_2 \tag{6}$$

The products of N_2O decomposition are the substances that result from decomposition reaction (N_2 and O_2).

Description of catalytic reduction process:

Although the term catalytic reduction nowadays has a more general definition in terms of the transfer of electrons, the following definition is sufficient for present purposes: Catalytic reduction of N_2O occurs when reactions take place between N_2O and other substances in contact with a catalyst, such that the oxygen is removed from the N_2O molecule and forms one or more compounds with other species. The substance or substances that react with N_2O to remove oxygen are termed reducing agent. A general reaction equation for the catalytic reduction of N_2O can be given as:

$$n\ N_2O + x\ RA \rightarrow n\ N_2 + y_1\ P(1)O_A + y_2\ P(2)O_B + \ldots + z_1\ Q(1) + z_2\ Q(2) + \ldots \tag{7}$$

where RA is a molecule of the reducing agent, $P(1)O_A$, $P(2)O_B$ are the compound formed by reaction with the oxygen of the N_2O and Q(1), Q(2) represents further products of the oxidation reaction, n, x, y_1, y_2, z_1, z_2 are the appropriate stoichiometric coefficients.

Equations for N_2O reduction with hydrocarbons:

e.g.

Reducing agent is **methane:**

$$CH_4 + 3\ N_2O \rightarrow CO + 2\ H_2O + 3\ N_2 \tag{8}$$

or

$$CH_4 + 4\ N_2O \rightarrow CO_2 + 2\ H_2O + 4\ N_2 \tag{9}$$

e.g.
Reducing agent is **ethane**, overall reaction is:

$$C_2H_6 + 5\ N_2O \rightarrow 2\ CO + 3\ H_2O + 5\ N_2 \quad \textbf{(10)}$$

or

$$C_2H_6 + 7\ N_2O \rightarrow 2\ CO_2 + 3\ H_2O + 7\ N_2 \quad \textbf{(11)}$$

e.g.:
Reducing agent is **propane**, overall reaction is:

$$C_3H_8 + 7\ N_2O \rightarrow 3\ CO + 4\ H_2O + 7\ N_2 \quad \textbf{(12)}$$

or

$$C_3H_8 + 10\ N_2O \rightarrow 3\ CO_2 + 4\ H_2O + 10\ N_2 \quad \textbf{(13)}$$

e.g.
Reducing agent is **butane**, overall reaction is:

$$C_4H_{10} + 9\ N_2O \rightarrow 4\ CO + 5\ H_2O + 9\ N_2 \quad \textbf{(14)}$$

or

$$C_4H_{10} + 13\ N_2O \rightarrow 4\ CO_2 + 5\ H_2O + 13\ N_2 \quad \textbf{(15)}$$

The definition does not exclude the possibility of side reactions resulting in consumption of reducing agent without any reduction of N_2O, for example with propane:

$$2\ C_3H_8 + 7\ O_2 \rightarrow 6\ CO + 8\ H_2O \quad \textbf{(16)}$$

or

$$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O \quad \textbf{(17)}$$

The world's nitric acid plants represent the single greatest industrial process source of N_2O emissions. Currently, approx. 700 nitric acid plants are operated globally with an estimated amount of N_2O emissions of 400,000 t N_2O p.a. (corresponding to 125 Mio t CO_2e p.a.).

In response to this, UHDE GmbH, a leading company in the field of nitric acid technology, has undertaken the task of developing processes for removing N_2O from nitric acid plant tail gas streams based on the catalytic decomposition or catalytic reduction of N_2O. Efforts have been concentrated on treating the tail gas, as this end-of-pipe approach offers the general advantage, compared with other possible measures (called primary and secondary measures, see section A.4.3.), that minimum interference with the nitric acid production process is caused. In particular, any possibility of nitric acid product contamination, or loss of NO that could otherwise influence nitric acid production, is eliminated.

Project Specific description:

EUROCHEM OJSC Novomoskovsky Azot operates two identical UKL 7-71 nitric acid plants equipped wit SCR DeNOx units at its production complex in Novomoskovsk. Each nitric acid plant has a designed capacity of 14.8 $tHNO_3$ per hour.

Principles of the EnviNOx® process at the UKL 7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot:

The UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot are operated as medium pressure combustion nitric acid plants.

The EnviNOx® process to be used is based on the catalytic reduction of NO_x (NO and NO_2) with ammonia (NH_3) and of nitrous oxide (N_2O) with a hydrocarbon. The hydrocarbon used will be methane (CH_4). The reactions take place over an iron zeolite catalyst bed.

First the NO_x is reduced with ammonia according to such reactions as:

$$6\,NO_2 + 8\,NH_3 \rightarrow 7\,N_2 + 12\,H_2O \quad \textbf{(18)}$$

$$6\,NO + 4\,NH_3 \rightarrow 5\,N_2 + 6\,H_2O \quad \textbf{(19)}$$

$$NO + NO_2 + 2\,NH_3 \rightarrow 2\,N_2 + 3\,H_2O \quad \textbf{(20)}$$

$$4\,NO + O_2 + 4\,NH_3 \rightarrow 4\,N_2 + 6\,H_2O \quad \textbf{(21)}$$

Effectively, all the NO_x is removed in the first process step, whereas some destruction of N_2O also occurs.

Secondly the nitrous oxide (N_2O) is reduced with hydrocarbons over the iron zeolite catalyst according to such reactions as:

$$3\,N_2O + CH_4 \rightarrow 3\,N_2 + 2\,H_2O + CO \quad \textbf{(22)}$$

$$4\,N_2O + CH_4 \rightarrow 4\,N_2 + 2\,H_2O + CO_2 \quad \textbf{(23)}$$

Some direct oxidation of the hydrocarbons may also take place:

$$2\,O_2 + CH_4 \rightarrow 2\,H_2O + CO_2 \quad \textbf{(24)}$$

$$3\,O_2 + 2\,CH_4 \rightarrow 4\,H_2O + 2\,CO \quad \textbf{(25)}$$

Similar reactions take place between nitrous oxide and the small quantities of other hydrocarbons such as ethane (C_2H_6), propane (C_4H_8) and butane (C_4H_{10}) that are present in natural gas. N_2O reduction by these reactions is much more effective when NO_x is absent.

A large proportion of the carbon monoxide (CO) that is formed is further oxidised to carbon dioxide:

$$2\,CO + O_2 \rightarrow 2\,CO_2 \quad \textbf{(26)}$$

All the above reactions are exothermic and cause a temperature rise over the EnviNOx® reactor.

Compared with the reduction in greenhouse gas emission achieved by the destruction of N_2O the additional greenhouse gas emissions (CO_2) caused by the use of hydrocarbons in the process are insignificant but will be determined.

The proposed project activity will reduce the N_2O emissions from UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot by more than 94% by installing the EnviNOx® process. The project will use methane as reducing agent.

It is important to emphasise that the hydrocarbon and ammonia are not employed as fuels, to increase the temperature of the tail gas to a level at which high rates of N_2O decomposition can take place, but that they are used as genuine chemical reagents that take part in reactions with N_2O and NO_X respectively on specific sites on the surface of catalysts specially developed for the purpose by UHDE.

The proposed project activity will consume small quantities of natural gas. The precise specific consumption figures of the reducing agent (methane) will be fine-tuned during commissioning of the EnviNOx® system.

One of the most efficient catalytic destruction technologies for N_2O emission reduction in the tail gas of nitric acid plants (furthermore called "EnviNOx® system") provided by the manufacturer UHDE GmbH will be implemented in the project activity (see section A.3.). EUROCHEM OJSC Novomoskovsky Azot will install and operate the EnviNOx® system at two UKL 7-71 nitric acid plants.

The **project's aim** is to destruct (almost eliminate) N_2O emissions at the UKL 7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot with potential additional environmental and secure social benefits. The project activity will not result in any revenues except the income from the sale of CERs. The catalytic N_2O destruction project activity is expected to reduce more than 94% of the N_2O emissions that would be emitted without the project activity. Under related project circumstances at the nitric acid of AMI in Austria, UHDE's EnviNOx® system reduces more than 98% of all N_2O emissions of the nitric acid plant. A similar CDM project in Egypt (Abu Qir Fertilizer Company, Alexandria), which went into operation in October 2006, showed a N_2O destruction rate of about 99%.

A.3. Project participants:

Name of Party involved	Private and/or public entity(ies) project participants (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Russian Federation (Host)	MCC EuroChem Russia	No
Republic of Austria	Carbon Climate Protection GmbH	No

Host country is **Russian Federation**. Russia ratified the Kyoto Protocol on November 18, 2004.

Project participant, MCC EuroChem Russia (herein after called **EuroChem**) was established in 2001. EuroChem Mineral and Chemical Company is the major agrochemical Company in Russia, one of the top ten global fertilizer producers. EuroChem is comprised of 6 enterprises for raw materials extraction and production of fertilizers, organics, feed phosphates, as well as transport divisions and a broad marketing network in Russia and abroad. EuroChem is a manufacturer of over 100 products all of which are certified and customer-oriented. Demand satisfaction, product and management quality are fundamentals of EuroChem corporate culture.

Project participant, Carbon Climate Protection GmbH (herein after called **CARBON**), is a limited liability company located and registered in Austria under Austrian law. Carbon will finance the proposed project activity and is responsible for the project development. The company is an experienced financing and investment company specialized in the development and implementation of Greenhouse Gas reduction projects according to Article 6 of the Kyoto Protocol (Joint Implementation) and Article 12 of the Kyoto Protocol (Clean Development Mechanism). CARBON has experience with CDM project development in Africa, Latin America and Asia and is specialised in the catalytic N_2O destruction in the tail gas of nitric acid plants. It has developed the methodology for destruction of N_2O in the tail gas of nitric acid plants (AM0028) and has implemented the first N_2O destruction CDM project at nitric acid plants at Abu Qir Fertilizer Company in Egypt as well as similar CDM project at three nitric acid plants at Hu-Chems Fine Chemicals Corporation in Korea and ENAEX S.A. in Chile.

Project operator, **EuroChem OJSC** Novomoskovsky **Azot** in Novomoskovsk (herein after called EuroChem Novomoskovsky), is a private owned entity registered under the laws of the Russian Federation. EUROCHEM OJSC Novomoskovsky Azot is part of EUROCHEM group.

Project investor, EuroChem Trading GmbH, is a limited liability company incorporated under the law of Switzerland in 2004. The principal activities of the company include trading of wide range of mineral fertilizers (nitric group, organic and inorganic, phosphoric group and ammonia). EuroChem Trading GmbH has the convenient location in the centre of Europe and benefits of the simplified procedure of customs clearance, provides the optimization of export supply as a result of centralized export of products by all EuroChem enterprises.
Ownership: the company is owned 100% by JSC Mineral and chemical Company EuroChem, a Russian Open Joint Stock Company whose principal activities include extracting of concentrates, processing of fertilizers and distributing them both in domestic and foreign markets.

Project Technology Provider, UHDE GmbH (herein after called **"UHDE"),** is a 100% subsidiary of ThyssenKrupp. UHDE is world market leader in the field of fertilizer technology engineering and construction. Consequently, UHDE has constructed many modern fertilizer plants including nitric acid plants. In response to increasing concerns surrounding climate change and the destruction of the ozone layer, UHDE has developed catalyst-based processes for removing N_2O from nitric acid tail gas streams and has already successfully delivered its EnviNOx system to several CDM project activities (e.g. Abu Qir-Egypt)

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

The Russian Federation

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

The project activity is located in the Central Russia in the Oblast Tula.

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

The project activity is located in the city Novomoskovsk.

The city was founded in 1929, when a chemical complex was built in the region. The population of Novomoskovsk is about 130.000.

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

The project is located in the Central Russia in the Oblast Tula in the city of Novomoskovsk.

Company:	EUROCHEM Novomoskovsky
City:	Novomoskovsk
Region:	Oblast Tula
Country:	Russia

Latitude:	54°02’ N
Longitude:	38°16’ O

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

The possible ways to destroy or reduce N_2O emissions at nitric acid plants can be categorized into three groups:

- Primary: Part of the N_2O is prevented from forming. This requires modifications to the precious metal ammonia oxidation gauzes to reduce N_2O formation. Alternative materials can also be employed as the ammonia oxidation catalyst. Cobalt oxide, for example, does not generate any N_2O by-product, but suffers from being less selective for the production of NO.
- Secondary: N_2O, once formed, is removed anywhere between the outlet of the ammonia oxidation gauzes and the inlet of the absorption tower. The preferred position of choice for secondary methods is directly after the gauzes. A real-time continuous measurement of baseline and project emissions is not possible.
- Tertiary: N_2O is removed from the tail gas downstream of the absorption tower by catalytic destruction (either by catalytic decomposition or by catalytic reduction). In general the optimum position for a tertiary N_2O destruction facility is at the hottest position in the tail gas stream. In tertiary catalytic N_2O destruction processes a hydrocarbon input may be necessary to achieve the highest available N_2O destruction rate. Thus hydrocarbons may be used to increase the tail gas temperature for catalytic decomposition processes (considered as leakage emissions) or as a reducing agent in catalytic reduction processes of N_2O (considered as project emissions).

A tertiary approach offers a number of advantages:
- A tertiary measure is the most efficient for N_2O destruction at nitric acid plants compared to primary and secondary measures.
- The tertiary approach, as an end-of-pipe technology, is analogous to the various well-established catalytic NO_x reduction processes. Therefore, high acceptance of this technology by plant operators is to be expected.
- There is no interference with the nitric acid production process itself. The tertiary N_2O destruction technology will not cause a nitric acid production increase and therefore no financial incentive for the implementation of the proposed project activity exists.
- A tertiary process incorporates a selective catalyst suitable for destroying N_2O and also NO_x, which can lead to additional environmental benefit.
- No technical possibility that relevant N_2O will be destroyed downstream the tertiary N_2O destruction facility. Consequently, an overestimation of N_2O baseline emissions is not possible whenever tertiary N_2O destruction facility will be installed.
- A real-time continuous measurement of baseline and project emissions can be verified easily.

The **project technology provider** is **UHDE GmbH**, a German company and 100% subsidiary of Thyssen-Krupp. UHDE GmbH is the world market leader in the field of fertilizer technology engineering and construction and has constructed several nitric acid plants all over the world.

In response to climate change, UHDE has developed and tested different processes for abating and removing N_2O from nitric acid plants. In this context, UHDE invented a process for the combined removal of N_2O and NO_X from the tail gas of nitric acid plants. The EnviNOx® system, a tertiary abatement technology for combined N_2O and NO_X emission removal in the tail gas of nitric acid plants, has been patented by UHDE world-wide. UHDE has developed a tertiary measure for the reduction of N_2O to avoid a direct interference in the production process of nitric acid. In particular, any possibility of nitric acid product contamination, or loss of the valuable intermediate product nitric oxide (NO) that could otherwise influence nitric acid production, is eliminated.

The N_2O and NO_X destruction efficiency of the EnviNOx® system can be measured and monitored easily and independently from the production process (these are the main differences to primary and secondary technologies, which are treating N_2O emissions directly in the ammonia oxidation reactor at the same time the N_2O is produced). The EnviNOx® system is currently the best available technology for N_2O (more than 98% removal) and NO_X (down to 0-3 ppmv) destruction. Therefore it can be summarized that the EnviNOx® system is an environmentally safe and sound technology. The technology transfer is organized by CARBON and the reputable suppliers of the technology. Several trainings will be carried out to enable the plant staff to operate, maintain and monitor the project activity.

The EnviNOx® system is an example of a tertiary measure for the destruction of N_2O from nitric acid plant tail gas streams based on the catalytic decomposition or catalytic reduction of N_2O. Therefore, the EnviNOx® system is located between the existing SCR DeNOx systems and the tails gas turbines. The reactor in an EnviNOx® system houses one or two catalyst beds through which the tail gas flows.

Technology to be used at UKL 7-71 nitric acid plants of EUROCHEM Novomoskovsky:

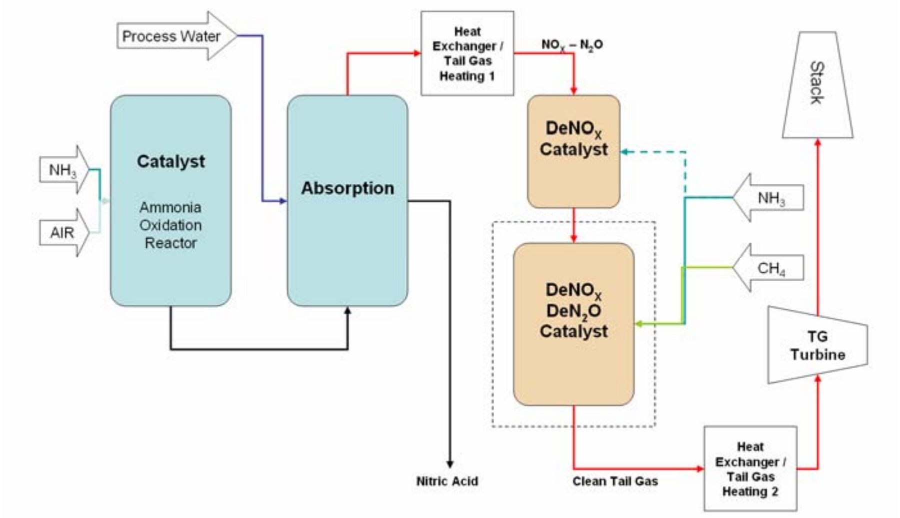
Each of the UKL 7-71 nitric acid plants will be equipped with its own EnviNOx® system.

Each relevant existing tail gas section comprises of following components:
- SCR DeNOx
- Tail gas heater
- Tail gas turbine

The existing SCR/DeNOx reactor which uses ammonia as the reducing agent for NO_x will be replaced by the EnviNOx® reactor. The inlet temperature of the existing SRC/DeNOx which is the temperature of the tail gas leaving the final tail gas / nitrous gas heat exchanger is about 220°C to 280°C depending on the individual plant and particular operating conditions. The tail gas will first heated up to a temperature to between 420°C and 500°C, then ammonia is added. The mixture enters the EnviNOx® reactor. Therefore the tail gas heating system will be modified. In the first catalyst basket a large proportion of the NO_x is destroyed by catalytic reduction with ammonia. Some destruction of N_2O also takes place. Natural gas and further ammonia are added to the gas stream leaving the first catalyst basket. In the second catalyst basket essentially all the NO_x is destroyed by catalytic reduction with the ammonia while a very large percentage of the remaining N_2O is reduced by reaction with the reducing agent.

The temperature of the tail gas is raised by the chemical reaction but the gas leaving the EnviNOx® reactor is still too cold to be sent directly to the tail gas turbine, but higher as at the existing SCR unit. Therefore tail gas heating will still be required. The second heater will be operated so as to keep the temperature at the inlet of the tail gas turbine before and after the installation of the EnviNOx® reactor essentially unchanged. The purpose of this is not to disturb the overall energy balance of the turbo-machines in the plant (process air compressor, tail gas turbine, steam turbine). Since the installation of the EnviNOx® reactor makes additional heat available through the destruction of N_2O (exothermic reaction), which did not occur in the existing SCR/DeNOx reactor, the total quantity of natural gas required by the nitric acid plant will be reduced slightly after project realisation.

Location of EnviNOx® system:



Ammonia feed:

Since the UKL 7-71 plants are of the mono pressure type the superheated ammonia vapour used in the AOR has sufficient pressure to be used in the EnviNOx® system. Ammonia is supplied to the EnviNOx® reactor under flow control. If for any reason the supply of ammonia to the EnviNOx® system must be interrupted, either due to a trip or operator intervention, an automatic double block and bleed system isolates the ammonia system from the tail gas side of the nitric acid plant.

Natural gas feed:

Natural gas is already available in the UKL 7-71 plants. Natural gas required by the EnviNOx® reactor will be supplied under flow control. As with the ammonia supply system, the natural gas feed is isolated from the tail gas side of the nitric acid plant in case of an interruption of supply caused by operator action or a trip by means of a double block and bleed arrangement.

Mixers:

Ammonia vapour is supplied to the lance of the tail gas / ammonia mixer which is located upstream of the EnviNOx® reactor. This inline device ensures that the ammonia is intimately mixed with the tail gas before the mixture enters the EnviNOx® reactor.

Natural gas and ammonia vapour are supplied to the lance of the tail gas / ammonia / natural gas mixer which is an integral part of the EnviNOx® reactor. This device ensures that the reducing agents ammonia and natural gas are intimately mixed with the tail gas before the mixture enters the second basket of the EnviNOx® reactor.

Tail gas flow measurement:

One tail gas flow measurement system (e.g. venturi tube) will be installed. The precise location of this device and the requirements for accurate monitoring of other streams so that the tail gas flow rate can be calculated at any necessary location by sum or by difference will be fixed at a later stage. (Please refer on this issue to section D.1.)

N_2O and NO_x reduction:

At the inlet of the EnviNOx® reactor, the NO_x concentration is estimated to be about 1000 ppm and the N_2O typically has a concentration of about 1000 – 1400 ppm.

The NO_x concentration increases with plant load and temperature in the absorption tower while increased absorption tower pressure or O_2 concentration reduces the NO_x concentration. Thus the NO_x concentration is subject to short term fluctuations without any long term trend. While the tail gas N_2O concentration too, can rise with increasing plant load, it also depends significantly on the state of the ammonia oxidation catalyst. The state of the catalyst deteriorates over the length of a production campaign. So the short term fluctuations in N_2O concentration are generally – although not in every campaign – overlaid with a long term trend to higher N_2O concentrations as the campaign advances.

The EnviNOx® reactor contains two catalyst baskets arranged in series as described above. In the first basket the EnviNOx® catalyst reduces the concentration of NO_x significantly by reaction with ammonia and also destroys some of the N_2O and in the second basket the EnviNOx® catalyst reduces NO_x and N_2O to very low levels by reaction with ammonia and natural gas hydrocarbons, respectively. Compared with the reduction in greenhouse gas emissions achieved by the destruction of N_2O the additional greenhouse gas emissions (CH_4) caused by the use of natural gas in the EnviNOx® reactor are insignificant but will be determined by a CH_4 concentration measurement. There is no overall increase in CO_2e emissions due to the use of the hydrocarbon, on the contrary the additional heat released by the N_2O destruction reactions serves to actually lower the overall natural gas consumption.

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:

Nitrous oxide (N_2O) is an unwanted, invisible and previously neglected by-product of the manufacture of nitric acid (HNO_3). It is formed during the catalytic oxidation of ammonia (NH_3) in air over noble metal gauzes.

- N_2O is formed as an un-wanted by-product

Under current legislation there is no requirement to limit N_2O emissions. In the absence of national regulations on N_2O emissions it is obvious that nitric acid will install any N_2O abatement technology. This is due to the fact, that N_2O destruction facilities generate no financial or economic benefits other than JI related incomes. No income from any kind of potential products or by-products are technically feasible and able to pay back the additional investment costs as well as additional operating costs for the installation of a N_2O abatement technology as no marketable product or by-product exists.

- N_2O in the tail gas has no economic value
- N_2O destruction facilities require investment and operating costs of several million Euros
- In the absence of regulations, N_2O is discharged to atmosphere

Therefore it is obvious that (1) in the absence of relevant regulations and (2) in the absence of JI, N_2O will be discharged to the atmosphere. The single existing incentive to install any N_2O abatement technology is JI.

- Single existing incentive for N_2O abatement in Russia is JI.

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

The implementation of the project activity will result in an ex-ante estimation of GHG emission reductions conservatively calculated at 2.1 million t CO_2e for period 2009 to 2012. Please note - that estimates of GHG emission reductions are made for reference purposes only - actual baseline and project emissions and emission reductions will be determined based on measurement results and measurement uncertainties on ex-post basis. The global warming potential of N_2O is set at 310 according to the Kyoto Protocol rules.

The project is planned to start from 01/05/2009 and estimation of the emission reductions are shown in the table below.

Table: Summary Emission Reduction 2009-2012 for two Nitric Acid Plants:

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2009	384,665
2010	576,997
2011	576,997
2012	576,997
Total estimated reductions (tonnes of CO_2e)	**2,115,656**
Annul average of estimated emission reductions over the crediting period 2009-2012 (tonnes of CO_2e)	**528,914**

Years	Annual estimation of emission reductions in tonnes of CO_2e
2013	576,997
2014	576,997
2015	576,997
2016	576,997
2017	576,997
2018	576,997
2019	576,997
2020	576,997
2021	576,997
2022	576,997
2023	576,997
2024	576,997
2025	576,997
2026	576,997
2027	576,997
2028	576,997
2029	576,997
2030	576,997

2031	576,997
2032	576,997
2033	576,997
Total estimated reductions over period 2013 - 2033 (tonnes of CO_2e)	12,116,939
Annul average of estimated emission reductions over the crediting period (tonnes of CO_2e)	569,304

The crediting period has been set from 01/01/2009 until the end of the 2033. This is based on the minimum lifetime of the project activity. Crediting period of the project after 2012 is subject to the approval by the host country.

A.5. Project approval by the Parties involved:

After determination of the proposed project activity, documents for applying Letter of Approval will be submitted to the Russian authorities.

SECTION B. Baseline

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

Step 1. Referencing of the approved baseline and monitoring methodology applied to the project.

The applied baseline methodology is the approved CDM baseline methodology **AM0028 / Version 04** “Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants”, referred to below as monitoring methodology AM0028.

The applied monitoring methodology is the approved CDM monitoring methodology **AM0028 / Version 04** “Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants”, referred to below as monitoring methodology AM0028.

Step 2. Justification of the choice of the methodology and why it is applicable to the project.

The proposed project activity destroys N_2O emissions by catalytic reduction of N_2O in the tail gas of the UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot.

The use of the methodology is justified because the following statements are true:

Condition 1: The commercial production of the UKL-7-71 nitric acid plants in the project activity started in the 1970´s. The existing production capacity is applied for the process with the existing ammonia oxidation reactor. Existing production capacity is defined as the designed capacity, measured in tonnes of nitric acid per year as specified in Annex 3.

Condition 2: is not applicable to nitric acid plants.

Condition 3: The proposed project activity at two UKL-7-71 nitric acid plants of EUROCHEM Novomoskovsky have currently not installed any N_2O destruction or abatement technology. The project activity will not result in any shut down of an existing N_2O destruction or abatement facility.

Condition 4: The project activity will not cause a nitric acid production increase.

Condition 5: Both UKL-7-71 nitric acid plants is equipped with a $DeNO_x$ SCR unit. The project activity will result in NO_x emission reductions that are at least as effective as the existing $DeNO_x$ units.

Condition 6: The $DeNO_x$ units installed at both UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot are Selective Catalytic Reduction (SCR) $DeNO_x$ units.

Condition 7: The N_2O concentrations will be measured in real time at the inlet and the outlet of the N_2O destruction facilities.

This baseline methodology is used in conjunction with the approved monitoring methodology for AM0028/ Version 04.

Step 3. Description of how the methodology is applied in the context of the project

The approved baseline methodology AM0028 Version 4 “Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants “ is applied to the “Catalytic N2O destruction project in the tail gas of the nitric acid plants OJSC Novomoskovsky Azot” in the following five steps:

Step 1: Identify technically feasible baseline scenario alternatives to the project activity:
The baseline scenario alternatives should include all technically feasible options which are realistic and credible.

Step 1a: The baseline scenario alternatives should include all possible options that are technically feasible to handle N_2O emissions. For both UKL-7-71 nitric acid plants these options are:

- 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 alternative production method not involving ammonia oxidation process
- Alternative use of N_2O:
  - Recycling of N_2O as a feedstock for the plant;
  - The use of N_2O for external purposes.
- Installation of a Non-Selective Catalytic Reduction (NSCR) DeNOx unit[1]
- The installation of a N_2O destruction or abatement technology
  - Tertiary measure for N_2O destruction (proposed project activity)
  - Primary or secondary measures for N_2O destruction or abatement.

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

Technologically not feasible options:
The switch to alternative production method not involving ammonia oxidation process is not prevailing and is not available to UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot, because currently the method using ammonia oxidation process is most common for manufacturing nitric acid and is already installed at the UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot.
The use of N_2O for external purposes is technically not feasible at the UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot, as the quantity of gas to be treated is enormous compared to the amount of nitrous oxide that could be recovered. Note, the N2O concentration in the tail gas at the proposed nitric acid plants is expected to be less than 0.2%. The use of N2O for external purposes is neither in the region/country nor in any other nitric acid plant applied.
The recycling of N2O as a feedstock for the plant is technically not practicable, as N2O is not a feedstock for nitric acid production. The recycling of N2O as a feedstock is neither in the region/country nor in any other nitric acid plant applied.

Therefore the following alternatives are technically not feasible:

- Switch to alternative production method not involving ammonia oxidation process;
- The use of N_2O for external purposes;
- Recycling of N_2O as a feedstock for the plant.

Step 1b: In addition to the baseline scenario alternatives of step 1a, all possible options that are technically feasible to handle NO_x emissions should be considered. The installation of a NSCR $DeNO_x$ unit could also cause N_2O emission reduction. Therefore NO_x emission regulations have to be taken into account in determining the baseline scenario. The respective options are:

- The continuation of the current situation, where $DeNO_x$ units are installed;

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[1] NSCR: As 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 alternative N_2O reduction technology.

- Installation of new Selective Catalytic Reduction (SCR) $DeNO_x$ units;
- Installation of new Non-Selective Catalytic Reduction (NSCR) $DeNO_x$ units;
- Installation of new tertiary measures combining NO_x and N_2O emission reductions. (project scenario).

Actual the relevant NO_x emission regulation is fulfilled, as EUROCHEM OJSC Novomoskovsky Azot already operates SCR $DeNO_x$ units at both nitric acid plants. Therefore EUROCHEM OJSC Novomoskovsky meets all relevant legal limits. As there are already SCR $DeNO_x$ units installed at both UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot, the installation of NSCR $DeNO_x$ units, which are not state of the art[2], is not conceivable as baseline alternative. Therefore it is obvious that EUROCHEM OJSC Novomoskovsky Azot will not install other $DeNO_x$ units.

Therefore the following alternatives are technically not feasible:

- Installation of new Selective Catalytic Reduction (SCR) $DeNO_x$ units;
- Installation of new Non-Selective Catalytic Reduction (NSCR) $DeNO_x$ units.

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

Currently, there are no national regulations or legal obligations in Russian Federation concerning N_2O emissions. All remaining baseline alternatives are in compliance with all relevant legal and regulatory requirements on N_2O and NO_x emissions. Therefore no baseline alternative is eliminated at step 2.

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

Sub-Step 3a: On the basis of the alternatives that are technically feasible and in compliance with all legal and regulatory requirements, the project participant should establish a complete list of barriers that would prevent alternatives to occur in the absence of JI/CDM.

In the case of the proposed project the following barriers that would prevent baseline alternatives to occur in the absence of JI are identified:

- **Investment barriers (economic/financial barriers):**
  N_2O destruction facilities generate no financial or economical benefits other than JI related income. 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 a N_2O destruction or abatement technology as no marketable product or by-product exists. As national regulations on NO_x emissions are more than fulfilled at both UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot and no national regulations or legal obligations in the Russian Federation concerning N_2O emissions exists, investment barriers are clearly identified for all baseline options which require significant investments (primary, secondary and tertiary N_2O destruction or abatement).

- **Technological barriers**:
  In addition to investment barriers identified above, technological barriers are identified as primary and secondary N_2O emission reduction technologies interfere with the nitric acid

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[2] See also: UBA 2001: Umweltbundesamt. State-of-the-art for production of Nitric Acid with regard to the IPPC Directive. Vienna 2001. EFMA 2000: European Fertilizer Manufactures' Association, Production of Nitric Acid, Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry, Brussels 2000.

production process. The implementation of primary or secondary measures could cause an intervention in the nitric acid production process, which is not in the mind of EUROCHEM. Besides, N_2O destruction efficiency is considered significantly lower at primary or secondary measures.

- **Barriers due to prevailing practice**:
  No nitric acid plant in the region has installed any N_2O destruction or abatement technologies (outside JI project activities).

Therefore the following baseline alternatives are eliminated:

- Primary or secondary measures for N_2O destruction or abatement
- Tertiary measure for N_2O destruction (proposed project activity)

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

In conclusion, the single scenario that does not face barriers (see step 3) is:

- The continuation of the current situation, where $DeNO_x$ units are installed at the UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot and national regulations on NO_x emissions are more than fulfilled. No N_2O destruction or abatement technology will be installed. As national regulations on NO_x emissions are more than fulfilled at the UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot and no national regulations or legal obligations in the Russian Federation concerning N_2O emissions exists, investment barriers (and also technological barriers and barriers due to prevailing practice) are clearly identified for all baseline options except the continuation of the status quo.

Therefore the continuation of the status quo can be pre-selected as baseline scenario.

As the outcome of the barrier analysis (step 3) is clear, Step 4 of the methodology can be omitted.

Step 4: Identify the most economically attractive baseline scenario alternative:
Determine which of the remaining project alternatives that are not prevented by any barrier is the most economically of financially attractive, and then is a possible baseline scenario.

Sub-step 4a: Determine appropriate analysis method
Sub-step 4b: Option I: Apply simple cost analysis

As the outcome of the barrier analysis (step 3) clearly identifies the baseline scenario, Step 4 of the methodology is omitted.

The procedure to identify the baseline scenario clearly results in that the most likely baseline scenario is the continuation of the status quo and therefore the continuation of emitting N_2O to the atmosphere, without the installation of N_2O destruction or abatement technologies.

Therefore the continuation of the current situation is clearly identified as the baseline scenario.

Step 5: Re-assessment of baseline scenario in course of proposed project activity's 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 should 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, determination of the baseline scenario will be re-assessed at the start of a crediting period. Baseline scenario alternatives to be analysed should 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 project participant should re-assess the baseline scenario and shall apply baseline determination process as stipulated above (Steps 1 – 5).

Potential outcomes of the re -assessment of the baseline scenario (to be in line with NO_x regulation)	**Consequence (adjusted baseline scenario)**
SCR $DeNO_x$ installation	Continuation of original (N_2O) baseline scenario
NSCR $DeNO_x$ installation	The N_2O emissions outlet of NSCR become adjusted baseline N_2O emissions, as NSCR may reduce N_2O emissions as well as NO_x.
Tertiary measure that combines NO_x and N_2O emission reduction	Adjusted baseline scenario results in zero N_2O emissions reduction
Continuation of original baseline scenario	Continuation of original baseline scenario

Note, UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot have already installed SCR $DeNO_x$ units. New or modified NO_x emission regulations introduced after the project start will be taken into account according to AM0028.

Sub Step 5b: New or modified N_2O-regulation:
If legal regulations on N_2O emissions are introduced or changed during the crediting period, the baseline emissions shall be adjusted at the time the legislation has to be legally implemented.

Baseline Scenario:
Therefore the **baseline scenario** is the continuation of the status quo and N_2O emissions are not reduced by any N_2O destruction or abatement technology at UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot. The baseline scenario consists of the continuation of the currently installed SCR $DeNO_x$ units in which only NO_x (nitric oxide NO, and nitrogen dioxide NO_2) is reduced to water vapour and nitrogen by reaction with ammonia.

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:

The **baseline scenario** is the continuation of the status quo and N2O emissions are not reduced by any N2O destruction or abatement technology at the UKl-7-71 nitric acid plants of EUROCHM OJSC Novomoskovsky Azot. Therefore the baseline emissions are measured at the inlet of the EnviNOx® system.

The baseline scenario consists of the continuation of the currently installed SCR DeNOx unit in which only NOx (nitric oxide NO, and nitrogen dioxide NO_2) is reduced to water vapour and nitrogen by reaction with ammonia.

The **project scenario** is the implementation of the proposed project activity consisting of the installation of the EnviNOx® systems at UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot.

Tertiary measures offer a number of advantages:

- The proposed project activity (tertiary measure), as an end-of-pipe technology, is analogous to the various well-established catalytic NO_x reduction processes.
- There is no interference with the nitric acid production process itself. The tertiary N_2O destruction technology will neither cause a nitric acid production increase nor decrease.
- A tertiary process incorporates a selective catalyst suitable for destroying N_2O and NO_x, which will lead to additional environmental benefit.

Taking into account that:

- The proposed project activity (tertiary measure) is analogous to the already successful implemented SCR $DeNO_x$ unit,
- the expected N_2O reduction rate of tertiary measures up to 99%,
- primary and secondary measures requires modifications to the ammonia oxidation reactor (operational risks),
- tertiary measures will not influence the production process of EUROCHEM OJSC Novomoskovsky Azot´s core business.

Based on this line of arguments, EUROCHEM OJSC Novomoskovsky Azot obviously and explicitly gives their technological preference to a tertiary technology.

The EnviNOx® system is a tertiary technology for destruction of N_2O emissions in the tail gas of UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot and is located between the existing SCR DeNOx reactors and the tail gas turbines. It is expected that the project activity reduces minimum 94% of the N_2O emissions that would be emitted without the project activity (under related project circumstances the EnviNOx® system reduces more than 99% of N_2O emissions).
A catalytic reduction process will be installed at the UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot. In order to permit very high rates of N_2O removal the existing natural gas heaters before the tail gas turbines will be substituted by two smaller ones. The tail gas temperature will therefore be heated up to the optimal temperature for the EnviNOx® systems by the first heaters after the SCR DeNOx reactors and after the EnviNOx® systems a second heater will be installed to increase the tail gas temperature to provide the optimal temperature for the existing tail gas turbines.

The additionality of the project activity is demonstrated and assessed using the “Tool for demonstration and assessment of additionality” agreed by the Executive Board.

Because of the similarity of both approaches used to determine the baseline scenario and the additionality tool, step1 of the tool for demonstration and assessment of additionality can be ignored.

Step 2. Investment analysis:
Sub-step 2a. Determine appropriate analysis method:
As catalytic N_2O destruction facilities generates no financial or economical benefits other than JI or CDM related income, Option I as stated in the applied baseline methodology (simple cost analysis) has been chosen.

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 EnviNOx® system as no marketable product or by-product exists.
The investment costs of several million Euros (excluding potential financing costs) consist of the engineering, construction, erection, installation and commissioning of the EnviNOx® system and the measurement equipment. The running costs consist of the regular change of the catalysts, hydrocarbon and ammonia inputs as well as personnel costs for the supervision of the EnviNOx® system and the measurement equipment.
Confidential information on investment and operation costs will be provided to the AIE when requested. Confidential financial information shall not be disclosed and published.

Baseline scenario: The baseline scenario “The continuation of the current situation” will neither cause any additional investments costs nor any additional running costs.

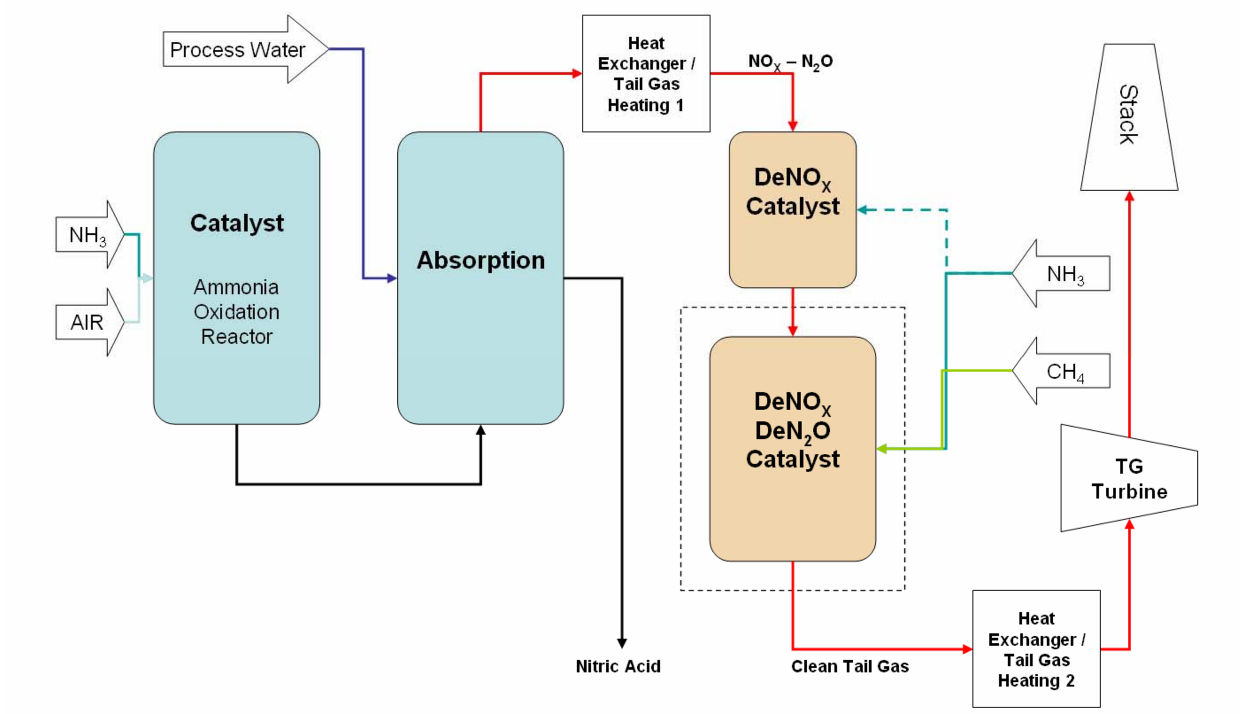
Therefore, the proposed JI project activity is, without the revenues from the sale of ERUs, obviously less economically and financially attractive than the baseline scenario.

Step 4. Common practice analysis
The proposed project activity is the “first of its kind” in the region, no similar project activity of this kind is currently operational and therefore the proposed project activity is not common practice.

Conclusion: The proposed JI project activity is undoubtedly additional, since it passes all the steps of the tool for the demonstration and assessment of additionality. 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 proposed project activity as no marketable product or by-product exists.
The registration of the project activity as a JI Project and corresponding ERU revenues are the single source of project revenues. Based on the ex-ante estimation of N_2O emission reductions, it is expected that the income from selling of ERUs of the registered JI project activity is at least as high as the investment, financing and running costs. Therefore EUROCHEM is willing to finance the project activity under the condition of the registration of the project activity. JI registration is therefore the decisive factor for the realization of the proposed project activity.

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

N_2O is a by-product of the manufacture of nitric acid. It is formed alongside the main, desired product nitric oxide during the catalytic oxidation of ammonia over platinum/rhodium gauzes. Once leaving the gauzes some of the N_2O may be destroyed in the part of the plant upstream of the absorption tower by high temperature homogeneous gas phase decomposition and by catalytic decomposition on platinum deposits formed from metal lost from the gauzes. Since platinum dust carryover into the tail gas section of the plant is prevented by the absorption tower, which acts as a very efficient scrubber, and the temperatures encountered in the tail gas section of the plant are lower than those leading to homogeneous gas phase N_2O decomposition, there is no loss of N_2O in the tail gas section unless nitrous oxide destruction facility is installed. Nitrous oxide that has reached the tail gas section is thus discharged to atmosphere in the tail gas, and has no economic value.



The project boundary encompasses all anthropogenic emissions by sources of greenhouse gases under the control of the project participants that are significant and reasonable attributable to the project activity.
More specifically, the project boundary comprises the N_2O destruction facilities including the auxiliary methane input as reducing agent to UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot. According to AM0028 the auxiliary ammonia input will be considered equal to ammonia input of the baseline scenario. Note, in case of UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot SCR-$DeNO_x$ units already installed prior to the starting date of the project activity. For monitoring purposes however, the project boundary encompasses the nitric acid plant, to measure the nitric acid production and the operating parameters at the ammonia oxidation reactor.

The possibility that in the future some national, provincial or local regulation governing the emissions of N_2O or NO_x may occur has been taken into account in the monitoring methodology. Accordingly, the baseline scenario will be re-assessed according to AM0028. If new or modified NO_x emission regulations are introduced after the project start, determination of the baseline scenario will be re-assessed at the start of the following crediting period.

For the purpose of determining project activity emissions, the following emission sources are included:

- N_2O emissions in the tail gas downstream the project activity;
- CO_2 emissions associated with the use of methane as reducing agent.

For the purpose of determining baseline emissions, the following emission sources are included:

- N_2O emissions in the tail gas upstream the project activity.

The following table illustrates which emissions sources are included and which are excluded from the project boundary for determination of both baseline and project emissions.

Table: Overview on emission sources included or excluded from the project boundary

Baseline Emissions

Source	*Gas*		*Justification/Explanation*
Emissions of N_2O as a result of side reaction to the nitric acid production process	N_2O	Included	Main emission source, taking national N_2O emission regulations into account.
Emissions related to the production of ammonia used for NO_x reduction (Attention: Ammonia used for NO_x-reduction does not cause GHG emissions, only the production of ammonia causes GHG emissions)	CO_2 CH_4 N_2O	Excluded according to AM0028	In case of UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot SCR $DeNO_x$ units are already installed prior to the project start: ammonia input for SCR is considered to be of the same magnitude to project related ammonia input for NO_x reduction. Baseline emissions and project emissions are similar and therefore not considered for calculation.
N_2O emissions from SCR $DeNO_x$ units	N_2O	Excluded according to AM0028	The presence of SCR $DeNO_x$ units tend to increase the N_2O emissions. Therefore the ex-post measurement of the baseline emissions at the inlet of the N_2O destruction facility represents a conservative determination of the baseline N_2O emissions.

Project Emissions

Source	*Gas*		*Justification/Explanation*
Emissions of N_2O as a result of side reaction to the nitric acid production process	N_2O	Included	Main emission source that remains in the tail gas after the N_2O destruction facility (taking national N_2O emission regulations into account).
Emissions related to the production of ammonia input used for NO_x reduction (Attention: Ammonia used for NO_x-reduction doesn't cause GHG emissions, only production causes GHG emissions)	CO_2 CH_4 N_2O	Excluded according to AM0028	In case of UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot SCR $DeNO_x$ units are already installed prior to the project start: ammonia input for SCR is considered of the same magnitude as project related ammonia input for NO_x-reduction. Baseline emissions and project emissions are similar and therefore not considered for calculation.
In case of N_2O reduction process installed: Emissions at the project site resulting from hydrocarbons used as reducing agent and/or re-heating the tail gas	CO_2	Included	At UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot a N2O reduction process will be installed and methane will be used as reducing agent. Methane is used to enhance the efficiency of a N_2O catalytic reduction facility. In this case hydrocarbons are mainly converted to CO_2, while some hydrocarbons may remain intact.

			In order to apply a conservative approach methane is assumed to be completely converted to CO_2. At all UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot tail gas turbines are in operation at the end of the pipes. According to AM0028 emissions from tail gas heaters need only be analyzed if the project activity does not involve any energy recovery from the tail gas.
Emissions from electricity demand	CO_2 CH_4 N_2O	Excluded	GHG emissions related to the electricity consumption are insignificant (< 0.005%) and are excluded as monitoring would lead to unreasonable costs.
Emissions related to the production of the hydrocarbons	CO_2 CH_4 N_2O	Excluded	GHG emissions related to the production of hydrocarbons used as reducing agent represent less than 0.001% of expected emission reductions and will not be taken into account due to unreasonable costs for monitoring.

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

The baseline was completed 27/02/2008.

Persons/entities responsible for the application of the baseline and monitoring methodology to the project activity are show below.

Persons/entities	***Project Participant Yes / No***
CARBON CLIMATE PROTECTION GmbH Am Südblick 5 A-3550 Langenlois Austria Tel. +43 2734 322 70 0 Fax. +43 2734 322 70 99 Ferdinand Heilig – Managing Director Gerald Dunkel - JI/CDM Director Email: heilig@carbon-austria.com Email: dunkel@carbon-austria.com	***No***

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

19/02/2008

C.2. Expected operational lifetime of the project:

25 years

C.3. Length of the crediting period:

Length of crediting ERU period: **01/01/2009 – 31/12/2012**
Starting date of the crediting period: **01/01/2009**

The first period for crediting of ERUs is from 1st January 2009 to 31st December 2012.
The total crediting period will not extend beyond the operational lifetime of the project, minimum of 25 years, and is therefore 01/01/2009 – 31/12/2033. Emission reductions generated after the first crediting period (2008-2012) are subject to any relevant UNFCCC agreement and the approval by the Russian Federation.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The applied monitoring methodology is based on the approved CDM monitoring methodology **AM0028 / Version 04** "Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants", referred to below as monitoring methodology AM0028.

Please see Section B.1 in this PDD regarding justification of the choice of the baseline methodology and why it is applicable to the project.

Modification of AM0028 / Version 04 for the proposed JI project activity:

1. Determination of volume flow rate at the inlet/outlet of the destruction facility:

A tertiary destruction facility is a closed system with three input streams (tail gas inlet, ammonia input, hydrocarbon input) and one output stream (tail gas outlet). Measurement of three streams is sufficient to calculate the remaining. Therefore the determination on the volume flow rate at the inlet and exit of the destruction facility could be based on:

a) FTE,i and FTI,i will be measured. Two tail gas flow meters (e.g. venture tubes), (AM0028 / Version 04) or
b) (1) FTE,i or FTI,i will be measured. One tail gas flow meter (e.g. venture tube) either at the inlet or exit of the DF and (2) QNH3,y - the ammonia input to the destruction facility and (3) QHC,y - measurement of hydrocarbon input if used as reducing agent.

Option (b) will be applied to the proposed project activity, as the accuracy under option (b) is higher and due to the limited space available for installation of equipment.

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

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P1	PE_y Project emissions	Monitoring system	tCO_2e	Calculated	Annual	100%	Electronic	
P2	$PE_{ND,y}$ Project emissions from N_2O not destroyed	Monitoring system	tCO_2e	Calculated	Annual	100%	Electronic	
P3	$PE_{DF,y}$ Project emissions from destruction facility	Monitoring system	tCO_2e	Calculated	Annual	100%	Electronic	
P4	$PE_{N2O,y}$ N_2O not destroyed by facility	Monitoring system	tCO_2e	Calculated	Daily	100%	Electronic	
P5	$F_{TE,i}$	Flow meter	m^3/h	Measured	Daily	100%	Electronic	Flow metering

	Volume flow rate at the outlet of destruction facility during interval *i*			continuously or calculated				system will automatically record volume flow adjusted to standard temperature and pressure. Either the inlet or the outlet volume flow DF will be measured.
P6	$CO_{N2O,i}$ N_2O concentration at destruction facility outlet	Gas chromatography in the 0–5000 ppm range or Non-dispersion infrared absorption analyzer	tN_2O/m^3	Measured continuously	Daily	100%	Electronic	In case non-dispersion infrared absorption analyzer is used, it shall be checked by sampling by gas chromatography periodically
P7	M_i Measuring Interval	Measuring device, Data management system	h	Measured continuously	Daily	100%	Electronic	
P8	$PE_{NH3,y}$ Emissions from ammonia use in destruction facility	Monitoring system	tCO_2e	Calculated	Annual	100%	Electronic	
P9	$PE_{HC,y}$ Emissions from	Monitoring system	tCO_2e	Calculated	Annual	100%	Electronic	

	hydrocarbon use in destruction facility and/or re-heating the tail gas							
P10	$Q_{NH3,y}$ N_2O destruction facility: Project Ammonia Input	Measuring device	tNH_3, m^3	Measured	Daily	100%	Electronic	
P11	EF_{NH3} Ammonia Production GHG Emission Factor	IPCC	tCO_2e $/tNH_3$	Calculated	Once	100%	Electronic	
P12	$HCE_{C,y}$ Converted hydrocarbon emissions	Monitoring system	tCO_2e	Calculated	Annual	100%	Electronic	
P13	$HCE_{NC,y}$ Non-converted methane emissions	Monitoring system	tCO_2e	Calculated	Annual	100%	Electronic	
P14	$Q_{HC,y}/Q_{CH4,y}$ Hydrocarbon input (reducing agent and/or re-	Monitoring device	m^3	Measured	Daily	100%	Electronic	

	heating the tail gas)							
P15	ρ_{HC}/ρ_{CH4} Hydrocarbon density	Certificate hydrocarbon supplier or default value	t/m^3	Measured	Yearly	100%	Electronic	
P16	EF_{HC} Hydrocarbon CO_2 emissions factor	IPCC	tCO_2e/t	Calculated	Once	100%	Electronic	
P17	$OXID_{HC}$ Hydrocarbon oxidation factor	Measuring device	%	Measured continuously	Daily	100%	Electronic	
P18	$Type_{HC}$ Type of hydrocarbon	Hydrocarbon supplier	-			100%	Electronic	

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

The emissions due to the project activity are composed of (a) the emissions of not destroyed N_2O and (b) emissions from auxiliary ammonia and hydrocarbons input resulting from the operation of the N_2O destruction facility. The procedure of determining the project N_2O emissions is similar to that used for determining baseline emissions.

Project emissions are defined by the following equation:

$$PE_y = PE_{\mathrm{ND},y} + PE_{\mathrm{DF},y}$$

Where:

PEy	Project emissions in year y (tCO_2e)
PEND,y	Project emissions from N_2O not destroyed in year y (tCO_2e)
PEDF,y	Project emissions related to the operation of the destruction facility in year y (tCO_2e)

N_2O emissions not destroyed by the project activity

N_2O emissions not destroyed by the project activity are calculated based on the continuous measurement of the N_2O concentration in the tail gas of the N_2O destruction facility and the volume flow rate of the tail gas stream.

The emissions of non destroyed N_2O are given by:

$$PE_{\mathrm{ND},y} = PE_{\mathrm{N2O},y} \times \mathrm{GWP}_{\mathrm{N2O}}$$

Where:

PEND,y	Project emissions from N_2O not destroyed in year y (tCO2e)
PEN2O,y	Project emissions of N_2O in year y (tN_2O)
GWPN2O	Global warming potential of N_2O = 310

$$PE_{\mathrm{N2O},y} = \sum_{i}^{n} F_{\mathrm{TE},i} \times CO_{\mathrm{N2O},i} \times M_i$$

Where:

PEN2O,y	Project emissions of N_2O in year y (tN_2O)

FTE,i	Volume flow rate at the exit of the destruction facility during interval i (m^3/h)
$CON2O,i$	N_2O concentration in the tail gas of the N_2O destruction facility during interval i (tN_2O/m^3)
Mi	Length of measuring interval i (h)
i	interval
n	number of intervals during the year

$$FTE,i = FTI,i + Q_{NH3,y} + Q_{CH4,y}$$

FTI,i	Volume flow rate at the inlet of the destruction facility during interval i (m^3/h)
$Q_{CH4,y}$	Methane used in year y (m^3)
$Q_{NH3,y}$	Ammonia input to the destruction facility in year y (m^3)

Project emissions from the operation of the destruction facility

The operation of the N_2O destruction facility may require the use of ammonia and hydrocarbon *(e.g.* methane, LPG, butane) as input streams.

The emissions related to the operation of the N_2O destruction facility are given by (1) upstream emissions related to the production of ammonia used as input and (2) on-site emissions due to the hydrocarbons use as input to the N_2O destruction facility:

$$PE_{DF,y} = PE_{NH3,y} + PE_{HC,y}$$

Where:

$PE_{DF,y}$	Project emissions related to the operation of the destruction facility in year y (tCO_2e)
$PE_{NH3,y}$	Project emissions related to ammonia input to destruction facility in year y (tCO_2e)
$PE_{HC,y}$	Project emissions related to hydrocarbon input to destruction facility and/or re-heater in year y (tCO_2e)

<u>Ammonia Input to the destruction facility:</u>

- In case an existing SCR DeNOx unit is already installed prior to the starting date of the project activity or has to be installed according to legal requirements, the project ammonia input will be considered equal to the ammonia input of the baseline scenario.
- Should no SCR DeNOx unit be installed prior to the starting date of the project activity, project emissions related to the production of ammonia are considered as follows:

$$PE_{NH3,y} = Q_{NH3,y} \times EF_{NH3}$$

Where:

$PE_{NH3,y}$	Project emissions related to ammonia input to destruction facility in year y (tCO_2e)
$Q_{NH3,y}$	Ammonia input to the destruction facility in year y (tNH_3)
EF_{NH3}	GHG emissions factor for ammonia production (CO_2e/tNH_3)

Please note: Ammonia input for NO_X emission reduction will not cause GHG emissions other than related to the production of ammonia.

A default factor of 2.14 $tCO_2e/tNH3$ is suggested (GEMIS 4.2).

Hydrocarbon Input:

Hydrocarbons can be used as reducing agent and/or re-heating the tail gas to enhance the catalytic N_2O reduction efficiency. In this case hydrocarbons are mainly converted to CO_2 (HCEC,y), while some methane remain unconverted to CO_2 (HCENC,y).

The fraction of the converted hydrocarbons is OXIDHC.

$$PE_{HC,y} = HCE_{C,y} + HCE_{NC,y}$$

Where:

$PE_{HC,y}$	Project emissions related to hydrocarbon input to destruction facility and/or re-heater in year y (tCO_2e)
$HCE_{C,y}$	Converted hydrocarbon emissions in year y (tCO_2)
$HCE_{NC,y}$	Methane emissions in year y (tCO_2e)

For calculation of the GHG emissions related to the hydrocarbons converted and not converted, the following formulae are used:

$$\mathrm{HCE}_{\mathrm{NC,y}} = \rho_{CH4} \times \mathrm{Q}_{\mathrm{CH4,y}} \times \mathrm{GWP}_{\mathrm{CH4}} \times (1 - \mathrm{OXID}_{\mathrm{CH4}}/100)$$

Where:

$HCE_{NC,y}$	Methane emissions in year y (tCO_2e)
ρ_{CH4}	Methane density (t/m^3)
$Q_{CH4,y}$	Methane used in year y (m^3)
GWP_{CH4}	Global warming potential of methane
$OXID_{CH4}$	Oxidation factor of methane (%)

$$\mathrm{HCE}_{\mathrm{C,y}} = \rho_{HC} \times \mathrm{Q}_{\mathrm{HC,y}} \times \mathrm{EF}_{\mathrm{HC}} \times \mathrm{OXID}_{\mathrm{HC}}/100 + \rho_{CH4} \times \mathrm{Q}_{\mathrm{CH4,y}} \times \mathrm{OXID}_{\mathrm{CH4}}/100)$$

Where:

$HCE_{C,y}$	Converted hydrocarbon emissions in year *y* (tCO_2e)
ρ_{HC}	Hydrocarbon density (t/m^3)
$Q_{HC,y}$	Hydrocarbon, with two or more molecules of carbon, input in year *y* (m^3)
$OXID_{HC}$	Oxidation factor of hydrocarbon (%), with two or more molecules of carbon
EF_{HC}	Carbon emissions factor of hydrocarbon (tCO_2/t HC), with two or more molecules of carbon

The hydrocarbon CO_2 emission factor is given by the molecular weights and the chemical reaction when hydrocarbons are converted (*e.g.* where CH_4 is used as hydrocarbon, each converted tonne of CH_4 results in 44/16 tonnes of CO_2, thus the hydrocarbon emission factor is 2.75).

Project emissions are limited to the design capacity of the existing nitric acid or caprolactam production plant. If the actual production of nitric acid or caprolactam (*P*product,*y*) exceeds the design capacity (*P*product,max) then emissions related to the production above *P*product,max will neither be claimed for the baseline nor for the project scenario.

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
B1	$P_{product,y}$ Plant output of HNO_3	Production reports	$tHNO_3$	Measured or Calculated	Daily	100%	Electronic	Based on available parameters
B2	$QI_{N2O,y}$ Quantity of N_2O at inlet of destruction facility		tN_2O	Calculated	Daily	100%	Electronic	$F_{TI,i}$ and M_i fromB4 and P7
B3	$CI_{N2O,i}$ N_2O concentration at N_2O destruction facility inlet	Gas chromatography in the 0-5000 ppm range or Non-dispersion infrared absorption analyzer	tN_2O/m^3	Measured continuously	Daily	100%	Electronic	In case non-dispersion infrared absorption analyzer is used, it shall be checked by sampling by gas chromatography periodically
B4	$F_{TI,i}$ Volume flow	Flow meter	m^3/h	Measured continuously or calculated	Daily	100%	Electronic	Flow metering system will automatically

	rate at the inlet of destruction facility during interval *i*							record volume flow adjusted to standard temperature and pressure. Either the inlet or the outlet volume flow DF will be measured.
B5	$QR_{N2O,y}$ Regulation I: annual quantity N_2O limited	National legislation	tN_2O	Calculated	Date of regulation	100%	Electronic	
B6	$RSE_{N2O,y}$ Regulation II: N_2O emissions per unit of nitric acid or Caprolactam	National legislation	$tN_2O/ tHNO_3$ or $tN_2O/ t_{Caprolactam}$	Calculated	Date of regulation	100%	Electronic	
B7	CR_{N2O} Regulation III: N_2O concentration in tail gas limited	National legislation	tN_2O/m^3	Calculated	Date of regulation	100%	Electronic	
B8	$P_{product,hist}$ Design Capacity	Manufacturer's specifications	t	Measured/ calculated	Once	100%	Electronic	
B9	$T_{g,hist}$ Historical operating	Production reports / manufacturer's specifications	°C	Measured / calculated	Once	100%	Electronic	.

	temperature range of the ammonia oxidation reactor							
B10	$P_{g,hist}$ Historical operating pressure range of the ammonia oxidation reactor	Production reports/ manufacturer's specifications	Pa	Measured / calculated	Once	100%	Electronic	
B11	T_g Actual operating temperature ammonia oxidation reactors	Measuring device	°C	Measured	Continuous	100%	Electronic	
B12	P_g Actual operating pressure ammonia oxidation reactors	Measuring device	Pa	Measured	Continuous	100%	Electronic	
B13	Reg_{NOx} National regulation on NO_X emissions	National regulations, Ministry of Environment	tNO_x/m^3	Calculated	Date of regulation	100%	Electronic	
B14	G_{sup} Supplier of the ammonia oxidation catalyst	Supplier information	-					
B15	G_{com}	Annual reports,	%		Date of changing	100%	Electronic	

	Composition of the ammonia oxidation catalyst	supplier information			gauze composition			
B16	$G_{sup,hist}$ Historical supplier of ammonia oxidation catalyst	Annual reports, Supplier information	-		Once	100%	Electronic	
B17	$G_{com,hist}$ Historical composition of the ammonia oxidation catalyst	Supplier information	%		date of start of use of catalyst	100%	Electronic	
B18	SE_{N2O} N_2O emission rate per ton of nitric acid	Monitoring Reports	tonne of HNO_3	Calculated	Yearly	100%	Electronic	
B19	$A_{OR,hist}$ Max. historical ammonia flow rate to the ammonia oxidation reactor	Production reports/ manufacturer's specifications/ Literature	tNH_3/ day	Measured/ calculated	Once	100%	Electronic	
B20	$A_{OR,d}$	Measuring device	tNH_3/ day	Measured/ calculated	Daily	100%	Electronic	

	Actual ammonia flow rate to the ammonia oxidation reactor							

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

Baseline emissions are given by the following equation:

$$BE_y = BE_{N2O} \times GWP_{N2O}$$

Where:

BE_y Baseline emissions in year y (tCO_2e)

$BE_{N2O,y}$ Baseline emissions of N_2O in year y (tN_2O)

GWP_{N2O} Global warming potential of N_2O = 310

Depending on the implementation of regulations on N_2O emissions and the character of the regulation, baseline N_2O emissions (BEN2O,y) are calculated as shown below:

Case 1: The most plausible baseline scenario is that no N_2O would be abated in the absence of the project activity (i.e. no secondary or tertiary reductions measures and no NSCR DeNOx unit would be installed).

$$BE_{N2O,y} = QI_{N2O,y}$$

Where:

$BE_{N2O,y}$ Baseline emissions of N_2O in year y (tN_2O)

$QI_{N2O,y}$ Quantity of N_2O supplied to the destruction facility in year y (tN_2O)

The quantity of N_2O supplied to the N_2O destruction facility (DF) is calculated based on continuous measurement of the tail gas volume flow rate and the N_2O concentration at the inlet of the N_2O destruction facility. Therefore the quantity of the N_2O at the inlet is given by:

$$QI_{N2O,y} = \sum_{i}^{n} F_{TI,i} \times CI_{N2O,i} \times M_i$$

Where:

$QI_{N2O,y}$	Quantity of N_2O emissions at the inlet of the destruction facility in year y (tN_2O)
$F_{TI,i}$	Volume flow rate at the inlet of the destruction facility during interval i (m^3/h)
$CI_{N2O,i}$	N_2O concentration a destruction facility inlet during interval i (tN_2O/m^3)
M_i	Length of measuring interval i (h)
i	interval
n	number of intervals during the year

Baseline emissions are limited to the design capacity of the existing nitric acid or caprolactam production plant. If the actual production of nitric acid or caprolactam(Pproductt,y) exceeds the design capacity (Pproduct,max) then emissions related to the production above Pproduct,max will neither be claimed for the baseline nor for the project scenario.

If, $P_{product,y} >= P_{product,max}$

Then

$$BE_{N2O,y} = SE_{N2O,y} \times P_{product,max}$$

Where:

$BE_{N2O,y}$	Baseline emissions of N_2O in year y (tN_2O)
$SE_{N2O,y}$	Specific N_2O emissions per unit of output product of nitric acid or caprolactam in year y (tN_2O/ t Product)
$P_{product,max}$	Design capacity ($tHNO_3$ t Product)

The specific N_2O emissions per unit of output of nitric acid or caprolactam is defined as:

$$SE_{N2O,y} = QI_{N2O,y} / P_{product,y}$$

Where:

$SE_{N2O,y}$	Specific N_2O emissions per unit of output of nitric acid or caprolactam in year y (tN_2O/ t Product)
$QI_{N2O,y}$	Quantity of N_2O emissions at the inlet of the destruction facility in year y (tN_2O)
$P_{product,y}$	Production of nitric acid or caprolactam in year y (t Product)

Case 2: Legal regulations for N_2O are implemented:
In case national regulations concerning N_2O emissions are implemented during the crediting period, the impact on baseline N_2O emissions is considered without any delay by adjusting the measured N_2O emissions at the time the regulation has to be implemented. Depending on the character of the regulation the adjustment is done as shown below:

Case 2.1: Regulation setting of a threshold for an absolute quantity of N_2O emissions per nitric acid or caprolactam production plant over a given time period:

Baseline N_2O emissions are limited by the absolute quantity of N_2O emissions given by the regulation. If the measured baseline N_2O emissions are exceeding the regulatory limit, then measured baseline N_2O emissions are substituted by the regulatory limit.

This leads to the following condition:

If,

$QI_{N2O,y} > QR_{N2O,y}$

then,

$BE_{N2O,y} = QR_{N2O,y}$

else,

$BE_{N2O,y} = \text{min of } [QI_{N2O,y}, SE_{N2O,y} \times P_{\text{product,max}}]$

Where:

$QI_{N2O,y}$	Quantity of N_2O emissions at the inlet of the destruction facility in year y (tN_2O)
$QR_{N2O,y}$	Regulatory limit of N_2O emissions in year y (tN_2O)
$BE_{N2O,y}$	Baseline emissions of N_2O in year y (tN_2O)
$SE_{N2O,y}$	Specific N_2O emissions per unit of output of nitric acid or caprolactam in year y (tN_2O/t Product)
$P_{\text{product,y}}$	Production of nitric acid or caprolactam in year y (t Product)

The quantity of N_2O emissions at the inlet of the N_2O destruction facility (DF) is calculated based on continuous measurement of the tail gas volume flow rate and the N_2O concentration at the inlet of the N_2O destruction facility (see equation 11).

Case 2.2: Regulation setting of a threshold for specific N_2O emissions per unit of product:

This leads to the following condition: If,

$SE_{N2O,y} > RSE_{N2O}$

then,

$BE_{N2O,y} = \text{min of } [RSE_{N2O} \times P_{product,y}, SE_{N2O,y} \times P_{product,max}]$

else,

$BE_{N2O,y} = \text{min of } [QI_{N2O,y}, SE_{N2O,y} \times P_{product,max}]$

where:

$SE_{N2O,y}$	Specific N_2O emissions per unit of output of nitric acid or caprolactam in year y (tN_2O/t Product)
RSE_{N2O}	Regulatory limit of N_2O emissions per unit of output of nitric acid or caprolactam (tN_2O/ t Product)
$BE_{N2O,y}$	Baseline emissions of N_2O in year y (tN_2O)
$P_{product,y}$	Production of nitric acid or caprolactam in year y ($tHNO_3$ t Product)
$QI_{N2O,y}$	Quantity of N_2O emissions at the inlet of the destruction facility in year y (tN_2O)

The specific N_2O emissions per unit of output of nitric acid or caprolactam is defined as:

$SE_{N2O,y} = QI_{N2O,y} / P_{product,y}$

Where:

$SE_{N2O,y}$	Specific N_2O emissions per unit of output of nitric acid or caprolactam in year y (tN_2O/ t Product)
$QI_{N2O,y}$	Quantity of N_2O emissions at the inlet of the destruction facility in year y (tN_2O)
$P_{product,y}$	Production of nitric acid or caprolactam in year y (t Product)

The quantity of N_2O emissions at the inlet of the N_2O destruction facility is calculated based on continuous measurement of the tail gas volume flow rate and the N_2O concentration at the inlet of the N_2O destruction facility (see equation 11).

Case 2.3: Regulation setting of a threshold for N_2O concentration in the tail gas

This leads to the following condition:

If,

$C_{N2O,y} > CR_{N2O}$

Then

$$BE_{N2O,y} = \sum_{i}^{n} C_{N2O,i} \times [F_{TG,i} \times M_i]$$

where CN2O,i is min [CN2O,y, CRN2O, and {(SEN2O,y x Pproduct,max)/(sum(FTE,i * Mi)}]

else,

$$BE_{N_2O,y} = QI_{N_22O,y}$$

Where:

$C_{N2O,i}$	N_2O concentration a destruction facility inlet during interval i (tN_2O/m^3)
$CR_{N2O,i}$	Regulatory limit for specific N_2O concentration during interval i (tN_2O/m^3)
$BE_{N2O,y}$	Baseline emissions of N_2O in year y (tN_2O)
$F_{TE,i}$	Volume flow rate at the exit of the destruction facility during interval i (m^3/h)
M_i	Length of measuring interval i (h)
i	interval
n	number of intervals during the year
$QI_{N2O,y}$	Quantity of N_2O emissions at the inlet of the destruction facility in year y (tN_2O)

The quantity of N_2O emissions at the inlet of the N_2O destruction facility is calculated based on continuous measurement of the tail gas volume flow rate and the N_2O concentration at the inlet of the N_2O destruction facility (see equation 11).

Change in NO_X or N_2O regulations will automatically cause a re-assessment of the baseline scenario.

Procedures used to determine the permitted operating conditions of the nitric acid or caprolactam production plant in order to avoid "overestimation of emission reductions":

In order to avoid that the operation of the nitric acid or caprolactam production plant is manipulated in a way to increase the N_2O generation, thereby increasing the ERUs, the following procedures relating to the operating temperature and pressure and the use of ammonia oxidation catalysts shall be applied.

1. Operating temperature and pressure of the ammonia oxidation reactor (AOR):

If the actual average daily operating temperature or pressure in the ammonia oxidation reactor (Tg and Pg) are outside a "permitted range" of operating temperatures and pressures (Tg,hist and Pg,hist), the baseline emissions are calculated for the respective time period based on lower value between (a) the conservative IPCC default values of the latest IPCC GHG Inventory Guidelines accepted by the IPCC[3] for the equivalent N_2O emission process. For nitric acid plants, the figure shall be 4.5kgN_2O/tonne of nitric acid, whereas for caprolactam the figure shall be 5.4kgN_2O/tonne of caprolactam, both conservatively applying the IPCC default values, (b) $SE_{N2O,y}$ and (c) any related value as a result of legal regulations (*e.g.* $RSE_{N_2O,y}$).

Required monitoring parameters:

$T_{g,d}$	Actual operating temperature AOR on day *d* (°C)
$P_{g,d}$	Actual operating pressure AOR on day *d* (Pa)
$T_{g,hist}$	Historical operating temperature range AOR (°C)
$P_{g,hist}$	Historical operating pressure range AOR (Pa)

In order to determine the "permitted range" of the operating temperature and pressure in the ammonia oxidation reactor, the project applicant has the obligation to determine the operating temperature and pressure range by:

a) Firstly, data on historical temperature and pressure ranges; or, if no data on historical temperatures and pressures are available, then
b) Secondly, by range of temperature and pressure stipulated in the operating manual for the existing equipment; or, if no operating manual is available or the operating manual gives insufficient information, then
c) Thirdly, by literature reference (*e.g.* from Ullmann's Encyclopedia of Industrial Chemistry, Fifth, completely revised edition, Volume A 17, VCH, 1991, P. 298, Table 3. or other standard reference work or literature source).

If historical data on daily operating temperatures and pressures are available (*i.e.* case a), statistical analysis shall be used for determining the permitted range of operating temperature and pressure. To exclude the possibility of manipulating the process, outliers of historical operating temperature and pressure shall be eliminated by statistical methods. Therefore, the time series data are interpreted as a sample from a stochastic variable. All data that are part of the 2.5% Quantile or that are part of the (100-2.5)% Quantile of the sample distribution are defined as outliers and shall be eliminated. The permitted range of operating temperature and pressure is then calculated based on the remaining historical minimum and maximum operating conditions.

If a permissible operating limit is exceeded, the baseline N_2O emissions for that period are capped at 4.5kgN_2O/tonne of nitric acid, applying conservative IPCC default value.

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[3] According 2006 IPCC Guidelines accepted by the 21st Session of the IPCC, the conservative IPCC default value of Nitric Acid Plants is based on the default emission factor for low-pressure plants (5kgN_2O/tonne of nitric acid, accounting for 10% uncertainty factor), whereas for caprolactam plants using Raschig process are 9 kgN_2O/tonne of nitric acid, accounting for 40% uncertainty factor.

2. Composition of ammonia oxidation catalyst:

The plant operator is allowed to use compositions of ammonia oxidation catalysts that are common practice in the region or have been used in the nitric acid or caprolactam production plant during the last three years without limitation of N_2O baseline emissions.

In case the nitric acid or caprolactam production plant operator wishes to change to a composition not used during the last three years, but is common practice in the region and supplied by a reputable manufacturer, or if it corresponds to a composition that is reported as being in use in the relevant literature, the plant operator is allowed to use these ammonia oxidation catalysts without limitation of N_2O baseline emissions.

In case the nitric acid or caprolactam production plant operator changes the composition of ammonia oxidation catalysts and the composition is not common practice in the region and not reported as being in use in the relevant literature, the project applicant has to demonstrate (either by economic or other arguments) that the choice of the new composition was based on considerations other than an attempt to increase the rate of N_2O production. If the project applicant can demonstrate appropriate and verifiable reasons, the plant operator is allowed to use new ammonia oxidation catalysts without limitation of N_2O baseline emissions.

The first composition of ammonia oxidation catalyst used during the crediting period shall be of the same kind of catalyst composition already in operation in the specific nitric acid or caprolactam production plant. This is to avoid gaming at the beginning of the project activity.

In case the nitric acid or caprolactam production plant operator changes the composition of ammonia oxidation catalysts and the composition is not common practice in the region and not reported as being in use in the relevant literature, and the project applicant **cannot** demonstrate appropriate and verifiable reasons for this.

Baseline emissions are limited to the maximum specific N_2O emissions of previous periods ($tN_2O/tHNO3$ or tN_2O/tCaprolactam), documented in the verified monitoring reports.

Required monitoring parameters:

*G*sup	Supplier of the ammonia oxidation catalyst
*G*sup,hist	Historical supplier of the ammonia oxidation catalyst
*G*com	Composition of the ammonia oxidation catalyst
*G*com,hist	Historical composition of the ammonia oxidation catalyst
$SE_{N2O,y}$	Specific N_2O emissions per ton of product of nitric acid or caprolactam in year y (tN_2O/t Product)

3. Ammonia flow rate to the ammonia oxidation reactor:

If the actual daily ammonia flow rate exceeds the (upper) limit on maximum historical daily permitted ammonia flow rate, the baseline emissions for this operating day are calculated based on the conservative IPCC default values and are limited by the legal regulations. The upper limit on ammonia flow should be determined based on:

a) historical operating data on maximum daily average ammonia flow; or, if not existing, on
b) calculation of the maximum ammonia flow rate allowed as specified by ammonia oxidation catalyst manufacturer or on typical catalyst loadings; or, if not existing,
c) based on the literature.

If the daily ammonia input to the oxidation reactor exceeds the limit on permissible ammonia input, baseline N_2O emissions are capped at conservative IPCC default values.

Required monitoring parameters on daily basis:

AOR,d	Actual ammonia input to oxidation reactor (tNH3/day)
AOR,hist	Maximum historical ammonia input to oxidation reactor (tNH3/day)

Data and information in order to determine the permitted operating conditions of the nitric acid plants will be presented and discussed with the AIE during determination process.

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

Not applicable.

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

Not applicable.

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

Not applicable as leakage emissions need only be analyzed if the project activity does not involve any energy recovery from the tail gas.

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

Not applicable.

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):

The emission reduction ERy by the project activity during a given year y is the difference between the baseline emissions (BEy) and project emissions (PEy), as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	emissions reductions of the project activity during the year y (tCO_2e)
BE_y	baseline emissions during the year y (tCO_2e)
PE_y	project emissions during the year y (tCO_2e)

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:

The catalytic N_2O destruction project in the tail gas of the nitric acid plants OJSC Novomoskovsky Azot is a sustainable project that contributes to the environmental, economic and social benefits in Russia. No transboundary impacts are expected. The ex-ante GHG emission reduction is estimated to be about 0.58 million tons of CO_2e per standard year. Additionally, the NO_x emissions at the nitric acid plants OJSC Novomoskovsky Azot will be reduced. No negative environmental impacts are expected.
All required information in order to meet the relevant Russian regulations will be presented and discussed with the AIE.

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.
B1	*Low*	*Historical plant specific nitric acid production data are not available. Procedure for determination of required data will be adapted with AIE and will be incorporated in the quality management system.* *All used meters will be subject to regular maintenance and testing regime once per year to ensure accuracy.*
B3 *P6*	*Low*	*In the feed of the EnviNOx- system, the concentration of nitrous oxide (N_2O) are analysed continuously. Analysis is done by using non-dispersive infrared photometry. Sample handling includes provisions for pressure reduction, separation of residual solids, sample flow adjustment, and supply with test gases. The analyser is, as far as technically possible, corrected for any applicable cross sensitivity.* *In the effluent of the EnviNOx- system, the concentration of nitrous oxide (N_2O) are analysed continuously. Analysis is done by using non-dispersive infrared photometry for N_20. Sample handling includes provisions for pressure reduction, separation of residual solids, sample flow adjustment, and supply with test gases. The analysers are, as far as technically possible, corrected for any applicable cross sensitivity.* *Both N_2O concentration measurement devices will be subject to regular maintenance and testing regime to ensure accuracy.*
B4 *P5*	*Low*	*Either the inlet or the outlet volume flow will be measured by a standard flow meter. Flow is converted to standard conditions based on temperature and pressure measurement.* *All meters will be subject to regular maintenance and testing regime once per year to ensure accuracy.*
P7	*Low*	*Time stamps are generated by a GPS clock module.*

P14	*Low*	*The methane used as reducing agent will be measured by a standard flow meter. Flow is converted to standard conditions based on temperature and pressure measurement.* *All meters will be subject to regular maintenance and testing regime once per year to ensure accuracy.*
B20	*Low*	*The actual ammonia flow to the ammonia oxidation reactor will be calculated based on values obtained from existing measuring devices.* *All used meters will be subject to regular maintenance and testing regime once per year to ensure accuracy.*

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

The Monitoring Plan describes the procedures for data collection and auditing required for the project in order to determine and verify the emission reductions achieved by the project activity. Historical data and data based on the operating manual required for the project monitoring will be discussed with the assigned AIE during determination process and will be documented in the final Project Design Document. All remaining required data are automatically transferred to the digital process control system where they are displayed, evaluated, and stored. Evaluation includes calculation of flow rate at standard conditions and mass flow rates of N_2O. The system also performs calculation of daily mean values and generates automatically reports.

The monitoring procedures will be integrated in EUROCHEM OJSC Novomoskovsky Azots quality management system. EUROCHEM OJSC Novomoskovsky Azot is currently undergoing assessment under ISO 9001. Final Certification is expected for late 2008 or 2009. The proposed project activity will incorporated in the ISO quality system. All monitoring equipment will be serviced, calibrated and maintained according to the manufacturers' instructions and international standards.

It is the responsibility of the Project Developer and Project Operator to ensure that required and experienced capacity is available and that their operational staffs participate in training to be enabled to operate the monitoring system properly. Initial training will be provided to the staff before the project activity starts operation. It is also the responsibility of the Project Developer and Project Operator to organize and implement a quality management system that ensures the integrity of the data.

Find below a list of institutions (expected) to allocate personnel for the monitoring of the CDM Project:

Activity	**Institution nominated (expected)**
CDM Project Manager	CARBON
Project Administration	CARBON / EUROCHEM OJSC Novomoskovsky Azot
Project Communication DOE	CARBON
Project Operation	EUROCHEM OJSC Novomoskovsky Azot
Project Maintenance	EUROCHEM OJSC Novomoskovsky Azot/ UHDE
Project Construction	CARBON / EUROCHEM OJSC Novomoskovsky Azot / UHDE
Project Review: Monitoring Reports	CARBON
Project Monitoring (data collection)	CARBON

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

The baseline was completed 27/02/2008.

Persons/entities responsible for the application of the baseline and monitoring methodology to the project activity are show below.

Persons/entities	***Project Participant Yes / No***
CARBON CLIMATE PROTECTION GmbH Am Südblick 5 A-3550 Langenlois Austria Tel. +43 2734 322 70 0 Fax. +43 2734 322 70 99 Ferdinand Heilig - Managing Director Gerald Dunkel - JI/CDM Director Email: heilig@carbon-austria.com Email: dunkel@carbon-austria.com	***No***

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

>>

The anthropogenic emissions of the proposed project activity within the project boundary consist of the emissions of non destroyed N_2O and emissions from hydrocarbon input related to the operation of the N_2O destruction facility.

Ex-ante estimation of project emissions is made by projecting nitric acid output, N_2O formation, efficiency of the catalytic N_2O destruction process as well as the demand of hydrocarbon. Estimation is for reference purposes only, actual project and baseline emissions will be determined on measurement results on an ex-post basis.

At the UKL-7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot, SCR $DeNO_x$-units are already installed prior to the starting date of the CDM project. Therefore according of AM0028 the operation of the project activity does not require additional ammonia inputs.
Additional hydrocarbon (methane) input is required in order to enhance the catalytic N_2O destruction efficiency. Therefore additional hydrocarbon input will be taken into account and monitored.

Assuming a very conservative N_2O destruction rate of 94% (please note, same technology used at the registered and verified CDM project Abu Qir reaches efficiency > 99%) and technology specific N_2O formation rate, ex-ante estimations will result in conservative estimation of project emissions.

Given the projected nitric acid production, volume flow rate of the tail gas, N_2O concentration in the tail gas at the outlet of the EnviNOx®-system, the efficiency of the EnviNOx-System and the hydrocarbon input, total project emissions are estimated at about 36,936 tCO_2e per standard year.

Tentative expected starting date of project activity:
Both UKL-7-71 nitric acid plants: 1st May 2009

The table below summarizes the project emissions by sources for the period 2009 – 2012:

Year	**Project Emissions from N_2O not destroyed (tonnes of CO_2e)**	**Project emissions from Hydrocarbons used (tonnes of CO_2 e)**	**Project emissions from additional NH_3 used (tonnes of CO_2e)**	**Total Project Emissions (tonnes of CO_2 e)**
2009	24,564	60	-	24,624
2010	36,845	90	-	36,936
2011	36,845	90	-	36,936
2012	36,845	90	-	36,936
Total (tonnes of CO_2 e)	135,100	331	-	**135,431**

E.2. Estimated leakage:

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In case of the project activity no leakage is expected.

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

>>

With no leakage overall emission of the project are described in chapter E.1. The table below summarizes the project emissions by sources for 2009 - 2012.

Year	Project Emissions from N_2O not destroyed (tonnes of CO_2e)	Project emissions from Hydrocarbons used (tonnes of CO_2 e)	Project emissions from additional NH_3 used (tonnes of CO_2e)	Total Project Emissions (tonnes of CO_2 e)
2009	24,564	60	-	24,624
2010	36,845	90	-	36,936
2011	36,845	90	-	36,936
2012	36,845	90	-	36,936
Total (tonnes of CO_2 e)	135,100	331	-	**135,431**

E.4. Estimated baseline emissions:

>>

Baseline emissions are estimated based on the quantity of N_2O emitted in the baseline scenario, taking national regulations into account.

Ex-ante estimation of baseline emission is made by projecting the nitric acid output and the N_2O formation. Estimations are for reference purposes only, actual baseline emissions will be determined on measurement results on an ex-post basis.

At present there are no national regulations on N_2O emissions in Russia. Furthermore it is unlikely that any limits on N_2O emissions will be imposed in the near future. However, national regulations will be monitored and taken into account.

Given the projected nitric acid production, volume flow rate of the tail gas and the N_2O concentration in the tail gas, the baseline emissions are estimated at about 613,933 tCO_2e per standard year.

The table below summarizes the baseline emissions by sources.

Year	Baseline N_2O emissions (tonnes of N_2O)	Total Baseline Emissions (tonnes of CO_2 e)
2009	1,320	409,289
2010	1,980	613,933
2011	1,980	613,933
2012	1,980	613,933
Total	**7,262**	**2,251,087**

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

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The GHG emission reduction achieved by the project activity during a given year is the difference between the total GHG emissions in the baseline and the project emissions. Please note, in case of the proposed project activity, leakage is zero.

The implementation of the project activity will result in GHG emission reductions of about 0.58 million tCO_2e per standard year. The global warming potential of N_2O is set at 310 according to the Kyoto Protocol rules.

Emissions Summary		**Unit**	**Year**	**% of BL GHG Emissions**
Baseline emissions	**BE_y**	**tCO2e**	**306,966**	**100.00%**
Project emissions related to the operation of the DF	PE_DF_y	tCO2e	45	0.01%
Project emissions from N2O not destroyed	PE_ND_y	tCO2e	18,423	6.00%
Project emissions	**PE_y**	**tCO2e**	**18,468**	**6.02%**
Total Leakage GHG Emissions	**L_E_y**	**tCO2e**	**0**	**0.00%**
Total GHG Emissions Reduction	**ER_y**	**tCO2e**	**288,499**	**93.98%**

These ex-ante emission reduction estimations are for reference purposes only, since emission reductions will be determined on an ex-post basis by monitoring the actual baseline and project emissions once the project activity is operational. Ex-post determination of baseline emissions generates the most accurate N_2O emission data and the most reliable monitoring system.

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

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Year	**Estimation of Project Activity Emissions (tonnes of CO_2e)**	**Estimation of Baseline Emissions (tonnes of CO_2e)**	**Estimation of Leakage (tonnes of CO_2 e)**	**Estimation of overall Emission Reductions (tonnes of CO_2 e)**
2009	24,624	409,289	0	384,665
2010	36,936	613,933	0	576,997
2011	36,936	613,933	0	576,997
2012	36,936	613,933	0	576,997
Total (tonnes of CO_2e)	**135,431**	**2,251,087**	**0**	**2,115,656**

Year	Estimation of Project Activity Emissions (tonnes of CO_2e)	Estimation of Baseline Emissions (tonnes of CO_2e)	Estimation of Leakage (tonnes of CO_2 e)	Estimation of overall Emission Reductions (tonnes of CO_2 e)
2013	36,936	613,933	0	576,997
2014	36,936	613,933	0	576,997
2015	36,936	613,933	0	576,997
2016	36,936	613,933	0	576,997
2017	36,936	613,933	0	576,997
2018	36,936	613,933	0	576,997
2019	36,936	613,933	0	576,997
2020	36,936	613,933	0	576,997
2021	36,936	613,933	0	576,997
2022	36,936	613,933	0	576,997
2023	36,936	613,933	0	576,997
2024	36,936	613,933	0	576,997
2025	36,936	613,933	0	576,997
2026	36,936	613,933	0	576,997
2027	36,936	613,933	0	576,997
2028	36,936	613,933	0	576,997
2029	36,936	613,933	0	576,997
2030	36,936	613,933	0	576,997
2031	36,936	613,933	0	576,997
2032	36,936	613,933	0	576,997
2033	36,936	613,933	0	576,997
Total 2013-2033 (tonnes of CO_2e)	775,651	12,892,591	0	12,116,939

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 catalytic N_2O destruction project in the tail gas of the nitric acid plants OJSC Novomoskovsky Azot is a sustainable project that contributes to the environmental, economic and social benefits in Russia.

The ex-ante GHG emission reduction is estimated to be about 0.58 million tons of CO_2e per standard year. Additionally, the NO_x emissions at the nitric acid plants OJSC Novomoskovsky Azot will be reduced. No further environmental impacts are expected.

No transboundary impacts are expected.

According to the relevant Russian regulations the following permissions are required: (1) Decision of State Senior Expertise , (2) Decision of Industrial Safety Organisation, (3) Decision of Emercom and (4) Decision of Labour Ministry.

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:

The proposed project activity has strong positive environmental impacts and has no negative impacts on air, soil and water.

SECTION G. Stakeholders' comments

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

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Since the project will not result in any negative environmental or social impacts, no local stakeholder consultation is required.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

The following table summarizes information on data used for ex-ante calculation of GHG emission reductions (for reference purpose only) – note actual baseline and project emissions and emission reductions will be determined based on measurement results ex-post basis.

Table Baseline data.

Data	Unit	Value	Data Source
Tail gas flow rate Inlet	Nm³/h	48,978	Uhde: EnviNOx® design parameter
Tail gas flow rate Outlet	Nm³/h	48,991	Uhde: EnviNOx® design parameter
Production days	d/a	330	Assumption
Additional Ammonia demand by EnviNOx® System	kgNH3/tHNO3	-	AM0028
N2O concentration	tN2O/Nm³	2.55E-06	Uhde: EnviNOx® design parameter
Efficiency DF	%	94%	Uhde: min. efficiency EnviNOx®
N2O GWP	-	310	Kyoto Protocol rules
Hydrocarbon:			
Type of Hydrocarbon	-	Methane	Uhde: EnviNOx® design parameter
HC Input	kg/h	1.9	Uhde: EnviNOx® design parameter
Carbon emission factor of hydrocarbon	tCO2/tHC	3.00	AM0028, conservative assumption
Methane GWP	-	21	Kyoto Protocol rules
Standard Conditions:			
Temperature	K	273.15	ISO 10780
Pressure	hPa	1,013.25	ISO 10780

Further data and information in order to determine the real time baseline will be presented and discussed with the AIE during determination process.

Annex 3

MONITORING PLAN

The Catalytic N_2O destruction project in the tail gas of two UKL 7-71 nitric acid plants of EUROCHEM OJSC Novomoskovsky Azot employs state of the art monitoring and control equipment that measures, records and reports all key parameters to determine the GHG emission reductions.

The Monitoring Plan describes the procedures for data collection and auditing required for the project in order to determine and verify the emission reductions achieved by the project activity. Historical data and data based on the operating manual required for the project monitoring will be discussed with the assigned AIE during determination process and will be documented in the final Project Design Document. All remaining required data are automatically transferred to the digital process control system where they are displayed, evaluated, and stored. Evaluation includes calculation of flow rate at standard conditions and mass flow rates of N_2O. The system also performs calculation of daily mean values and generates automatically reports.

The monitoring procedures will be integrated in EUROCHEM OJSC Novomoskovsky Azots quality management system. EUROCHEM OJSC Novomoskovsky Azot is currently undergoing assessment under ISO 9001. Final Certification is expected for late 2008 or 2009. All monitoring equipment will be serviced, calibrated and maintained according to the manufacturers' instructions and international standards.

It is the responsibility of the Project Developer and Project Operator to ensure that required and experienced capacity is available and that their operational staffs participate in training to be enabled to operate the monitoring system properly. Initial training will be provided to the staff before the project activity starts operation. It is also the responsibility of the Project Developer and Project Operator to organize and implement a quality management system that ensures the integrity of the data.

Monitoring equipment:

To permit the greenhouse gas emission reduction to be calculated accurately, a direct measurement of the quantity of tail gas flowing through the EnviNOx® reactor is necessary. One tail gas flow measurement system (e.g. venturi tube) will be installed upstream or downstream of the reactor, designed and installed according to the international standard ISO. The measurement is temperature and pressure compensated.

Tail gas is taken off continuously from upstream of the tail gas / ammonia / methane mixer and downstream of the EnviNOx® reactor. The two analyser chains are independent of one another but located in a common instrument container. The concentrations of the components N_2O, NO_X (NO and NO2) are measured at the inlet and outlet.

Measured data are stored and evaluated in a digital process control system, which also provides control functions for the EnviNOx®- system. Data storage is redundant and manipulation-proof.

Measurement of tail gas flow:

The tail gas flow at the inlet or outlet is measured by using a venturi tube, which is designed and manufactured in accordance with ISO 5167-4:2003. The venturi tube will be of rough welded sheet iron type with annular pressure tapping chambers. Differential pressure is measured with two (redundant) differential pressure transmitters. For calculation of the volume flow rate at standard conditions or (with known molecular weight) the mass flow, the system is equipped with two (redundant) pressure transmitters and two (redundant) temperature measurements.

On-line analysis of tail gas feed:
In the feed of the EnviNOx®- system, the concentrations of nitrous oxide (N_2O), nitric oxide (NO) and nitrogen dioxide (NO_2) are analysed continuously.
Readings of the raw data will be stored. Based on the raw data average daily figures will be calculated, reported and stored at the data storage system. Sample handling includes provisions for pressure reduction, separation of residual solids, sample flow adjustment, and supply with test gases. The analyser is, as far as technically possible, corrected for any applicable cross sensitivity.

On-line analysis of tail gas effluent:
In the effluent of the EnviNOx®- system, the concentrations of nitrous oxide (N_2O), nitric oxide (NO) plus nitrogen dioxide (NO_2) and oxygen (O_2) are analysed continuously.
Readings of the raw data will be stored. Based on the raw data average daily figures will be calculated, reported and stored at the data storage system. Sample handling includes provisions for pressure reduction, separation of residual solids, sample flow adjustment, and supply with test gases. The analysers are, as far as technically possible, corrected for any applicable cross sensitivity.

Actual production of Nitric Acid:
The actual nitric acid production will be determined based on AIEs recommendations.

Actual temperature and pressure of the ammonia oxidation reactor:
The actual temperature and pressure of the ammonia oxidation reactor is monitored using the existing (or exchanged) instruments. The instrument signals will be recorded in the control room and used to determine whether the nitric acid plant is being operated within the normal range of operation (daily basis).

Actual ammonia input to the ammonia oxidation reactor:
The actual ammonia flow to the ammonia oxidation reactor is monitored applying a procedure suggested by the AIE.

Composition of the ammonia oxidation catalyst
The composition of the ammonia oxidation catalyst will be monitored according to catalyst supplier information.

Methane input:
The methane used as reducing agent will be measured by flow. Flow is converted to standard conditions based on temperature and pressure measurement.

Data acquisition and storage:

The measured values are transferred to a digital process control system, where they are displayed, evaluated, and stored. Evaluation includes calculation of flow rate at standard conditions and mass flow rates of N_2O. The system also performs calculation of daily mean values and generates reports. Data storage for raw data as well as for evaluated data is done automatically on a computer network which is directly connected to the process control system. Network connections are redundant fibre optic links. The software for data storage is designed in a way that falsification of data is excluded. Time stamps are generated by a GPS clock.

Instrument Container, DCS and data logging:
The instrument containers house the analysers, parts of the sample handling system, and the controllers of the DCS. It controls the EnviNOx® system, generates alarm and trip signals as necessary and logs all process data in the EnviNOx® system area and, in addition, selected operating data from the nitric acid plants, as required by the relevant CDM methodology AM0028.

Operation of the Monitoring system:

The system is designed for automatic operation, so that activities by operation personnel are not required during normal operation. However, it is required to observe the system for possible failures, and to perform required maintenance activities on a regular basis.

Training:
As mentioned above the proposed project activity also includes training course for operation of the EnviNOx® system and also for accurate monitoring. It is EUROCHEM OJSC Novomoskovsky Azots responsibility to ensure that the required capacity and internal training is made available to assigned staff, to enable them to undertake the tasks required by the project operation and monitoring. All staff involved in any procedures will be trained before the start of the crediting period.
The supplier of the measurement equipment will carry out an on-site training course for operation and maintenance of the measurement equipment prior to the start of the crediting period. Contents and procedures of the training are detailed in the operating manual of the monitoring system. Uhde will also carry out an on-site training for operation of the EnviNOx® system.

Troubleshooting procedures:
Malfunction of system components is indicated on the operator console in the control room as an alarm. The occurrence of such an alarm requires the operator to immediately take measures to remedy the problem. This is normally done by informing the instrument department, which then decides whether the problem can be fixed immediately by itself, or whether external support from manufacturer is required. In such a case it is important to act immediately in order to avoid loss of valuable data. Detailed instructions on how to proceed in such cases are given in the manufacturer's documentation.

The probability of downtime or malfunctions of the measuring instruments and/or data storage is very low. In those cases procedures as described in AM0028 will be applied for determination of the relevant factors. In such cases it is indispensable to act immediately in order to avoid further loss of valuable data.

Adjustment, calibration and maintenance:
The analysers need an adjustment ('calibration') on a regular basis (e.g. zero point: every 2 days). This adjustment procedure is done automatically, and can be triggered manually from the operating console or automatically on a time basis.
Since adjustment is done with test gases, it is essential that availability of test gases is ensured. EUROCHEM OJSC Novomoskovsky Azots instrument technicians are responsible for the availability of test gas. Stock of test gases will be controlled regularly, and spare supply is made available in proper time. A detail specification for the various test gases to be used will be available from analyser manufacturer.

The automated monitoring system will be based on latest applicable standards and norm (e.g EN 14181), which prescribes the features needed for Automated Measuring Systems need and how they are to be calibrated and maintained, will be used as basis for the operating the monitoring system.

Internal control process:
EUROCHEM OJSC Novomoskovsky Azot will perform a visual inspection of system on a regular basis by the operating staff (e.g. once every week). Such an inspection can give indications on oncoming problems and allow to be prepared for them.
Data export from the data storage is to be done manually upon operational requests, but at least once a month. Detailed instructions are given by the manufacturer.
Internal review of project performance and calculation of emission reductions will be executed by EUROCHEM OJSC Novomoskovsky Azot with the support of CARBON on a regular basis (e.g. daily).

Verification:
Quarterly verification is planed for this CDM project.

Uncertainties of measurement:

Uncertainties of measurement equipment will be determined according to the manufacturers' instructions and international standards and will be described in the final PDD.