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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

Nitrous Oxide Emission Reduction Project at GP Nitric Acid Aggregate in AB Achema Fertiliser Plant

Version number of the document: PDD v.01

Date: 29 06 2007

A.2. Description of the project:

Nitrous Oxide (N_2O) is a greenhouse gas, which is formed as a by-product of the nitric acid (HNO_3) production process in nitric acid production plants. In order to produce nitric acid, ammonia (NH_3) is oxidized in a reactor with the precious metal (platinum-rhodium) catalyst gauzes into NO – desired product. NO then is oxidized to NO_2 which is absorbed in water to form HNO_3. N_2O, formed during the process is emitted to the atmosphere as a tail gas.

The objective of this project is to reduce N_2O emissions from Achema GP (Grande Paroisse) nitric acid production aggregate by utilizing secondary catalyst technology that converts N_2O into Oxygen (O_2) and Nitrogen (N_2) - zero global warming potential gases. BASF technology of catalytic destruction will be used for this purpose. Project activity will not effect other emissions such as NOx or nitric acid production.

In order to calculate N_2O emission reductions from the project, ABB continuous multi-component measuring system Advance Cemas-NDIR is installed and operated.

A.3. Project participants:

Countries/Parties involved	Legal entities, participating in the project	Please indicate, if the Party involved wishes to be considered as project participant (Yes/No)
Lithuania (Host party)	AB Achema	No
Germany (Investing party)	BASF	No

AB Achema is the largest Nitrogen fertiliser plant in Lithuania and Baltic states. Annual fertiliser production exceeds 2 million tons. The plant also produces compound fertilisers, adhesives, paints, resins, industrial gases, other chemical products and intermediates.

BASF is a multinational company producing chemicals, plastics, performance products, agricultural products, fine chemicals, crude oil and natural gas.

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

Lithuania

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

Kaunas region

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

Rukla county, Jonalaukis village

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

The project will be implemented in the territory of the AB Achema fertiliser factory, which is located in the central part of Lithuania near the Jonava town. The closest city Kaunas is situated about 30km southwest from Jonava.

Figure 1 Geographical location of AB Achema fertiliser plant

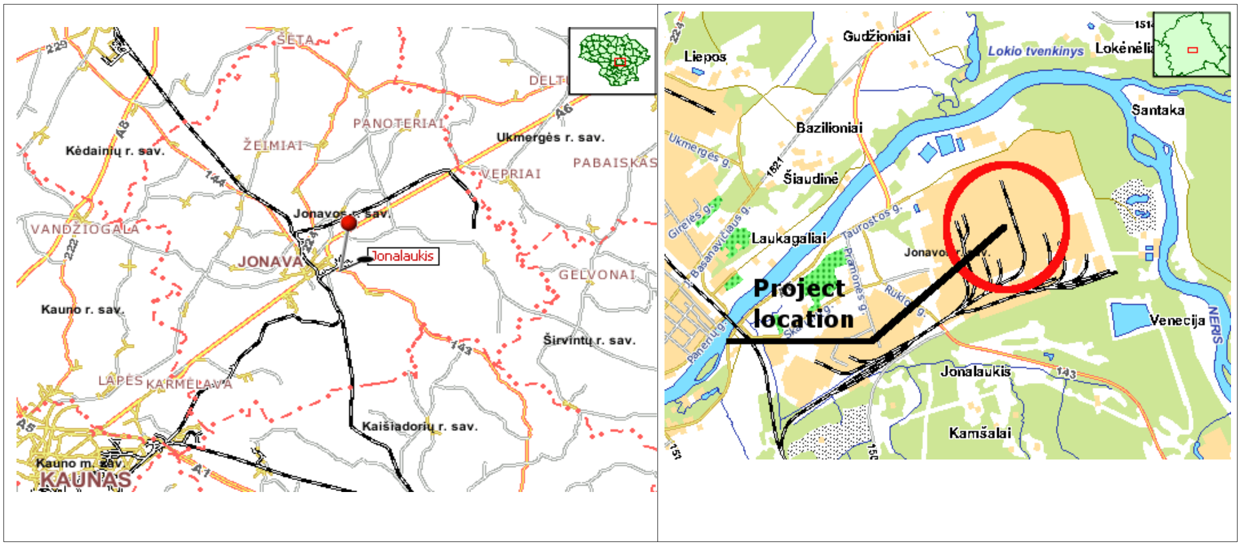

Figure 2 Physical location of AB Achema fertiliser plant

The project will be implemented in the GP Nitric acid aggregate within AB Achema fertiliser plant.

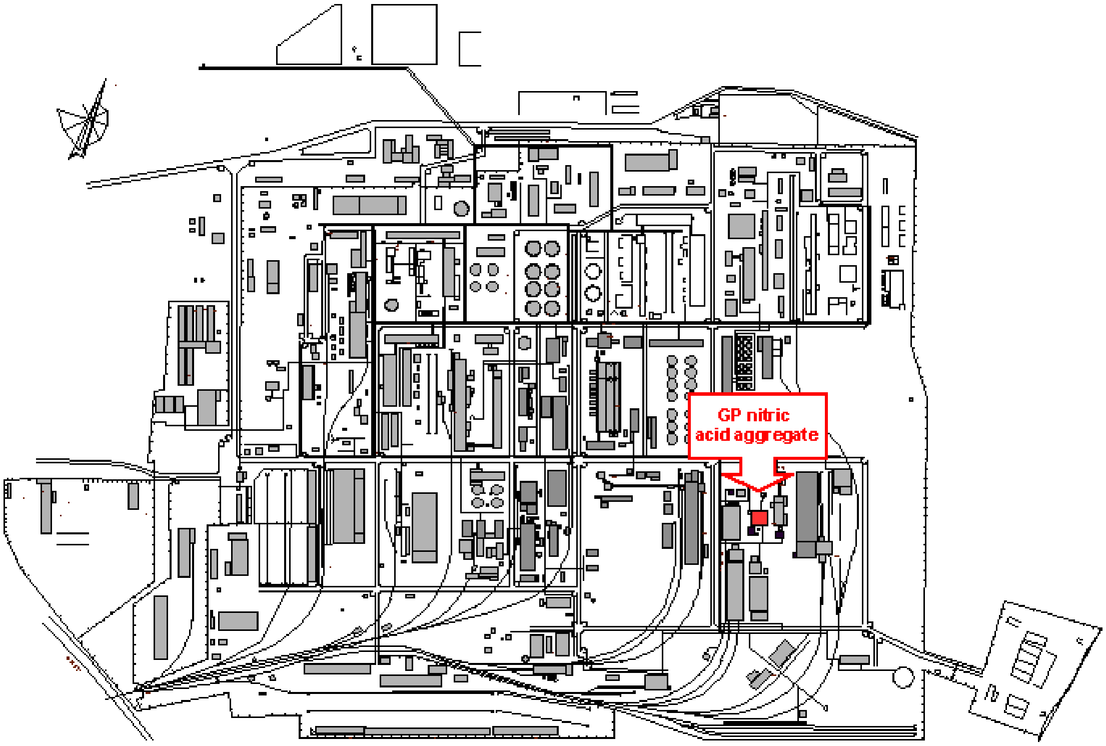

Figure 3 Location of the GP nitric acid aggregate within the fertiliser plant

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

HNO_3 production process in GP aggregate

Nitric acid is produced by burning of ammonia in four oxidation reactors. Liquid ammonia is delivered to the aggregate and evaporated by warming it with water in vaporizer. Then gaseous ammonia is heated in heater to the temperature of 100°C at 350 kPa pressure. Major part of ammonia of this quality is mixed with air and the other part is directed to the selective cleaning reactor.
Gaseous ammonia is delivered to the lower part of the mixer and is mixed with filtrated air that is delivered to the upper part of the mixer. Ammonia-air mixture of 160°C temperature containing 10.5% ammonia is directed to the burner.
Catalytic combustion takes place on the platinum (with palladium supplement) alloy gauzes inside the burner at 850°C temperature.

$$4\ NH_3 + 5\ O_2 = 4\ NO + 6\ H_2O + Q \quad [1]$$
$$4\ NH_3 + 4\ O_2 = 2\ N_2O + 6\ H_2O + Q \quad [2]$$
$$4\ NH_3 + 3\ O_2 = N_2 + 6\ H_2O + Q \text{ (subsidiary)} \quad [3]$$

Acquired mixture of nitric oxides, water steam, ammonia and oxygen is called nitrous gases. These gases are directed to the nitrous gas boiler for production of steam of 2 MPa pressure and 400°C temperature. Nitric oxide is further oxidized in the gas tract.

$$2\ NO + O_2 = 2\ NO_2 + Q \quad [4]$$

By passing heat exchangers nitrous gases cool to 180°C. Later, gases are directed and further condensed in the coolers condensers to 60°C. When temperature decreases, water steam condenses and reacts with nitric oxide in nitrous gases which leads to formation of 40-50 % nitric acid which is directed to the absorption column. Remaining nitrous gases are directed to the bottom of absorption column while demineralised water is supplied to the top of the column. Concentration of the nitric acid gradually increases while it flows down in the absorption column.

$$3\ NO_2 + H_2O = 2\ HNO_3 + NO + Q \quad [5]$$

From the bottom plate acid flows to the cube of the column and further to the inflation column where remaining nitric oxides are blown from the acid and returned to the column. After crossing whole absorption column nitric gases lose nitric oxides and become tail gases of 30°C temperature and containing 0.11-0.15% nitric oxides. Tail gases are further directed to the cleaning of remaining nitric oxides.

Table 1 Main parameters of nitric acid production at GP aggregate

Process	**Value**
Production of HNO_3	41,67 t HNO3 100% / h
Air intake to NH_3 burner	135.800 Nm^3/h
Ammonia intake	15.500 Nm^3/h
O_2 in tail gas	2,8 %-3,5%
N_2O in tail gas	~1000 ppm
Tail gas flow	139.000 Nm3/h

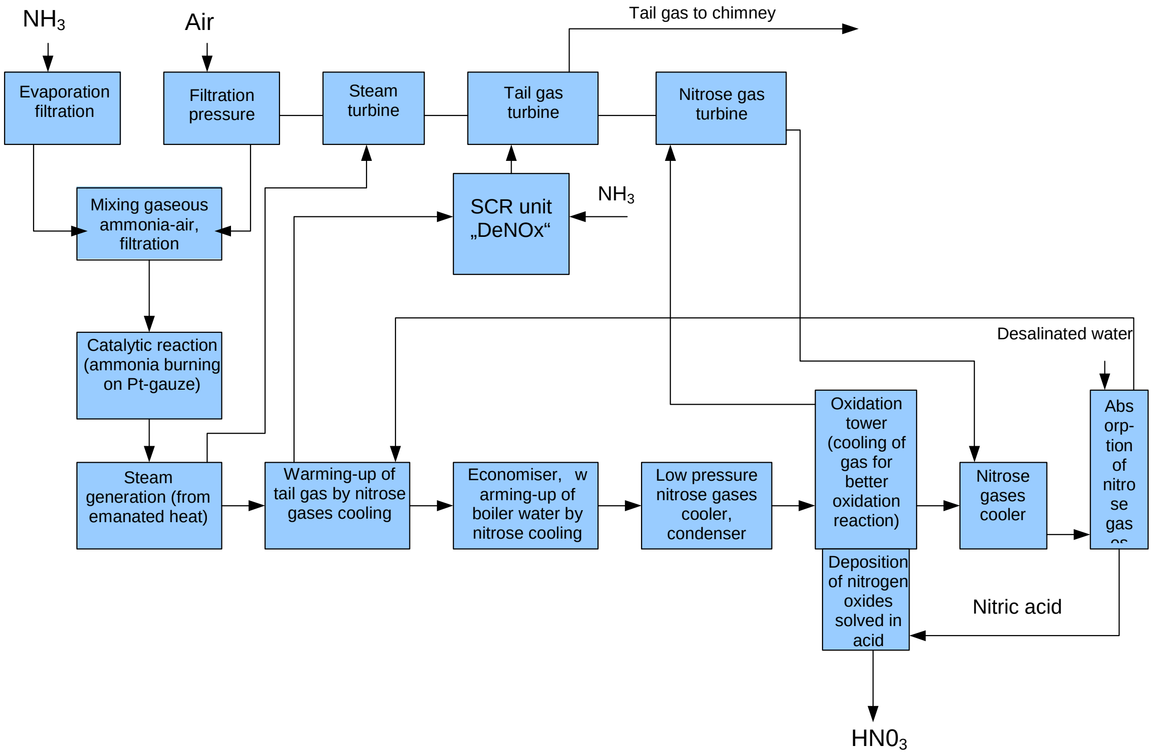

Figure 4 Nitric acid production process at GP aggregate

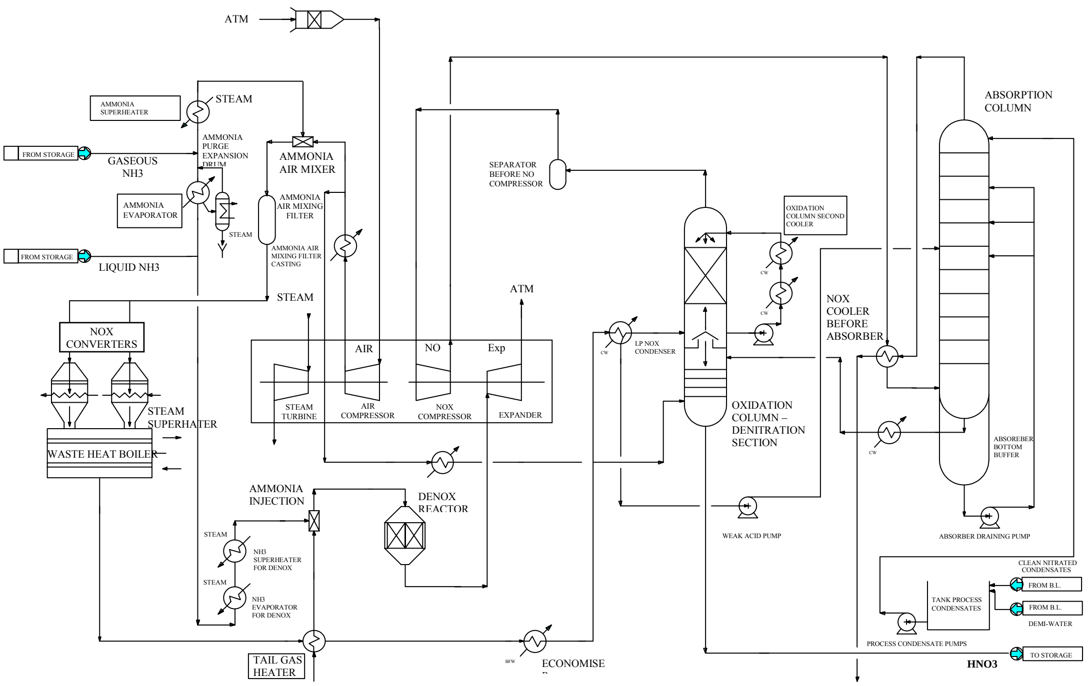

Figure 5 Nitric acid production scheme at GP aggregate

Available N_2O abatement technologies

In the nitric acid manufacturing process N_2O is inevitably generated as a by-product. The process typically generates N_2O quantities at levels of 2-19 kg per tonne of 100% nitric acid. The classification of potential N_2O abatement technologies at Nitric acid plants is based on the process location of the treatment device. There are three main technologies to reduce N_2O emissions from HNO_3 production process:

Primary - N_2O is prevented from forming in the oxidation gauzes. This requires modifications to the precious metal ammonia oxidation gauzes or utilization of another ammonia oxidization catalyst to reduce N_2O formation.

Secondary - N_2O is removed anywhere between the outlet or the ammonia oxidation gauzes and the inlet of the absorption tower. Technologies that belong to this group are:

- High Temperature Catalytic Destruction in oxidation reactor (>800° C)
- Homogeneous decomposition in reactor

Tertiary - N_2O is removed at the tail gas, after the absorption tower and previous to the expansion turbine. Technologies that use tertiary process are:

- Low Temperature Catalytic Destruction in tail gas (<400° C)
- Non-selective catalytic reduction in tail gas
- Thermal destruction in tail gas

N_2O abatement technology applied in the GP aggregate

After thorough evaluation of potential technologies for the reduction of N_2O emissions at Achema plant, a secondary catalyst technology of catalytic destruction in the reactor has been selected. The project activity comprises the installation of secondary catalysts in the oxidation reactors of the nitric acid plant GP at Achema. Some advantages specific to the selected secondary catalyst are:

- No measurable effect on ammonia to nitric oxide yield.
- Low level of N_2O in tail gas is achievable by adjusting the catalyst bed thickness.
- Proven performance. As of today, successful industrial-scale installations have been made with extremely low N_2O emissions and have been running for more than 6 campaigns.

BASF technology will be applied by introducing a new catalyst bed which is installed in a new basket, directly under the Platinum gauze in the nitric acid reactors. The technology is owned and patented by BASF (German patent BASF Catalysts 03-80, 03-85 and 03-86), it has also been installed in several plants and operated without problems. The performance of the catalyst technology is guaranteed by BASF and does not have any effects on the present production (no yield loss).

The secondary catalyst (on Al_2O_3 basis with active metal oxides CuO and ZnO) will be installed underneath the platinum gauze. The installation does not need any significant technological modifications in the plant. It is only required 20-100 mm additional free space under the Platinum gauze. For this purpose some reconstruction of burner basket is needed to make required space. The reconstruction and installation will be done during the planned shut down for maintenance of the GP aggregate.
The lifetime of the secondary catalyst is about 3 campaigns (lifetime of the platinum gauze), e. g. - about 550 days in the high-pressure nitric acid reactors and about 1000 days in the medium-pressure nitric acid reactors. The expected efficiency of the secondary catalyst is 80%.

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:

N_2O emissions at Achema fertiliser plant will be reduced by installing BASF secondary catalyst in 4 oxidation reactors of GP nitric acid production aggregate. The catalyst is expected to work with 80% efficiency - hence the baseline emissions will be reduced by the corresponding amount.

The Baseline scenario is considered to be a continuation of nitric acid production in GP plant in business as usual case i.e. with the current technologies and levels of N_2O emissions. N_2O is not considered as a pollutant in Lithuania nor it is regulated by any Lithuanian environmental legislation. Hence, Achema is not obliged in any way to consider abatement of N_2O emissions. Capture of N_2O as a potential product is not feasible because N_2O flow contains impurities and has variable concentrations that would imply complex purification and concentration units in order to produce potentially marketable N_2O. The feasibility of using the nitric acid tail gas containing N_2O as a feedstock for the petrochemical industry has not been demonstrated. Thus, from the economic perspective, installation of secondary catalyst in the nitric acid production plant is a costly task that gives revenues only within the framework of Kyoto flexible mechanisms i.e. does not give any other benefits apart from revenues related to ERU or CER sales.

Baseline emissions will be monitored and calculated by installing continuous multi-component measuring system Advance Cemas-NDIR manufactured by ABB, prior to installation of secondary catalysts. The monitoring system will allow to measure N_2O concentration in the tail gas flow continuously during the entire lifespan of the primary catalysts in the oxidation reactor i.e. for 11 months, starting June 2007. Monitoring results will give the average value of N_2O emissions released to the atmosphere while producing 1 ton of HNO_3 without abatement technique. After the installation of the secondary catalyst, the baseline emissions will be compared to the actual emissions that will be continuously measured. The difference between baseline emissions and actually measured emissions will give emission reduction values.

Prior to the installation of the continuous measurement system, a mobile analyser SICK-Mayhak UNOR 6N (infrared) was used to measure N_2O concentration in the tail gas flow during April 2007. The measurement data was processed statistically according to AM0034 methodology and the mean value of 1079 ppm was obtained. This gives an average value of 7.070 $kgN_2O/t\ HNO_3$ (section B1) which is used for calculation of preliminary emission reductions of the project.

The annual production at Achema's GP aggregate is 330 000 tons of HNO_3 and it will remain stable at this level during the 2008 - 2012 period. By using the above mentioned emission factor of 7.070 $kgN_2O/t\ HNO_3$ and N_2O emission reduction efficiency of 80%, guaranteed by BASF, estimated annual emission reductions are 578,569 tCO2eq. Considering the beginning of emission reductions to be mid of 2008, total project emission reduction is estimated to be 2,603,560tCO2eq.

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

Table 2 Estimated emission reductions

	Years
Crediting period	**5 (2008-2012)**

Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	289,285
2009	578,569
2010	578,569
2011	578,569
2012	578,569
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	2,603,560
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	578,569

A.5. Project approval by the Parties involved:

Letter of Endorsement (LoE) was issued to Achema's N_2O reduction JI project by the Ministry of Environment on 8th January 2007, by communication No. (10-5)-D8-216. The evaluation of the Project Idea Note was made in consideration of provisions settled out in the regulation for JI project implementation in Lithuania, approved by the ordinance No D1-183 of the Minister of Environment of the Republic of Lithuania on April 1, 2006 (Official Gazette, 2005 No 50-1671). Also the assent from the Lithuanian Environmental Investment Fund was taken into consideration in the decision making procedure.

Project Idea Note was also submitted to the German DFP on 30th of March, which is also expected to issue LoE.

SECTION B. Baseline

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

In order to set the baseline for the Achema GP JI project, the approved baseline methodology AM0034 "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants" shall be applied. The methodology can be found on the UNFCCC website at the following link:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

The AM 0034 methodology is applicable to Achema GP JI project, because the project complies with all applicability requirements set in the methodology:

- ✓ Existing nitric acid production facilities at Achema fertiliser plant were installed earlier than 31 December 2005
- ✓ The project activity will not result in the shut down of any existing N_2O destruction or abatement facility or equipment in the plant

- ✓ The project activity shall not affect the level of nitric acid production (the manufacturer of secondary catalyst technology – BASF, guaranties that the level of nitric acid production will not be affected)
- ✓ There are currently no regulatory requirements or incentives to reduce levels of N_2O emissions from nitric acid plants in Lithuania (N_2O is not regulated by IPPC permits or any other legislation).
- ✓ No N_2O abatement technology is currently installed in the plant
- ✓ The project activity will not increase NO_X emissions (assured by the manufacturer)
- ✓ NOX abatement catalyst installed, if any, prior to the start of the project activity is not a Non-Selective Catalytic Reduction (NSCR) DeNOX unit (assured by the manufacturer)
- ✓ Operation of the secondary N_2O abatement catalyst installed under the project activity does not lead to any process emissions of greenhouse gases, directly or indirectly (assured by the manufacturer).
- ✓ Continuous real-time measurements of N_2O concentration and total gas volume flow can be carried out in the stack:
  - o Prior to the installation of the secondary catalyst for one campaign, and
  - o After the installation of the secondary catalyst throughout the chosen crediting period of the project activity

The N_2O monitoring system is designed according to the requirements set in the approved CDM baseline methodology AM0034 .

Baseline emissions will be monitored and calculated by installing continuous multi-component measuring system Advance Cemas-NDIR manufactured by ABB, prior to installation of secondary catalysts. The monitoring system will allow to measure N_2O concentration in the tail gas flow continuously during the entire lifespan of the primary catalysts in the oxidation reactor i.e. for 11 months, starting June 2007. Monitoring results will give the average value of N_2O emissions released to the atmosphere while producing 1 ton of HNO_3 without abatement technique. After the installation of the secondary catalyst, the baseline emissions will be compared to the actual emissions that will be continuously measured. The difference between baseline emissions and actual emissions after the installation of the secondary catalyst will give emission reduction values.

Location of sampling probes for on-line measurement of tail gas volume flow, temperature, pressure and N_2O concentration with ABB multi-component measuring system at GP nitric acid plant are shown in a figure below.

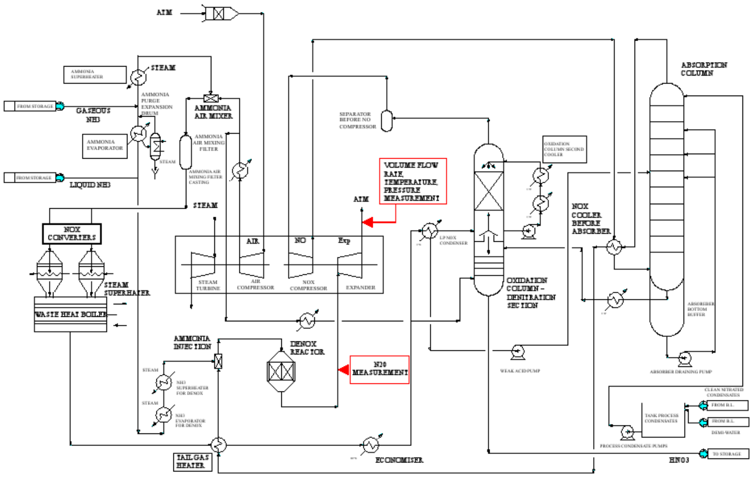

Figure 6 Sampling points for N2O monitoring at GP aggregate

As it can be seen on the process scheme above, the volume flow, temperature and pressure measuring probe will be installed after expander unit and N_2O sampling probe directly after DeNOx reactor.

Part of the volume flow rate monitoring system is also the measurement of the gas temperature and gas pressure. Technical details of monitoring equipment for N_2O concentration measurement are described below. Flow volume, temperature and pressure of the tail gas are measured separately from N_2O because length of straight duct at the N_2O sampling point is not long enough according to requirements for such measurements.

The N_2O monitoring system at GP aggregate is comprised of:

- ✓ N_2O analyzer AO-2000-URAS-14 (ABB)
- ✓ Flow meter DELTAFLOW (Systec)
- ✓ Data Server EMI 3000
- ✓ Distributed control system (DCS)

A simplified scheme of the monitoring system is presented below:

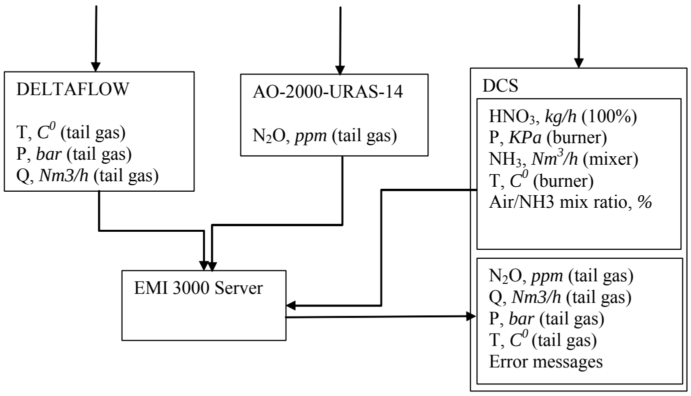

Figure 7 Automated monitoring system at GP aggregate

A flow meter measures volume flow (m^3/h), temperature and pressure in the tail gas and sends signals to the server. The server stores data and forwards signal to the Distributed Control System (DCS). The N_2O analyzer continuously measures concentration of N_2O in the tail gas and also sends signal to the data server which forwards it to DCS.

The AM0034 methodology requires monitoring scheme to be installed according to the European Norm 14181 (2004). The Norm requires evaluation of the automated measuring system (AMS) against three Quality Assurance Levels (QAL1, QAL2 and QAL3) and an Annual Surveillance Test (AST). Besides that, it must be ensured that the automated measuring system (AMS) is installed in accordance with the relevant European/ international standards and manufacturer requirements and functional test is performed at the commissioning of the AMS.

On the commissioning of the AMS, TUV experts have performed evaluation and issued "Report on checking the correct installation of an automated measuring and electronic data evaluation system".

QAL1 procedure requires compliance of the equipment with EN ISO 14956. AO-2000-URAS-14 and DELTAFLOW are ISO 14956 certified by the manufacturers.

QAL2 procedure requires determination of the calibration function and a test of the measured values of the AMS compared with the uncertainty given by legislation. During the maintenance period of the GP aggregate (September 2007) the openings required for QAL2 tests will be made in the duct. QAL2 procedure will be performed by TUV at the end of the next campaign.

QAL3 is a procedure to check drift and precision in order to demonstrate that the AMS is in control during its operation so that it continues to function within the required specifications for uncertainty. QAL3 procedures will be performed automatically as the system will calibrate itself once a week. In addition, Achema experts will perform maintenance of the equipment – will fix faults, change filters, remove condensate from the system etc.

AST is a procedure to evaluate whether the measured values obtained from the AMS still meet the required uncertainty criteria – as demonstrated in the previous QAL2 test. AST will be performed annually by the selected validator.

After the baseline monitoring period is over, records of the monitored data (N_2O concentration and tail gas flow volume) shall be statistically examined according to AM0034 methodology:

a) Sample mean (x) calculated
b) Sample standard deviation (s) calculated
c) 95% confidence interval (equal to 1.96 times the standard deviation) calculated
d) All data that lie outside the 95% confidence interval will be eliminated
e) New sample mean from the remaining values (volume of stack gas (VSG) and N_2O concentration of stack gas (NCSG)) will be calculated

N_2O concentration units from ppm to mg/nm^3 will be translated accordingly:

1ppm = 1,964 mg/nm^3 (44/22.4 = 1.964. Mole mass of N_2O - 44, volume of one mole - 22.4)

The average mass of N_2O emissions per hour will be estimated as product of the NCSG and VSG. The N_2Oemissions per campaign will be estimated as product of N_2O emission per hour and the total number of complete hours of operation of the campaign using the following equation:

$BE_{BC} = VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC}$ (tN_2O) (1)

The plant specific baseline emissions factor representing the average N_2O emissions per tonne of nitric acid over one full campaign will be derived by dividing the total mass of N_2O emissions by the total output of 100% concentrated nitric acid for that period. The overall uncertainty of the monitoring system shall also be determined and the measurement error will be expressed as a percentage (UNC). The N_2O emission factor per tonne of nitric acid produced in the baseline period (EFBL) shall then be reduced by the estimated percentage error as follows:

$EF_{BL} = (BE_{BC} / NAP_{BC}) (1 – UNC/100)$ ($tN_2O/tHNO_3$) (2)

where:

EF_{BL} - Baseline N_2O emissions factor ($tN_2O/tHNO_3$)
BE_{BC} - Total N_2O emissions during the baseline campaign (tN_2O)
$NCSG_{BC}$ - Mean concentration of N_2O in the stack gas during the baseline campaign (mgN_2O/m^3)
OH_{BC} - Operating hours of the baseline campaign (h)
VSG_{BC} - Mean gas volume flow rate at the stack in the baseline measurement period (m^3/h)

NAP_{BC} - Nitric acid production during the baseline campaign ($tHNO_3$)
UNC - Overall uncertainty of the monitoring system (%), calculated as the combined uncertainty of the applied monitoring equipment

In June 2008, the aggregate will be stopped for second maintenance period, during which modification of oxidation reactors will take place and secondary catalysts will be installed. After the installation of secondary catalysts – the monitoring of project emissions will take place.

As the methodology requires monitoring of baseline emissions for entire lifespan of platinum gauzes i.e. for 11 months, the exact baseline can be determined only after the entire baseline monitoring period. In order to project N_2O emission reductions a mobile analyser SICK-Mayhak UNOR 6N (infrared) was used to measure N_2O concentration in the tail gas flow in April 2007. The measurement data was processed statistically according to AM0034 methodology and the mean value of 1079 ppm was obtained. Stack gas flow volume is 139000 nm^3/h.

To translate N_2O concentration units:

$1079ppm * 1,964 = 2119.16\ mg/nm^3$

Following the AM0034 methodology:

$BE_{BC} = VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC}$ (1)

$BE_{BC} = 139000\ nm^3 * 2119.16\ mg/nm^3 * 10^{-9} * 7920h = 2332.94\ tN_2O$

$EF_{BL} = (BE_{BC} / NAP_{BC}) (1 – UNC/100)$

$EF_{BL} = 2332.94 / 330000\ tHNO_3 = 0.007070\ tN_2O/tHNO_3$

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

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

To translate N_2O emissions to CO_2 equivalents it is multiplied by the global warming potential of N_2O:
$2332.94\ tN_2O * 310 = 723,211\ tCO_2ekv$

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 Nitrous Oxide Emission Reduction Project at GP Nitric acid aggregate in Achema fertiliser plant is completely additional as there exist no economic, technical, institutional or other incentives in Lithuania to reduce N_2O emissions bellow the current levels. The Tool for the demonstration and assessment of additionality (version 3) is used to describe how the anthropogenic emissions of greenhouse gases are reduced below those that would have occurred in the absence of the JI project.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

A) Proposed project activity is undertaken without JI mechanism

B) Installation of different N_2O abatement technologies (other than secondary catalysts)

C) Continuation of the current situation (no project activity or other alternatives undertaken) – i.e. no secondary catalysts are installed in the oxidation reactors

Sub-step 1b. Consistency with mandatory laws and regulations:
The existing legal and regulatory requirements in Lithuania are not in favour of Alternative A. N_2O emission reduction in the HNO_3 production process is a costly procedure and does not give any revenues, except from ERU sales. This implies that the project can be implemented only under the JI mechanism.

The existing regulation in Lithuania does not require implementation any technologies for N_2O abatement. There are no subsidies or other support available for such technologies. Hence, alternative B is not feasible as any of the existing N_2O abatement technologies imply additional costs and no revenues outside the JI mechanism.

The existing regulation is in favour of alternative C - continuation of the current situation. The existing regulation in Lithuania does not demand N_2O emission reductions nor does it consider N_2O as pollutant, so the emitter is not obliged to reduce N_2O emissions from the production process.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

Simple cost analysis (option I) is applied for the project as the activity produces no economic benefits other than JI related income.

The costs of secondary catalysts, reactor reconstruction works, design and installation are in range of several million EUR. In addition to that there are significant costs related to the JI project development. The only revenues from the project are ERU sales, which are to be generated during the JI activity. As no other revenues are available for the project, it is economically feasible only under the JI mechanism.

Step 3. Barrier analysis

Not applied.

Step 4. Common practice analysis

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

Achema fertiliser plant is the only producer of Nitric acid in Lithuania, so no other N_2O abatement projects were carried out or are to be carried out in Lithuania.

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

Not applicable.

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

“The project boundary shall encompass all anthropogenic emissions by sources and/or removals by sinks of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the JI project.” (Guidelines for users of the Joint Implementation project design document for, Version 01)

Project boundary covers entire GP aggregate (the diagram of the aggregate is presented in Figure 5 in chapter A.4.2). The only significant and reasonably attributable to the JI project GHG source within the project boundary is N_2O emissions.

	Source	**Gas**	**Included ?**	**Justification / Explanation**
Baseline	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	Excluded	The project does not lead to any change in CO_2or CH_4emissions, and, therefore, these are not included.
		CH_4	Excluded	
		N_2O	Included	
Project Activity	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	Excluded	The project does not lead to any change in CO_2or CH_4emissions
		CH_4	Excluded	
		N_2O	Included	
	Leakage emissions from production, transport, operation and decommissioning of the catalyst.	CO_2	Excluded	No leakage emissions are expected.
		CH_4	Excluded	
		N_2O	Excluded	

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 study was prepared by consulting a company UAB Ekostrategija and completed on 01 06 2007.

Company name	*Ekostrategija*
Street	J.Galvydžio
Building No	5
State/Region/City	Vilnius
Post code	LT-08236
Country	Lithuania
Telephone number	+370 5 2745465
Fax number	+370 5 2745466
E-mail	info@ekostrategija.lt
Website	www.ekostrategija.lt
Representative	Vaidotas Kuodys
Position	Head of Environmental Division
Salutation	
Surname	Kuodys
Second name	-
First name	Vaidotas

Subdivision	-
Telephone number (direct)	+370 5 2745868
Fax number (direct)	+370 5 2745466
Mobile phone number	+370 655 04365
E-mail (personal)	vk@ekostrategija.lt

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Installation of the secondary catalysts is envisioned for 01 07 2008.

C.2. Expected operational lifetime of the project:

20 years

C.3. Length of the crediting period:

Four years and six months: 01 07 2008 – 31 12 2012.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

Approved monitoring methodology AM0034 “Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants” is used for the project.

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

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P.1	*NCSG* *N_2O concentration in tail gas*	*N_2O analyser* *AO-2000-URAS-14*	*mg N_2O /m^3 (converted from ppm)*	*m*	*Every 2 seconds*	*100%*	*Electronic*	*The data output from analyser will be processed using Anayse IT Explorer*
P.2	*VSG* *Volume flow rate of the stack gas*	*Gas volume flow meter DELTAFLOW*	*nm^3/h*	*m*	*Every 2 seconds*	*100%*	*Electronic*	*The data output from flow meter will be processed using Anayse IT Explorer*
P.3	*PE_n* *N_2O emissions of nth project campaign*	*Calculation from measured data*	*t N_2O*	*c*	*Once after each campaign*	*100%*	*Electronic and paper*	
P.4	*OH*	*Production log*	*Hours*	*m*	*Daily, compiled for entire*	*100%*	*Electronic and paper*	

	Operating hours				*campaign*			
P.5	*NAP* *Nitric Acid production (100% concentrate)*	*Production log*	*tHNO*$_3$	*m*	*Daily, compiled for entire campaign*	*100%*	*Electronic and paper*	*Total production over project campaign.*
P.6	*TSG* *Temperature of Stack gas*	*Probe (part of gas volume flow meter) DELTAFLOW*	C^0	*m*	*Every 2 seconds*	*100%*	*Electronic and paper*	
P.7	*PSG* *Pressure of stack gas*	*Probe (part of gas volume flow meter) DELTAFLOW*	*Pa*	*m*	*Every 2 seconds*	*100%*	*Electronic and paper*	
P.8	EF_n *Emissions factor calculated for nth campaign*	*Calculated from measured data*	*t* N_2O */ tHNO*$_3$	*c*	*After end of each campaign*			
P.9	$EF_{mn,a}$ *Moving average emissions factor*	*Calculated from campaign emissions factors*	*t* N_2O */tH NO3*	*c*	*After end of each campaign*			
P.10	*CLn* *Campaign length*	*Calculated from nitric acid production data*	*tHNO*$_3$	*c*	*After end of each campaign*	*100%*	*Electronic and paper*	

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

Monitoring system will continue function after the installation of the secondary catalysts. Readings of N_2O concentration and gas volume flow will be automatically corrected by eliminating error and extreme values. The same statistical data processing method will be applied as to the baseline measurement results (B.1).

Project emissions shall be using the following formula:

$PE_n = VSG * NCSG * 10^{-9} * OH$ (tN_2O)

Where:

PE_n - Total N_2O emissions of the nth project campaign (tN_2O)
VSG - Mean stack gas volume flow rate for the project campaign (m^3/h)
NCSG - Mean concentration of N_2O in the stack gas for the project campaign (mgN_2O/m^3)
OH - Number of hours of operation in the specific monitoring period (h)

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

Step1: campaign specific emissions factor for each campaign during the project's crediting period will be estimated by dividing the total mass of N_2O emissions during that campaign by the total production of 100% concentrated nitric acid during that same campaign:

$EF_n = PE_n / NAP_n$ ($tN_2O/tHNO_3$) (4)

Where:
NAP_n - Nitric acid production during the n^{th} campaign ($tHNO_3$)

Step 2: a moving average emissions factor will be calculated at the end of a campaign n as follows:

$EF_{ma,n} = (EF1 + EF2 + \ldots + EF_n) / n$ ($tN_2O/tHNO_3$) (5)

This process will be repeated for each campaign such that a moving average, $EF_{ma,n}$, is established over time, becoming more representative and precise with each additional campaign. To calculate the total emission reductions achieved in a campaign in formula (7) below, the higher of the two values EFma,n and EFn shall be applied as the emission factor relevant for the particular campaign to be used to calculate emissions reductions (EFp):

If $EF_{ma,n} > EF_n$ then $EF_p = EF_{ma,n}$ (6)
If $EF_{ma,n} < EF_n$ then $EF_p = EF_n$

Where:
EF_n - Emission factor calculated for a specific project campaign ($tN_2O/tHNO_3$)
$EF_{ma,n}$ - Moving average (ma) emission factor of after nth campaigns, including the current campaign ($tN_2O/tHNO_3$)
n - Number of campaigns to date
EF_p - Emissions factor that will be applied to calculate the emissions reductions from the specific campaign ($N_2O/tHNO_3$)

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
B.1	*$NCSG_{BC}$* *N_2O concentration in the stack gas*	*N_2O analyser* *AO-2000-URAS-14*	*mg N_2O /m^3 (converted from ppm)*	*m*	*Every 2 seconds*	*100%*	*Electronic*	*The data output from analyser will be processed using Anayse IT Explorer*
B.2	*VSG_{BC}* *Volume flow rate of the stack gas*	*Gas volume flow meter DELTAFLOW*	*nm^3/h*	*m*	*Every 2 seconds*	*100%*	*Electronic*	*The data output from flow meter will be processed using Anayse IT Explorer*
B.3	*BE_{BC}* *Total N_2O for baseline campaign*	*Calculation from measured data*	*t N_2O*	*c*	*Once after each campaign*	*100%*	*Electronic and paper*	
B.4	*OH_{BC}* *Operating hours*	*Production log*	*Hours*	*m*	*Daily, compiled for entire campaign*	*100%*	*Electronic and paper*	

B.5	*NAP_{BC}* *Nitric Acid production (100% concentrate)*	*Production log*	*t HNO_3*	*m*	*Daily, compiled for entire campaign*	*100%*	*Electronic and paper*	*Total production over project campaign.*
B.6	*TSG* *Temperature of Stack gas*	*Probe (part of gas volume flow meter) DELTAFLOW*	*C^0*	*m*	*Every 2 seconds*	*100%*	*Electronic and paper*	
B.7	*PSG* *Pressure of stack gas*	*Probe (part of gas volume flow meter) DELTAFLOW*	*Pa*	*m*	*Every 2 seconds*	*100%*	*Electronic and paper*	
B.8	*EF_{BL}* *Emissions factor calculated for nth campaign*	*Calculated from measured data*	*t N_2O /t HNO_3*	*c*	*After end of each campaign*			
B.9	*UNC* *Overall measurement uncertainty of the monitoring system*	*Calculation of the combined uncertainty of the applied monitoring equipment*	*%*	*c*	*Once after monitoring system is commissioned*		*Electronic and paper*	
B.10	*AIFR* *Ammonia gas flow rate to the AOR*	*Monitored*	*m^3/h*	*m/c*	*Every hour*	*100%*	*Electronic and paper*	*To be obtained from the operating condition campaign*
B.11	*OT_h* *Oxidation temperature for each hour*	*Monitored*	*°C*	*m*	*Every hour*	*100%*	*Electronic and paper*	

B.12	*OP_h Oxidation Pressure for each hour*		*Pa*	*m*	*Every hour*	*100%*	*Electronic and paper*	*To be obtained from the operating condition campaign*

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 will be estimated by using the following formula:

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

Where:

BE_{BC} - Total N_2O emissions during the baseline campaign (tN_2O)

$NCSG_{BC}$ - Mean concentration of N_2O in the stack gas during the baseline campaign (mgN_2O/m^3)

OH_{BC} - Operating hours of the baseline campaign (h)

VSG_{BC} - Mean gas volume flow rate at the stack in the baseline measurement period (m^3/h)

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

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

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

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

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

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

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

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

No leakage is expected.

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):

Emission reductions will be calculated by using the following formula:

$ER = (EF_{BL} – EF_{P}) * NAP * GWP_{N2O}$ (tCO_2e)

ER - Emission reductions of the project for the specific campaign (tCO_2e)
NAP - Nitric acid production for the project campaign ($tHNO_3$)
EF_{BL} - Baseline emissions factor ($tN_2O/tHNO_3$)
EF_P - Emissions factor used to calculate the emissions from this particular campaign
GWP_{N2O} – Global warming potential of the N_2O (310)

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:

N/A

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.
P1, B1	*Low*	*QAL1, QAL2 and QAL3 procedures are performed according to European Norm 14181*
P2, B2	*Low*	*QAL1, QAL2 and QAL3 procedures are performed according to European Norm 14181*
P6, B6	*Low*	*QAL1, QAL2 and QAL3 procedures are performed according to European Norm 14181*
P7, B7	*Low*	*QAL1, QAL2 and QAL3 procedures are performed according to European Norm 14181*
B9	*Low*	*Assured by the producers and designer of the monitoring scheme*
B10	*Low*	*Ammonia input is measured with Ammonia flow meter which is regularly calibrated and tested*
B11	*Low*	*Oxidation temperature is measured with the device which is regularly calibrated and tested*
B12	*Low*	*Oxidation pressure is measured with Ammonia flow meter which is regularly calibrated and tested*

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

“Sistematika” a division of AB Achema is in charge of operation and maintenance of the N_2O monitoring system. The Nitric acid production department is responsible for the N_2O monitoring and for reporting faults in the operation of the monitoring system to “Sistematika”. Monitoring will be performed by the DCS operators and the technical support will be provided by the directly responsible automation engineer.

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

Company name	UAB Ekostrategija
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Representative	Vaidotas Kuodys
Position	Project manager
Salutation	
Surname	Kuodys
Second name	-
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SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Project emissions are directly related to the efficiency of the secondary catalyst. BASF, a producer and supplier guarantees a minimum 80% efficiency of the catalyst. This would imply that the remaining 20% of N_2O will be released to the atmosphere.

$NCSG = NCSG_{BC} * 0.2$

$NCSG = 2119.16\ mg/nm^3 * 0.2 = 423.83\ mg/nm^3$

Project emissions per campaign (annual) are:

$PE_n = VSG * NCSG * 10^{-9} * OH\ (tN_2O)$

$PE_n = 139000\ nm^3 * 423.83\ mg/nm^3 * 10^{-9} * 7920h = 466.59\ tN_2O/year$

PE_n - Total N_2O emissions of the nth project campaign (tN_2O)
VSG - Mean stack gas volume flow rate for the project campaign (m^3/h)
NCSG - Mean concentration of N_2O in the stack gas for the project campaign (mgN_2O/m^3)
OH - Number of hours of operation in the specific monitoring period (h)

Total project emissions for the crediting period are:

466.59 * 4.5 = **2,099.65 tN_2O**

E.2. Estimated leakage:

E.2 = 0

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

E.1 + E2 = 2,099.65 + 0 = **2,099.65 tN_2O**

E.4. Estimated baseline emissions:

Estimated baseline emissions per campaign (annual):

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

$BE_{BC} = 139000\ nm^3 * 2119.16\ mg/nm^3 * 10^{-9} * 7920h = 2332.94\ tN_2O$

BE_{BC} - Total N_2O emissions during the baseline campaign ($t\ N_2O$)
$NCSG_{BC}$ - Mean concentration of N_2O in the stack gas during the baseline campaign (mgN_2O/m^3)
OH_{BC} - Operating hours of the baseline campaign (h)
VSG_{BC} - Mean gas volume flow rate at the stack in the baseline measurement period (m^3/h)

Total baseline emissions:
2332.94 * 4.5 = **10,498.23 $t\ N_2O$**

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

E.4 – E.3 = 10,498.23 - 2,099.65 = **8,398.58 tN_2O**

8,398.58 * 310 **= 2,603,560 tCO2eq**

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

Year	Estimated project emissions (tonnes of CO_2equivalent)	Estimated leakage(tonnes of CO_2equivalent)	Estimated baseline emissions (tonnes of CO_2equivalent)	Estimated emission reductions (tonnes of CO_2equivalent)
2008	72,321	0	361,606	289,285
2009	144,642	0	723,211	578,569
2010	144,642	0	723,211	578,569
2011	144,642	0	723,211	578,569
2012	144,642	0	723,211	578,569
Total	650,892	0	3,254,451	2,603,560

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:

No negative environmental impacts are envisioned.

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:

N/a

SECTION G. Stakeholders' comments

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

N/a

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

Baseline monitoring data is expected to be available in summer 2008.

Annex 3

MONITORING PLAN

The N_2O monitoring system in AB Achema GP aggregate is implemented according to European Norm 14181 and AM0034 methodology. All three Quality Assurance Levels (QAL1, QAL2 and QAL3) and Annual Surveillance Test (AST) shall be applied to ensure that the monitoring system functions in line with the standards. QAL1 is ensured by the suppliers of the monitoring equipment, QAL2 is performed by TÜV SÜD Industrie Service GmbH and QAL3 is to be performed by the responsible personnel of AB Achema and during the authomatic calibration procedures of the monitoring equipment. AST shall be performed annually by a selected certification body. Short summary:

- ✓ QAL1 procedure requires compliance of the equipment with EN ISO 14956. AO-2000-URAS-14 and DELTAFLOW are ISO 14956 certified by the manufacturers.

- ✓ QAL2 procedure requires determination of the calibration function and a test of the measured values of the AMS compared with the uncertainty given by legislation. During the maintenance period of the GP aggregate (September 2007) the openings required for QAL2 tests will be made in the duct. QAL2 procedure will be performed by TUV at the end of the next campaign.

- ✓ QAL3 is a procedure to check drift and precision in order to demonstrate that the AMS is in control during its operation so that it continues to function within the required specifications for uncertainty. QAL3 procedures will be performed automatically as the system will calibrate itself once a week. In addition, Achema experts will perform maintenance of the equipment – will fix faults, change filters, remove condensate from the system etc.

- ✓ AST is a procedure to evaluate whether the measured values obtained from the AMS still meet the required uncertainty criteria – as demonstrated in the previous QAL2 test. AST will be performed annually by selected certifier.

N_2O emission monitoring is performed automatically by the installed equipment. A flow meter measures volume flow (m^3/h), temperature and pressure in the tail gas and sends signals to the server. The server stores data and forwards signal to the Distributed Control System (DCS). The N_2O analyzer continuously measures concentration of N_2O in the tail gas and also sends signal to the data server which forwards it to DCS.

The monitoring system shall be operated and maintained by “Sistematika” a division of AB Achema. Data collection and fault reporting to “Sistematika” is a responsibility of the Nitric acid production department. Monitoring will be performed by the DCS operators while the technical support will be provided by automation engineers.

After the baseline monitoring period is over, records of the monitored data (N_2O) concentration and tail gas flow volume) shall be statistically examined according to AM0034 methodology:

a) Sample mean (x) calculated
b) Sample standard deviation (s) calculated
c) 95% confidence interval (equal to 1.96 times the standard deviation) calculated
d) All data that lie outside the 95% confidence interval will be eliminated
e) New sample mean from the remaining values of volume of stack gas (VSG) and N_2O concentration of stack gas (NCSG)) will be calculated

In order to avoid the possibility that the operating conditions of the nitric acid production plant are modified in such a way that increases N_2O generation during the baseline campaign, the normal ranges for operating conditions shall be determined for the following parameters:

a) oxidation temperature
b) oxidation pressure
c) ammonia gas flow rate
d) air input flow rate

The permitted range of the parameters shall be established in combination of all three data sources specified in the AM0034 methodology:
a) Historical data of the operating range from the previous campaigns;
b) The range stipulated in the operating manual for the existing equipment;
c) Appropriate technical literature

The historical data shall be processed in line with the requirements stipulated in AM0034.