JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
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Emission Reduction of Nitrous Oxide in Nitric Acid Production at Neochim PLC

presented by

Neochim PLC
6403 Dimitrovgrad
Bulgaria

Dimitrovgrad, 09.07.2011

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

Emission reduction of Nitrous Oxide in Nitric Acid Production at Neochim PLC in Dimitrovgrad
Sectorial scope: 05, Chemical industry
Version 3
Date: 09.07.2011

A.2. Description of the project:

Neochim PLC operates a nitric acid production plant at the production site in Dimitrovgrad, Bulgaria. Nitric acid has been produced in Dimitrovgrad since 1951. Nitric acid (HNO3) is one of the most important and quantitatively one of the top ten industrial chemicals. It is mainly used for production of fertilizers, aside the manufacture of explosives and chemicals. The nitric acid produced at Neochim PLC is used for the production of fertilizers and partly sold to third parties. Other product of the nitric acid plant in Neochim PLC, obtained by alkaline absorption is sodium nitrate used in the glass production and as fertilizer. As sodium nitrate stems from the same ammonia oxidation reaction as nitric acid and can be calculated as 100% nitric acid equivalent, it is included into the project and subsumed under nitric acid production.

Nitric acid is produced through the oxidation of ammonia (NH3) on precious metal catalyst gauze in the ammonia burner of a nitric acid plant. During the production of nitric acid, nitrous oxide (N_2O) is generated as an unintended by – product of the high temperature catalytic oxidation of ammonia. This waste N_2O is typically released into the atmosphere, as it does not have any economic value or toxicity at emission levels typical for nitric acid manufacture.

Nowadays nitric acid manufacturing, as a trade product, is being implemented using Oswald process by ammonia oxidation and the following products reaction of oxidation with water.
Oswald's process includes three major chemical steps:

A) Catalytic oxidation of ammonia with atmospheric oxygen yields nitrogen monoxide (or nitric oxide)

$$4\ NH_3 + 5\ O_2 \longleftrightarrow 4\ NO + 6\ H_2O \qquad (a)$$

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

$$2\ NO + O_2 \longleftrightarrow 2\ NO_2 \longleftrightarrow N_2O_4 \qquad (b)$$

C) Absorption of nitrogen dioxide in water yields nitric acid.

$$3\ NO_2 + H_2O \longleftrightarrow 2\ HNO_3 + NO \qquad (c)$$

During the catalytic oxidation of ammonia nitrous oxide is formed. Whit the use of proper catalyst, 98% at most (92 -96% typical) of the introduced ammonia are transformed in nitric oxide (NO), according to the above reaction (a). The remaining part reacts in an undesirable chemical reactions that lead to formation of nitrous oxide (N_2O), along with other compounds.

Side reactions during ammonia oxidation are the following:

$$4\ NH_3 + 4\ O_2 \longleftrightarrow 2\ N_2O + 6\ H_2O \text{ (nitrous oxide formation)} \qquad (d)$$

$$4\ NH_3 + 3\ O_2 \longleftrightarrow 2\ N_2 + 6\ H_2O \qquad (e)$$

$$2\ NO \longleftrightarrow N_2 + O_2 \qquad (f)$$

$$4\ NH_3 + 6\ NO \longleftrightarrow 5\ N_2 + 6\ H_2O \qquad (g)$$

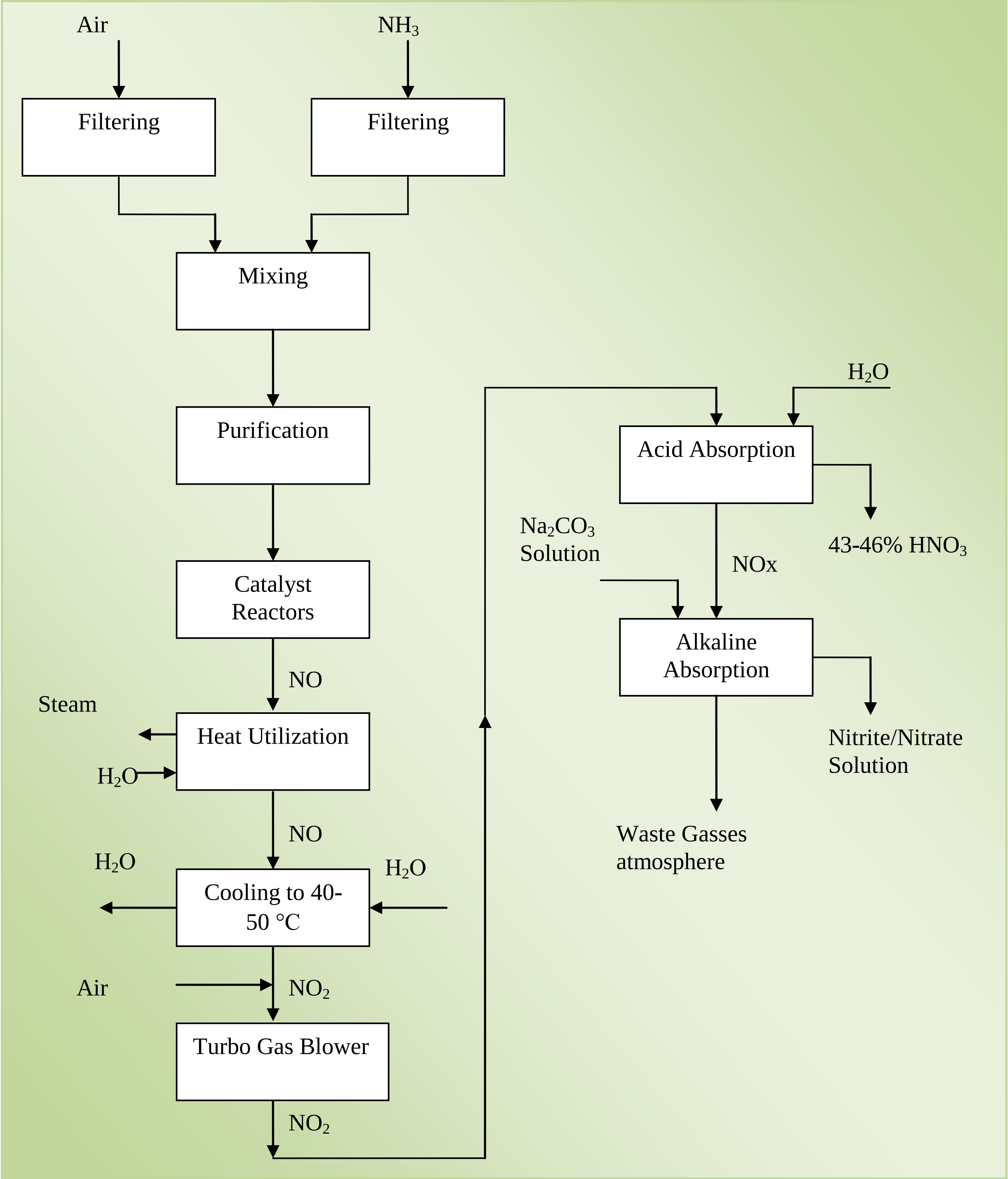

Figure 1 Simplified nitric acid production process scheme at Neochim PLC

This is also the case at Neochim nitric acid plant where some 80,000 tonnes nitric acid equivalents (calculated as 100% , including sodium nitrate production calculated as 100% percent nitric acid equivalent) are produced annually. The plant is a network of twelve oxidation reactors, feeding NOx gas into a ring that distributes the gas stream to two absorption process trains, each comprised of acid and alkaline low pressure absorption. Since there is no obligation for Neochim to decompose the N_2O from the nitric acid plant, so far it is released to the atmosphere with and intensity of ca. 7.34.kg N_2O per tonne nitric acid, leading to overall emissions of some 587 tons of N_2O equal to 182, 000 CO_2 average per year. This is common practice in the nitric acid industry.

The idea of the project is to install selective De N_2O catalysts right below the platinum gauze in the catalytic reactor and that catalyst is to be called secondary catalyst for the remainder of the project design document.

The level of N_2O in the gas mix, formed as a result of primary ammonia oxidation reaction, will be reduced with the help of that secondary catalyst.

$$2\,N_2O \longleftrightarrow 2N_2 + O_2 \qquad (h)$$

Introducing of additional heat and other energy resources is not needed, because temperature levels inside the ammonia oxidation reactor are sufficient, to ensure optimal effectiveness of reduction for the catalyst.

There are no additional greenhouse gases or other emissions generated from reactions in N_2O reduction catalyst.

The baskets that hold the catalyst shall be installed in each reactor during the summer 2011 planned overhaul and charged with a De N_2O catalyst. The overall investment is expected to exceed one million Euro, leading to estimated emission reduction of some 84,537 t CO_2e per year on average. With no economic benefit from N_2O abatement and the lacking legal obligation, the emission reductions will only be realized when the investment can be financed by a JI project. In addition to the investment barrier, relevant uncertainties regarding the technical feasibility and achievable performance, prevent the N_2O abatement measures from being the business as usual scenario.

The proposed project considers the future developments both from the technical and regulatory perspective. The incentive for optimizing N_2O reduction yield shall come from the JI mechanism, leading to greenhouse gas emission reductions that do not occur in the business as usual scenario.

In order to ensure conservativeness and to compensate the limited number of measurements and rejection of AM 0034 [1] elements, the IPCC conservative default emission factor of 4.5 $kgN_2O/tHNO_3$, for nitric acid production units with no N_2O destruction measures, will be applied in this project.

The emissions baseline scenario is determined by two series of dedicated measurements of N_2O concentration and gas flow volume of tail gas from absorption, performed in-between December 2010 and January 2011. The first measurement was performed prior to the planned catalyst gauze change and the second measurement after the change of primary gauzes of four single oxidation reactors or the maximum number per month, according to the schedule for catalyst gauzes change, till the end of 2012 and after 2012. Nitric acid production levels were registered simultaneously. The result achieved after subtracting of uncertainty was 7.03 kg N2O/tHNO3.In that way conservativeness of baseline is ensured, by using the default emission factor of 4.5 $kgN_2O/tHNO_3$.

A.3. Project participants:

Party involved	Legal entity project participant	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Bulgaria (host)	Neochim PLC	No
	First talks with potential buyers of ERU's are ongoing. At the time of validation, the buyer has yet to be determined and shall be named at the first verification at the latest.	

Bulgaria has ratified the Kyoto protocol [12] on 15th of August 2002.

A.4. Technical description of the project:

A.4.1. Location of the project:

The nitric acid plant and all connected facilities are located at the Neochim PLC production site in Dimitrovgrad, Region Haskovo. The nitric acid production unit number is 151 and it is housed in building 302. The Host Party for the proposed project activity is Bulgaria.

A.4.1.1. Host Party(ies):

Bulgaria

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

Haskovo

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

Dimitrovgrad

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

The nitric acid unit is housed in building 302(68).The following images give and overview.

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E=25°37′35″

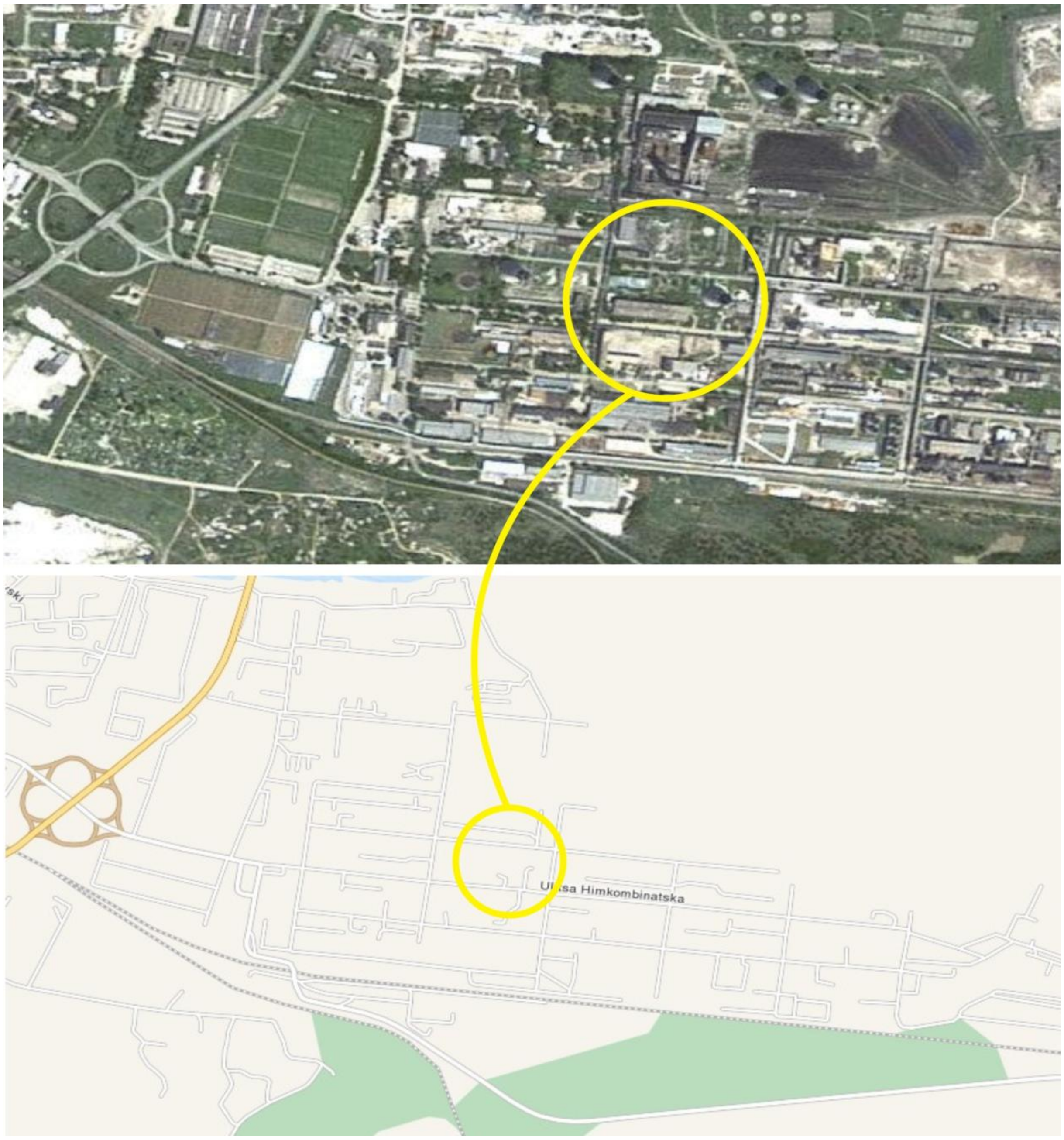


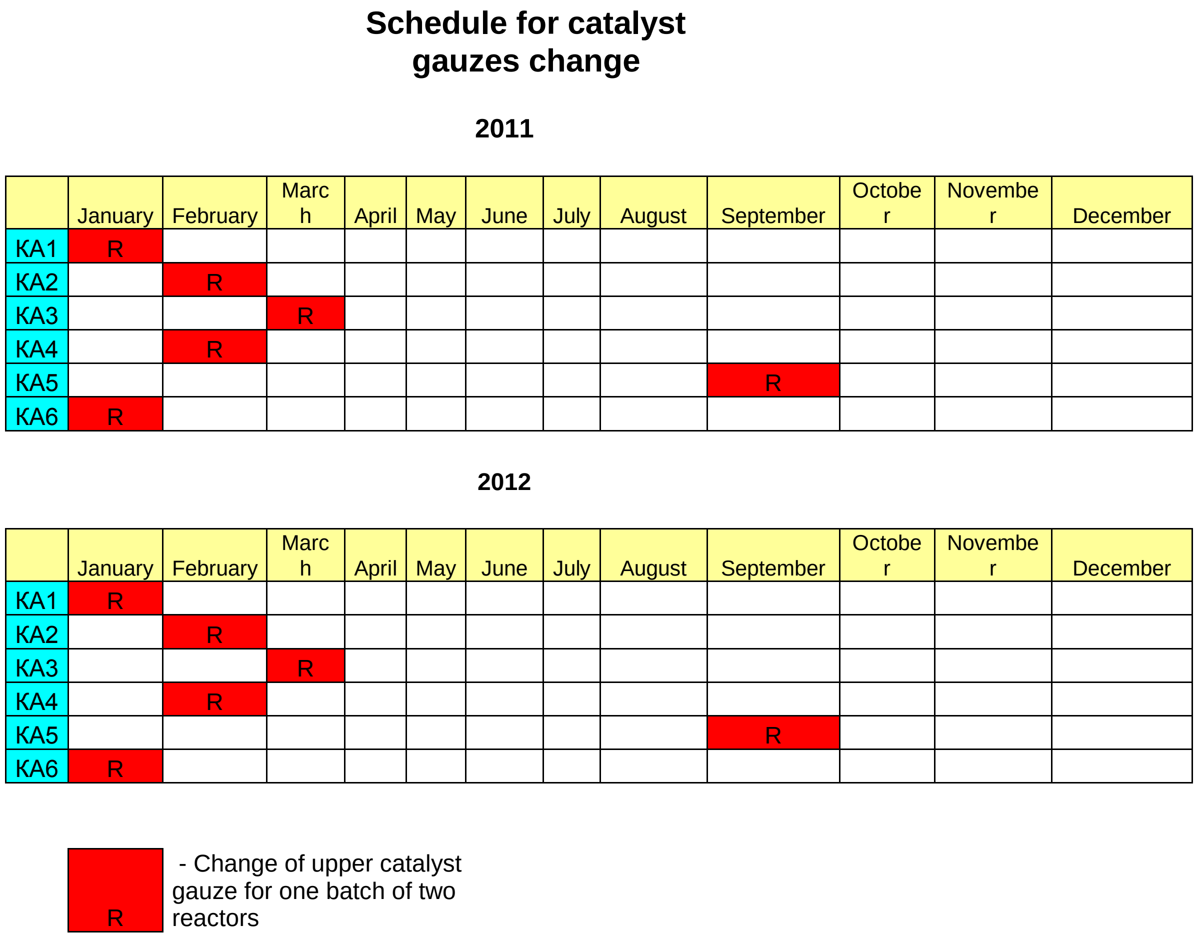
Figure 2: Location of the project activity, GPS coordinates of the plant:

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

The Neochim nitric acid plant comprises of 12 independently controllable reactor units (six batches of two reactors) for catalytic oxidation of ammonia to air. The heat that is generated during the reaction at the platinum catalyst gauze is used for the production of steam. The off - gases from each batch of reactors are merged into one boiler for steam production after which the combined gases from all six batches enter one collector. After the collector the gas stream passes through series of heat exchangers and wash tower and enters two parallel working trains including consecutively acid towers, oxidation towers and alkaline towers for absorption. By exiting alkaline absorption the two parallel trains gasses combine and enter the stack from which they are emitted into the atmosphere. Figure 3 shows a single reactor from Neochim nitric acid plant.

Figure 3 Single reactor from Neochim nitric acid plant

The plant operates continuously for around 280 days per year. Catalyst gauzes are changed according to schedule and operational hours which are shown on figure. 4



Schedule for catalyst gauzes change

2011

	January	February	March	April	May	June	July	August	September	October	November	December
KA1	R											
KA2		R										
KA3			R									
KA4		R										
KA5									R			
KA6	R											

2012

	January	February	March	April	May	June	July	August	September	October	November	December
KA1	R											
KA2		R										
KA3			R									
KA4		R										
KA5									R			
KA6	R											

🟥 R - Change of upper catalyst gauze for one batch of two reactors

Figure 4 Schedule for catalyst gauzes change

When a primary catalyst (platinum gauzes) shall be replaced, the accordant reactor is halted for some days. The replacement downtimes of the reactors are distributed over the years, so that nitric acid production is not interrupted.

Nitrous oxide (N_2O) generation during the production of nitric acid is an unavoidable side reaction of the ammonia oxidation. Nitrogen oxidation steps under overall reducing conditions are considered to be potential sources of N_2O[1]. Reactions that lead to the formation of N_2O are undesirable in that they decrease the conversion efficiency of NH3 and reduce the yield of the desired product, NO. Thus, it is in the interest of the nitric acid producer to optimize the operating conditions in a way that as little N_2O as possible is formed at the platinum gauze. The unavoidable amounts of N_2O are typically vented to the atmosphere together with the waste gas stream.

The proposed project comprises of secondary N_2O abatement system inclusive of baskets inside each oxidation reactor and charged with De N_2O catalyst placed right below the platinum gauzes in the high temperature zone of the reactor (between 830° and 850°C). Production proven De N_2O catalyst, manufactured by either BASF, Germany, Heraeus, Germany or Johnson Matthey U.K. will be used. With the help of De N_2O catalyst, N_2O load in the combustion gas can be reduced from some 2,000 mg/nm^3 to 400 mg/nm^3 depending on technical conditions.

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[1] See [3] p.3.19.

The nitric acid production unit at Neochim PLC belongs to the L/L category plants, i.e. plants with low pressure oxidation reactors and low pressure absorption stages.NO generation efficiency with this type of plants is naturally high, N_2O formation accordingly low compared to plants with medium/ high pressure reactors.

Measures for project implementation include:

- Selection of automated measuring system - September 2010.
- Preparation of project idea note – October 2010
- Letter of support issuance from MoEW – November 2010
- JI Project design document preparation – March 2011
- Supply and installation of automated measuring system – August 2011
- Validation of JI Project design document – July 2011
- Letter of approval issuance - August 2011
- Design ,manufacturing and installation of catalyst baskets – August 2011
- De N_2O catalyst fill of all baskets – September 2011
- Monitoring for the duration of the project
- Monitoring reports verification – after each monitoring period.
- Issuance and transfer of Emission reduction units.

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:

Regulatory frame:
The Regulatory frame for JI project implementation in Bulgaria is governed by several legislative acts.

The major frame is the stipulated by Kyoto Protocol United Nations Frame Convention on Climate Change (UNFCCC) [12] and the following decision of the legal parties of UNFCCC.
A legal framework exists in the European Union, which adapts its member states to Kyoto Protocol JI framework application . Such legal framework consists of Directive 2003/87/EC [14] for emissions trading, Directive 2004/101/EC [15] and different decisions respectively for JI from European Community decision- 2006/80/EC [16]of European Commission. Besides the legislative acts with direct effect, there are directives that cause indirect effect upon JI implementation such as DIRECTIVE 2008/1/EC [17].
European Community directives however do not lead to direct consequences to private entities, situated in European Community member states. In order for the directives to become enforceable on member states level, they have to be transformed in national legislation of the respective member state.
Bulgaria has ratified Kyoto protocol [12] in august 2002, thus engaging into national greenhouse gas emission reduction of 8% compared to year 1988 (base year). There are currently no compulsory and effective legislative and normative requirements in Bulgaria that could limit N_2O emissions in nitric acid production. Technological development and target accomplishment for emission reduction of different sectors of the economy could be achieved mainly by emission trading and use of Clean Development Mechanism and JI of Kyoto protocol [12].

In the absence of the proposed JI project, emission reductions would not occur, because

- no mandatory applicable legal and regulatory requirements to reduce nitrous oxide (N_2O) from nitric acid production plants do presently exist in Bulgaria.
- IPPC does not provide best available technology reference emission levels for atmospheric plants;
- N_2O emission reduction has been implemented in Bulgaria for the first time in nitric acid production unit at Agropolychim, Devnya. The unit operates with middle pressure in oxidation reactors and high pressure during absorption.
- Secondary N_2O abatement at atmospheric plant which is to be implemented at Neochim PLC, is first of its kind in Bulgaria and thus faces technical barriers and uncertainties;
- Relevant uncertainties come from a potential loss of production capacity in the atmospheric plant due to added pressure loss across the new catalyst bed.
- N_2O reduction measures require high investments and do not lead to any financial income or economic benefit.

With these reasons, described in more details below, the continuation of the current situation is the most plausible scenario. Only the income generated from a JI project may help to finance the investment into climate friendly N_2O reduction measures.

The quantity of N_2O emissions from nitric acid production in Bulgaria for 2008 was 1.87 ktN_2O [6] or 579, 700 tCO_2e. Project implementation would lead to significant reduction of these emissions. By using the established, during the two baseline measurement series emission factor of 7.34 $kgN_2O/tHNO_3$, along with production of 80, 000 $tHNO_3$ (100%), the real emission reduction for 2012 only would be around 145, 700 tCO_2e which represents 25 % of the annual emissions for the sector. When using the expected baseline emissions factor of (4.5 $kgN_2O/tHNO_3$), which will be applied in the project, emission reduction according to the project for 2012 would be 75, 144 tCO_2e.

The expected total reduction for the crediting period, when using the established emission factor of 7.34 $kgN_2O/tHNO_3$ during the two baseline measurement series, is 218, 550 tCO_2e and when using baseline emission factor that will be applied to the project -(4.5 $kgN_2O/tHNO_3$) 112, 716 tCO_2e.

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

The crediting period shall begin with the installation of all baskets with De N_2O catalyst and of the monitoring equipment. The timing depends on two matters:

- The receipt of a letter of approval by the Bulgarian authority, as this serves as basis for the decision to provide the project budget and order the technical equipment (baskets, catalyst, monitoring system);
- Terms of delivery of the technical equipment.

With these dependencies, the JI project will start in Sept 2011 at the earliest.

In compliance with the Kyoto protocol [12], the crediting period lasts until 31 December 2012. In case future regulations provide for the continuation of the JI project beyond 2012, a prolongation will be considered.

The following table shows the estimated emission reduction for the crediting period (derived in section E)

	Years
Length of the crediting period	1 year and four months
Year	Estimate of annual emission reduction in tons of CO_2e
2011	37,572
2012	75,144
Total estimated reductions [CO_2e]	112,716
Annual average of estimated emission reductions [CO_2e]	84,537

A.5. Project approval by the Parties involved:

MoEW issued a letter of support on 23rd of November 2010 on the basis of a project idea note (see annex 6) . After positive determination and project approval from MOEW the project proponent will receive a letter of Approval.

SECTION B. Baseline

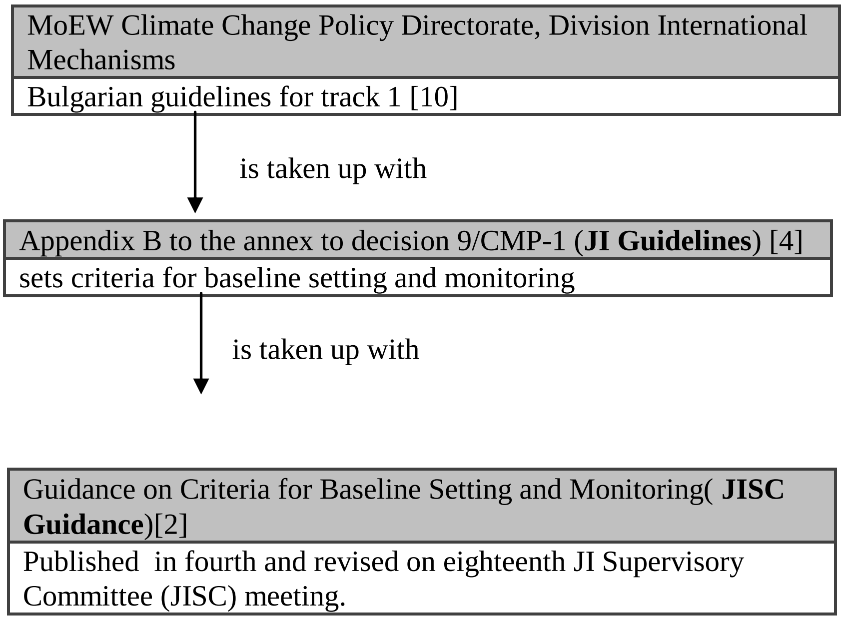
B.1. Description and justification of the baseline chosen:

Indication and description of the approach chosen for baseline determination,

The Baseline Scenario is the continuation of the existing situation, as neither a financial incentive nor a legal obligation exist so far that would justify the considerable investment into N_2O abatement measures.

This chapter describes the approach chosen to determine the baseline.

The legal framework for baseline setting consists of the following elements:



MoEW Climate Change Policy Directorate, Division International Mechanisms

Bulgarian guidelines for track 1 [10]

is taken up with

Appendix B to the annex to decision 9/CMP-1 (**JI Guidelines**) [4]

sets criteria for baseline setting and monitoring

is taken up with

Guidance on Criteria for Baseline Setting and Monitoring(**JISC Guidance**)[2]

Published in fourth and revised on eighteenth JI Supervisory Committee (JISC) meeting.

The JISC Guidance, in accordance with decision 10/CMP.1[7], offers two basic approaches for the establishment of a baseline:

1. Using an approved CDM technology
2. Establishing a project specific baseline, that is in accordance, with Appendix B of the JI Guidelines with the option of using selected elements or combinations of approved CDM methodologies or tools as appropriate.

The UNFCCC provides an approved CDM methodology AM 0034 “Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants”, that fits to the measures of the project at hand. However, it is not directly applicable because of various reasons.
For the purposes of baseline justification of this project, specific approach will be used according to paragraph 9 from UNFCCC – JISC- Guidance on criteria for baseline setting and monitoring, Version 02 [2] throughout the whole section B.
Furthermore elements from the approved CDM methodology AM 0034 UNFCCC-CDM Executive Board -Approved baseline and monitoring methodology AM0034 “Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants”, Version 05.1.0 [1]will be applied.
From another side, in connection to several aspects, AM 0034[1] refers to the following approved CDM methodology AM 0028 UNFCCC-CDM Executive Board –Approved baseline and monitoring

methodology AM0028 “.N2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants”. Version 05.1.0 (EB 60) [13] . They have been pointed out and applied for baseline scenario determination.

Applicability of criteria

Criteria applicability defined in AM 0034[1] will be verified according to the general approach of the methodology since these criteria specify the respective elements that guarantee conservativeness. The following could be assured.

- Commercial production had begun in 1951. No alternations have been made after 31 of December 2005.
- No legislation or stimulus for N_2O levels emission reduction do currently exist in Bulgaria.
- The project would not lead to increase of nitric acid production levels. Capacity decrease is possible due to additional catalyst.
- The project activity will not lead to nitrogen oxides emissions.
- There is no Non – Selective Catalytic Reduction (NSCR) installed in the nitric acid plant.
- There is an existing NO_x reduction (alkaline absorption) prior to the start of the project activities.
- The operation of the secondary De N_2O catalyst that will be installed during the project activity does not lead directly or indirectly to process emissions of GHG.
- At present Neochim nitric acid plant does not have destruction or emission reduction units which could affect project activity.
- During the two dedicated measurements for baseline determination, real time measurements of N_2O concentration and total volume of gas flow in stack were performed.

In the following, the AM 0034[1] shall be briefly analysed by dividing it into its relevant elements and demonstrating which elements will be applied for the baseline setting and which not.

Discussion of AM0034 elements

The specifications of the AM0034[1] methodology are to a large extent based on the assumption that the nitric acid operates on discrete production runs, the campaigns. As described above, this is not the case at the plant at Neochim. The plant operates continuously, with a cluster of twelve oxidation reactors, each of them connected to a single stem generation boiler, together feeding a batch of absorption columns. The shutdowns of the single couple of oxidation reactors for the replacement of the primary catalyst gauzes are distributed over the year, so that the effect of the shutdown times on the overall production as well as the effect of the catalyst replacement on the N_2O load in the tail gas is hardly noticeable. Primary catalyst gauzes are replaced every 11 to 17 months. i.e. relating to the entire plant a catalyst replacement takes place according to schedule during various months of the year. With this plant layout, all the campaign specific rules of AM0034 [1] have to be adjusted.

The following table quotes the accordant elements of AM0034 [1] and briefly refers to their applicability for the proposed project.

Elements: General	**Element applied**
Applicability criteria	adjusted
All applicability criteria are fulfilled except for one: no baseline campaign is provided. The AM0034 [1] criteria do not oppose to the proposed project design.	

Project boundary	yes
The definition of the project boundary is consistent with AM0034[1]	

Elements: Baseline & Additionality	**Element applied**
Baseline determination throughout one baseline campaign	adjusted
Defining baseline campaign is not possible, due to the continuous production in Neochim. The baseline emissions are determined by concrete measurements before project start. The baseline approach is described in B.1	
Baseline determination according to AM0028 [13]	yes
The approved CDM methodology AM0028 [13] will be applied for baseline scenario determination.	
Application of the additionality tool	yes
The official additionality tool will be applied, as this is required by AM0034[1] "Tool for the demonstration and assessment of additionality", Version 05.2 (EB 39) [11] The information is presented in section B.2.	
Determination of permitted range of operation parameters	adjusted
The element provides for the determination of a permitted range of parameters which may impact the formation of N_2O in a way that possible modifications to increase N_2O generation for the baseline setting are avoided. The application of this element is adjusted due to limited availability of historic data (see B.1)	
Statistical analysis of baseline emission data	no
A statistical procedure to eliminate volume flow and N_2O concentration data lying outside of a 95 % confidence interval makes sense in case of large data sets. The applied baseline approach consists of a limited number of measured data. Alternative measures to ensure conservativeness apply,	
Cap on baseline campaign length	no
The AM0034 [1] baseline campaign length shall not exceed the average historic campaign length in order to prevent the increase of the baseline emission factor (as N_2O formation is higher at the end of the campaign because of declining catalyst efficiency). As Neochim plant does not operate on campaigns and baseline determination will not be campaign based, this element is not applicable.	
Deduction of measurement uncertainty from baseline emission factor	yes
The uncertainty of monitoring equipment is considered in the baseline emission factor calculation in order to take a conservative approach	
Recalculation of baseline EF in case of shorter project campaign	no
This rule does only make sense in combination with emission factor being determined on the basis of one entire campaign (the baseline campaign). As for the proposed project no comparison of project and baseline campaign length is possible, this rule is not applicable.	
Impact of regulations	yes
The baseline emission factor shall be adjusted as soon and if new Bulgarian regulations set limits on N_2O emission from nitric acid plants.	

Elements: Project Emissions	**Element applied**
Project emissions campaign length	adjusted
Since the plant does not operate on campaigns, monitoring periods will be defined.	
Statistical analysis of project emissions	yes
Since a continuous monitoring system will be installed, statistical analysis can be applied.	
Moving average emission factor	no
Applying the average emission factor of the previous campaigns in case the actual emission factor of the specific campaign is higher shall ensure a conservative approach and account for possible long – term emission trends. This element shall not be applied for the project. Firstly, this rule is based on the existence of naturally definable periods, the campaigns, which do not exist at Neochim plant. Furthermore, this rule lowers the incentive to increase the efficiency of N_2O abatement with the growing experience from its application. At the time of replacement of the catalyst (after ca. two years), the layer height might be optimized. The project emissions shall reflect the real emissions during each period.	
Minimum project emission factor after ten campaigns	No
A cap on the project emission factor after ten campaigns shall make allowance for a potential built up of platinum deposits. This element shall not apply for the proposed project because of the same reasons as described under “Moving average emission factor” above and because this effect is considered to be negligible due to the low temperature in the downstream components of the L/L plant.	

Elements: Monitoring	**Element applied**
Installation of a complete N_2O monitoring system	Yes
A complete monitoring system that fulfils the AM0034[1] requirements will be installed.	
Composition of ammonia oxidation catalyst	adjusted
The supplier of the catalyst is Jh.M. The catalyst composition currently lies around 90% platinum and around 10% palladium and rhodium, with some minor changes over the years serving to improve the NO yield. This is in line with the aim of reducing nitrous oxide emissions and thus does not harm the principles of a JI project. As the baseline emission factor for this project activity is set to 4.5 kg $N_2O/tHNO_3$, which is also the fall- back value in case of catalyst composition changes according to AM0034[1], no further adjustments are intended. See also Annex 2.	
Collection of historic N_2O emissions baseline data.	no
As the baseline emission factor is defined prior to the start of the project and the project design does not provide for any ex post adjustments of the baseline emission factor other than impact of regulation, collection of historic N_2O emission data for baseline determination is not part of the monitoring.	

Baseline approach – Identification of the baseline scenario

The JISC Guidance defines the baseline for a JI project as “the scenario that reasonably represents the anthropogenic emissions by sources that would occur in the absence of the project”[4]

To identify the baseline scenario, the applied methodology AM0034 [1] refers to the AM0028 [13] methodology clauses in regards to proposed project activities described here as follows:

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

Step 1a: The baseline scenario alternatives should include all possible options that are technically feasible to handle N2O emissions. These options are, inter alia:

Technically feasible alternatives are:

1) Status quo: The continuation of the current situation, where there will be no installation of technology for the destruction or abatement of N_2O

2) The proposed project not implemented as a JI project

3) The installation of Non Selective Catalytic Reduction device (Non Selective Catalytic Reduction NSCR), DeNOx
4) The installation of alternative for primary or tertiary N_2O destruction or abatement technology

Technically not feasible alternatives are

5) Shift to production technology that does not involve ammonia oxidation. The World’s nitric acid production is based on Ostwald process that includes ammonia oxidation. No other production practices are applicable for commercial scale projects.
6) Alternative usage of N_2O as:
   - Utilization/recycling of the free N_2O as a raw material (reutilization in production processes) leads to various obstacles in the current technical configuration. The alternative usage of N_2O would be an independent project, coming along with high investment and complexity. At the moment, no such step is planned or considered for the exhaust gases within the project boundary. Anyway, isolation of N_2O in the range of the proposed project is technically not feasible.
   - Commercial utilization of the freed N_2O for external purposes is neither technically nor economically feasible for implementation at the moment.

Step 1b: In addition to the baseline scenario alternatives of Step 1a, all possible options that are technically feasible to handle NOX emissions should be considered. The installation of a NSCR DeNOXunit could also cause N2O emission reduction. Therefore NOX emission regulations have to be taken into account in determining the baseline scenario. The respective options are, inter alia:

1) Continuation of the current situation in which there is either installed DeNox or there is no such;

The already existing NO_x abatement (alkaline absorption)(DeNOx) prior to the project start currently fulfils all present required by law NO_x emission limits . In that sense no additional measures, including such for NO_x emissions, that could simultaneously lead to N_2O emission reduction are necessary. In case there are new regulations for upper limit of emissions they will be taken into account.

2) Installation of new device for selective catalytic reduction (SCR) DeNOx;

The existing NO_x abatement technology (alkaline absorption) fulfils all present and expected future regulations on NO_x emissions. Thus, no expensive technological changes are pending that could be used to additionally consider N_2O reduction (like e.g. Selective Catalytic Reduction SCR)

3) Installation of new device for non-selective catalytic reduction (NSCR)De NOx;

There are no appropriate non-selective De NOx(NSCR) devices in the proposed case since no pre-existing technical conditions are available for use of this technology in the atmospheric nitric acid production plant at Neochim. In order for this technology to function normally, preliminary technical measures have to be taken, so that the necessary temperatures in tail gas could be achieved. The increase of tail gas temperatures leads to higher fuel consumption and higher greenhouse gas emissions.

4) Installation of new tertiary abatement measure, which combines N_2O and NOx emissions reduction.

Significant measures for revamp of the current unit for reaching necessary temperatures above 400 °C in the tail gas have to be taken, so that tertiary emission reduction measure could be used. The increase of tail gas temperature (by using fuel) would lead to increase of greenhouse gas emissions.

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

The current situation is in compliance with all applicable legal and regulatory requirements. The plant permission refers to the thresholds specified by Bulgarian law regarding allowed NO_x emissions in the waste gas. Until now, no such limits exist for N_2O emissions. The LVIC BREF[5], which contains recommendations for best available technology emission levels for different types of nitric acid plants, leaves out a value for low pressure plants.

As a country member of European Union, a party of Frame Convention of Climate Change and Kyoto Protocol, Bulgaria actively takes part into the process of formulating and executing of climate change combating policy. It is expected that higher levels of technological development in the country's economy are achieved, when applying the flexible mechanisms of Kyoto Protocol [12]. The technological development and emission reduction targets accomplishment in the different economic sectors could be achieved mainly by emission trading and Clean Development Mechanism and JI from Kyoto protocol.

In case new legislation shall enter into force in Bulgaria, restricting N_2O concentration in tail gas from nitric acid production plant, the baseline emission factor will be adjusted in a way so that new threshold values are not exceeded.

The investment costs associated with project implementation in case it is not registered as JI are in the range between 1 and 1,1million euro. Continuation of the status quo, being production without of DeN_2O equipment installation, is the most plausible scenario.

With this analysis, the following conclusion could be drawn: Scenario 1, the continuation of the current situation is the most plausible scenario,

- as it is in compliance with all mandatory applicable legal and regulatory requirements,
- does not face any prohibitive barriers, and
- is the economically most attractive scenario.

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 CDM. Barriers should include, among others:

1) alternative 3 to the baseline (Non selective De NOx)

- investment barriers along with others

There will be significant additional costs associated with installation of non – selective DeNOx equipment (NSCR), as a result of the additional measures necessary for revamp of the existing unit along with the increased fuel consumption for obtaining of the necessary operating conditions with no any economic and/or business benefits arising.

- technological obstacles along with others

Non – selective (De NOx / NSCR) equipment are not appropriate in the specific case, as there are no pre-existing technical conditions for use of these technologies at Neochim nitric acid production plant. In order for these technologies to function effectively, technical measures for revamp have to be taken, so that tail gas could reach necessary temperature. The increase of the tail gas temperature respectively leads to greenhouse gases emissions.

- barriers due to prevailing practices along with others:

The use of NSCR technology is nowadays already non- representative. The abatement of one greenhouse gas will be achieved with the cost of other greenhouse gas generation.

2) alternative 4 to the baseline (primary and tertiary abatement measures)

- investment barriers along with other:
  There are no financial obstacles for purchasing of primary ammonia oxidation gauzes (Johnson Matthey, UK) for primary abatement measure application since that is already an everyday practice. There are only technological obstacles existing in that case.
  The costs associated with tertiary measures application resemble the costs associated with secondary measures. The major argument for not implementing is again absence of technical feasibility.

- technological barriers along with others:

The technological obstacles for installation of primary abatement measure are due to the fact that no technical solution for abatement of N_2O, formed on the catalyst gauze, does currently exist.

Significant measures for revamp of the current unit, including reaching necessary temperatures above 400 °C in the tail gas, have to be taken so that tertiary emission reduction measure could be used. The increase of tail gas temperature (by using fuel) would lead to increase of greenhouse gas emissions.

- barriers due to prevailing practices along with other:

The use of primary abatement measure is technically inappropriate since it is not sufficient for achievement of the defined N_2O emissions threshold values.

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

The baseline alternative 1 specified in sub- step 1 a does not face any prohibitive barriers.

The same applies to baseline alternative 2 – the proposed project activity not implemented as JI, however that comes along with technical uncertainties in regards to the secondary catalyst system. At present, there is no existing experience in wide application of that technology in low pressure installations. The possibility for reduced capacity, due to the additional catalyst, has to be taken into account.

Step 4: Identify the most economically attractive baseline scenario alternative

The most economically attractive baseline alternative is scenario1.

Sub-step 4a: Determine appropriate analysis method

The baseline scenario 2 does not generate financial or other economic benefits. Respectively accoriding to AM0028[13] methodology simple cost analysis will be applied (Option I).

Sub-step 4b: Option I: Apply simple cost analysis

In the case of simple cost analysis the most reasonable baseline alternative is the one associated with the lowest price. In this specific case the most reasonable baseline alternative is the one defined in Sub -step 1a as a baseline alternative 1) including maintaining/ continuation of the status quo. This alternative does not lead to any additional costs. In baseline alternative 2, identified as project activity implementation without project approval as JI leads to more additional costs for secondary catalyst system.

While the continuation of the current situation does not lead to any additional costs or investments compared to the business as usual, the installation of baskets and catalyst means a relevant investment, that is expected to exceed one million Euro (see costs in B2) Moreover the catalyst must be replaced every two years. Since both scenarios do not lead to any financial benefits, the continuation of the current situation is the most plausible scenario.

Step 5: Re-assessment of Baseline Scenario in course of proposed project activity's lifetime

If new legislation enters into force or emission restrictions for NOx (sub- step 5a) or N_2O (sub – step 5b) are altered during project lifetime, the baseline scenario has to be re- assessed.

Sub Step 5a: New or modified NOX-emission regulations

All current legal requirements for NOx emission reduction are currently met with the existing NOx emission reduction technology (alkaline absorption) (DeNOx). Monitoring is performed via uninterrupted measurements. For that reason no baseline corrections are necessary during the project lifetime in this regard. If new regulations lead to more stringent upper emission limit, they will be taken into account.

Sub Step 5b: New or modified N2O –regulation

If new regulation sets N_2O emission limits they will be taken into account.
Repeat of observation is required by AM0028 [13] and AM0034 [1] in case of new NOx emissions upper limits (see sub-step 5a).

The following conclusion could be drawn based on the five step assessment: All the scenarios, excluding alternative 1 (continuation of the status quo), will face larger investment barriers along with technological barriers (including increase of greenhouse gases emissions) and therefore have to be excluded from further analysis.
Scenario 1, the continuation of the current situation is the most plausible scenario,

- as it is in compliance with all mandatory applicable legal and regulatory requirements,
- does not face any prohibitive barriers, and
- is the economically most attractive scenario.

Application of the Baseline Determination Approach chosen – Baseline Emissions

The baseline emission scenario is established by two dedicated measurement series of N_2O concentration and gas volume flow in the tail gas of the absorption system between December 2010 and January 2011. The first measurement was performed before scheduled gauze change, and the second one after changing the primary gauzes of four single oxidation reactors, or. the maximum number per month as per the gauzes change schedule up to the end of 2012 and thereafter. Together with the registration of the simultaneous daily nitric acid production this served to calculate the baseline emission factor. The operating conditions during the day of the measurements were kept constant and fall within the customary, plant specific range.

The following aspects justify the significance and accuracy of this approach:

- The plant layout and operation mode determine a very narrow range of operation parameters where nitric acid production takes place. The main parameter, the ammonia /air ratio, is controlled manually and stays virtually constant. Oxidation temperature and pressure are dependent on the ammonia/air ratio and thus do accordingly move within very narrow ranges. Representative historical operation parameters are not available, as they were not regularly recorded.
- Besides the constant operation parameters, the distribution of primary catalyst replacements also favours obtaining representative results of a limited amount of measurements. The fact that a catalyst replacement takes place according to schedule during various mouths of the year leads to quite constant tail gas characteristics. There is no effect like in plants that run on campaigns, where N_2O concentrations in the waste gas follow a steadily growing path from the beginning to the end of one campaign. The regular gauzes replacement leads to an equalization of this effect. The baseline measurements were carried out in a way that four gauzes replacements took place between them, so that the effect on N_2O emissions are reflected in the results and conservativeness is assured.
- The plant layout favours the equalization of any effect emanating from the oxidation reactors, as the tail gas streams from all reactors are merged to one NO_x stream that is then divided to two absorption trains. With this, any possible effects of catalyst replacement on N_2O content in the

waste gas stream are not only smoothed but also hardly measureable or even assignable to a specific cause by measurements in the tail gas of the absorption columns.

N_2O concentration and gas volume flow were monitored during two 24 hours periods in December 2010 and January 2011. The measurements were carried out by an independent, certified company TÜV SÜD Industrie Service GmbH applying calibrated instruments. The average mass of N_2O emissions per hour is calculated as product of N_2O concentration and gas volume flow rate. The N_2O emissions per measurement period are calculated by multiplying N_2O emissions per hour with the total number of hours of the measurement period using the following equation:

$$BE_m = VSG_m \text{ x } NCSG_m \text{ x } 10^{-3} \text{ x } OH_m \qquad \textit{Formula 1}$$

Where:

BE_m	Total N_2O emissions during the measurement period m (kg N_2O)
VSG_m	Mean gas volume flow rate at the stack in the baseline measurement period (m^3/h)
$NCSG_m$	Mean concentration of N_2O in the stack gas during the baseline measurement period (g N_2O/m^3)
OH_m	Operating hours of a baseline measurement day (h)

The plant specific baseline emission factor representing the average N_2O emissions per tonne of nitric acid over the baseline measurement period is derived by dividing the total mass of N_2O emissions by the total output of 100% concentrated nitric acid for that period including the equivalent quantity of 100% nitric acid for sodium nitrate production (See Annex 3) The overall uncertainty of the monitoring system is determined and the measurement error is expressed as a percentage. The N_2O emission factor per tonne of nitric acid produced in the baseline period is then reduced by the estimated percentage error as follows:

$$EF_{BL} = (BE_m/NAP_m)x(1-UNC/100) \qquad \textit{Formula 2}$$

EF_{BL}	Baseline N_2O emission factor (kg $N_2O/tHNO_3$)
NAP_m	Nitric acid production during the baseline period ($tHNO_3$)
UNC	Overall uncertainty of the monitoring system (%), calculated as the combined uncertainty of the applied monitoring equipment

The baseline measurements and the derivation of the average emission factor are described in Annex 2. The two measurements, after subtraction of measurement uncertainties, result in average emission factor of 7.03 kg $N_2O/tHNO_3$., Emission factor for the lowest average hourly value for N_2O during the time of the measurement (kg N_2O/h) was calculated using the conservative approach. The average value after deduction of the uncertainty was 6.845 kg $N_2O/tHNO_3$.

These values lie significantly over commonly used emission factors for this sector:

- The IPCC provides a default emission factor of 5 kg $N_2O/tHNO_3$ for atmospheric plants with an uncertainty range of 10 percent, leading to the conservative default value of 4.5 kg $N_2O/tHNO_3$ for the nitric acid industry.
- The MoEW in Bulgaria does not apply an emission factor for nitric acid industry therefore the conservative default value of 4.5 kg $N_2O/tHNO_3$ will be used for Neochim JI project.

To ensure conservativeness and to compensate for the limited set of measurements and the disclaimer of AM0034[1] elements (baseline campaign, statistical analysis of a large set of baseline measurements), the conservative IPCC default emission factor for N_2O from nitric acid plants which have not installed N_2O destruction measures, 4.5 kg $N_2O/tHNO_3$, shall apply for the proposed JI project. With this the lowest and most conservative value for a N_2O emission factor in the nitric acid industry, which is only used as fall-back approach by AM 0034[1] in case of lacking data, will serve as baseline for the N_2O project in Neochim.
There are no methodical elements envisaged that allow for the adjustment of the baseline emission factor after project start besides the impact of new regulation. This waiving of accordant elements of AM0034[1] (like recalibration of baseline emission factor in case of shorter project campaigns, see table above) seems to be justified because of the operation mode and layout of the plant (no campaign). The presented baseline emission factor reflects the conservative scenario until new regulatory limits apply.

Normal operating conditions

AM0034[1] provides for an approach to determine a set of permitted operating conditions in order to avoid the possibility that baseline emissions are overestimated by modification of the production characteristics. The determination concerns

- oxidation temperature
- oxidation pressure
- ammonia gas flow rate and
- ammonia to air ratio

The preferred approach by AM0034[1] to determine the normal range for those parameters, a statistical analysis of historical data, cannot be followed here due to lack of data series. The following tables show why all parameters lay within the normal range during the baseline measurements.

Data/Parameter:	**OT_{normal} (normal operating temperature)**
Data unit:	**°C**
Description:	Normal oxidation temperature range in the ammonia oxidation reactor.
Time of determination / monitoring	The temperature is monitored during the two dedicated measurement series.
Source of data used.	The oxidation temperature is directly dependent on the ammonia to air ratio and is sporadically recorded. With the help of shift protocols it can be shown that oxidation temperatures vary within a certain range of 820 to 850°C around an average temperature between 830 °C in the twelve single reactors R1 – R12.
Value of the applied data (eg. preliminary calculations /determinations.	820 °C – 850 °C
Justification of data chosen or description of methods for measurements and procedures that are applied or are to be applied.	The oxidation temperature on the baseline measurement days was recorded and lay within the normal range and mostly exceeded the historic average of 830 °C . This represents a conservative approach, as higher temperatures tend to result in lower N_2O emissions. However, the measurement results do also show that the measurement is not fully controllable: the temperatures vary between the different reactors (which are identical in construction), although they are fed with the same

	ammonia – air mixture.
QA / QC procedures used /to be used	Not applicable
Any comment:	This information is part of TUV SUD report for N_2O emissions measurement during the two sets of measurements.

Data/Parameter:	**OP $_{normal}$ (normal operating pressure)**
Data unit:	**Pa**
Description:	Normal oxidation pressure range in the ammonia oxidation reactor.
Time of determination / monitoring	The pressure is monitored during the two dedicated measurement series.
Source of data used.	The pressure can be adjustable and is not recorded.
Value of the applied data (eg. preliminary calculations /determinations.	(-300)Pa - (+100) Pa
Justification of data chosen or description of methods for measurements and procedures that are applied or are to be applied.	Oxidation pressure does change, in very narrow limits (-300)Pa to (+100) Pa as a result of the turbofan load
QA / QC procedures used /to be used	Not applicable
Any comment:	This information is part of TUV SUD report for N_2O emissions measurement during the two sets of measurements.

Data/Parameter:	**AFR $_{max}$ (maximum ammonia flow)**
Data unit:	**Nm3/h**
Description:	Maximum value of ammonia flow in the ammonia oxidation reactor
Time of determination / monitoring	The ammonia flow is observed during the two dedicated measurement series
Source of data used.	Technological regulation
Value of the applied data (eg. preliminary calculations /determinations.	6000 Nm3/h
Justification of data chosen or description of methods for measurements and procedures that are applied or are to be applied.	The maximum flow of ammonia during the two dedicated measurements was 5581 Nm3/h. The flow chosen is lower than the maximum so that conservative approach can be applied since lower consumption usually leads to lower N_2O emissions level.
QA / QC procedures used /to be used	Not applicable
Any comment:	This information is part of TUV SUD report for N_2O emissions measurement during the two sets of measurements.

Data/Parameter:	**AIFR $_{max}$ (Maximum ammonia to air ratio)**
Data unit:	**% (**Nm^3/h $NH_3/(Nm^3$ NH_3+Nm^3 air)*100)
Description:	Maximum ratio of ammonia to ammonia to air
Time of determination / monitoring	The ammonia to air ratio is determined during the two dedicated measurement series.
Source of data used.	Technological regulation
Value of the applied data (eg. preliminary calculations /determinations.	11.7%
Justification of data chosen or description of methods for measurements and procedures that are applied or are to be applied.	The ammonia to air ratio at the plant in Neochim is manually controlled and does steadily move within a narrow range (11.3 to 11.7 % v/v). The ammonia to air ratio is technically limited to maximum 11.7%. During the two dedicated measurements ammonia content in ammonia to air mix was 11.5 to 11.6% v/v. Since correlation exists between ammonia content in the ammonia to air mix and oxidation temperature in the reactor, the following method for calculation is used for its determination. **AIFR = OT_h / 72.8**
QA / QC procedures used /to be used	Not applicable
Any comment:	This information is part of TUV SUD report for N_2O emissions measurement during the two sets of measurements.

The description of these parameters shows that the operating conditions were not actively modified in a way that increases N_2O generation during the baseline measurements, but rather lay in a range where conservative N_2O values were achieved.

With the use of conservative default emission factor of 4.5 kg $N_2O/tHNO_3$ instead of the actual calculated factor of 7.03 kg $N_2O/tHNO_3$. (without uncertainty), any further non – conservative modifications during the baseline measurements with the influence on the future emission reduction calculations are ruled out.

No legal environment to control N2O emissions generated in nitric acid production currently exists in Bulgaria. Therefore no impact of the legal environment is expected on the baseline.

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:

Indication and description of the approach applied:

For the demonstration of additionality, AM 0034 [1] refers to the latest version of the “Tool for demonstration and assessment of additionality” [11] agreed by the Executive Board. This is also recommended as first option by the JISC guidance.
The proposed project activity fulfills the additionality criteria requirement – emissions reduction will be classified as an additionality. The verification of the proposed project activity using “Tool for demonstration and assessment of additionality” [11]leads to the conclusion as it has been presented down further in the text which states that the expected emission reduction from the project activity adds

completely to that which could have been accomplished by not proposing reduction measures as JI project.

Application of the approach chosen:

As the above presented baseline determination follows an identical approach to the latest version of the additionality tool, the results from its application shall be briefly summarized here.

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

Sub- step 1a. Alternatives of the product activity:

The alternatives of project activity as well as legal requirements for emissions from nitric acid production at Neochim were already defined in section B.1.
The only realistic and credible alternatives available to Neochim PLC are:

1) Status quo: The continuation of the current situation, where there will be no installation of technology for the destruction or abatement of N_2O
2) The proposed project activity not implemented as a JI project

Sub step 1b. Consistency with mandatory laws and regulations:

As it was discussed above in section B.1 both alternatives are in compliance with all current applicable legal and regulatory requirements.

Step 2 Investment analysis

Sub- step 2a. Appropriate analysis method

As the project does not generate any financial or economic benefit other than JI related income, simple cost analysis is applied.

Sub- step 2b. Simple cost analysis

The cost for the proposed project activity consists of the investment needed for the design, manufacturing and installation of the baskets, the cost for the catalyst fillings and the cost for uninterrupted monitoring. The operational costs include costs for regular change of catalyst and monitoring equipment maintenance. The initial investment amounts to 1,1 million Euro.
The resistance caused by the increased pressure when secondary catalyst is employed, would lead to decrease in nitric acid production levels. The production costs per 1 ton 100% nitric acid will increase with 20.79 BGN due to the reduced production rate in the proposed JI project activities, compared to the status quo. Calculations are provided in Section 7 – Investment analysis and should be considered confidential.
The N_2O abatement does not lead to any economic initial benefit other than JI related income.
Therefore the costs associated with the proposed JI project activity are higher compared to the costs that occur in the status quo.

Step 3 Barrier analysis

No barrier analysis is required, since the investment analysis is performed according to "Tool for the demonstration and assessment of additionality", Version 05.2 (EB 39) [11]

Step 4 Common practice analysis.

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

The installation of N_2O emission reduction selective catalyst in the existing nitric acid plant is not a common practice neither in Bulgaria nor in Europe. Installation of selective techniques for De NOx is common practice which however does not affect N_2O emission. Besides, effective use of ammonia oxidation catalysts, such as the ones from Johnson Matey installed at Neochim nitric acid plant's reactor, is common practice .This however has not led to significant effectiveness of N_2O emission reduction.

When secondary catalyst is installed, attention has to be paid to the fact that installation, maintenance and most of all possible necessary corrections, are achievable only during downtime of the production unit. When such a decision is made the increased costs for downtime have to be taken into account.

Modernization of existing installations for N_2O reduction technologies in this sector are implemented mainly by using CDM and JI mechanisms all over the world. The main reason for that is the existing reasonable risk premium for possible failure of the new technology added to the financing of the necessary investments for catalyst technologies.

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

There are currently three operating nitric acid production units in Bulgaria. N_2O abatament technology, using secondary catalyst and JI mechanism is implemented practically in only one of them – at Agropolychim. The nitric acid production unit at Agropolychim operates with medium pressure in oxidation reactors and high pressure in absorption section.

Secondary N_2O abatement which is to be implemented at Neochim's atmospheric pressure plant is the first of its kind and for that reason it faces technical barriers and uncertainties due to potential losses of production capacity in the atmospheric pressure plant caused by pressure drop from new catalyst layer.

Conclusion – Provision of additionality proof.

There are no national legislations or legal requirements in Bulgaria currently for N_2O emissions. It is less likely for such N_2O emissions restrictions to be applied until the end of the crediting period. In that case no investment in other technology for N_2O destruction or abatement is necessary other than the project activity. There are neither national motivation nor sector politics for motivation of such project activities.

With no income from ERU there will be no generated income from project activity and no N_2O destruction or abatement technology will be installed. If secondary catalyst technology is installed nitrous oxide emissions will be reduced by 80%, compared to ones with no such technology installed.

The proposed project activity is undeniably additional since it passes through all the necessary steps of "Tool for the demonstration and assessment of additionality", Version 05.2 [11], approved by CDM executive board.

The approval and registration of the project activity as JI and its subsequent benefits and stimulus, will significantly compensate the secondary catalyst costs and all the changes in the nitric acid plant and will

give the advantage of project implementation. Therefore Neochim PLC is ready to finance the project activity only if it is defined as JI project activity.
The project Emission Reduction of Nitrous Oxide in Nitric Acid Production at Neochim PLC is additional.

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

The project boundary comprises the whole nitric acid plant from the inlet to the oxidation reactors to the stacks.

The following figure illustrates the parts of the plant which lie within the project boundaries.

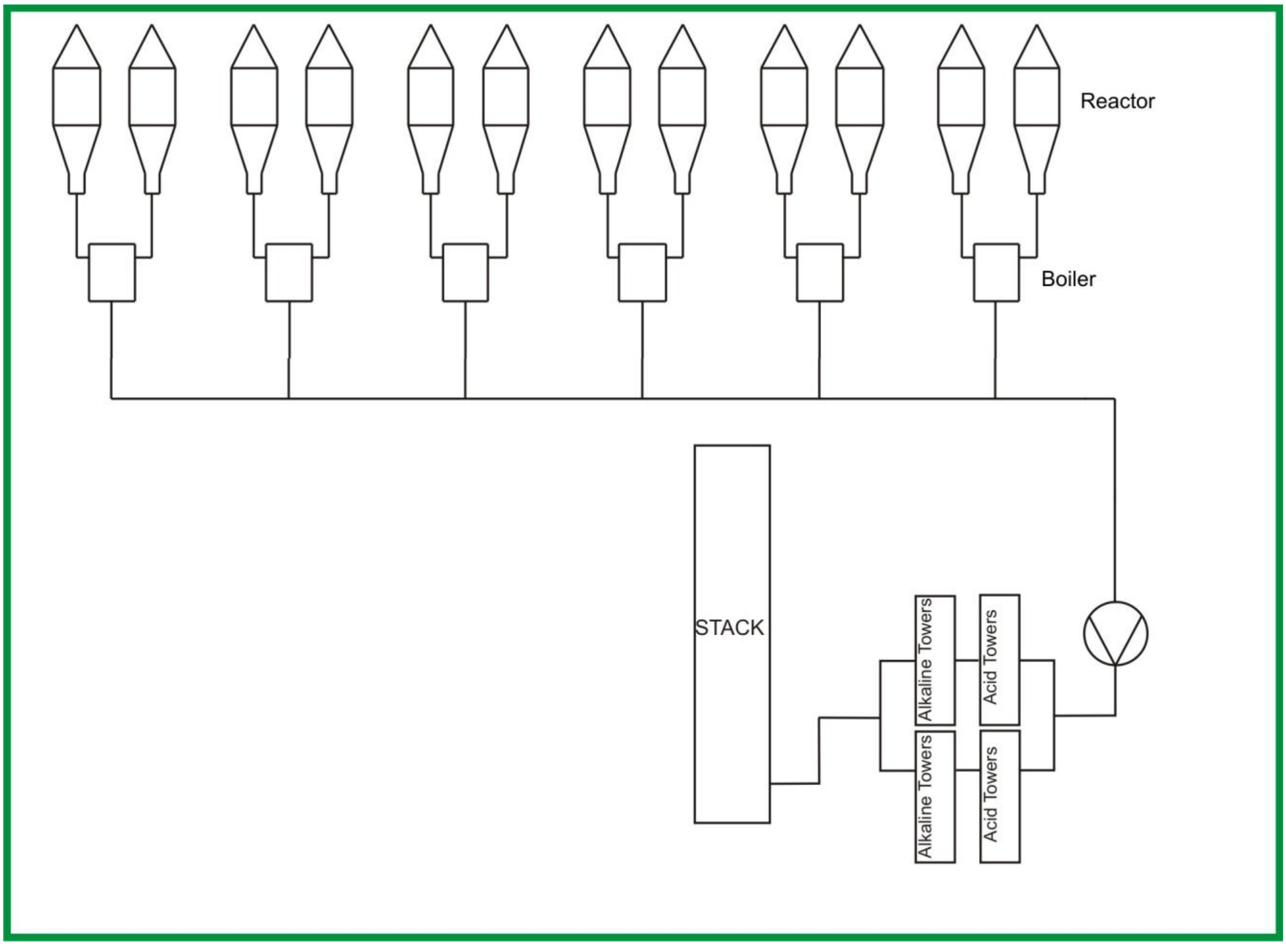


Figure 5 Project boundaries (marked in green)

The only greenhouse gas to be included is N_2O.

	Source	**Gas**	Included?	**Justification**
Baseline	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	Excluded	The project does not lead to any changes in CO_2 or CH_4 emissions, therefore they 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 changes in CO_2 or CH_4 emissions
		CH_4	Excluded	
		N_2O	Included	
	Leakage emissions from, transport, handling ,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:

Date of baseline setting: 15th of February 2011.

The baseline methodology was applied by :

Neochim PLC (project participant)
Town of Dimitrovgrad 6403, Haskovo district
Dimitrovgrad municipality
HIMKOMBINATSKA Street
EASTERN INDUSTRIAL ZONE
BULGARIA

Phone: +359 391 65 205
Fax: +359 391 60 555
http://www.neochim.bg

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

The starting date of the project is 07.10.2010, with decision from the board of directors at Neochim documented with protocol from board of directors meeting (07.10.2010).

C.2. Expected operational lifetime of the project:

The project consists of the operation of secondary N_2O catalysts within the twelve oxidation reactors at the Neochim's nitric acid plant in Dimitrovgrad. The catalyst fillings are expected to be replaced around every two years to maintain the N_2O destruction efficiency. The baskets can be replaced in case of any damage. With this, the project has no operational lifetime that depends on the technical characteristics of the equipment. The operational lifetime of the project is linked to the operational lifetime of the nitric acid plant, which is approximately 15 years and 0 months

C.3. Length of the crediting period:

The starting date of the crediting period will be 1st of September 2011. The length of the crediting period is 1 year and 4 months.

In accordance with the rules, defined in the Kyoto protocol[12] , the crediting period lasts until 31 December 2012. As soon as rules for the handling of existing JI projects in Bulgaria after 2012 are published, the prolongation of the crediting period will be initiated.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

Definition and description of the approach chosen

According to decision 10/CMP.1[7],, paragraph 4(a), methodologies for monitoring approved by the CDM Executive Board may be applied also for JI projects. JI specific approach according to paragraph 9 from UNFCCC – JISC- Guidance on criteria for baseline setting and monitoring, Version 02[2] will be used throughout the whole D1 section and the monitoring plan. More precisely – elements from the approved CDM methodology AM 0034 [1] will be used.
As discussed in section B.1., the procedure for the proposed project does basically follow the official methodology AM 0034, which contains both a baseline and a monitoring methodology. The AM0034 monitoring methodology shall be applied for this project, taking into consideration the discussion of the AM 0034 elements under section B.1.

Application of the approach chosen

The AM0034[1], monitoring methodology shall be applied for this project, taking into consideration the discussion of the AM 0034[1], elements under section B.1.

An automated measuring system (AMS) will be installed using the guidance document EN 14181 and will ensure separate readings for N_2O concentration and gas flow volume continuously, generating average values for every 60 minutes of operation. Error readings (e.g. downtime or malfunction) and extreme values are automatically eliminated from the output data series by the monitoring system. Besides these two parameters, the temperature and pressure of the stack gas will be recorded in the AMS.

Statistical evaluation will be applied to the project data series for N_2O concentration and gas flow volume in order to eliminate mavericks from downtime or malfunction of the monitoring system.

Notwithstanding the specifications of AM0034 [1],, the monitoring plan does not include the collection of historic N_2O emissions baseline data and accordant parameters prior to the installation of the De N_2O catalyst, as these parameters are fixed and their deviation explained at the time of PDD writing and no ex post adjustments of the baseline emission factor other than impact of eventual new Bulgarian regulation do apply. Chapter B.1 describes the derivation of the baseline emission factor.

The following sections describe the parameters which have to be monitored in order to determine project emissions and baseline emissions.

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 the stack gas*	*N_2O analyser*	*mg N_2O/m^3(converted from ppmv)*	*m*	*Every second*	*100%*	*Electronic* *8 years*	*Measurement device: ABB Infrared Photometer URAS26*
P.2	*VSG* *Volume flow rate of the stack gas*	*Gas volume flow meter*	*m^3/h*	*m*	*Every second*	*100%*	*Electronic* *8 years*	*Measurement device: DURAG D-FL 100, differential pressure technique for volume flow measurement*
P.3	*PE_n* *N_2O emissions of nth monitoring report*	*Calculation from measured data from tail gas in the stack*	*tN_2O*	*c*	*At least once after each monitoring period*	*100%*	*Electronic* *2 years after the last transfer of ERU generated from the project*	*A monitoring period will be individually defined and is expected to last no longer than one year. It is not dependent on any campaigns as described above.*
P.4	*OH* *Operating Hours*	*Data collection system D-EMS 2000*	*Hours*	*m*	*Daily*	*100%*	*Electronic* *8 years*	*Entered into the data processing system*
P.5	*NAP* *Nitric Acid*	*Operational journals*	*$tHNO_3$*	*m* *c*	*Every 24 hours*	*100%*	*Electronic* *2 years after*	*Total production over monitoring period. Includes*

	Production (100% concentrate)						*the last transfer of ERU generated from the project*	*sodium nitrate. Sources and procedures for data acquisition presented in Annex3*
P.6	*TSG* *Temperature of stack gas*	*Probe(part of gas volume flow meter*	*°C*	*m*	*Every second*	*100%*	*Electronic* *8 years*	
P.7	*PSG* *Pressure of stack gas*	*Probe (part of gas volume flow meter)*	*bar*	*m*	*Every second*	*100%*	*Electronic* *8 years*	
P.8	EF_n *Emission factor calculated for nth monitoring period*	*Calculated from measured data*	$tN_2O/tHNO_3$	*c*	*After end of each monitoring period*	*100%*	*Electronic2 years after the last transfer of ERU generated from the project*	

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

Project emissions are determined by calculating the mean values for N_2O concentration (P.1) and gas flow (P.2) and multiply those with the number of operating hours (P.4). Statistical analysis will be applied to both N_2O concentration (P.1) and gas volume flow (P.2):

a) Calculate the sample mean
b) Calculate the sample standard deviation
c) Calculate the 95 % confidence interval
d) Eliminate all data that lie outside the 95% confidence interval
e) Calculate the new sample mean from the remaining values

Formula for the calculation of project emissions:

$$PE_n = VSG \times NCSG \times 10^{-9} \times OH \qquad \textit{Formula 3}$$

Where:

VSG	Mean stack gas volume flow rate for the monitoring period, $m^{3/}h$
NCSG	Mean concentration of N_2O in the stack gas for the monitoring period, mgN_2O/m^3
$PE_{n,}$	Total N_2O emissions of the nth monitoring period, tN_2O
OH	Number of hours of operation in the specific monitoring period, h

From the project emissions (PE_n) and the accordant nitric acid production (P.5) in the monitoring period, the specific project emission factor is calculated:

$$EF_n = PE_n / NAP_n \qquad \textit{Formula 4}$$

Where:

EF_n	Project N_2O emission factor ($tN_2O/tHNO_3$)
NAP_n	Nitric acid production during the monitoring period ($tHNO_3$)

All calculations will be carried out in an appropriate Excel file, where all relevant values from the AMS and the process control system will be entered.

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	*EF_{BL} Baseline Emission Factor*	*Conservative IPCC value*	*$kgN_2O/tHNO_3$*	*Default value*	-	-	-	*Default value:4.5 $kgN_2O/tHNO_3$. For derivation and justification refer to section B.1 and Annex 2*
B.2	*NAP Nitric Acid Production (100% concentrate)*	*Operational journals*	*$tHNO_3$*	*m*	*Every 24 hours*	*100%*	*On paper and electronic2 years after the last transfer of ERU generated from the project*	*Total production over monitoring period. Includes sodium nitrate. Sources and procedure for data acquisition presented in Annex 3*
B.3	*EFreg Emissions threshold s from introduced new politics and regulations*	-	-	-	-	-	-	*See B.1 Impact of regulations*

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 calculated by multiplying the actual nitric acid production during one monitoring period with the baseline emission factor (B.1):

$$BE_n = NAP_n \ X \ EF_{BL} \qquad \textit{Formula 5}$$

Where:

BE_n Baseline emissions of the nth monitoring period (tN_2O)
EF_{BL} Baseline N_2O emission factor ($tN_2O/tHNO_3$)

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

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:

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

No leakage emission pertains to this project.

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 for the project over a specific monitoring period are determined by deducting the specific emission factor of the monitoring period (EF_n see Formula 4) from the baseline emission factor (EF_{BL}, see B1(D.1.1,3) and multiplying the result by the production output of 100% concentrated nitric acid over the monitoring period and the GWP of N_2O:

$$ER_n = (EF_{BL} - EF_n) \times NAP_n \times GWP_{N20} \qquad \textit{Formula 6}$$

Where:

ER_n	Emission reduction of the project for the specific monitoring period (tCO_2e)
GWP_{N20}	Global Warming Potential of N_2O : 310

As soon as and if regulation is adopted limiting the N_2O emissions of the nitric acid plants in Bulgaria, the corresponding plant – specific emission factor cap (max. allowed t N_2O/$tHNO_3$) will be derived from the regulatory level. If the regulatory limit is lower than the baseline factor determined for the project, the regulatory limit shall serve as new baseline emission factor, that is:

If $EF_{BL} > EF_{reg,}$, the baseline N_2O emission factor shall be EF_{reg} for all calculations. EF_{reg} is the emission limit set by newly introduced policies or regulations (t t N_2O/$tHNO_3$)

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:

According to the requirements of article 4, paragraph 1 of Regulation for conditions and of performing order of environmental impact assessment, informative note for investment incentive named Emission reduction of nitrous oxide in old nitric acid plant (43-45 %)site A, according to JI mechanism from the Kyoto protocol has been sent to Ministry of Environment and Waters on 30th of march 2011. The Ministry of Environment and Water response, dated 30th of May, states that no assessment procedure for the impact on the environment and ecological assessment are necessary.

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.
D.1.1.1.: P.1, P.2, P.6, P.7	Low	Data acquisition by AMS (Automated Measuring System). The analysis equipment will be supplied by ABB Automation Gmbh and combined with a data processing system from DURAG GmbH. The system fulfils the latest applicable European standards and norms, especially EN 14181. EN 14181 defines comprehensive quality assurance measures (defined as QAL 2, QAL 3 and AST) which are followed by the installed system and will be adequately documented. Staff will be trained to operate the analysis equipment and the data processing system. The system has conformity certificate QAL 1. QAL2 will be carried out first time in August 2011 and will then be repeated every year. QAL 3 will be carried out continually on a weekly basis by qualified staff of the quality assurance group of Neochim's business unit QA. AST is repeated annually by a laboratory certified according to EN ISO 17025. The data from QAL 2, AST and QAL 3 will be archived during 3 years time period. The data recording unit is requesting failure messages every minute. In case of an error message the average value of the last minute is cancelled. In case of more than 20 average minute values are cancelled also the hourly average value is eliminated and the emission reductions of the project activity in this hour will not be considered.
D.1.1.1.:P.4	low	Operating hours are by default recorded by the process control system.

D.1.1.1.:P5	low	• Nitric acid production, material flows and analytical data are recorded not only for the project, but also for production balance reporting. The procedures and data are therefore not only included in the validation and verification process for the JI project, but are primarily a subject of the internal quality procedures and financial auditing. The uncertainty level of these data is consequently low, independent from their use for the JI project. The nitric acid flow meter, nitric acid level indicator, sodium nitrate solution level indicator will be calibrated on every 2 years. The calibration data will be archived during 3 years time period.

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

In order to ensure a reliable and transparent implementation of the monitoring plan, all staff which is in charge of tasks connected to data acquisition for the monitoring will be trained and instructed accordingly. A detailed concept with the designation of tasks shall be developed. This will be done in the form of an internal “JI handbook” prior to the start of the project and documented in the first monitoring report.

The following chart shows the distribution of responsibilities for the JI project. The overall responsibility lies with the project manager, V.Grancharov. Emissions procedures, data acquisition, operation of AMS and process information system, service and maintenance and documentation are allocated to the different job positions under the supervision of the project management.

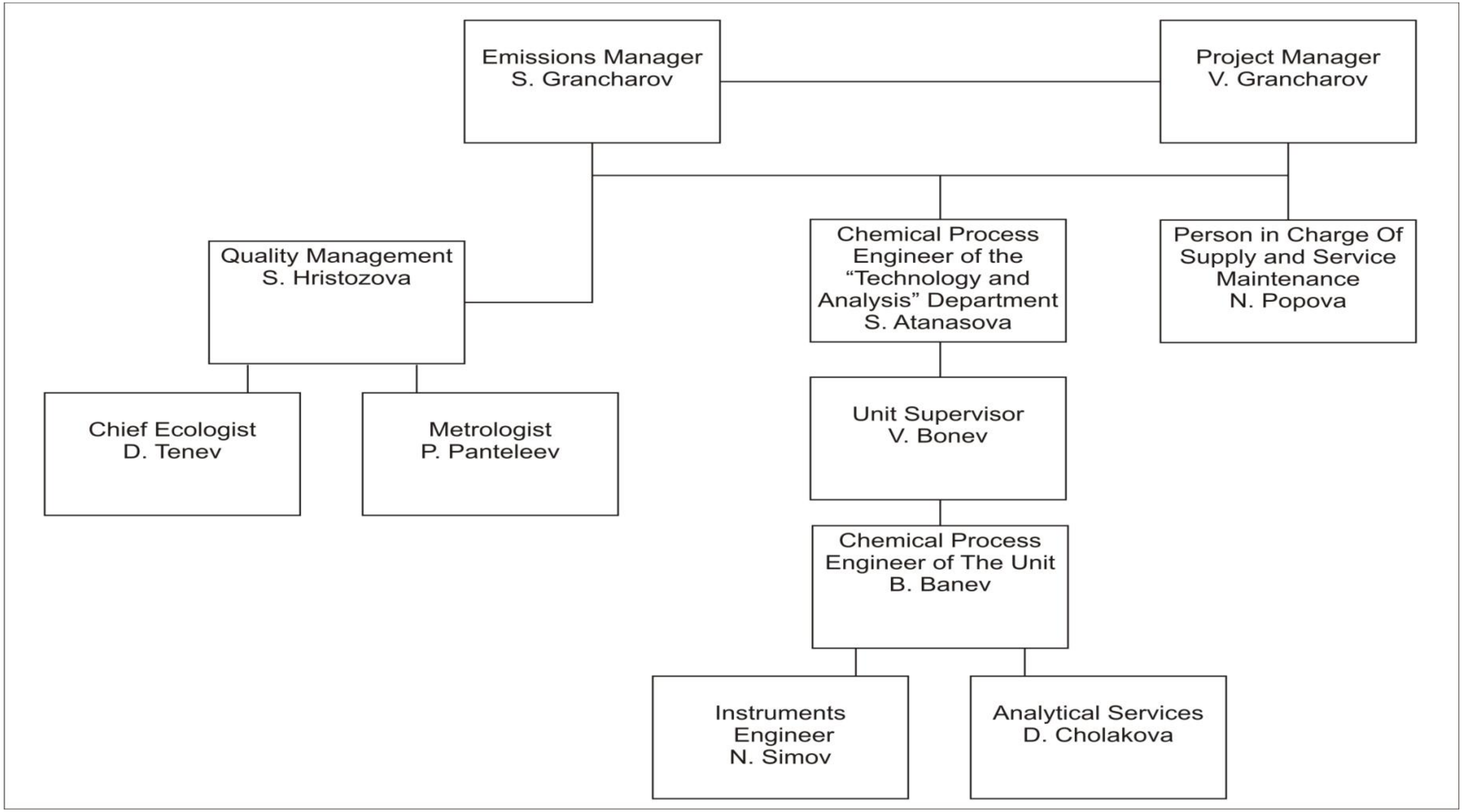


Figure: 6 Operational responsibilities for the JI project.

Person in charge for Supply and technical service

- Responsible for AMS supply and service maintenance

Instruments engineer

- Responsible for service of surveillance equipment and measurements of important for the process parameters.
- Responsible for operating condition, normal operations and on time technical services for AMS including QAL3 activities.
- Informs the chief metrologist for necessary actions after repairs of the equipment.

Analytical control

- Responsible for ensuring of analytical activities, according to monitoring plan (see annex 3) and documenting of their results in analytical journal

Unit Chemical processes engineer

- Responsible for registering of quantities of raw materials used in the technological process and matching of the received data with consumption norms of the production unit. Performs reviewing of technological parameters adherence.
- Responsible for data entry in a proper Excel file of all applicable values from AMS and parameters necessary for calculation of produced nitric acid (NAP) according to the monitoring plan.

Unit supervisor

- Responsible for providing of normal operation conditions and production process and in particular for raw materials consumption according to consumption norms of the production unit. Performs reviewing and internal verification of data used in the monitoring. The data resume will be available in the local network.

Chemical processes engineer from Technologies and Analysis department

- Analyses primary data received from production unit necessary for monitoring report preparation.
- If monitoring plant update is necessary participates directly into the process as well as during the monitoring report preparation.

Metrologist

- Organizes calibration and internal measurement instruments inspection for process important parameters according to approved schedule.
- Responsible for QAL 2 and AST of AMS procedures provision. The calibration intervals are set according to producer's instructions and international standards (EN 14181). These intervals are included into the annual inspection schedule according to integrated management system consistent with ISO 9001 , ISO 14001 and BS OHSAS 18001.

Chief ecologist

- Follows legislation issued from the government changes into NOx anf N_2O emissions requirements and informs the person responsible for quality for these changes. Participates into annual monitoring report preparation.

Person in charge for Quality control

- Responsible for adhering to quality and control procedures and monitoring data quality assurance. Follows monitoring plant adherence. Prepares annual monitoring report according to approved from the competent organization structure and contents. Organizes monitoring report verification.

Emissions manager

- Participates into annual monitoring report verification process arrangement and is responsible for its submission to the competent organization in a timely manner.
- Responsible for verified ERU sales.

Project manager
- Approves monitoring system, monitoring data and annual monitoring report.
- Management supervision of monitoring system and the actions taken for assurance of greenhouse gases emissions monitoring quality.

The box containing gas – analyzer system, along with control board for data collection and analysis will be installed in the existing air – conditioned room in proximity to the sampling point. The data processor will be installed in the control room and operated by the plant manager.

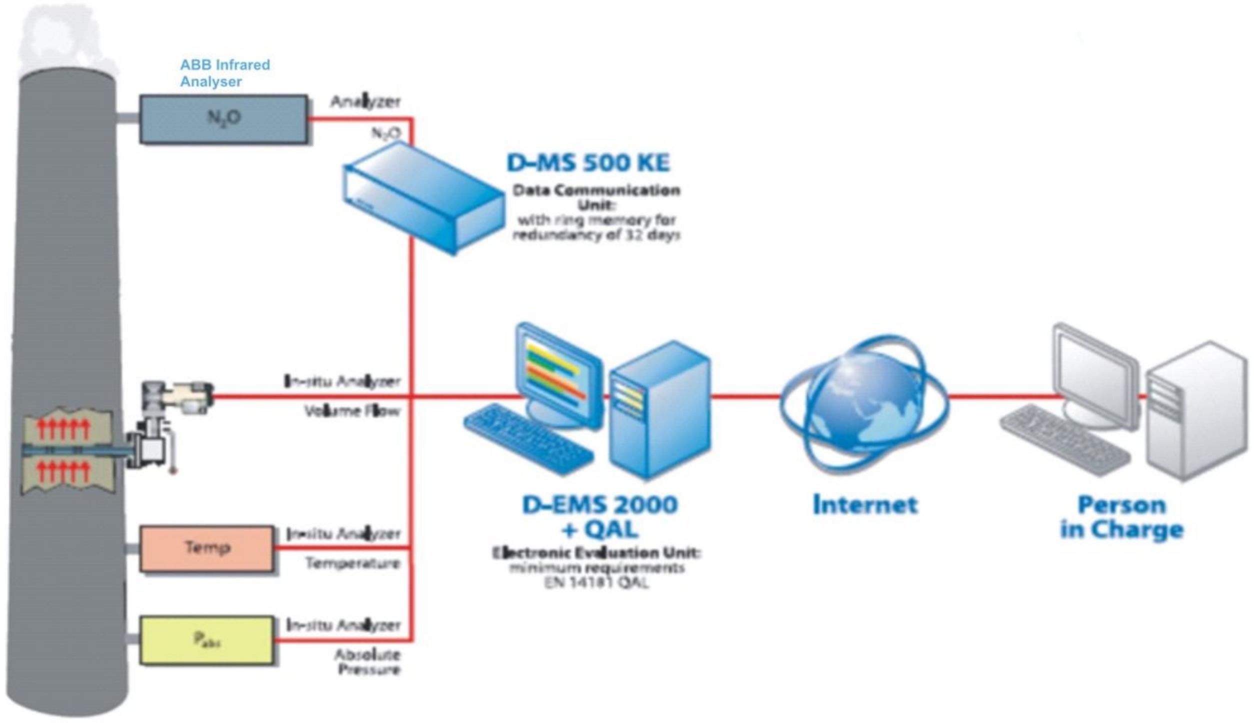


Figure 7 Monitoring system and system for data collection and processing.

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

The monitoring plan was defined and documented by:

Neochim PLC
Town of Dimitrovgrad 6403, Haskovo district
Dimitrovgrad municipality
HIMKOMBINATSKA Street
EASTERN INDUSTRIAL ZONE
BULGARIA

Phone: +359 391 65 205
Fax: +359 391 60 555
http://www.neochim.bg

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Year	Expected nitric acid production and nitric acid equivalent production [$tHNO_3$, 100%]	Estimated project emission factor [$kgN_2O/tHNO_3$]	Estimated project emissions [tN_2O]	Estimated project emissions [tCO_2e]
2011	40, 000	1.47	58.8	18, 228
2012	80, 000	1.47	117.6	36, 456

E.2. Estimated leakage:

No leakage emissions do accrue

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

Year	Expected nitric acid production and nitric acid equivalent production [$tHNO_3$, 100%]	Estimated project emission factor [$kgN_2O/tHNO_3$]	Estimated project emissions [tN_2O]	Estimated project emissions [tCO_2e]
2011	40, 000	1.47	58.8	18,228
2012	80, 000	1.47	117.6	36,456

E.4. Estimated baseline emissions:

From the start of the crediting period, the baseline emission factor of 4.5$kgN_2O/tHNO_3$ applies.

Year	Expected nitric acid production and nitric acid equivalent production [$tHNO_3$, 100%]	Estimated baseline emission factor [$kgN_2O/tHNO_3$]	Estimated baseline emissions [tN_2O]	Estimated baseline emissions [tCO_2e]
2011	40, 000	4.5	180	55, 800
2012	80, 000	4.5	360	111, 600

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

Year	Emission reduction [tN_2O]	Emission reduction [tCO_2e]
2011	121.1	37,572
2012	242.4	75,144
Total	363.6	112,716
Average	272.7	84,537

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

Year	Estimated project emissions[tCO_2e]	Estimated leakage [tCO_2e]	Estimated baseline emissions [tCO_2e]	Estimated emission reductions [tCO_2e]
2011	18,228	--	55,800	37,572
2012	36,456	--	111,600	75,144
Total	54,684	--	167,400	112,716

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including trans boundary impacts, in accordance with procedures as determined by the host Party:

No environmental impacts are expected. No requirements regarding the analysis of environmental impacts are defined by law or by the competent authority.

N_2O emission reduction is expected as a result of project implementation. No changes in NOx concentration in emissions and quantity of waste gases are expected during operation. No Trans - boundary effects are expected.

Informative note for investment intention is submitted to Ministry of Environment and Water on 30th of March 2011, in connection with the requirements of article 4, paragraph 1 of Regulation for conditions and order of performing of environmental impact assessment. The ministry's reply from 30th of May states that no environmental impact and ecological assessment are required for the above mentioned investment proposal.

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:

Not applicable, as no significant environmental impacts were identified.

SECTION G. Stakeholders' comments

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

Neochim PLC has submitted information to the public for intentions for project idea implementation in various ways:

1) Work meeting in at Dimitrovgrad municipality on the following topic: Industrial pollution restriction, preserving of the environment and human health and living conditions improvement in the Dimitrovgrad district for the period 2000 – 2010. held in November 2010.

2) Press publications:

- "Trakia" newspaper , edition 15 9-13 of April 2011;
- "Novinar Ug" newspaper, edition 15 , 15th of April 2011.

Informal notice for investment incentive "Nitrous oxide emission reduction from nitric acid production – old (43-45%) at Neochim PLC site A under the Joint Implmentation mechanism from the Kyoto protocol to the minister of environment on 30th of march 2011. The ministry's reply from 30th of May states that no environmental impact and ecological assessment are required for the above mentioned investment proposal.

As the project is technically imited to installation of new internals (baskets and catalysts) within existing oxidation reactors at Neochim's production site in Dimitrovgrad without any negative environmental or social impact, no other stakeholder's comments have been received.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	NEOCHIM PLC
Street/P.O.Box:	3 Chimkombinatska street
Building:	
City:	Dimitrovgrad
State/Region:	Haskovo
Postal code:	6400
Country:	Bulgaria
Phone:	+ 359 391 65 205
Fax:	+ 359 391 60 555
E-mail:	neochim@neochim.bg
URL:	www.neochim.bg
Represented by:	Stefan Grancharov
Title:	Emissions Manager
Salutation:	
Last name:	
Middle name:	
First name:	
Department:	MSDNV
Phone (direct):	+ 359 391 65 240
Fax (direct):	+ 359 391 60 555
Mobile:	+ 359 886 837 116
Personal e-mail:	sgrancharov@neochim.bg

Annex 2

BASELINE INFORMATION

In the following, the baseline parameters are explained and the data that are available for validation are also presented.

As explained in section B.1 dedicated series of measurements on different days serve to set the baseline emission factor. The measurements were carried out by TÜV SÜD Industrie Service GmbH on 20/21st of December 2010 and 12/13th of January 2011. The dates were chosen in a way that catalyst gauze replacements fell into the measuring period in order to record the according effect and take a conservative approach. The ammonia oxidation gauzes were replaced on 23rd of December (two gauzes) and on 7th of January (two gauzes). Four new gauzes in total were replaced before the scheduled set of measurements on January 12/13th 2011.

The following two tables show the results from the measurements:

<table>
<tr><td>Data / Parameter</td><td>$NCSG_m$</td></tr>
<tr><td>Data Unit</td><td>mg/nm^3</td></tr>
<tr><td>Description</td><td>Mean concentration of N_2O in the stack gas during the baseline measurement period</td></tr>
<tr><td>Source of data used</td><td>Report on N_2O – concentration measurements by TÜV SÜD Industrie Service GmbH on 20/21st of December and 12th of January</td></tr>
<tr><td>Value applied</td><td><table><tr><td>20/21 December</td><td>12/13 January</td></tr><tr><td>2,001</td><td>1,814</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurements methods and procedures actually applied.</td><td>TÜV SÜD Industrie Service GmbH, a certified laboratory for emission measurements was commissioned to carry out dedicated state – of – the – art measurements of N_2O emissions during normal plant operation in order to set the baseline scenario. A separate report on the measurements is available, where the method, the equipment and the handling of uncertainties is described.</td></tr>
<tr><td>Any comment</td><td>The values, measured and reported as dimensionless quantities (vpm, were converted to g/m^3 by applying a molar volume of 22.414 l/mol and a molar mass of 44.013 g/mol for N_2O.</td></tr>
</table>

<table>
<tr><td>Data / Parameter</td><td>VSG_m</td></tr>
<tr><td>Data unit</td><td>Nm^3/h</td></tr>
<tr><td>Description</td><td>Mean gas volume flow rate at the stack in the baseline measurement period.</td></tr>
<tr><td>Source of data used</td><td>Report on N_2O – concentration measurements by TÜV SÜD Industrie Service GmbH on 20/21st of December and 12/13th of January.</td></tr>
<tr><td></td><td><table><tr><td>20/21</td><td>12/13</td></tr></table></td></tr>
</table>

<table>
<tr><td>Value applied</td><td><table><tr><td>December</td><td>January</td></tr><tr><td>52, 771</td><td>62, 960</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurements methods and procedures actually applied.</td><td>TÜV SÜD Industrie Service GmbH, a certified engineering company for emission measurements was commissioned to carry out dedicated state – of – the – art measurements of N_2O emissions during normal plant operation in order to set the baseline scenario. A separate report on the measurements is available, where the method, the equipment and the handling of uncertainties is described.</td></tr>
<tr><td>Any comment</td><td>Shown values for dry gas</td></tr>
</table>

With the results the daily N_2O emissions are calculated according to Formula 1:

	Daily N_2O emissions [kgN_2O /d]
20/21 December 2010	2,534
12/13 January 2011	2,741

The following table shows the daily nitric acid production on the three measurement days:

<table>
<tr><td>Data/Parameter</td><td>NAP_m</td></tr>
<tr><td>Data unit</td><td>$tHNO_3$</td></tr>
<tr><td>Description</td><td>Nitric acid production during the baseline period (100% concentrate)</td></tr>
<tr><td>Source of data used</td><td>Bulgarcontrola PLC report separately attached , Neochim’s records and calculations</td></tr>
<tr><td>Value applied</td><td><table><tr><td>20/21 December</td><td>12/13 January</td></tr><tr><td>352.17</td><td>365.98</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurements methods and procedures actually applied.</td><td>For the acquisition of production data, the services of independent surveyor Bulgarkontrola were employed. The calculations were performed by Neochim team according to annex 3 formulas. They have been documented in a separate excel sheet.</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

Data/Parameter	**UNC**
Data unit	
Description	Overall uncertainty of the monitoring system, and measuring unit for production nitric acid % calculated as combined error.

<table>
<tr><td>Sources of data used</td><td>Report of N_2O measurements by TÜV SÜD Industrie Service GmbH</td></tr>
<tr><td>Value applied</td><td><table><tr><td>20/21 December</td><td>12/13 January</td></tr><tr><td>4.31</td><td>4.31</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurements methods and procedures actually applied.</td><td>The report of TÜV SÜD Industrie Service GmbH on the two measurement series contains information about maximum allowed uncertainty of the measurement devices and the actual determined error, which is far below the allowed values. The calculation of the overall uncertainty is based on application of ISO/IEC 98-3:2008 [8] and IPCC , Uncertainty Management in National Greenhouse gas Inventories, Chapter 6 – Quantifying Uncertainties in practice [9]</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

Applying Formula 2 to the presented data leads to the following emission factors for each of the two measurements:

	Emission factor without uncertainty reporting [$kgN_2O/tHNO_3$]	Emission factor after subtraction of uncertainty [$kgN_2O/tHNO_3$]
December	7.20	6.89
January	7.49	7.17
Average	7.34	7.03

Applying formula 2 to the presented data from TÜV SÜD Industrie Service GmbH for the lowest average hourly value of N_2O emissions during each of the two measurements:

	Emission factor without uncertainty reporting [$kgN_2O/tHNO_3$]	Emission factor after subtraction of uncertainty [$kgN_2O/tHNO_3$]
December	7.01	6.71
January	7.29	6.98
Average	7.15	6.85

The plant operated under normal conditions during the baseline measurement days. This is demonstrated by comparing the oxidation temperature during the baseline measurement days with the available historic records.

The ammonia oxidation catalyst has been supplied by Johnson Matthey, U.K., the last years. The composition of the gauze is approximately 90% platinum and 10.% palladium and rhodium

Annex 3

MONITORING PLAN

N_2O emissions

The AMS (Automated Measuring System) will be supplied by ABB and DURAG from Germany. Analysis equipment (marked with "AMS") will be installed as shown in on Fig. 8

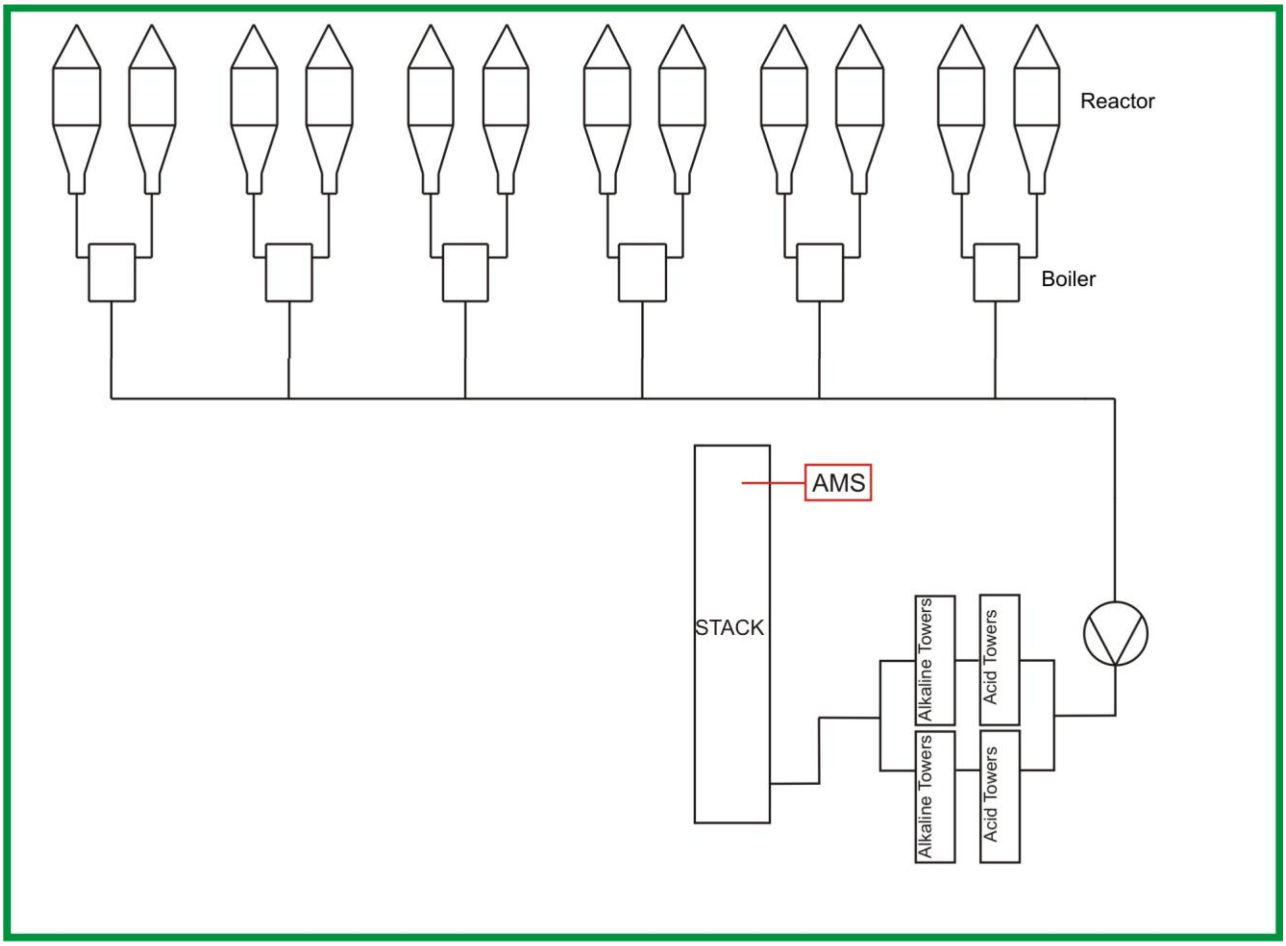


Figure 8 Automated Measuring System (AMS) installed on the stack

The acquisition of N_2O concentration and gas volume flow is subject of the strict quality requirements defined by EN ISO 14956 and EN 14181, against which the system is certified. The supplier is aware of the application of the AMS within the scope of AM 0034[1] and guarantees that all requirements are met. An accredited certifier carries out calibration, the operator carries out quality assurance measures.

Calibration procedure
The system has conformity certificate QAL 1.

QAL2 will be carried out first time in August 2011 and will then be repeated every three years. QAL 3 will be carried out continually on a weekly basis by qualified staff of the quality assurance group of Neochim's business unit QA. AST is repeated annually by a laboratory certified according to EN ISO 17025.
The data from QAL 2, AST and QAL 3 will be archived during 3 years time period.
The following data are recorded by the AMS (reference to table D.1.1.1):

- N_2O – concentration in the stack gas (NCSG, P.1)
- Volume flow rate of stack gas (VSG, P.2)
- Temperature of stack gas (TSG, P.6)
- Pressure of stack gas (PSG, P.7)

For the calculation of the emission factor for a monitoring period, the 60 minutes mean values for N_2O concentration and gas volume flow will be calculated in the Durag system, where the statistical analysis is carried out and mean values are calculated for a monitoring period. The operating hours data (OH, P.4) will be taken from the data collection and processing system and nitric acid production data will be taken from the Excelfile for each monitoring period, and the emission factor for the actual period will be calculated.

Downtime of AMS: In the event that the monitoring system is down, the highest measured value in the monitoring period will be applied for the downtime period emission factor.

Specific performance characteristics of the monitoring system are described in the supplier's product description.

Nitric acid production

The products from the absorption processes at the nitric acid plant at Neochim are nitric acid (HNO_3) and sodium nitrate ($NaNo_3$). The material flows have to be balanced for the calculation of the amount of 100% nitric acid equivalent produced by the nitric acid plant alone (NAP). The following explanations show the principle system and procedure for the acquisition of nitric acid production data for a monitoring period. Figure 9 shows material flows, no emission flows. With this, it is independent from the definition of the project boundaries as explained in section B.3

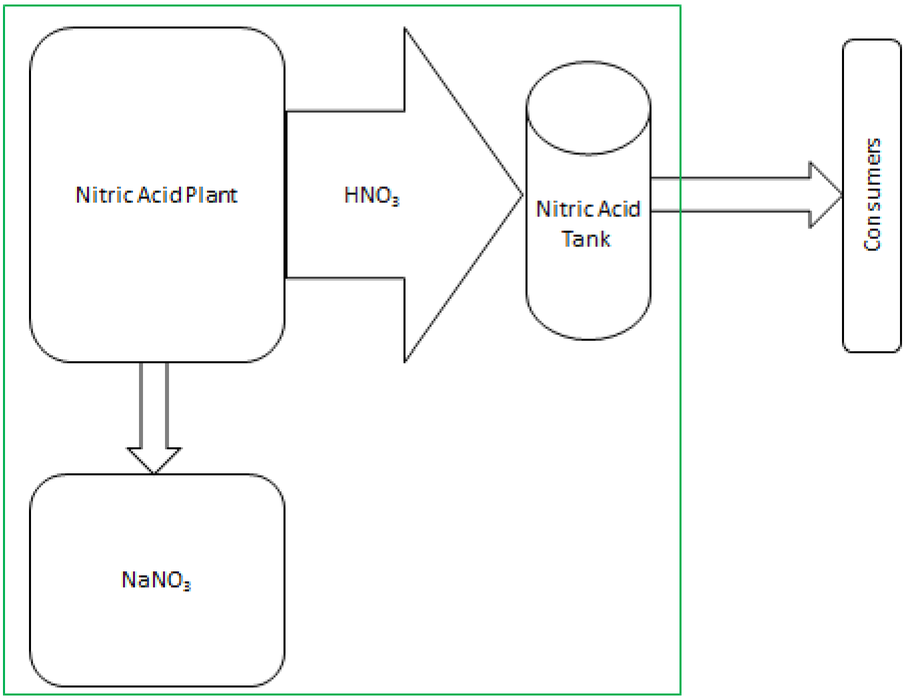


Figure 9: Material flow of HNO_3 and derivative product, schematic overview

The production nitric acid released from the HNO_3 plant is fed into tank, from where the fluid is led for further processing. These amounts are not equal to the nitric acid production that will be used to determine the emission reductions, as they do not include the equivalent quantity of nitric acid corresponding to the sodium nitrate ($NaNO_3$) produced. The $NaNO_3$ has to be converted to 100 % HNO_3 by stoichiometric calculation and then added to nitric acid produced as such. Sodium nitrate ($NaNo_3$) production at the nitric acid plant is included into the project, as it is product from the same reaction as nitric acid, namely the oxidation of ammonia in the reactors. Thus the N_2O generation during ammonia oxidation is directly connected to both nitric acid and sodium nitrate production but cannot be assigned to the different products on a quantity basis. As nitrogen is the central element of the input – output – equation of the plant and N_2O is generated in a process step that is independent from the final product, an adequate and complete approach requires the inclusion of all nitrogen containing products into the balance.

The following table shows information and sources for the above drafted data.

Collection of HNO_3 production data

	Term, Reference	Description of data acquisition
A	Production nitric acid that has exited the tank	Flow: It is measured continuously upon exiting the tank.(Emerson process management flow meter) Concentration: Measuring average sample on every 12 hours in laboratory. Density: The values are taken from technical reference book according to measured concentration. [18] Stoichiometric calculation as 100 % nitric acid.
B	Sodium nitrate in sodium nitrate solution after inversion.	Flow: Solution volume is measured prior to each transfer to sodium nitrate production unit (KRONE level indicator will be used , model Optiwave 7300 C) Concentration: Laboratory analytical determination of solution concentration prior to each transfer. Stoichiometric calculation as 100 % nitric acid.
C	Sodium nitrite in sodium nitrate solution after inversion.	Flow: Solution volume is measured prior to each transfer to sodium nitrate production unit. (KRONE level indicator will be used , model Optiwave 7300 C) Concentration: Laboratory analytical determination of solution concentration prior to each transfer. Stoichiometric calculation as 100 % nitric acid.
D	Production nitric acid , reporting alternations as a result of nitric acid tank fill in the beginning and at the end of the monitoring period	Correction: The volume measurement of the solution in the beginning and at the end of the monitoring period performed in the production nitric acid tank. (KRONE level indicator will be used , model Optiwave 7300 C) Concentration: Concentration measurement of the production nitric acid in the tank in the beginning and at the end of the monitoring period. Density: The values are taken from technical reference book according to measured concentration. [18] Stoichiometric calculation as 100 % nitric acid.

All measured data from HNO_3 and $NaNO_3$ flows are directly normed to 100% HNO_3 concentrate.

A Calculation of production nitric acid expressed as 100% nitric acid.

$$A = \frac{V_{HNO3} \times \rho_{HNO3} \times W_{HNO3}}{100} \qquad \textbf{\textit{Formula (7)}}$$

where:

A is nitric acid production quantity calculated as 100% nitric acid in tonnes;
$\mathbf{V_{HNO3}}$ **is** volume of production nitric acid that has exited production nitric acid tank in m^3;
$\boldsymbol{\rho}_{\mathbf{HNO3}}$ **is** nitric acid density in g/cm^3;
W_{HNO3} is the concentration of nitric acid content in, в % m/m.

B Calculation of sodium nitrate in sodium nitrate solution after inversion to 100% nitric acid.

Process chemism:

$2HNO_3+Na_2CO_3 = 2NaNO_3 + H_2O + CO_2$
1 mol $NaNO_3$ is received from от 1 mol HNO_3

$$B = \frac{V_{NaNO3} \times W_{NaNO3} \times M_{HNO3}}{M_{NaNO3} \times 1000} \qquad \textbf{\textit{Formula (8)}}$$

where:

B is the quantity of $NaNO_3$ converted to 100% nitric acid in tonnes;
$\mathbf{V_{NaNO3}}$ is volume of sodium nitrate solution after inversion in m^3;
$\mathbf{W_{NaNO3}}$ is the concentration of $NaNO_3$ in sodium nitrate solution after inversion in g/dm^3;
M_{HNO3} is molecular mass of nitric acid; in g/mol
M_{NaNO3} is molecular mass of sodium nitrate in g/mol

C Calculation of sodium nitrite in sodium nitrate solution after 100% nitric acid inversion.

Process chemism:

$2HNO_2 + Na_2CO_3 = 2NaNO_2 + H_2O + CO_2$
$3HNO_2 = HNO_3 + 2NO + H_2O - Q$
$2NO + H_2O + 1{,}5O_2 = 2HNO_3$
Could be expressed summed: $2HNO_3 + Na_2CO_3 = 2NaNO_2 + H_2O + CO_2 + O_2$
1 mol $NaNO_2$ is received from от 1 mol HNO_3

$$C = \frac{V_{NaNO3} \times W_{NaNO2} \times M_{HNO3}}{M_{NaNO2} \times 1000}$$ ***Formula (9)***

where:

C is the quantity of $NaNO_2$ converted into 100 % nitric acid in tonnes;
$\mathbf{V_{NaNO3}}$ is sodium nitrate solution volume after inversion in m^3;
$\mathbf{W_{NaNO2}}$ is the concentration of $NaNO_2$ in sodium nitrate solution after inversion in g/dm^3;
M_{HNO3} is the molecular mass of nitric acid in g/mol
M_{NaNO2} is the molecular mass of sodium nitrite in g/mol

D Calculation of correction of quantity nitric acid produced, reporting alternation of nitric acid tank fill in the beginning and at the end of the monitoring period.

The changes in the fill level of nitric acid tank and sodium nitrate solution as well as their concentration will be reported in the beginning and at the end of the process and will be accounted for, when calculating the balance of end values for a given period.

$$D = \frac{V_{1HNO3} \times \rho_{1HNO3} \times W_{1HNO3}}{100} - \frac{V_{2HNO3} \times \rho_{2HNO3} \times W_{2HNO3}}{100}$$ ***Formula (10)***

where:

D is the quantity of production nitric acid reporting alternation in the fill level of the nitric acid tank in the beginning and at the end of the monitoring period expressed as 100% nitric acid in tones;

$\mathbf{V_{1HNO3}}$ is the volume of production nitric acid reporting alternation in the production nitric acid tank in the beginning of the monitoring period in m^3;

$\boldsymbol{\rho_{1\,HNO3}}$ is the density of the nitric acid in the production nitric acid tank in the beginning of the monitoring period in g/cm^3;

$\mathbf{W}_{\mathbf{1}HNO3}$ is the concentration of the nitric acid in the production nitric acid tank in the beginning of the monitoring period in % m/m;

$\mathbf{V_{2HNO3}}$ is the volume of the production nitric acid in the production nitric acid tank at the end of the monitoring period in m^3;

$\boldsymbol{\rho_{2\,HNO3}}$ is the density of the nitric acid in the production nitric acid tank at the end of the monitoring period in g/cm^3;

$\mathbf{W}_{\mathbf{2}HNO3}$ is the concentration of nitric acid in the production nitric acid tank at the end of the monitoring period in % m/m

The continuous measurement of production nitric acid flow are archived and accumulated in the data storage memory of the measurement unit and are being recorded on every 12 hours in the operational journal of the unit. Sodium nitrate solution and production nitric acid concentrations are recorded in a laboratory protocol. All manually collected data are entered into Excel file and the quantity of 100% nitric acid is calculated using formulas (7), (8) and (9).

The HNO_3 production for one monitoring period in project boundaries is calculated according to the following scheme:

NAP = Ⓐ + Ⓑ + Ⓒ + Ⓓ

Where:

A	is the net quantity of production nitric acid in nitric acid production unit, that has exited the tank calculated as 100% HNO_3
B	is the net quantity of NaNO3, produced in nitric acid production unit calculated as 100%. HNO_3
C	is the net quantity of $NaNO_2$, produced in nitric acid production unit calculated as 100%. HNO_3
D	is correction of the net quantity of production nitric acid in the nitric acid production unit reporting alternation in the fill level of the nitric acid tank in the beginning and at the end of the monitoring period expressed as 100% nitric acid in tones

This equation leads to the net nitric acid production (NAP), expressed as 100% concentrate, that correlates with the project boundaries defined for the N_2O emissions (cf. section B.3.) which in turn is consistent with , the calculation of the emission factor, quotient from N_2O emission and nitric acid production, cf. Formula 2 and Formula 4 stays consistent.

Changes in the fill level of the nitric acid tank and sodium nitrate solution as well as their concentration will be recorded at the beginning and at the end of the process and will be considered for the end – of – period balancing.

The measuring devices data for production nitric acid and $NaNO_3$ solution are archived electronically and are part of the quality management system. Analytical methods for determination of $NaNO_3$ and $NaNO_2$ concentration in sodium nitrate solution are part of production unit's laboratory methodologies.

Calibration procedure

- ***Nitric acid flow meter***

  producer- Emerson
  model- 8705TS
  type of measurement - Magnet – inductive flow meter
  calibration frequency - on every two years.
  time period for data archiving – 3 years

- ***Nitric acid level indicator***

  producer - KRONE
  model - Optiwave 7300 C
  type of measurement - Radar level indicators
  calibration frequency – on every two years.
  time period for data archiving – 3 years

- ***Sodium nitrate solution level indicator***

  producer - KRONE

model - Optiwave 7300 C
type of measurement - Radar level indicators
calibration frequency – on every two years.
time period for data archiving – 3 years

Downtime of :

- ***nitric acid flow meter:*** In case there is a malfunction of nitric acid flow meter, data from calibrated spare flow meter will be used and for emission factor calculation for that period the lowest measured volume value during the period of monitoring will be applied.

- ***Sodium nitrate solution level indicator:*** In case there is a malfunction of sodium nitrate solution level indicator it will be replace with a calibrated spare one and for emission factor calculation for that period the lowest measured volume value during the period of monitoring will be applied .

- ***Nitric acid level indicator*** The data from nitric acid tank level indicator will be used only in the beginning and at the end of the monitoring period. In case there is a malfunction of the nitric acid level indicator it will be replaced with a calibrated spare one.

Annex 4

ABBREVIATIONS AND MARKINGS

MARKINGS

CH_4	: methane
CO_2	: carbon dioxide
N_2O	: nitrous oxide
NO_x	: common designation for nitrogen oxides
$NaNO_3$	: Sodium nitrate
$NaNO_2$	: Sodium nitrite

ABBREVIATIONS

IPCC	: Inter governmental Panel on Climate Change
IPPC	: Integrated pollution prevention and control
JI	: Joint implementation Project according to Article 6 – Kyoto Protocol
CDM	: Clean Development Mechanism
MoEW	: Ministry of Environment and Waters

Annex 5

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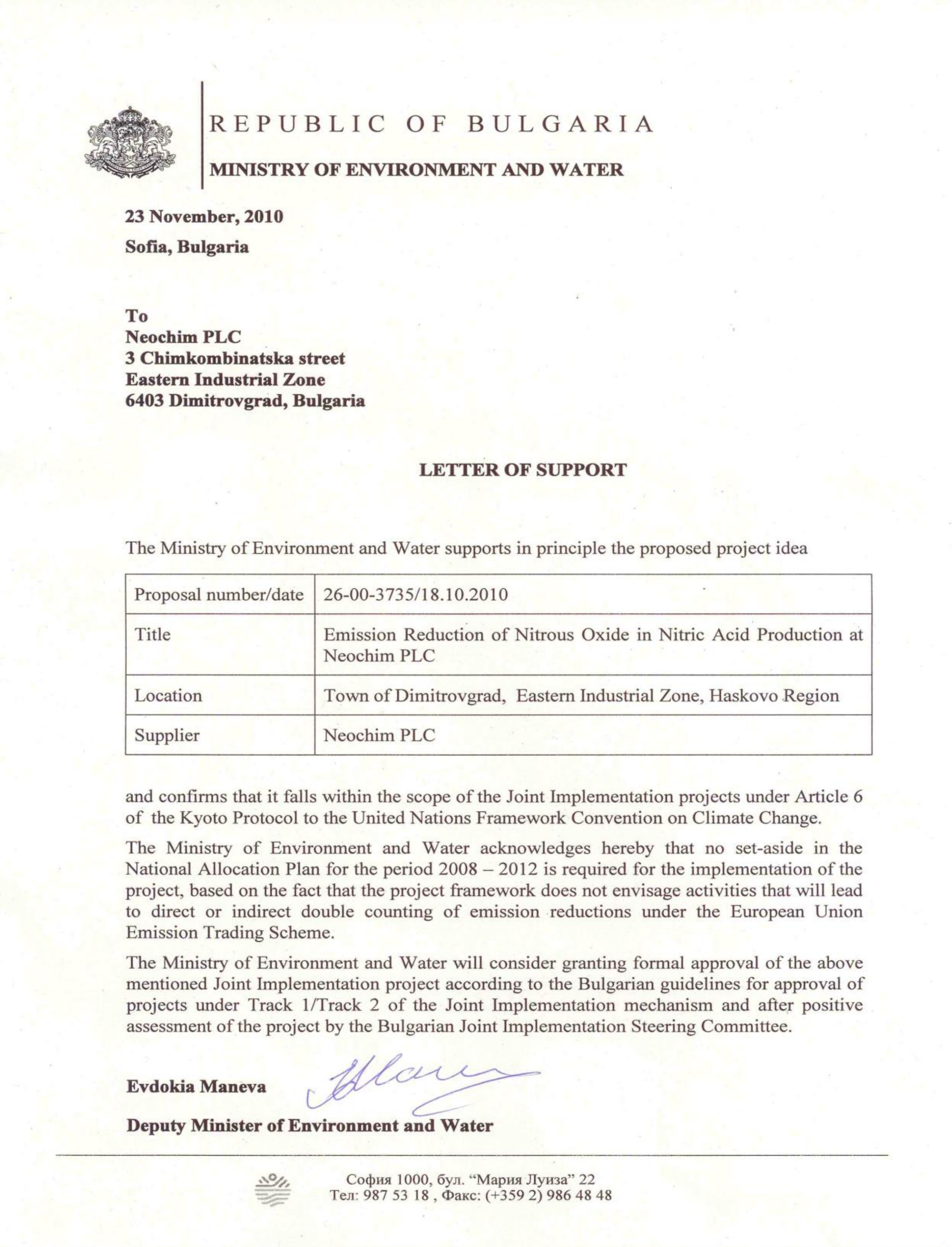
Annex 6

LETTER OF SUPPORT



REPUBLIC OF BULGARIA
MINISTRY OF ENVIRONMENT AND WATER

23 November, 2010
Sofia, Bulgaria

To
Neochim PLC
3 Chimkombinatska street
Eastern Industrial Zone
6403 Dimitrovgrad, Bulgaria

LETTER OF SUPPORT

The Ministry of Environment and Water supports in principle the proposed project idea

Proposal number/date	26-00-3735/18.10.2010
Title	Emission Reduction of Nitrous Oxide in Nitric Acid Production at Neochim PLC
Location	Town of Dimitrovgrad, Eastern Industrial Zone, Haskovo Region
Supplier	Neochim PLC

and confirms that it falls within the scope of the Joint Implementation projects under Article 6 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

The Ministry of Environment and Water acknowledges hereby that no set-aside in the National Allocation Plan for the period 2008 – 2012 is required for the implementation of the project, based on the fact that the project framework does not envisage activities that will lead to direct or indirect double counting of emission reductions under the European Union Emission Trading Scheme.

The Ministry of Environment and Water will consider granting formal approval of the above mentioned Joint Implementation project according to the Bulgarian guidelines for approval of projects under Track 1/Track 2 of the Joint Implementation mechanism and after positive assessment of the project by the Bulgarian Joint Implementation Steering Committee.

Evdokia Maneva

Deputy Minister of Environment and Water

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Annex 7

INVESTMENT ANALYSIS

(Confidential information)