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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

YARA Köping S2 N_2O abatement project in Sweden
Version: 2nd September 2011 (Version #8)
Sectoral Scope: 5 – Chemical industry

A.2. Description of the project:

The sole purpose of the proposed project activity is to significantly reduce current levels of N_2O emissions from the production of nitric acid at YARA's nitric acid plant Syra 2 at Köping, Sweden.

The nitric acid plant was designed by Uhde. Commercial nitric acid production started in 1955 with four ammonia oxidation reactors. A further two reactors were added in 1969. It is an atmospheric pressure plant with a design production output of 400 metric tonnes of HNO_3 (100% conc.) per day[1]. Depending on whether or not the plant is shut down for maintenance purposes or exchange of the primary catalyst gauzes, the plant is operated for around 348 days per year, resulting in a maximum annual production output of up to 139,200 $tHNO_3$[2].

To produce nitric acid, ammonia (NH_3) is reacted with air over precious metal – normally a platinum-rhodium- (Pt-Rh) alloy – catalyst gauze pack in the ammonia oxidation reactor (AOR) of the nitric acid plant. The main product of this reaction is NO, which is metastable at the conditions present in the ammonia oxidation reactor and therefore it reacts with the available oxygen to form NO_2, which is later absorbed in water to form HNO_3 – nitric acid. Simultaneously, undesired side reactions yield nitrous oxide (N_2O), nitrogen and water. N_2O is a potent greenhouse gas with a Global Warming Potential (GWP) of 310[3]. The plant is currently emitting around 7.27kg N2O/$tHNO_3$[4], which means that the continued operation of the plant without any N_2O abatement technology installed would entail emissions of approximately 315,000tCO_2e annually. Since there is no legal obligation to reduce these emissions, the plant would continue operating in this way.
The plant has a total of 6 Ammonia Oxidation Reactors (AORs), arranged in three sets of two.. All 3 'systems' lead jointly into 9 absorption columns and subsequently into one stack. The primary catalyst gauzes are changed in rotation in each of these systems at intervals of several months, with each individual set of gauzes being replaced approximately once every two years.

The project activity involves the installation of a new N_2O abatement technology. The secondary catalyst will be installed inside all six of the AORs, underneath the precious metal primary catalyst gauzes. It is expected that this catalyst will reduce approximately 90% of current N_2O emissions on average over its lifetime.

The N_2O abatement catalyst applied to the proposed project has been developed by YARA.

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[1] All nitric acid amounts are provided in metric tonnes of 100% concentrated HNO_3, unless otherwise indicated.

[2] See also section E.5 for information regarding the cap that will be applied to HNO_3 production eligible to receive ERUs.

[3] IPCC Second Assessment Report (1995); applicable according to UNFCCC-decision 2/CP.3, paragraph 3. After 2012 the GWP of N_2O will be 298, as defined by the IPCC Fourth Assessment Report in connection with Art 5 paragraph 3 Kyoto Protocol.

[4] See section A 4.3.1 for details

For monitoring the N_2O emission levels, YARA Köping S2 will install and operate an Automated Monitoring System according to EU standards[5].

YARA Köping S2 adheres to the ISO 9001:2000 management standard[6] and will implement procedures for monitoring, regular calibrations and QA/QC in line with the requirements of this standard.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Sweden (host)	• YARA AB (Sweden)	No
Netherlands	• N.serve Environmental Services GmbH (Germany)	No

This project will be developed as an independently-verified JI Project activity in accordance with UNFCCC decision 9/CMP.1, paragraph 24. The project will be developed under Track 2 JI, since the Swedish government has decided not to undertake Track 1 projects.

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

Sweden

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

Köping Municipality

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

Köping

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[5] See section D.1 for detailed information.

[6] All quality management documents are stored on the internal YARA Köping database and will be made available to the AIEs upon request.

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

Plant address:
P.O Box 908
SE - 73129
Köping
Nya Hamnvägen 14
SWEDEN

The pictures below illustrate the location of the plant:

Figure 1: Location of YARA Köping S2 plant

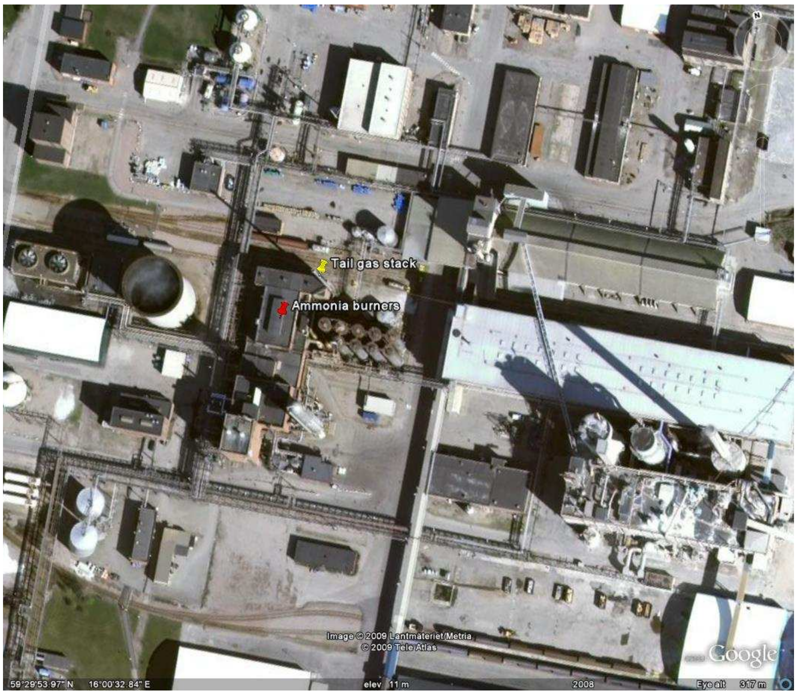

Figure 2: Close up image of YARA Köping S2 plant

The yellow pin indicates the location of the tail gas stack and the red pin shows where the ammonia burners are housed.

Plant Coordinates[7]:
Ammonia burners: 59°29’54.86” N & 16°00’29.69” E
Tail gas stack: 59°29’55.29” N & 16°00’31.09” E

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

The main parts of the plant as currently set up are the three sets of two ammonia burners (total 6 burners), inside which the ammonia oxidation reaction takes place, the 9 absorption towers where the gas mix from the burner is led through water in order to form nitric acid and the one tail gas stack through which the off-gasses are vented into the atmosphere. Please see section B.3 for the detailed process flow sheet.

The precious metal gauze packs – i.e. the primary catalyst required for the formation of NO in the first step of the nitric acid production process – are manufactured by KAR Rasmussen, located in Norway.

The project activity entails the implementation of:

- Secondary N_2O abatement technology that will be inserted in the ammonia oxidation reactors; and
- Specialised monitoring equipment to be installed at the stack (detailed information on the AMS is contained in section D.1).

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[7] Coordinates according to Google Earth©

Catalyst Technology

A number of N_2O abatement technologies have become commercially available in the past 4 years after several years of research, development and industrial testing. Since the end of 2005, many CDM project activities employing various kinds of N_2O abatement catalysts have been registered with the CDM EB. But these activities are of course limited to plants located in developing nations.

Due to lack of incentives for voluntary reductions before 2008 and the absence of legal limits on industrial N_2O emissions in nearly all the European Union member states, the vast majority of EU-based plant operators have so far not invested in N_2O abatement devices. YARA International ASA (Norway) is a noteworthy exception to this general rule, because the company conducted long term industrial trial runs of its self-developed catalyst system in various plants, mainly in France, since 2005.

However, the plant operated by YARA Köping S2 is an atmospheric pressure plant. At the time of starting this project, hardly any atmospheric plants were undertaking JI or CDM projects, with the exception of one JI project starting at BASF in Germany and one line at one plant at Lutianhua in China. Two other plants in France have since followed their example in 2010 with JI projects, yet secondary catalyst installations at atmospheric plants still remain very rare. . This is largely for four reasons:

1) Atmospheric plants generally tend to emit less N_2O than medium and high pressure plants (on average 5kg N_2O per tonne of nitric acid produced, as opposed to 7kg and 9kg for medium and high pressure plants respectively – according to average plant data compiled by the IPCC)
2) The ammonia oxidation reactors (AORs) are often wider in diameter and therefore more catalyst is needed at significantly greater cost
3) The AORs generally have less bed depth available for the secondary catalyst and abatement efficiencies therefore tend to be much lower
4) Pressure drop resulting from the insertion of secondary catalyst can lead to significant loss of production (only rarely a problem in medium or high pressure plants)

To overcome these issues, Yara is the process of developing a slightly different type of secondary catalyst, with the same material as the standard Yara secondary catalyst, optimised for installation in atmospheric plants. This is due to be ready for installation by October 2010, at which point Yara hopes to undertake a JI project at the S2 plant.

It is Yara’s intention to fill the baskets with batches of the new secondary catalyst (a total of approximately 6.1 tonnes for all 6 burners) from the beginning of the production campaign in October 2010. The exact date is yet to be confirmed.

YARA Köping S2 will install the YARA base metal catalyst system below the standard precious metal gauze packs in the ammonia burners.

The secondary catalyst will reduce N_2O levels in the gas mix resulting from the primary ammonia oxidation reaction. A wide range of metals (e.g. Cu, Fe, Mn, Co and Ni) have shown to be of varied effectiveness in N_2O abatement catalysts. The YARA abatement catalyst contains cobalt as an active ingredient. The abatement efficiency is expected to be around 90% in the following reaction:

$2\ N_2O \rightarrow 2N_2 + O_2$

If operated properly, the secondary catalyst system is expected to significantly reduce N_2O emissions for up to three years before the catalyst material needs to be replaced.

The materials used in the new YARA secondary abatement catalyst for atmospheric plants are the same as those used for the standard YARA catalyst, which is successfully installed in many CDM and JI projects all over the world. This material has been proven by industrial testing not to have any significant influence on plant production levels[8]. No additional heat or other energy input is required, because the temperature levels present inside the ammonia oxidation reactor suffice to ensure the catalyst's optimum abatement efficiency. There are no additional greenhouse gases or other emissions generated by the reactions at the N_2O abatement catalyst.

Due to the lack of experience in industrial application of this new type of catalyst, if any unforeseen problems should occur during its operation, the project participants reserve the right to replace it with the standard Yara N_2O abatement catalyst that is widely installed in medium pressure plants in order to continue the project activity.

N_2O abatement catalyst installation

The secondary catalyst itself can easily be installed during a routine plant shut-down and gauze change. The catalyst is inserted into the support basket / perforated plate arrangement and the gauze pack is then installed directly above the catalyst.

After the end of its useful life, the catalyst will be refined, recycled or disposed of according to EU regulations.

YARA's Köping S2 nitric acid plant operates at atmospheric pressure inside the ammonia oxidation reactors. Through the introduction of the secondary catalyst into the ammonia reactor, a slight pressure drop (ΔP) is expected to occur. This ΔP may lead to a slight reduction in ammonia conversion efficiency and hence a small reduction in nitric acid output. In practice, this reduction is unlikely to be significant.

Technology operation and safety issues

As mentioned before, the Yara secondary abatement material has been tested in several industrial trials and has proven to be a reliable and environmentally safe method of reducing N_2O.

Once installed, the catalyst and the AMS will be operated, maintained and supervised by the employees of YARA Köping according to standards that are normally used in the European industry[9].
Due to the fact that the catalyst is developed by Yara itself, there is expert know-how readily available within the YARA group. Therefore, YARA Köping is very confident that the effective operation of the catalyst technology, the operation of the monitoring system and the data collection, storage and processing can be managed in accordance with the JI requirements. Adherence to the applicable standards will be ensured by a thorough training session for the YARA employees involved.

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[8] This was confirmed by the catalyst manufacturer in official correspondence dated 23.02.2010. The relevant information was made available to the determining AIE. Also see the European IPPC Bureau publication „Integrated Pollution Prevention and Control; Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilizers (August 2007), page 124 therein.

[9] See section D.3 below.

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:

Without JI participation (and therefore in a 'Business as Usual' scenario), emission levels:

- Would remain unchanged until end of December 2012, because:
    - there is currently no legal requirement for YARA Köping to reduce the emissions of its plant, in fact there is not even a BAT reference value recommendation from the IPPC for atmospheric plants;
    - implementing N_2O reduction catalyst technology requires significant investments and may result in some technical difficulties with regard to the plant's operation, potentially even causing a reduction in production output; and
    - implementing N_2O catalyst technology does not yield any other benefits besides potential revenues from ERU sales.
- May be reduced from 1st January 2013, because:
    - It is highly possible that N2O emissions from nitric acid plants could be covered under the EU ETS[10]
    - Yara Köping S2 agreed with the Swedish Environmental Protection Agency that they would reduce emissions in 2013 to meet any applicable IPPC BAT reference value for atmospheric plants (providing that such a value exists at that time)
    - The regulatory emissions factor that may be imposed upon nitric acid plants from 2013 is still unknown

If ultimately no such cap is applied under the EU ETS, or no IPPC BAT reference value for atmospheric plants is introduced, emissions would most likely remain at current levels for the full 10-year crediting period.

More detail on these assumptions will be provided in section B.2 below.

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

The following paragraph describes the estimated emission reductions achievable by the project activity.

Nitric acid production and estimation of Business-as-Usual emissions

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[10] On 23rd January 2008, the EU Commission published a communication on its post-2013 climate change strategy (see http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0035:FIN:EN:PDF), which announces the determination to expand the EU ETS beyond its present scope, especially mentioning the inclusion of non-CO_2 gasses into the system. This development is no news to the industry, because responding to Article 30 of the EU ETS Directive 2003/87/EC, the Commission had submitted a report to the European Parliament and the Council considering the inclusion of non-CO_2 GHGs into the EU ETS already in November 2006. See the EU homepage under http://ec.europa.eu/environment/climat/emission/pdf/com2006_676final_en.pdf for this report which expressly considers extending the EU ETS into N_2O emissions (see page 6 therein).

The factual emission reductions depend on the factual emissions of the plant prior to installation of the catalyst and the amount of nitric acid produced. In accordance with AM0034 ver 03.4, emission reductions are determined per unit of product measured in metric tonnes of 100% concentrated nitric acid produced.
At YARA Köping S2, the nitric acid production is currently monitored by a differential-pressure flow meter for continuous HNO_3-flow and HNO_3 concentration measurement. It is possible that this flow meter might be replaced with an ultrasonic flow meter in the future, in order to take the same HNO_3-measurement approach as is used in the Syra 3 plant. The concentration measurement is checked every four hours by the operator and once a month by a central laboratory. A cross-check is carried out once per month with a mass balance calculation, taking into account the NH_3 consumption of the plant, the weight of solid ammonium nitrate produced from the nitric acid, and the weight of nitric acid that is exported off-site.

Table 1 below displays the expected nitric acid production amounts for the years 2010 to 2012 and the estimated N_2O emissions in the absence of the secondary abatement catalyst.

Hourly average measurements of stack gas volume flow, N_2O concentration and HNO_3 flow have been used to calculate daily average N_2O values (kg/$tHNO_3$). This data was recorded during the first 7 days following the installation of a new set of primary catalyst gauzes in one of the AOR systems (4th to 10th June 2010), and the daily design capacity of the plant was not exceeded on any of the 7 days. The recorded data shows an average value of 7.27kg $N_2O/tHNO_3$ and the lowest daily average value recorded during this period was 6.96kg $N_2O/tHNO_{3.}$ These values are considered to be conservative, since N_2O emissions are lowest after the installation of new primary gauzes. The data was recorded using the new EN14181-compliant Automated Monitoring System (AMS), which is a Dr Foedisch MCA 04 hot extractive analyser. This analyser successfully passed a QAL 2 test on 1st June 2010. More details on this analyser are to be found in section D.1.
In addition, an analysis was conducted to establish that the plant was operating within its normal operating parameters during the 7-day measurement period. All standard plant operating data for all 6 burners, recorded since the installation of the new AMS, was subjected to a statistical analysis and compared with the operating parameters recorded from 4th to 10th June 2010.

Analysted data: May to August 2010 (4 months)

1) Taking into account the relevant trip point parameters, an average figure was calculated for each of the operating parameters for the period May to August
2) The standard deviation of each parameter was calculated
3) Taking into account the relevant trip point parameters, an average figure was calculated for each of the operating parameters for the period 4th to 10th June
4) The two averages derived from steps 1 and 3 above were then compared to see whether the average figure for the period 4th – 10th June lay within the average for the period May to August, +/- the standard deviation.

It can be concluded from the above statistical analysis that the plant was operating within its normal operating ranges for the 7-day measurement period. Evidence of this analysis has been provided to the Determining AIE.

Lastly, the composition of the primary catalyst gauze pack installed at the beginning of June 2010 was compared with the previous pack installed in the same AOR system (system 1) back in September 2008 and it can be seen that the gauze design has not been changed. The gauze weights and compositions are of a very confidential nature, but more detailed information has been provided to the determining AIE.

This Business-as-Usual (BAU) emissions factor of 7.27kgN_2O/tHNO_3, in conjunction with the predicted abatement efficiency of the catalyst (90%), will be used in this PDD in order to make realistic assumptions on the likely factual emissions reductions that might be expected during the project.

Year	**Budgeted nitric acid production (tHNO_3/y)**	**BAU Emissions factor (kgN_2O/tHNO_3)**	**Expected BAU emissions (tCO2e/yr)**
2010 (Oct to Dec)	34.000	7,27	76.626
2011	136.000	7,27	306.503
2012	136.000	7,27	306.503
Following years	136.000	7,27	306.503

Table 1: Planned nitric acid production and estimated Business-as-Usual N_2O emissions at Köping S2

However, as a result of the very specific and unusual layout of the S2 plant and its complex gauze changeover schedule, it is extremely difficult to establish the definition of a standard production 'campaign' in accordance with AM0034. The methodology AM0034 ver 03.4 states that "the start of a campaign is characterized by the installation of a new set of primary catalyst gauzes in the oxidation reactor........the period of time beginning from the installation of a new gauze pack until the subsequent plant shut down is defined as a 'campaign"'.

However, in the case of Syra 2 the pattern is more complex: There are three sets of two ammonia oxidation reactors (a total of 6 burners), named systems 1, 2 & 3. Since all 3 systems lead jointly into 9 absorption columns and subsequently into one stack, it is impossible to monitor which N_2O emissions and which HNO_3 production can be attributed to which individual burner or system.

The primary catalyst gauzes are changed in rotation in each of these systems at intervals of several months, with each individual set of gauzes being replaced approximately once every two years.

In order to overcome the difficulty of defining one 'production campaign' and to ensure conservativeness throughout the project, the conservative IPCC default emissions factor for N_2O from nitric acid plants that have not installed destruction measures - 4.5kg N_2O/tHNO_3 – shall be applied for the proposed project[11]*. Thus, the lowest and most conservative value for an N_2O emissions factor within the nitric acid industry (and one that is moreover suggested as a fallback value in case of missing data according to AM0034) shall serve as the baseline Emissions Factor for the project at Köping S2.*

Accordingly, the **following assumptions** apply to the establishment of the emissions reductions eligible to receive ERUs:

- The project activity starts on 1st October 2010;
- YARA Köping S2 produces the amounts of nitric acid according to the production budget provided above, each year's production being equally distributed throughout the period;
- The secondary catalyst employed performs with an expected abatement efficiency of 90% throughout the project's lifetime (resulting in an average project emissions factor of 0.727kgN_2O/tHNO_3).

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[11] The actual specified default value is 5kg N2O/tHNO3, but there is a 10% variability factor that should be deducted.
Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 3: Chemical Industry Emissions, paragraph 3.3.2.2, table 3.3.

- The ERU figures included in this PDD are *estimations* only. ERUs will therefore be awarded for those factual emissions reductions actually achieved below the IPCC default emissions factor and subsequently verified by the responsible AIE, and *not* in accordance with the preliminary estimations provided in this PDD.

In the case of introduction of national or local regulations that would limit N_2O emissions at Köping S2, ERUs would be awarded only for those emissions reductions that take place below the new regulatory level, in accordance with the Methodology AM0034 ver 03.4.

The following tables 2 and 3 display the emissions reductions expected during the crediting period, below the default baseline emissions factor of 4.5kg $N_2O/tHNO_3$. However, a communication from the Swedish Environmental Protection Agency, dated 13/08/2010, states that the Syra 2 plant will be required to comply with any applicable BAT reference value from 1st January 2013. There is currently no applicable BAT reference value for atmospheric pressure nitric acid plants, but should such a value be introduced, then the figures in Table 3 part B will be adjusted accordingly.

Please note that all figures in the calculation tables have been rounded to the nearest tonne of CO2e. In view of the fact that the figures link directly to a detailed excel spreadsheet, the final total may not accord completely with the preceding figures.

Crediting Period (year)	**Estimate of annual emissions reductions in tonnes of CO2 equivalent**
2010 (Oct to Dec)	39.767
2011	159.070
2012	159.070
Total estimated emission reductions over the crediting period until end 2012 (tonnes of CO2 equivalent)	**357.907**
Annual average of estimated emissions reductions over the crediting period until end 2012 (tonnes of CO2 equivalent)	**159.070**

Table 2 (part A): Estimated emission reductions until 2012

Crediting Period (year)	**Estimate of annual emissions reductions in tonnes of CO2 equivalent**
2013	152.912
2014	152.912
2015	152.912
2016	152.912
2017	152.912
2018	152.912
2019	152.912
2020	114.684
Total number of crediting years	**10**
Total estimated emission reductions over the 10-yr crediting period (tonnes of CO2 equivalent)	**1.542.976**
Annual average of estimated emissions reductions over the 10-yr crediting period (tonnes of CO2 equivalent)	**154.298**

Table 3 (part B): Estimated emission reductions from 2013 onwards.

* Due to the likely inclusion of N_2O emissions emanating from nitric acid production into the EU ETS from 1st January 2013 onwards, the project may not be eligible to earn ERUs after that time, or continuing the project under the JI may not be economically viable. Also, from 2013 onwards a GWP of 298 for N_2O, as defined by the IPCC Third Assessment Report, will be applied. This is why this PDD differentiates between prospective emission reductions achieved until 31st December 2012 and emissions reductions generated from 1st January 2013 onwards.

A.5. Project approval by the Parties involved:

The Swedish government has decided that JI projects to be undertaken on Swedish territory should be implemented in accordance with the JI Track 2 procedures. The project proponents submitted on 12th October 2009 a Project Idea Note (PIN) to the Swedish DFP (Swedish Energy Agency) and requested a Letter of Endorsement (LoE). The DFP issued a LoE for the project on 11th November 2009, stating that they do not have any objections to the realisation of the planned JI project.

A final decision by the DFP regarding approval of the JI project (in the form of an official Letter of Approval) will be taken only after the final PDD and Determination Report have been submitted to the DFP.

Once approval is received from the host country DFP, the project participants will apply for an investor country LoA.

A copy of both host and investor country LoAs will be made available to the determining AIE and the project documentation will then be submitted to the JI Supervisory Committee for approval and final registration of the project.

SECTION B. Baseline

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

Applicability of Methodologies

The project will largely be based on the CDM methodology AM0034 ver 03.4, which is applicable to project activities aiming to install secondary N_2O abatement catalyst at a nitric acid plant. The participants also refer to CDM methodology AM0028 (Version 04.2) for the baseline scenario selection and the calculation of project emissions.

However, as is permitted under JI, the project participants have chosen to take a JI-specific approach in some areas of project implementation, where the application of AM0034 was not appropriate. Further details of these JI-specific approaches are addressed below in the table under 'Explanation and Justification for deviations from AM0034'.

YARA Köping S2 consists of three sets of two ammonia burners feeding into nine absorption columns. The off-gasses are emitted through one tail gas stack. The secondary N_2O catalyst system will be inserted into the ammonia reactors during a routine shut down; the abatement system is installed underneath the primary catalyst gauzes. This corresponds to the defined scope of the methodology AM0034 (ver 03.4).

Furthermore, the following applicability criteria of the above methodology are met by the proposed project activity:

1. The proposed project activity will be applied to a production facility that was operated for commercial nitric acid production before the 31st December 2005 (based on design capacity installed).

   The S2 nitric acid plant was commissioned in 1955, when it started operating with four ammonia burners. An additional 2 burners were installed in 1969, but the basic plant design has not been modified since then. The daily design capacity of the plant is 400tHNO_3/day. Since the plant operates for around 348 days per year, the annual capacity of the plant is considered to be 139,200 tHNO3.
2. Currently, no N_2O abatement technology is installed in the plant that could be affected by the project activity.

   No N_2O abatement technology is currently installed at the plant.
3. The project activity has no influence on the plant's nitric acid production levels.

   The plant's production levels are not expected to be significantly affected by the installation of the secondary N_2O catalyst[12].
4. The host country does not have any legal requirements to reduce N_2O emissions from nitric acid plants.

   Swedish environmental legislation, be it on national or local level, currently does not limit N_2O emissions.
5. The project activity will not increase NO_X emissions.

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[12] This was confirmed by the catalyst manufacturer in official correspondence dated 23.02.2010. The relevant information was made available to the determining AIE. Please also see the European IPPC Bureau publication „Integrated Pollution Prevention and Control; Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilizers (August 2007), page 124 therein.

The secondary catalyst technology to be installed has no effect on NO_X emission levels[13]. In addition, the regular and compulsory NO_X tests conducted by YARA, and reported to the responsible local environmental authority, would reveal any changes in NO_X emission levels.

6. There is no NSCR De-NO_x unit installed in the plant.

   No NSCR technology is installed at the plant. The plant is in compliance with its NO_X emission limits, thanks to its existing SCR de-NOx unit.

Explanation and Justification for deviations from AM0034

The following aspects of the approved CDM baseline & monitoring methodology AM0034, version 03.4, “Catalytic reduction of N2O inside the ammonia burner of nitric acid plants” are either not applied or applied in a modified manner:

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[13] This was confirmed by the catalyst manufacturer in official correspondence dated 23.02.2010. The relevant information was made available to the determining AIE. Please also see the European IPPC Bureau publication „Integrated Pollution Prevention and Control; Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilizers (August 2007), page 124 f. therein.

Project Implementation Aspect	**AM0034**	**Adjustment in JI project specific context**	**Explanation / Justification**
Continuous N_2O measurement	Continuous measurements of N_2O concentration & total gas volume flow are carried out in the stack prior to the installation of the secondary catalyst for one campaign	No continuous measurement of N_2O concentration & total gas volume flow is necessary prior to the installation of the secondary catalyst	In order to overcome the difficulty of defining one production campaign (as explained in A.4.3.1), the project proponents are taking a project-specific approach to the determination of the baseline emissions factor. The conservative lowest IPCC default emissions factor for N_2O emissions from nitric acid plants will be applied as the baseline emissions factor, and therefore the measurement of N_2O concentration & total gas volume flow in the stack for one campaign prior to the installation of secondary catalyst is no longer necessary.
Baseline campaign	Baseline emissions established based on distinct baseline campaign.	The IPCC default emissions factor for N_2O emissions from nitric acid plants is used for determining the baseline emissions factor	For establishing the baseline, a project-specific approach has been adopted: the conservative IPCC default emissions factor for N2O from nitric acid plants that have not installed destruction measures - 4.5kg N2O/tHNO3 – shall be applied for the proposed project. However, in order to show that historic plant emissions are higher than the default emissions factor, a 'Business-as-Usual' (BAU) emissions factor has been defined. See section A.4.3.1 for details.
Baseline Emissions	Baseline Emissions are based on the factual business as usual emissions.	The IPCC default value is applied as the Baseline Emissions Factor for assessing the amount of emission reductions for which ERUs will be allocated.	In order to overcome the difficulty of establishing the definition of one 'production campaign' at Syra 2 (as explained in section A.4.3.1), this alternative approach for establishing the assumed baseline scenario ensures conservativeness. The chosen value is the lowest and most conservative value for an N_2O emissions factor within the nitric acid industry, and one that is moreover suggested as a fallback value in case of missing data according to AM0034.

Permitted range of operational parameters	These are established in order to prevent “baseline gaming” (i.e. manipulation of baseline emissions) by plant operators aiming to unduly increase their emission reduction potential.	No permitted range of operational parameters is established.	In theory, a plant operator could increase N_2O emission levels by modifying the plant’s operational parameters (e.g. increasing the ammonia to air ratio). This would unduly increase the emission reduction potential of the project activity, because baseline emissions would not represent the business-as-usual scenario. As no baseline campaign is measured, but the baseline emissions factor is instead based on the conservative IPCC default emissions factor, there is no possibility for the operator for ‘baseline gaming’.
Statistical Analysis of baseline and project emissions data	Collected baseline and project campaign data is subject to statistical analysis in order to eliminate values which are not representative for standard plant operation.	No statistical analysis of baseline and project emissions is undertaken.	As no baseline campaign is measured, there is no baseline campaign data that could be subject to statistical analysis. Project emissions are calculated based on Verification Periods and not on standard production campaigns (see ‘Monitoring periods based on campaigns’ below). In order to ensure a conservative approach in this context, project emissions will be calculated in accordance with the methodology AM0028, which advocates calculating emissions on an hourly basis (and not on a campaign basis with statistical analysis).
Calculation of project emissions	Project campaign data is subject to statistical analysis in order to eliminate values which are not	No such step is undertaken.	In order to ensure conservativeness (since project emissions are calculated based on verification periods and not on standard production campaigns), project emissions will be calculated in accordance with the methodology AM0028. Emissions will be calculated on an hourly basis, using hourly average values for NCSG and VSG.

	representative for standard plant operation.		
Cap on baseline campaign length	Maximum allowable nitric acid production is capped for the baseline campaign.	No baseline campaign is conducted.	In an AM0034 project, baseline emissions could be increased by extending the baseline campaign beyond its business-as-usual production. This is due to N_2O emission levels generally increasing the longer a primary catalyst gauze is used. In the project-specific scenario, no baseline campaign is conducted.
Deduction of AMS uncertainty from baseline emissions factor	Combined uncertainty for all parts of the AMS is deducted from EF_{BL}.	Uncertainty is not taken into account.	No baseline campaign is conducted and emission reductions achieved by the project will not be assessed based on measured factual baseline emissions, but on the non-measured IPCC default value instead. Applying uncertainty is not appropriate, as the IPCC default emissions factor is already sufficiently conservative.
Recalculation of EF_{BL}-value in case of shorter project campaign.	In case a project campaign is shorter than the baseline campaign, EF_{BL} is re-calculated for that campaign.	Recalculation of the EF_{BL} in case of shorter project campaign is not applicable.	EF_{BL} is not determined based on the factual emissions of the plant measured during one campaign, but using a fixed default value as described above.
Monitoring Periods based on campaigns	Verifications can only be undertaken for full campaigns, not merely for parts of campaigns.	This restriction does not apply.	Under AM0034, emission reductions are assessed by comparing project campaign emissions to those of the baseline campaign. Due to the modification of not assessing emission reductions based on factual emissions (and thus not being dependent on a baseline campaign) and also due to the difficulty of defining a campaign in the context of the more complex plant layout,

			emission reductions can also be determined for parts of campaigns. This will be defined as a ‘Verification Period’.
Moving Average Emissions Factor	Project emissions are compared to the average emission factor of all previous project campaigns (of the first 10 campaigns only). The higher value applies for calculating emission reductions.	This step is not being applied.	Since this project is calculating emissions reductions based on verification periods and not on standard production campaigns, this measure is not appropriate. Since primary catalyst gauzes will be of varying ages during each verification period, the EFn value can vary significantly and thus the moving average emissions factor will lead to unrealistic and unrepresentative emissions factors.
Minimum project emissions factor after 10th campaign	No project emissions factor after the 10th project campaign may be higher than the lowest recorded during these campaigns.	This restriction does not apply.	Since this project is calculating emissions reductions based on verification periods and not on standard production campaigns, this measure is not appropriate. Since primary catalyst gauzes will be of varying ages during each verification period, the EFn value can vary significantly and thus the minimum project emissions factor will lead to unrealistic and unrepresentative emissions factors.

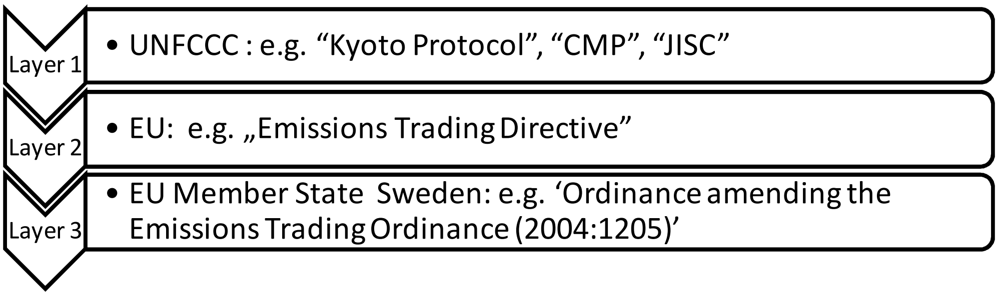
AMS downtime	AM0034 states: In the event that the monitoring system is down, the lowest between the conservative 4.5 $kgN_20/tHNO_3$ IPCC default factor or the last measured value will be valid and applied for the downtime period for the baseline emission factor, and the highest measured value in the campaign will be applied for the downtime period for the campaign emission factor.	In the case of a period of AMS downtime that constitutes a malfunction of the AMS, the missing data from the relevant hour should be replaced with either a) the highest value measured during the whole of the relevant verification period or b) the highest value measured during the whole of the previous complete verification period, whichever is the higher. The assessment should be based on values measured during periods of standard AMS operation and recording after elimination of mavericks. This replacement of missing data will be done on the basis of hourly average values. In the case of equipment	Firstly there is no distinction between downtime during the baseline and downtime during the project, since no baseline is being measured. The sentence regarding application of the conservative 4.5 $kgN_20/tHNO_3$ IPCC default factor or the last measured value is therefore not applicable. Secondly, AM0034 does not distinguish between times when the AMS was malfunctioning and periods of standard calibration. The approach taken here differentiates between these two scenarios. In addition, the approach taken here with regard to replacement values during the project is more conservative, since it recommends using the highest value measured - either during the relevant verification period or during the whole of the previous complete verification period, whichever is the higher.

		downtime due to a routine calibration for any part of one hour, the hourly average value will be calculated pro-rata from the remaining available data from the hour in question. If the remaining available data from that hour constitutes less than 2/3 of the hour (less than 40 minutes), that hour should be considered missing. Each time it is impossible to calculate one hour of valid data, substitute values should be used instead of the missing hour for the further calculations of emissions reductions. As a substitute value, the last valid hourly average value before the calibration will be used for the calculation of emissions reductions.	

Regulatory framework

The regulatory framework for implementing JI projects in Sweden is influenced by several acts of law. The fundamental framework is provided by the Kyoto Protocol to the United Nations Framework Convention on Climate Change (“UNFCCC”) and subsequent decisions by UNFCCC-entities, most importantly the decisions of the Conference of the UNFCCC Parties serving as the Meeting of Parties to the Kyoto Protocol (“CMP”) and the Joint Implementation Supervisory Committee (“JI SC”).

In addition, there is the European Union legislation adapting the Kyoto JI framework for application in its member states such as the Emissions Trading Directive[14], the Linking Directive[15] and various JI relevant decisions by EU bodies[16]. Besides acts of law of direct relevance, there are also Directives that have an indirect influence on JI implementation such as the IPPC Directive[17].
EU Directives do not entail direct consequences on private entities located in the EU member states. In order to be enforceable on member state level, they generally have to be transformed into national legislation by the respective member state. These national transformation acts, as well as other national legislation, are the third layer of the regulatory framework relevant for JI project implementation. In Sweden, the most relevant transformation laws are the ‘Ordinance amending the Emissions Trading Ordinance (2004:1205)’, dated 31st August 2006, and the ‘Regulation concerning project based mechanisms under the Kyoto Protocol’, dated 18th October 2006.
Sweden has opted to follow JI Track 2 for the implementation of its JI projects.



llustration: Three layers of jurisdiction relevant for the implementation and subsequent operation of N2O nitric acid JI projects in Sweden

This project is based on Approved Baseline and Monitoring methodology AM0034 (Version 03.4): “Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants”.

Furthermore, the project draws on approved methodology AM0028 (Version 04.2) for the baseline scenario selection and employs the “Tool for the demonstration and assessment of additionality” (Version 05.2). Furthermore, AM0028 (version 04.2) will also be used for the calculation of project emissions.

Identification of the baseline scenario

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[14] 2003/87/EC, published on the internet under http://ec.europa.eu/environment/climat/emission/implementation_en.htm

[15] 2004/101/EC, published on the internet under http://ec.europa.eu/environment/climat/emission/implementation_en.htm

[16] Such as the Double Counting decision 2006/780/EC, published on the internet under http://ec.europa.eu/environment/climat/emission/pdf/l_31620061116en00120017.pdf

[17] 2008/1/EC, published on the internet under http://ec.europa.eu/environment/air/pollutants/stationary/ippc/index.htm

The approved baseline methodology AM0034 (Version 03.4) refers to AM0028 (Version 04) with regard to the identification of the baseline scenario. Furthermore, the following steps are based on the "Combined Tool to identify the baseline scenario and demonstrate additionality" (Version 02.2)[18].

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

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

Step 1a:_The baseline scenario alternatives should include all possible options that are technically feasible to handle N_2O emissions. These options are, inter alia:

- Status quo: The continuation of the current situation
- Switch to alternative production method not involving ammonia oxidation process;
- Alternative use of N_2O such as:
    - Recycling of N_2O as a feedstock for the plant;
    - The use of N_2O for external purposes.
- Installation of a Non-Selective Catalytic Reduction (NSCR) DeNOx unit;
- The installation of an N_2O destruction or abatement technology:
    - Tertiary measure for N_2O destruction;
    - Primary or secondary measures for N_2O destruction or abatement.

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

1.1 Assessment and continuation of the current situation, the "Status Quo"

There is currently no N_2O abatement technology installed in the plant and Yara Köping S2 would not invest in any N_2O abatement technology in the future in the absence of any regulations restricting N_2O emissions at the plant.

1.2 Switch to alternative production method not involving ammonia oxidation process

Changing the production process would require setting up a new production facility, because the present plant cannot be amended to employ a different production procedure. Choosing another production procedure would also not be state-of-the-art, because the current operating procedures are the most advanced available.

1.3 Alternative use of N2O, such as:

- Recycling of N2O as a feedstock for the plant

  The use of N_2O as a feedstock for the production of nitric acid is not feasible, because it is not possible to produce nitric acid from N_2O at the quantities emitted during nitric acid production.

- The use of N2O for external purposes

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[18] AM_Tool_02, provided by the CDM EB in its 28th Meeting; published on the UNFCCC web site under http://cdm.unfccc.int/Reference/tools/index.html

> The use of N_2O for external purposes is not practised anywhere in the world, as it is technically and economically unfeasible. The quantity of gas to be used as a source is enormous compared to the amount of nitrous oxide that could be recovered. The average N_2O concentration in the tail gas of the Köping S2 plant during standard operation without any abatement catalyst would be between 700 and 800 ppmv[19], which is considered far too low to economically recover and separate from the tail gas.

1.4 Installation of a Non-Selective Catalytic Reduction (NSCR) De-NOx unit (step 1b);

The NSCR scenario alternative could be triggered by NO_X regulation. From this perspective, YARA Köping S2 could be forced to reduce N_2O in a business as usual scenario if NO_X regulation forced the plant operators to install NSCR technology. Such technology would be useful for reducing NO_X emission levels, but would also lower N_2O emissions.

However, the installation of a Non-Selective Catalytic Reduction (NSCR) de-NO_X catalyst unit is uneconomic, because YARA Köping S2 is already in compliance with the prevailing NO_X regulations[20]. The EFMA BAT reference document explains that an NSCR functions by injecting hydrogen, natural gas or hydrocarbons over a precious metal based catalyst, leading to high investment and operational costs. The use of hydrocarbons as a reducing agent also results in emissions of carbon monoxide, CO_2 and unburned hydrocarbons. Also, NSCR units require very high tail gas temperatures to be able to function. By being led through the absorption tower the gas mix has been cooled down to a temperature level below that required for NSCR abatement catalysts to function[21]. Because of this, an NSCR abatement system would only work if the stack gas mix is re-heated[22].

If even lower NO_X levels were introduced, the most economical option would instead be to upgrade the existing SCR NO_X abatement unit already installed at the plant. The current NOx emissions limit applicable at YARA Köping S2 since the 17th June 2010 is 130ppm[23], while the plant's average NOx emissions are 128ppm[24]. The regulatory level would therefore need to be lower in order to enforce any significant additional adaptation requirements upon the plant.

As the existing SCR-NO_X abatement system is already very efficient, there would be no point in also installing NSCR, even if this technology were considered an alternative option.

Therefore, at this stage, baseline scenarios 1.2, 1.3 & 1.4 can be excluded from further assessment.

1.5 Implementation of primary, secondary and tertiary technologies

The primary catalyst composition is the most significant factor in determining nitric acid production efficiency and is carefully calculated to ensure a maximum production of HNO_3 at minimum cost: it is not an N_2O reduction technology.

Tertiary measures may be considered when building a new plant, but installation in an existing plant is rarely an economical option. It is necessary to install a complete additional reactor between the

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[19] Based on N_2O emissions data measured during the first week following installation of new gauzes in June 2010.

[20] Environmental permit 'M 481-09', dated 17th June 2010 (page 2 therein)

[21] NSCR abatement catalysts require a gas mix temperature of around 550°C in order to operate effectively; see the booklet no. 2 of the European Fertilizer Manufacturers Association (EFMA), published in the internet under http://www.efma.org/EPUB/easnet.dll/ExecReq/Page?eas:template_im=000BC2&eas:dat_im=000EAE (page 17 therein) for further information.

[22] For other disadvantages of NSCR technology see the EFMA-booklet published on the internet under http://www.efma.org/EPUB/easnet.dll/ExecReq/Page?eas:template_im=000BC2&eas:dat_im=000EAE (page 18 therein).

[23] Environmental permit 'M 481-09', dated 17th June 2010 (page 2 therein)

[24] Average NOx emission measurements taken during the period January 2008 to October 2009

absorption column and the tail gas stack in order to house the catalyst. Since the temperature of the tail gas after the absorption column is around 25°C, the tail gas would need to be re-heated to a temperature high enough for the tertiary catalyst to function. Both these requirements mean that tertiary catalyst is ultimately considerably more expensive than secondary catalyst and a longer period of plant downtime is necessary in order to install the additional reactor[25].

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

- The continuation of the current situation, where either a DeNOx-unit is installed or not;

  An SCR De-NOx unit is installed at the plant.

- Installation of a new Selective Catalytic Reduction (SCR) DeNOx unit;

  As mentioned above in section 1.4 of Step 1a, the SCR is functioning efficiently enough to satisfy the plant's applicable NOx regulations. The plant would therefore not consider the installation of a new unit.

- Installation of a new Non-Selective Catalytic Reduction (NSCR) DeNOx unit;

  The installation of a Non-Selective Catalytic Reduction (NSCR) de-NO_X catalyst unit is uneconomical, for the reasons explained in section 1.4 of Step 1a above.

- Installation of a new tertiary measure that combines NO_X and N_2O emission reduction.

  The installation of a new tertiary measure is uneconomical, for the reasons explained in sections 1.4 and 1.5 of Step 1a above.

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

There are currently no national and no regional regulatory restrictions for YARA Köping S2 in Sweden regarding N_2O emissions.

The only current requirement regarding N_2O emissions imposed by the Swedish Environmental Protection Agency ('Naturvårdsverket') is that emissions must be reported once a certain threshold is exceeded. In the case of Yara Köping, the combined N_2O emissions from plants Syra 2 and Syra 3 must be reported to the EPA if they jointly exceed 10,000kg/year. Since the quantity of N_2O emitted by both plants is far above this threshold, Yara Köping reports its emissions each year and the figures are made publicly available in the 'Pollutant release and transfer registry' on the Naturvårdsverket website[26]. The reported emissions figures have been made available to the determining AIE.

Additionally, the plant was issued with a new environmental permit number M 481-09 on the 17th June 2010. This permit does not contain any regulatory limits on N_2O emissions at Köping S2 and as such, does not represent any obligation or incentive for the plant to reduce its emissions at the present time. However, as part of the discussions between the Swedish Environmental Protection Agency and Yara

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[25] Footnotes 21 and 22 also tend to apply to tertiary catalysts, depending on the exact type.

26 http://kur.naturvardsverket.se:7001/kur/search/simple/load.do#1910?locale=en

Köping in the period leading to the issuance of the new permit, Köping S2 undertook to reduce its emissions in the year 2013 to the level of any IPPC BAT reference value for atmospheric plants that may be applicable at that time.

NO_X-emissions are also regulated by the new environmental permit for the YARA Köping S2 plant, number M 481-09, dated 17th June 2010. According to this document, the permitted level is now 130ppm, applied as a monthly average value. According to readings taken with the Rosemount Gaslog analyser during 2008 and 2009[27], the plant is in compliance with these requirements. The measurements during this period show an average concentration of 128ppm.

YARA Köping S2's NO_X emissions will remain constant and in compliance with the regulatory limit also after the installation of the secondary catalyst. NOx emissions at Köping S2 are reported to the municipal authorities once per month and the national authorities (Länsstyrelse and naturvårdsverket) once per year.

In consequence, all scenarios are in compliance with all applicable laws and regulatory requirements.

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

At the next step, baseline alternatives that face prohibitive barriers are eliminated from the further baseline identification process (barrier analysis).

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

Barriers include:

Investment barriers

The investment barriers analysis asks which of the remaining scenario alternatives is likely to be prevented by the costs associated with it becoming reality. The assumption is that these scenarios would be unlikely to be the business as usual scenario.

None of the N_2O destruction technology options (including NSCR) are expected to generate any financial or economic benefits other than JI-related income. Their operation does not create any marketable products or by-products. Plant operators would face significant investment requirements if they decided to install N_2O abatement (including NSCR) technology. Unless there is a legal obligation to reduce N_2O emission levels (NO_X limits already being complied with), there is no need to overcome these barriers. See step 1 (1.4) above for additional information on investment barriers facing NSCR technology.

Any operator willing to install and thereafter operate N_2O abatement technology under the JI faces significant investment and additional operating costs:

The proposed project activity aims to install and operate 6 batches of secondary catalyst technology at the plant throughout the crediting period. In order to assess the project emissions, an Automated Monitoring System (AMS) has to be installed and operated. In addition to the initial investment for the 6 batches of catalyst material and a suitable AMS, Köping S2 employees and management will have a significant additional work load to cope with in order to initiate the project activity and maintain it for the project's lifetime. Required training for AMS operation has to be undertaken by the responsible staff, and AMS calibration and other JI Project-related audits have to be arranged, facilitated and paid

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[27] NO_X-readings were provided to the AIE during the on-site Determination.

for. The table below shows an approximate cost analysis from the start of the project until the end of 2012. Please note that many of these costs are only estimates, based on experience at similar projects:-

Estimated costs Syra 2 JI Project:		
Secondary catalyst:	€	900,000
AMS and installation:	€	150,000
Basket/burner modifications:	€	200,000
QAL2 audit	€	20,000
QAL3	€	45,000
AST x 2	€	20,000
Determination:	€	20,000
Verifications:	€	80,000
Approx total until 2012:	**€**	**1,435,000**

Only the revenues from ERU sales would therefore be sufficient to pay back the investment costs of the project activity. The registration of the project activity as a JI Project is therefore the decisive factor for the realisation of the proposed project activity.

For all these reasons, the only alternative that does not face significant investment barriers is 1.1, the “continuation of the status quo”.

Technological barriers

Firstly, sufficient infrastructure does exist to enable the implementation of the secondary catalyst, and Yara personnel are suitably skilled to operate this technology.

However, any of the available N_2O abatement technologies would have to be integrated into the nitric acid plant. Primary abatement technologies would be installed inside the ammonia oxidation reactor where they may, if not correctly designed and installed, interfere with the nitric acid production process by causing a deterioration of product quality or a loss of production output. Tertiary measures require the installation of a complete reactor between the absorption column and the stack, as well as a re-heating system, which may cause significant downtime of the plant during construction and commissioning.

Since very little experience exists with implementing secondary abatement technologies in atmospheric pressure nitric acid plants, the technological risks are more significant than with medium and high pressure plants. When a bed of secondary catalyst is installed inside the burner, it is more likely that the plant will encounter problems associated with pressure drop. This is especially the case where the bed depth is very limited (as is the case at S2). This may affect the gas flow through the burner, potentially lowering nitric acid production yields.

It is therefore unlikely that any plant operator would be willing to confront these possible technical risks and install such technologies on a voluntary basis without the incentive of any regulatory requirements (emissions caps) or financial benefits (such as revenues from the sale of ERUs).

Barriers due to prevailing practice

This test reconfirms the previous assessments: If the steps taken so far have led to the conclusion that one or more baseline scenario alternatives meet investment related or technological barriers, these scenarios should be excluded. Of course, similar plants that gain ERU or CER revenues by participating in the JI or CDM, and can thus overcome the identified barriers by using the additional financial means available, are not to be taken into account.

So far, secondary catalyst technology has only been operated in some European countries on an industrial trial basis. Researching this technology made sense due to the prospective revenues obtainable under the Kyoto Protocol's Clean Development Mechanism (CDM), by employing it in nitric acid plants located in developing nations on a voluntary basis. Also, it is expected that N_2O emissions from nitric acid production may be included in the European Union Emissions Trading Scheme ("EU ETS")[28] from 2013 onwards or regulated otherwise. Both aspects provided some incentive for developing N_2O abatement technology.

However, since there are only two atmospheric plants out of more than 100 in the world that have so far decided to install secondary catalyst technology, this can by no means be considered common practice in the industry.

For European nitric acid producers, the only incentive to operate such technology before the likely inclusion of N_2O emissions into the EU ETS from 2013 onwards is to take advantage of the incentives available under the Kyoto Protocol's Joint Implementation ("JI") mechanism. While this option has in principle been available since the beginning of 2008, EU member states took some time developing a coherent policy approach on whether or not to allow JI participation in their respective territories, and if so, under which conditions. This process has not been fully completed yet.

JI projects in medium and high pressure plants are currently being developed across the EU, e.g. Poland, Lithuania, Hungary, Romania, Bulgaria, France, Finland and Germany. Only one atmospheric pressure plant (in Germany) is undertaking a JI N_2O-reduction project.

All scenarios, with the exception of the continuation of the "Status Quo", face significant investment barriers, as well as some technological and common practice barriers, and therefore have to be excluded from further analysis.

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

The only scenario that does not face any technical, investment or common practice barriers and that is in compliance with all applicable regulations is the continuation of the present situation, the 'Status Quo': the continued operation of the plant without installing any N_2O reduction technology.

Step 4: Identify the most economically attractive baseline scenario alternative

The most economically attractive baseline scenario alternative is the continuation of the present situation: the operation of the plant without any abatement technology installed.

Sub-step 4a: Determine appropriate analysis method:

Since the implementation of the proposed project activity will generate no financial or economic benefits other than JI-related income, a simple cost analysis (Option 1) shall be applied.

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[28] See footnote 10

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

As described in Sub-step 3a above, any operator willing to install and thereafter operate N_2O abatement technology under the JI faces significant investment and additional operating costs:

The plant must make significant initial investments for installation of the expensive secondary catalyst material and a sophisticated Automated Monitoring System (AMS). In addition, required training for AMS operation has to be undertaken by the responsible staff, and AMS calibration and other JI Project-related audits have to be arranged, facilitated and paid for.

Only the revenues from ERU sales would therefore be sufficient to pay back the investment costs of the project activity.

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

At the start of a crediting period, a re-assessment of the baseline scenario due to new or modified NOx or N_2O emission regulation should be executed as follows:

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

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

- Selective Catalytic Reduction (SCR);
- Non-Selective Catalytic Reduction (NSCR);
- Tertiary measures incorporating a selective catalyst for destroying N_2O and NO_X emissions;
- Continuation of baseline scenario.

For the determination of the adjusted baseline scenario, the project participant should re-assess the baseline scenario and should apply the baseline determination process as stipulated above (Steps 1 – 5).

Sub Step 5b: New or modified N_2O regulation

If legal regulations on N_2O emissions are introduced or changed during the crediting period, the baseline emissions shall be adjusted at the time the legislation has to be legally implemented.

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:

In this step, the JI project's additionality is ascertained. Project proponents need to demonstrate that the intended JI activity could only be realised if ERU sales revenues were available to offset the investments to be made. Because the project has no revenues other than JI-related revenues, a simple cost analysis is sufficient for demonstrating the project's additionality[29].

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[29] See the "Tool for the demonstration and assessment of additionality" (Version 05.2); CDM EB 39th Meeting Report, Annex 10; published under http://cdm.unfccc.int/EB/039/eb39_repan10.pdf.

The proposed project activity aims to install 6 batches of secondary catalyst technology at the plant (a total of approximately 6.1 tonnes) and to operate this catalyst throughout the crediting period. In order to assess the project emissions, an Automated Monitoring System (AMS) has to be installed and operated. In addition to the initial investment for the catalyst, YARA Köping S2 employees and management will have a significant additional work load to cope with in order to initiate the project activity and maintain it for the project's lifetime. The required training for catalyst and AMS operation has to be undertaken by the responsible staff, and the regular AMS calibration and other JI-related audits have to be arranged, facilitated and paid for.

As previously assessed, YARA Köping S2 has no need to invest in any N_2O destruction or abatement technology at present and so the identified baseline scenario alternative (the operation of the nitric acid plant without an N_2O abatement catalyst) would not incur any additional costs.

Revenues from the sale of ERUs are the only source of income that would be generated by the project activity.

In consequence, no income other than ERU sales revenues could be used to pay back the investment costs. The registration of the project activity as a JI Project and the resulting expected ERU revenues are the single source of project revenues. JI registration is therefore the decisive factor for the realisation of the proposed project activity.

The proposed JI project activity is undoubtedly additional, since it passes all the steps of the Additionality assessment, as defined by section B.2 above.

The identification of the baseline scenario and assessment of additionality should be re-conducted following any changes in legislation that may affect the JI project activity.

Conclusion

Köping S2 currently has no need to make any investment to decrease its N_2O emissions. Without the revenues from the sale of the ERUs generated by the project activity there would be no incentive to justify the additional cost and technical risks associated with the implementation of the project activity. The project activity would not take place without the revenues from the sale of ERUs and therefore JI Project registration is the decisive factor for the realisation of the proposed project activity.

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

The project boundary entails all parts of the nitric acid plant in so far as they are needed for the nitric acid production process itself. With regard to the process sequence, the project boundary begins at the ammonia burner inlets and ends at the tail gas stack. If and when installed, any form of NO_X-abatement device, such as the SCR unit, shall also be regarded as being within the project boundary, since this does not reduce N_2O emission levels.

The flow chart below provides an overview of the plant's process flow:

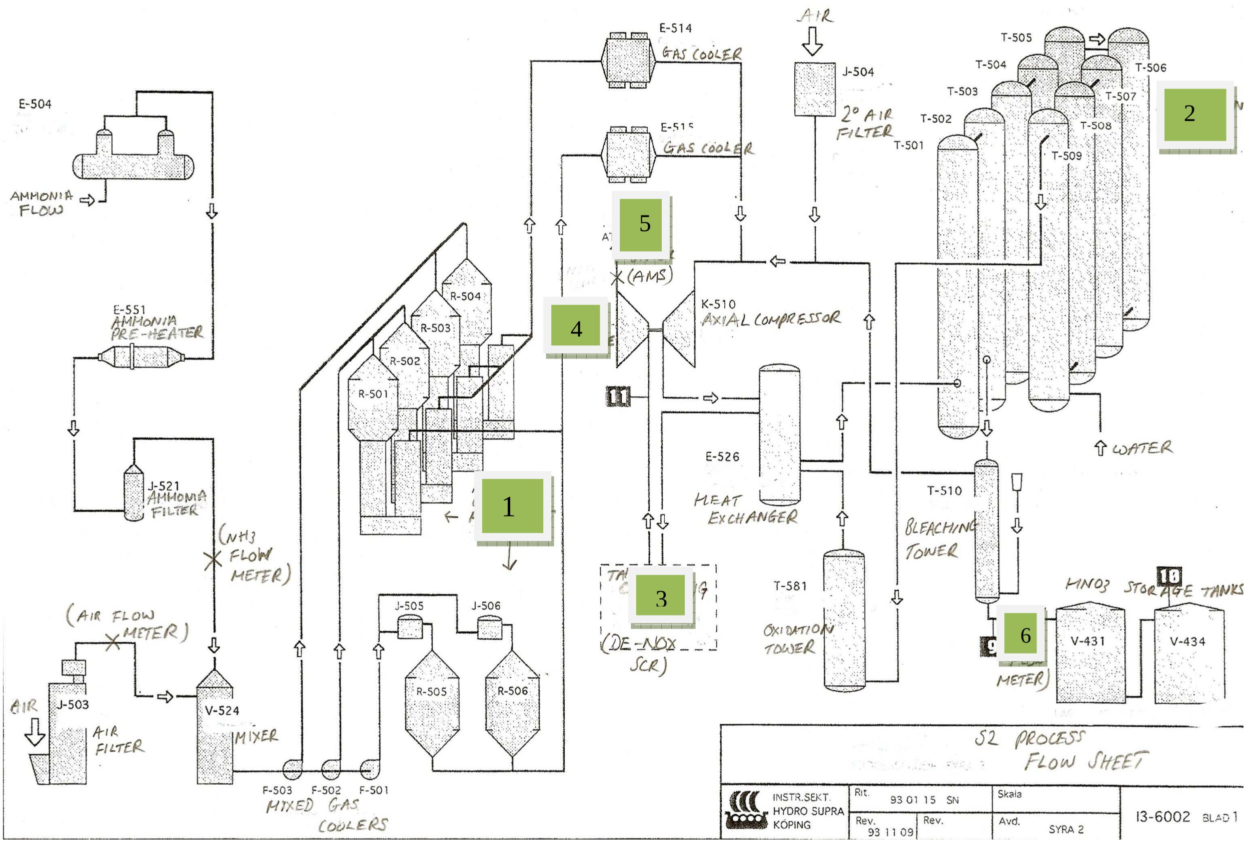

Illustration: Flow chart for the YARA Köping S2 nitric acid plant.

1 = Ammonia Oxidation Reactors (AORs)

2 = Absorption Columns

3 = SCR De-NOx reactor

4 = Tail gas turbine

5 = Tail gas stack (and N_2O concentration & Tail gas flow measurement points)

6 = HNO_3 flow measurement device

An overview of all emission sources within the project boundary is provided below:

	Source	**Gas**	**Included?**	**Justification / Explanation**
Baseline	Baseline Emissions Factor - IPCC conservative N_2O default emissions factor for	CO_2	Excluded	The process does not lead to any CO_2 or CH_4 emissions and therefore these are not included
		CH_4	Excluded	

	nitric acid plants	N_2O	Included	
Project Activity	Nitric Acid Plant (Burner Inlets to Stack)	CO_2	Excluded	The process does not lead to any change in CO_2 or CH_4 emissions
		CH_4	Excluded	
		N_2O	Included	
	Leakage emissions from production, transport, operation and decommissioning of the catalyst	CO_2	Excluded	No leakage emissions are expected.
		CH_4	Excluded	
		N_2O	Excluded	

Table 4: Overview of all emission sources within the project boundary

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

Date of baseline setting: 01/03/2010

The baseline is set by Mrs Rebecca Cardani-Strange of N.serve Environmental Services GmbH. N.serve is a Project Participant listed in Annex 1.

There is no measured historic baseline for this project, as explained in section A.4.3.1 above, but the conservative IPCC default emissions factor for N_2O emissions from nitric acid plants will be used as the Baseline Emissions Factor to determine the amount of ERUs to be awarded to the project.

However, a ‘Business-as-Usual emissions factor’ of 7.27kgN_2O/tHNO_3 has been used for estimating in this PDD the factual expected emission reductions that will result from the project activity. This factor is based on hourly average data recorded at the plant during a period of 7 days following the installation of a new set of primary catalyst gauzes, as explained in section A.4.3.1 above.

The Business-as-Usual emissions factor was calculated by Mrs Rebecca Cardani-Strange of N.serve Environmental Services GmbH on 15th June 2010.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Starting date of the project: 12/10/2009 (submission of Project Idea Note to Finnish DFP)

The start of the crediting period shall be the day of installation of the secondary abatement catalyst.

The N_2O abatement catalyst is in the final stages of development and will only be ready for installation in late summer 2010. Since the catalyst can only be installed during a routine shut-down, the official start of the crediting period is most likely to be the beginning of October 2010, when a new production campaign is scheduled to start (the exact date is yet to be confirmed).

C.2. Expected operational lifetime of the project:

Since the expected lifetime of the catalyst is three years, the anticipated duration of the project's operational life is three years. In reality, however, the project is expected to run for only 2 years and 3 months (until the end of December 2012), since it is expected that N_2O emissions from HNO_3 plants will be covered by the EU ETS from 2013 onwards and that the project will no longer be viable[30]. If this is not the case, and N_2O is not otherwise regulated in a way that prohibits the continuation of the project, the catalyst will continue to be replaced approximately every 3 years for the total operational lifetime of the plant, which is around 20 years.

The S2 plant has an operational life of around another 20 years and is therefore expected to be fully operational for the whole 10-year crediting period and beyond.

C.3. Length of the crediting period:

The starting date of the project crediting period is expected to be 01/10/2010. Since the project is expected to be eligible to earn ERUs only up to the end of 2012, the likely project crediting period is 2 years and 3 months.

If any relevant agreement under the UNFCCC or the EU ETS should allow the continuation of the project, the project participants will apply to extend the crediting period to 20 years. Any extension of the crediting period beyond the end of 2012 would be subject to approval of the host country DFP.

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[30] See footnote 10

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The emission reductions achieved by the project activity will be monitored largely on the basis of the approved monitoring methodology, AM0034 ver03.4, as prepared by N.serve Environmental Services GmbH, Germany, allowing for some project-specific deviations as described in section B.1 above. It is the appropriate monitoring methodology to be used in conjunction with the baseline methodology AM0034 ver 03.4, “Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants”. Its applicability depends on the same prerequisites as the mentioned baseline methodology. Additionally, but to a far lesser extent, certain aspects of the project monitoring approach will be taken from the approved CDM methodology AM0028 (ver 04.2).

AM0034 ver 03.4 requires the use of the European Norm EN14181 (2004) *“Stationary source emissions - Quality assurance of automated measuring systems”*[31] as a guidance for installing and operating the Automated Monitoring System (AMS) in the nitric acid plants for the monitoring of N_2O emissions.

An Automated Measuring System (AMS) consisting of the following shall be used for monitoring:

- An automated gas analyser system that will continuously measure the concentration of N_2O in the tail gas of the nitric acid plant; and
- A gas volume flow meter that uses differential-pressure to continuously monitor the gas volume flow, temperature and pressure, in the tail gas of the nitric acid plant.

Sampling shall be carried out continuously using a multiple-point sampling tube that is optimised to the specific width and height of the tail gas duct and the expected gas velocities in the tail gas. Temperature and pressure in the tail gas will also be measured continuously and used to calculate the gas volume flow at standard conditions.

Description of the AMS installed at YARA Köping S2 nitric acid plant

1. General Description of the AMS

YARA Köping S2 plant is now equipped with an EN-14181 compliant state-of-the-art AMS consisting of a Dr. Födisch MCA 04 Continuous Emissions Analyser, a sample probe, heated filter and heated sample-line connected directly to the analyzer, and a Dr. Födisch FMD 99 Stack Gas Flow meter. The new analyzer is connected to the plant’s existing data collection system (Emerson DeltaV).

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[31] This standard describes the quality assurance procedures needed to assure that an Automated Measuring System (AMS) installed to measure emissions to air is capable of meeting the uncertainty requirements on measured values given by legislation, e.g. EU Directives, or national legislation, and more generally by competent authorities.

Since this nitric acid plant has been in operation since 1955, YARA Köping's staff in general, and its instrument department in particular, is accustomed to operating technical equipment adhering to high quality standards.

At the time of writing this PDD, Mr Jon Sletten (Site Manager) and Mr Axel Pallin (Process Engineer) are responsible for the overall implementation of the project. Mr Axel Pallin, Mr Jozef Meglic and Mr Mikael Larsson are responsible for the quality assurance, operation and maintenance of the N_2O monitoring system installed at the plant. It is possible that the people responsible for these tasks may change throughout the course of the project crediting period. Operation, maintenance and calibration intervals are being carried out by staff from the instrument department according to the vendor's specifications and under the guidance of internationally relevant environmental standards, in particular EN 14181 (2004). Service will be performed according to vendor specifications. YARA has defined an AMS checking procedure schedule and will continue to plan ahead for the remaining years of the crediting period, strictly adhering to the relevant standards.

All monitoring procedures at YARA are also conducted and recorded in accordance with the procedures under ISO 9001:2000, which is regularly audited by an independent auditing organisation accredited for ISO 9001 certification[32].

2. Sample points

The sample points were chosen in accordance with the AMS requirements, EN 14181 requirements and the plant design specifications to allow an optimum of data collecting quality. The location of the sample points for the N_2O measurement [NCSG] and tail gas flow measurements [VSG] was selected to provide ease of access in a location close to the analyser. The most suitable location at Köping S2 is downstream of the tail gas expander in the vertical section of the tail gas pipe.

The suitability of the chosen VSG sampling points will be verified during the QAL2 audit.

3. Analyser

The Dr. Födisch MCA 04 Continuous Emissions Analyser is capable of analysing N_2O concentration in gas mixtures. The analysis system MCA 04 is an extractive, continuous measuring system. It extracts a partial gas flow from the flue gas, which is led to the analyser through a heated line (all heated components of the measuring system are regulated at 185 °C). This state of the art gas sampling and conditioning system and the most advanced photometer technology ensure high reliability and long operating times with short maintenance intervals.

The MCA 04 is a single beam photometer. It is based on the absorption of infrared light. For the calculation of a component's concentration the measuring technology registers unattenuated and attenuated intensity in the range of absorption wave lengths. For measurement of N_2O, Gas filter correlation technique is used.

According to EN 14181 the Analyser is QAL1[33] tested for the measurement of all standard components that usually are measured in the waste gas of large combustion plants, waste incineration plants or mechanical biological waste treatment plants. The QAL1 tested components are: CO, NO, SO_2, HCl, NH_3, H_2O.

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[32] External auditor: DNV

The QAL1 test for N_2O is currently ongoing and is expected to be completed in the near future. A QAL2 audit was performed by an independent laboratory with EN ISO/IEC 17025 accreditation following commissioning of the analyser on 1st June 2010.

A hot extractive analyser was chosen in order to address s safety concerns. In the case of the MCA 04 analyzer, all parts of the system that come into contact with the waste gas are heated well above 180°C. Therefore no solid deposits of nitrate/nitrite are possible. At the moment no QAL1 tested NDIR-Analyzer for N_2O is available on the market that fulfils the requirements of hot measurements according to the YARA internal safety rules.

4. Sample Conditioning System

As the gas sample is extracted, particles are removed with a heated filter unit at the sampling point and the clean sampling gas is delivered through a heated sampling line directly to the analyser in its cabinet, via the sampling pump. The temperature of the sampling gas is always maintained at 185 °C. The minimum flow rate to the analyser is controlled and connected to a general alarm. The alarm is connected to the data acquisition system.

5. Flow Meter

The Dr. Födisch FMD99 measuring system allows continuous determination of the flow rate of stack gas. It is type tested to the guidelines of the German Federal Ministry for the Environment, Nature Conservation and Reactor Safety on suitability testing of measuring equipment for continuous measuring of emissions[34] and is therefore officially QAL1 approved.

The flow measuring device FMD 99 is a highly sensitive system for continuous, in-situ flow measurement of the exhaust gas. The differential pressure is continuously measured via the dynamic pressure probe of the FMD 99.

The signal resulting from the differential pressure is a degree of the velocity respective to the flow of the exhaust gas. The flow meter is combined with the internal measurement of the absolute stack gas pressure (PSG) and the stack gas temperature (TSG).

Linking this device with the Emerson DeltaV data acquisition system, the data flows can be converted from operating to standard conditions, taking into account the other flow parameters, such as temperature and pressure.

6. The data acquisition system

The YARA Köping S2 nitric acid plant is currently equipped with an Emerson DeltaV data collection and storage system that collects and stores the values for all the relevant monitoring parameters, as well as different status signals of the AMS and the NH_3 valve status signal from the nitric acid plant that defines whether or not the plant is in operation.

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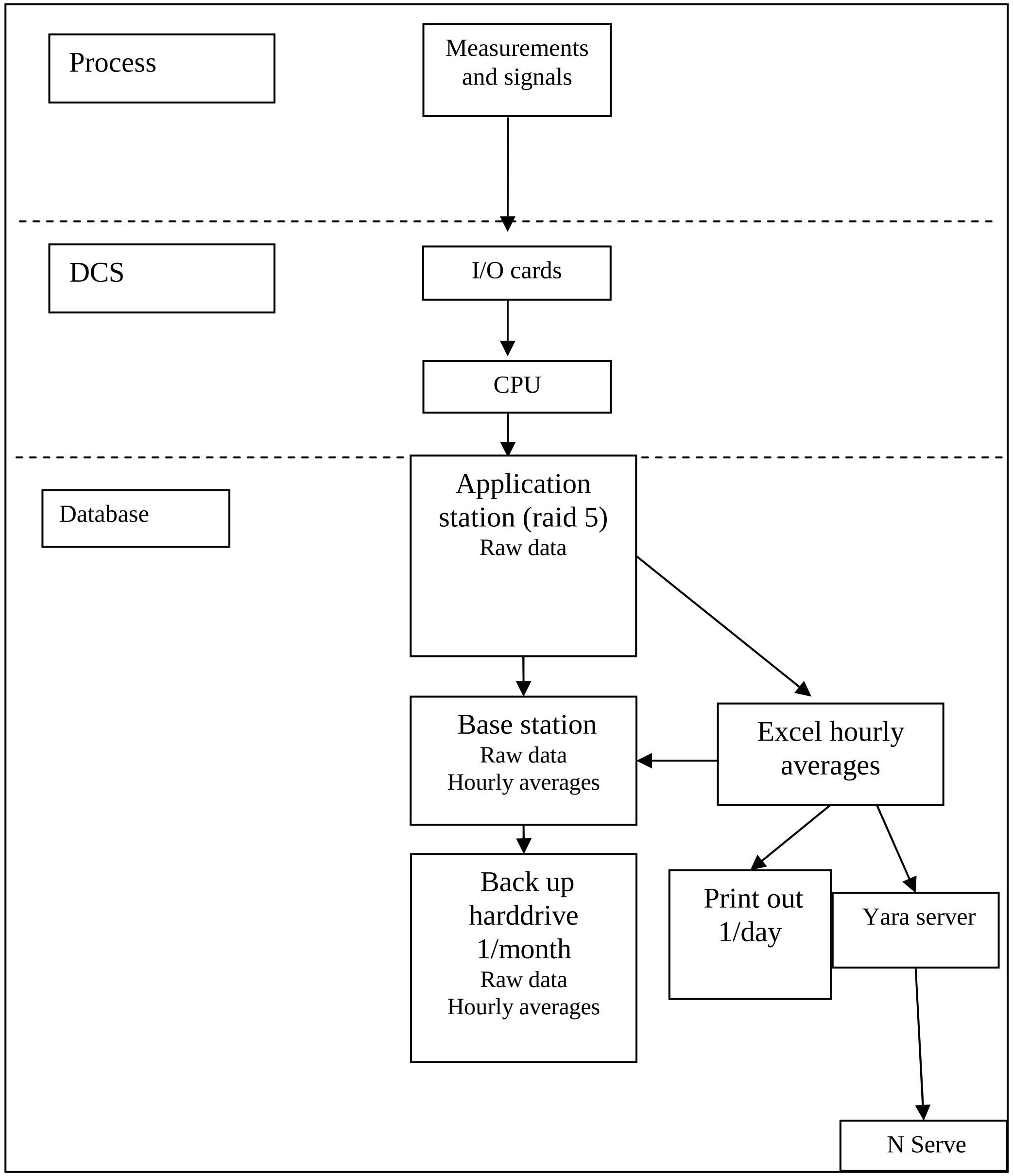
[33] TÜV Immissionsschutz und Energiesysteme GmbH, Köln TÜV Rheinland Group Report No. 936/21203173/A vom 13. Juli 2005

[34] TÜV Rheinland Sicherheit und Umweltschutz GmbH, Köln (report number 936/808 005/C vom 18. Februar 2000) and TÜV Immissionsschutz und Energiesysteme GmbH, Köln (report number 936/rö vom 15. Oktober 2003).

Data that is directly related to plant operation, such as oxidation temperature, oxidation pressure, ammonia flow rate, ammonia to air ratio and nitric acid production rate, is also stored.
From the beginning of the baseline campaign onwards (beginning May), the plant will also have installed a PIMS data management system, which allows quicker and more efficient management and import/export of the recorded data.

The flow chart below shows this system in more detail:


Process
Measurements and signals
DCS
I/O cards
CPU
Database
Application station (raid 5) Raw data
Base station Raw data Hourly averages
Excel hourly averages
Back up harddrive 1/month Raw data Hourly averages
Print out 1/day
Yara server
N Serve

7. Data evaluation

The nitric acid plant operator derives hourly averages for all of the monitored parameters from the Emerson DeltaV data collection system. This data is exported to EXCEL-format and delivered by email or CD from the plant operator to N.serve, who is responsible for the correct analysis of the delivered data in accordance with the PDD.

At N.serve the received data is stored on the N.serve fileserver in a special section for the storage of monitoring data separately for each project. The files are protected against manipulation by a password. Martin Stilkenbäumer at N.serve is currently responsible for the correct data handling and processing, but this may change throughout the course of the project crediting period.

After a first plausibility-check, the data is transferred to a special database system. All necessary calculations and steps of data analysis of the monitoring data according to AM 0034 regulations, as well as other regulations outlined in this PDD, are carried out by N.serve using the database tool.

The results of the data analysis are transferred to an Excel spreadsheet. The results are used for definition of Project emissions as well as for the preparation of the Monitoring reports.

8. AMS QA procedures

The following section describes how the procedures given in EN14181 for QAL1, 2 and 3 have been adapted and are practically applied at the YARA nitric acid plant.

QAL 1

An AMS shall ideally have been proven suitable for its measuring task (parameter and composition of the flue gas) by use of the QAL1 procedure as specified by EN ISO 14956. This standard’s objective is to prove that the total uncertainty of the results obtained from the AMS meets the specification for uncertainty stated in the applicable regulations. Such suitability testing has to be carried out under specific conditions by an independent third party on a specific testing site.

A test institute shall perform all relevant tests on the AMS. The AMS has to be tested in the laboratory and field.

The chosen Dr. Födisch MCA 04 gas analyser is QAL1 [35] tested for the measurement of all standard components that usually are measured in the waste gas of large combustion plants, waste incineration plants or mechanical biological waste treatment plants. The QAL1 tested components are: CO, NO, SO2, HC1, NH3, H2O. The QAL1 test for N_2O is currently ongoing and is expected to be completed in the near future. A hot extractive analyser was chosen in order to address a particular safety concern. As described above, this is a YARA internal safety precaution.

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[35] TÜV Immissionsschutz und Energiesysteme GmbH, Köln TÜV Rheinland Group Report No. 936/21203173/A from 13. July 2005

The chosen Dr. Födisch FMD 99 stack gas flow meter has fulfilled the requirements of the QAL1 and was successfully tested by TÜV Rheinland Sicherheit und Umweltschutz GmbH, Köln, Germany[36].

QAL2

QAL2 is a procedure for the determination of the calibration function and its variability, and a test of the variability of the measured values of the AMS compared with the uncertainty given by legislation. The QAL2 tests are performed on suitable AMS that have been correctly installed and commissioned on-site (as opposed to QAL 1 which is conducted off-site). QAL2 tests are to be performed at least every 3 years according to EN 14181 (or following any major change to the monitoring system).

A calibration function is established from the results of a number of parallel measurements performed with a Standard Reference Method (SRM). The variability of the measured values obtained with the AMS is then evaluated against the required uncertainty. There is a problem in fully complying with EN14181 since there is no regulation on N_2O emissions level and measurement uncertainty limit. According to EN14181, the QAL2 test including the SRM needs to be conducted by an independent “testing house” or laboratory which has to be accredited to EN ISO/IEC 17025. The QAL2 test was conducted following commissioning of the analyser on the 1st June 2010.

AST

In addition, Annual Surveillance Tests (AST) should be conducted in accordance with EN 14181; these are a series of measurements that need to be conducted with independent measurement equipment in parallel to the existing AMS. The AST tests are performed annually. If a full QAL 2 test is performed (at least every 3 years), an additional AST test is not necessary in that same year.

QAL3

QAL3 describes the ongoing quality assurance and maintenance procedures and documentation for the AMS conducted by the plant operator. With this documentation it can be demonstrated that the AMS is in control during its operation so that it continues to function within the required specifications for uncertainty.

This is achieved by conducting periodic zero and span checks on the AMS. Zero and span adjustments or maintenance of the AMS may be necessary depending on the results of the evaluation. The results of the checks will be recorded in control charts (for example Shewhart/CUSUM etc), which will be used to evaluate the zero and span drift. In essence, YARA staff performs QAL3 procedures through the established calibration procedures described below.

AMS calibration and QA/QC procedures

The monitoring equipment used to derive the N_2O emissions data for this project will be made part of the ISO 9001 procedures.

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[36] TÜV Rheinland Sicherheit und Umweltschutz GmbH, Köln (report number 936/808 005/C vom 18. Februar 2000) and TÜV Immissionsschutz und Energiesysteme GmbH, Köln (report number 936/rö from 15. October 2003

N_2O-Analyser Zero Adjustments/Calibration
Conditioned ambient air is used as reference gas for the zero check. The zero adjustment is conducted automatically every 24 hours. Manual checks are done at least once every four weeks. Zero adjustments or maintenance may be necessary depending on the results of the check (the calibration frequency might be adjusted if necessary).

N_2O-Analyser Span Adjustments/Calibration
Manual span checks are done with certified calibration gas at least once every four weeks. Span adjustments or maintenance may be necessary depending on the results of the check (the calibration frequency might be adjusted if necessary).
The results and subsequent actions are all documented as part of the QAL3 documentation. In addition, the analyser room and equipment is visually inspected at least once a week and the results are documented in analyser specific log-books.

Flow meter calibration procedures
The flow meter FMD 99 itself does not need to be calibrated since it is a physical device which will not have drift. Therefore, it is sufficient to regularly inspect the physical condition of the Dr. Födisch FMD. It is checked regularly for the following: Visual check; electric check; cleaning of probe, if necessary. In addition the flow meter is checked during the QAL2 and AST tests by an independent laboratory by comparison to a standard reference method (SRM).

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	*$NCSG_x$* *Hourly average N_2O concentration in the tail gas.*	*N_2O analyser (part of AMS)*	*mgN_2O/Nm^3 (converted from ppm if necessary)*	*Measured*	*Hourly average value based on a recording frequency of 2 seconds.*	*100%*	*Electronic*	*The data output from the analyser will be processed using appropriate software. The information will*

								be stored for the duration of the project, plus two years thereafter.
P.2	VSG_x *Hourly average Volume flow rate of the tail gas.*	*Gas volume flow meter (part of AMS)*	Nm^3/h	*Measured*	*Hourly average value based on a recording frequency of 2 seconds.*	*100%*	*Electronic*	*The data output from the tail gas flow meter will be processed using appropriate software. Corrected for standard conditions (273.15 °K, 1013.25 hPa) using TSG (P.7) and PSG (P.8) data.* *The information will be stored for the duration of the project, plus two years thereafter*
P.3	OH_n *Total operating hours during the project Verification Period n*	*Production Log, plant status signal*	*Hours*	*Measured*	*Daily, compiled for entire Verification Period*	*100%*	*Electronic*	*Electronically recorded, based on plant status signals*
P.4	NAP_n	*Differential pressure nitric*	$tHNO_3$	*Measured and calculated at*	*Daily, compiled for entire*	*100%*	*Electronic*	*Cross-checked one per month*

	Metric tonnes of 100% concentrated nitric acid during the project Verification Period n	*acid flow meter*		*100% concentration*	*Verification Period*			*against Mass Balance Calculation (MBC)*
P.5	*PE_n* *N_2O emissions during the project Verification Period n.*	*Calculation from measured data.*	*tN_2O*	*calculated*	*Calculated after each project Verification Period*	*100%*	*Electronic*	
P.6	*EF_n* *Emissions factor calculated for the project Verification Period n*	*Calculated from measured data*	*tN_2O / $tHNO_3$*	*Calculated*	*After each project Verification Period*	*100%*	*Electronic*	
P.7	*TSG* *Temperature of tail gas*	*Probe (part of the AMS gas volume flow meter).*	*°C*	*Monitored.*	*Hourly average value based on a recording frequency of 2 seconds.*	*100%*	*Electronic*	*Used for normalization of VSG measurement to standard conditions see P.2*
P.8	*PSG* *Pressure of tail gas*	*Probe (part of the AMS gas volume flow meter).*	*Pa*	*Monitored.*	*Hourly average value based on a recording frequency of 2 seconds.*	*100%*	*Electronic*	*Used for normalization of VSG measurement to standard conditions see P.2*
P.9	*AIFR* *Ammonia to air ratio*	*Ammonia & Air flow meters*	*%*	*Monitored & Calculated*	*Hourly value*	*100%*	*Electronic*	*Data of AIFR will be used to determine if*

	to the ammonia oxidation reactor (AOR)							*plant was operating outside of the trip point value* $AIFR_{trip}$.
P.10	OT_h *Oxidation temperature in the ammonia oxidation reactors (AOR) for each hour of the production campaign*	*Thermocouples inside the AORs*	*°C*	*Measured*	*Hourly value for each one of the 6 AORs, calculated as an average of the 3 thermocouples in each AOR*	*100%*	*Electronic*	*Data of* OT_h *will be used to determine if the plant was operating outside of the trip point range* (OT_{range})
P.11	EF_{reg} *Emissions cap for* N_2O *from nitric acid production set by government or local regulation*	*Swedish Environmental Law*	$kgN_2O/tHNO_3$ *(converted, if necessary)*	*Not applicable*	*Continuous.*	*100%*	*Paper*	*Continuous surveillance throughout crediting period*

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

Since the factual project emissions factors have not yet been established, the following equations are used for estimating in this PDD the emissions expected during the project:

$$EF_{Pest} = EF_{BAU} * (1 - AE) \qquad (kgN_2O/tHNO_3) \qquad \textbf{(1)}$$

Where:

Variable	Definition
EF_{Pest} =	Estimated Project Emissions Factor ($kgN_2O/tHNO_3$)
EF_{BAU} =	Business-as-Usual Emissions Factor, calculated in accordance with section A.4.3.1 ($kgN_2O/tHNO_3$)
AE =	Predicted Abatement Efficiency of secondary catalyst (%)

$$PEn_{est} = EF_{Pest} * NAPn_{est} / 1000 \qquad (tN_2O) \qquad \textbf{(2)}$$

Where:

Variable	Definition
PEn_{est} =	Estimated Project Emissions during Verification Period n (tN_2O)
$NAPn_{est}$ =	Estimated HNO_3 production during Verification Period n ($tHNO_3$)

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

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

As explained above in section A.4.3.1, the Baseline Emissions Factor for this project shall not be established based on factual pre-abatement measurements; emission reductions shall be calculated using the conservative IPCC default emissions factor for N_2O from nitric acid plants: 4.5kg $N_2O/tHNO_3$.

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

Since no factual baseline measurement will be conducted, the following equations are used for estimating in this PDD the emissions that would be associated with the conservative IPCC default emissions factor of 4.5kg $N_2O/tHNO_3$:

$$BE_{BL} = EF_{BL} * NAP_{est} / 1000 \qquad (tN_2O) \qquad \textbf{(3)}$$

Where:

Variable	Definition
BE_{BL} =	Baseline emissions - emissions associated with the 4.5kg $N_2O/tHNO_3$ IPCC default value (tN_2O)
EF_{BL} =	Baseline emissions factor - conservative IPCC default value emissions factor of 4.5kg $N_2O/tHNO_3$ ($kgN_2O/tHNO_3$)
NAP_{est} =	Estimated HNO_3 production during year n ($tHNO_3$)

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

Emissions reductions from the project will not be directly monitored, but calculated following measurement of the parameters listed in section D.1.1.1 above.

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):

Verification Periods

The project emission factor is assessed based on N_2O concentration ($NCSG_x$) and gas volume flow (VSG_x) measurements conducted throughout any period of time for which the project proponents decide to undertake a Verification (the “Verification Period”). Project proponents are free to decide what period of time they would like to define as a Verification Period as long as the following pre-requisites are met:

- The first Verification Period commences with the crediting period starting date.
- Any Verification Period after the first one will start at the termination date of the previous Verification Period.
- No Verification Period may exceed the crediting period ending date.

Over the duration of the project activity, N_2O concentration and gas volume flow in the stack of the nitric acid plant, as well as the nitric acid production of the plant, will be measured continuously and an **Emissions Factor (EF_n)** – given as $kgN_2O/tHNO_3$ – can be established at any given time for any period of time.

Because higher N_2O emissions during the project’s lifetime will lead to a reduced amount of issued ERUs issued, the project does not need to provide measures against any abusive practices. Syra 2 will be sufficiently incentivised to run its plant at emission levels as low as possible in order not to lose ERU revenues. In case S2 is emitting more N_2O than the Baseline Emissions Factor, no additional environmental consequences are to be feared, as the only effect from this would be that the project activity will not generate any ERUs during such times that would subsequently become available to carbon markets.

For these reasons, it is not relevant for which period of the production cycle ERUs are claimed.

Measuring of N_2O data sets for the calculation of project emissions

Throughout the project’s crediting period, N_2O concentration ($NCSG_x$) and volume flow in the stack gas (VSG_x) are to be monitored. The monitoring system provides separate hourly average values for $NCSG_x$ and VSG_x based on 2-second interval readings. These N_2O data sets (consisting of $NCSG_x$ and VSG_x average values for each operating hour) can be identified by means of a unique time / date key indicating when exactly the values were observed.
Furthermore, the operating hours (OH_n) and the nitric acid production output (NAP_n) are required for calculating the project emissions.

Because the default value - unlike the AM0034 Baseline Emissions Factor - was not determined based on certain plant operating parameters, there is no need to monitor those plant operating parameters and establish the comparability of the two data sets by adjusting the EF_{BL} for each Verification Period.

Downtime of Automated Monitoring System

In the case of a period of AMS downtime that constitutes a malfunction of the AMS, the missing data from the relevant hour should be replaced with either a) the highest value measured during the whole of the relevant verification period or b) the highest value measured during the whole of the previous complete verification period, whichever is the higher. The assessment should be based on values measured during periods of standard AMS operation and recording after elimination of mavericks. This replacement of missing data will be done on the basis of hourly average values.
In the case of equipment downtime due to a routine calibration for any part of one hour, the hourly average value will be calculated pro-rata from the remaining available data from the hour in question. If the remaining available data from that hour constitutes less than 2/3 of the hour (less than 40 minutes), that hour should be considered missing. Each time it is impossible to calculate one hour of valid data, substitute values should be used instead of the missing hour for the further calculations of emissions reductions. As a substitute value, the last valid hourly average value before the calibration will be used for the calculation of emissions reductions.

Measurement during plant operation

Only those data sets collected during operation of the plant shall be used as a basis for determining the Verification Period-specific project emissions. Most plants have one or more trip point values, normally defined by the manufacturer and specified in the plant's operating manuals. At Köping S2, the plant's operational status can be determined by whether or not NH3 is still flowing into the AOR. When the ammonia valve status signal indicates that the plant's ammonia valve is closed, the plant is considered to be off-line. Trip point values for oxidation temperature and ammonia to air flow ratio have been defined and these parameters will be used for the purposes of establishing whether or not the plant is in operation. See Annex 2 for details of the trip point values. If one of these parameters is outside the range specified by the trip point values, the plant should automatically shut down by closing the ammonia valve. Even if the trip point parameters are exceeded in only one of the six burners, all six burners should automatically shut down (with the exception of a scheduled gauze change, where one burner system can be purposely isolated from the other two).

In order to ensure the proper functioning of the NH_3 and air input transmitters, particularly following any major shutdown or trip of the plant, the performance of the transmitters and signals relating to NH_3 and air flows are checked by the operators following any shutdown of the plant that lasts longer than 6 hours.
In addition, the production figures are analysed on a daily basis by the responsible operator and any significant deviation in oxidation temperature is immediately investigated.

For the avoidance of doubt, data sets containing values during shut down of the plant are not to be regarded as AMS downtime readings (as defined above).

Application of instrument correction factors / elimination of implausible values

The correction factors derived from the calibration curve of the QAL2 audit for all components of the AMS, as determined during the QAL2-test in accordance with EN14181, must be applied onto both VSG and NCSG, unless these were already automatically applied to the raw data recorded by the data storage system at the plant.

All data sets containing values that are implausible are eliminated and replaced by default values according to the above-mentioned practice.

Calculation of the Project Emissions

N_2O concentration and gas volume flow are to be monitored throughout the verification period. The EN14181-compliant monitoring system will provide separate readings for N_2O concentration and gas flow volume for a defined period of time (an hourly average will be calculated from the values recorded every 2 seconds). Error readings (e.g., downtime or malfunction) and extreme values are to be automatically eliminated from the output data series by the monitoring system.

Calculation of Verification Period-specific project emissions

The total mass of N_2O emissions in a Verification Period (PE_n) is calculated based on the continuous measurement of the N_2O concentration in the tail gas and the volume flow rate of the tail gas stream. The N_2O mass-flow is calculated on the basis of the hourly average results, in accordance with the following equation:

$$PE_n = \sum_{x=1}^{x=vmp} NCSG_x \times VSG_x \times 10^{-9} \times M_x \qquad (tN_2O) \qquad \textbf{(4)}$$

The plant-specific project emissions factor, representing the average N_2O emissions per tonne of nitric acid over the respective Verification Period, is derived by dividing the total mass of N_2O emissions by the total output of 100% concentrated nitric acid for that period.

The average N_2O emissions per metric ton of 100% concentrated nitric acid for that Verification Period (EF_n) shall then be calculated as follows:

$$EF_n = (PE_n / NAP_n) \qquad (tN_2O/tHNO_3) \qquad \textbf{(5)}$$

where:

Variable	Definition
PE_n	total specific N_2O emissions during the campaign (tN_2O)
EF_n	Emissions factor used to calculate the emissions from the specific verification period n ($tN_2O/tHNO_3$)
$NCSG_x$	Hourly average concentration of N_2O in the tail gas stream in each measurement time interval of 1 hour during the verification measurement period (vmp) (mgN_2O/m^3)
VSG_x	Hourly average tail gas volume flow rate in each measurement time interval of 1 hour during the verification measurement period (vmp) (m^3/h)
NAP_n	Nitric acid production during the Verification Period ($tHNO_3$)
M_x	Length of measurement internal x (h)
x	Each measurement interval during the verification period (1h)
vmp	Verification measurement period

Leakage
No leakage calculation is required.

Calculation of emission reductions

The **emissions reductions for which ERUs will be issued** for the project activity are determined by deducting the project-specific emission factor from Baseline Emissions Factor (the conservative IPCC default value emissions factor of 4.5kg $N_2O/tHNO_3$) and multiplying the result by the production output of 100% concentrated nitric acid over the Verification Period and the GWP of N_2O, as follows:

$$ERU = (EF_{BL} - EF_n) \times NAP \times GWP_{N2O} \quad (tCO_2e) \qquad \textbf{(6)}$$

Where:

Variable	Definition
ERU =	Emission reductions awardable to the project for the specific Verification Period (tCO_2e)

NAP = Nitric acid production during the project Verification Period ($tHNO_3$). The maximum value of NAP shall not exceed the design capacity[37].
EF_{BL} = Baseline emissions factor - conservative IPCC default value emissions factor for N_2O from nitric acid plants ($kgN_2O/tHNO_3$);
EF_n = Emissions factor used to calculate the emissions from the specific Verification Period n ($tN_2O/tHNO_3$).
GWP_{N2O} = Global warming potential of N_2O as per IPCC default value (310) (tCO_2e/tN_2O)

Impact of regulations

Should N_2O emissions regulations that apply to nitric acid plants be introduced in the host country or jurisdiction covering the location of the project activity, such regulations shall be compared to the 4.5kg $N_2O/tHNO_3$ emissions factor for the project (EF_{BL}), regardless of whether the regulatory level is expressed as:

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

In this case, a corresponding plant-specific emissions factor cap (max. allowed $tN_2O/tHNO_3$) is to be derived from the regulatory level. If the regulatory limit is lower than the baseline emissions factor determined for the project, the regulatory limit shall serve as the new baseline emissions factor, that is:

$$\text{If } EF_{BL} > EF_{reg} \qquad \textbf{(7)}$$

Then the default N_2O emission factor shall be EF_{reg} for all calculations.

Where:

EF_{BL} = Baseline emissions factor - default value emissions factor ($tN_2O/tHNO_3$)
EF_{reg} = Emissions level set by newly introduced policies or regulations ($tN_2O/tHNO_3$).

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[37] The 'design' capacity means the total yearly capacity (considering 365 days of operation per year) as per the documentation of the plant technology provider (such as the Operation Manual). If the plant has been modified to increase production, and such de-bottleneck or expansion projects were completed before December 2005, then the new capacity is considered 'design', provided proper documentation of the projects is available

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

not applicable

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

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

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

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 following equation is used for estimating the emissions reductions to be awarded to the project in this PDD, since the factual project emissions factor has not yet been established:

$$EF_{Pest} = EF_{BAU} * (1 - AE) \qquad (kgN_2O/tHNO_3) \qquad \textbf{(8)}$$

Where:

Variable Definition

EF_{Pest} = Estimated Project Emissions Factor ($kgN_2O/tHNO_3$)
EF_{BAU} = Business-as-Usual Emissions Factor, calculated in accordance with section A.4.3.1 ($kgN_2O/tHNO_3$)
AE = Predicted Abatement Efficiency of secondary catalyst (%)

$$ERU_{PIS} = (EF_{BL} - EF_{Pest}) \times NAP_{yr} / 1000 \times GWP_{N2O} \qquad (tCO2e) \qquad \textbf{(9)}$$

$ERU_{PIS\,=}$ Estimated number of ERUs to be issued to the project (tCO2e)
$EF_{BL=}$ Baseline emissions factor - conservative IPCC default value emissions factor for N_2O from nitric acid plants ($kgN_2O/tHNO_3$)
$NAP_{yr\,=}$ Budgeted or Estimated Annual Nitric Acid Production ($tHNO_3$)
GWP_{N2O} = Global Warming Potential of N_2O (310 tCO_2e/tN_2O)

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:

For detailed information on good monitoring practice and performance characteristics see Annex 3.

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.: *P1, P2,* *P7, P8,*	*low*	Regular calibrations according to vendor specifications and recognised industry standards (EN 14181). Staff will be trained in monitoring procedures and a reliable technical support infrastructure will be set up. Third party audits by laboratories with EN ISO/IEC 17025 Accreditation
D.1.1.1.: *P5,P6,P11*	*low*	Calculated values included in evaluation by third party AIE
D.1.1.1.: *P3, P4, P9, P.10,*	*low*	Included in plant internal Quality Assurance program as validated by third party during ISO 9001/ ISO 14001 audit
D.1.1.1.: *P11*	*low*	Constant factors included in evaluation by third party AIE

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

At the time of writing this PDD, the following people are responsible for the listed project tasks. However, it is possible that the responsible people may change throughout the course of the project activity.

General Project Responsibilities

Yara central project coordination:
Peter Fauconnier (TPO Nitric acid)

- AMS/General coordination

Oystein Nirisen (catalyst department)

- Catalyst development

N.serve:

Rebecca Cardani-Strange (Project Manager)

- Project Implementation and official project documentation

Martin Silkenbaeumer (Monitoring Specialist)

- Final data analysis, ERU calculations and project monitoring consultant

Köping Site Management & Local Project Responsibilities:

Site Management:

Jon Sletten (Site Manager)

- Overall political and project strategy

Pär Höök (Production Manager)
Lars-Håken Karlsson (HESQ Manager)

- Environmental permit responsibilities

Plant personnel:

Axel Pallin (Process Engineer)

- Project management/implementation
- Data collection

Mikael Larsson (Instrumentation Supervisor)

- Instrumentation calibration and maintenance

Jozef Meglic (Automation Engineer)

- Data collection and storage, back-up procedures

Operation, maintenance, calibration and service intervals are being carried out by staff from the instrument department according to the vendor’s specifications and under the guidance of internationally relevant environmental standards, in particular EN 14181 (2004).
YARA Köping S2 has defined an AMS checking procedure schedule and will continue to plan ahead for the remaining years of the crediting period, strictly adhering to the relevant standards.

All monitoring procedures at YARA Köping S2 are also conducted and recorded in accordance with the procedures under ISO 9001, which is regularly audited by an independent auditing organisation accredited for ISO 9001 certification (see section D.1.)

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

N.serve Environmental Services GmbH
Grosse Theaterstr. 14
20354 Hamburg
Germany
www.nerve.net
contact@nserve.net

N.serve is listed as a project participant in Annex 1

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Using the assumptions from section A.4.3.1 above, the following project emissions are estimated for the project activity in the crediting period. The first crediting period would start on the 1st October 2010.

Please note that all figures in the calculation tables have been rounded to the nearest tonne of CO2e. In view of the fact that the figures link directly to a detailed excel spreadsheet, the final total may not accord completely with the preceding figures.

Crediting Period (year)	**Estimate of annual project emissions [tCO_2e]**
2010 (Oct to Dec)	7.663
2011	30.650
2012	30.650
Total estimated project emissions over the crediting period until end 2012 (tonnes of CO2 equivalent)	**68.963**
Annual average of project emissions over the crediting period until end 2012 (tonnes of CO2 equivalent)	**30.650**

Table 5 (part A): Estimated project emissions until 2012

Crediting Period (year)	Estimate of annual project emissions [tCO_2e]
2013	29.464
2014	29.464
2015	29.464
2016	29.464
2017	29.464
2018	29.464
2019	29.464
2020 (Jan to Sep)	22.098
Total number of crediting years	**10**
Total estimated project emissions over the 10-yr crediting period (tonnes of CO2 equivalent)	**297.308**
Annual average of estimated project emissions over the 10-yr crediting period (tonnes of CO2 equivalent)	**29.731**

Table 5 (part B): Estimated project emissions from 2013 onwards

E.2. Estimated leakage:

No leakage emissions do occur.

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

See E.1.

E.4. Estimated baseline emissions:

Baseline emissions

The emissions reductions eligible for ERUs will be calculated from the conservative IPCC default emissions factor for N_2O from nitric acid plants, which is 4.5kg/$tHNO_3$, and not from the business as usual emissions.
The figures in the table below show the emissions that would be associated with this baseline emissions factor, assuming that N_2O is not covered under the EU ETS from 2013 onwards. However, a communication from the Swedish Environmental Protection Agency, dated 13/08/2010, states that the Syra 2 plant will be required to comply with any applicable BAT reference value from 1st January 2013. There is currently no applicable BAT reference value for atmospheric pressure nitric acid plants, but should such a value be introduced, then the figures in Table 6 part B will be adjusted accordingly.
.

Crediting Period (year)	**Baseline emissions [tCO_2e]**
2010 (Oct to Dec)	47.430
2011	189.720
2012	189.720
Total baseline emissions over the crediting period until end 2012 (tonnes of CO2 equivalent)	**426.870**
Annual average of baseline emissions over the crediting period until end 2012 (tonnes of CO2 equivalent)	**189.720**

Table 6 (part A): Baseline emissions until 2012

Crediting Period (year)	**Baseline emissions [tCO_2e]**
2013	182.376
2014	182.376
2015	182.376
2016	182.376
2017	182.376
2018	182.376
2019	182.376
2020 (Jan to Sep)	136.782
Total number of crediting years	**10**
Total baseline emissions over the 10-yr crediting period (tonnes of CO2 equivalent)	**1.840.284**
Annual average of baseline emissions over the 10-yr crediting period (tonnes of CO2 equivalent)	**184.028**

Table 6 (part B): Baseline emissions from 2013 onwards.

* Due to the likely inclusion of N_2O emissions emanating from nitric acid production into the EU ETS from 1st January 2013 onwards, the project may not be eligible to earn ERUs after that time or continuing the project under the JI may not be economically viable. Also, from 2013 onwards a GWP of 298 for N_2O as defined by the IPCC Third Assessment Report will be applied. This is why this PDD differentiates in between prospective emission reductions achieved until 31st December 2012 and emissions reductions generated from 1st January 2013 onwards..

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

The ERU figures included in this PDD are *estimations* only. ERUs will therefore be awarded for those factual emissions reductions achieved below the baseline emissions factor and subsequently verified by the responsible AIE, and not in accordance with the preliminary estimations provided in this PDD.
The below tables show the estimated emission reductions that will be generated by the project activity:

However, in accordance with the methodology AM0034, the maximum value of NAP eligible for ERU issuance “shall not exceed the design capacity. By nameplate (design) implies the total yearly capacity (considering 365 days of operation per year) as per the documentation of the plant technology provider”. In the case of Syra 2, the daily design capacity of 400t/day multiplied by the annual number of operating days (348) results in 139,200 t $HNO_{3.}$ ERUs can therefore only be claimed for tonnes of nitric acid produced up to that amount.

Crediting Period (year)	**Estimate of annual emissions reductions in tonnes of CO2 equivalent**
2010 (Oct to Dec)	39.767
2011	159.070
2012	159.070
Total estimated emission reductions over the crediting period until end 2012 (tonnes of CO2 equivalent)	**357.907**
Annual average of estimated emissions reductions over the crediting period until end 2012 (tonnes of CO2 equivalent)	**159.070**

Table 7 (part A): Estimated emissions reductions until 2012

Crediting Period (year)	**Estimate of annual emissions reductions in tonnes of CO2 equivalent**
2013	152.912
2014	152.912
2015	152.912
2016	152.912
2017	152.912
2018	152.912
2019	152.912
2020	114.684
Total number of crediting years	**10**
Total estimated emission reductions over the 10-yr crediting period (tonnes of CO2 equivalent)	**1.542.976**
Annual average of estimated emissions reductions over the 10-yr crediting period (tonnes of CO2 equivalent)	**154.298**

Table 7 (part B): Estimated emission reductions from 2013 onwards

* Due to the likely inclusion of N_2O emissions emanating from nitric acid production into the EU ETS from 1st January 2013 onwards, the project may not be eligible to earn ERUs after that time or continuing the project under the JI may not be economically viable. Also, from 2013 onwards a GWP of 298 for N_2O as defined by the IPCC Third Assessment Report will be applied. This is why this PDD differentiates in between prospective emission reductions achieved until 31st December 2012 and emissions reductions generated from 1st January 2013 onwards.

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

Please note that all figures in the calculation tables have been rounded to the nearest tonne of CO2e. In view of the fact that the figures link directly to a detailed excel spreadsheet, the final total may not accord completely with the preceding figures.

Year	**Estimated Project Emissions [tCO_2e]**	**Estimated Leakage [tCO2e]**	**Baseline emissions [tCO_2e]**	**Estimated Emission Reductions [tCO_2e]**
2010 (Oct to Dec)	7.663	-	47.430	39.767
2011	30.650	-	189.720	159.070
2012	30.650	-	189.720	159.070
Total tonnes of CO2 equivalent	**68.963**	-	**426.870**	**357.907**

Table 8 (part A): Summary of calculation of estimated emissions reductions entitled to ERUs until 2012

Year	Estimated Project Emissions [tCO_2e]	Estimated Leakage [tCO2e]	Baseline emissions [tCO_2e]	Estimated Emission Reductions [tCO_2e]
2013	29.464	-	182.376	152.912
2014	29.464	-	182.376	152.912
2015	29.464	-	182.376	152.912
2016	29.464	-	182.376	152.912
2017	29.464	-	182.376	152.912
2018	29.464	-	182.376	152.912
2019	29.464	-	182.376	152.912
2020	22.098	-	136.782	114.684
Total tonnes of CO2 equivalent (2010 to 2020)	**275.210**	-	**1.703.502**	**1.542.976**

Table 8 (part B): Summary of calculation of estimated emissions reductions entitled to ERUs from 2013

* Due to the likely inclusion of N_2O emissions emanating from nitric acid production into the EU ETS from 1st January 2013 onwards, the project may not be eligible to earn ERUs after that time or continuing the project under the JI may not be economically viable.

SECTION F. Environmental impacts

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

The project will reduce gaseous emissions of nitrous oxide (N_2O) from the plant tail gas and will therefore contribute to international efforts to reduce greenhouse gas emissions. The project will have no negative effects on local air quality.

The project will have no impact on water pollution. No additional water is required for the project activity's implementation or operation. Therefore, there is no impact on the sustainable use of water. Also, the project does not impact on the community's access to other natural resources, as it will not require any additional resources. In addition, there is no impact on the efficiency of resource utilization, nor is there any impact on the population living in the vicinity of the plant.

There are no other positive or negative impacts on the environment.

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:

Given the facts stated in section F.1 above, no environmental impact assessment is necessary.

However, the installation of the catalyst must be reported to the local authorities “Miljökontoret Köpings Komun”.

SECTION G. Stakeholders’ comments

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

As the JI project does not have any relevance for local air, water or soil emissions, it is not necessary to undertake a local stakeholder consultation.

The Letter of Endorsement states that a public consultation will be conducted by the Swedish DFP before a final Letter of Approval is issued.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Represented by:	Albrecht von Ruffer
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Salutation:	Mr.
Last name:	von Ruffer
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Annex 2

BASELINE INFORMATION

As explained throughout the PDD, no baseline measurements will be conducted for the project at the Syra 2 plant.

However, the following information shows the assumptions made by the project participants prior to the implementation of the project activity. These figures are currently only predictions and estimates. They will be amended once full project data is available.

		Units
HNO3 capacity	400	$tHNO_3/d$
Annual production	136.000	$tHNO_3/y$
Current N2O emissions	7,27	$kgN_2O/tHNO_3$
N2O business-as-usual emissions per year	989	tN_2O
Global Warming Potential N2O	310	GWP
Annual N2O business-as-usual emissions	306.503	tCO2e
Catalyst abatement efficiency	90%	Percent
N2O project emissions factor	0,727	$kgN_2O/tHNO_3$
IPCC default emissions factor	4,5	$kgN_2O/tHNO_3$
Annual emissions reductions eligible for ERUs	**159.070**	**tCO2e**

Table 1: Assumptions prior to project implementation

Parameters not monitored

Table 2: Parameters that are to be established prior to the first verification:

	Parameter	*Unit*	*Source*	*Value*	*Comments*
P.1	EF_{BL} *Baseline Emissions Factor - conservative IPCC default emissions factor for N_2O from nitric acid plants*	*Kg/tHNO3*	*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3,*	*4.5*	*Used to calculate the emissions reductions from the project that are eligible to receive ERUs*
P.2	$AIFR_{trip}$ *Maximum ammonia to air ratio trip point value*	*%*	*Plant documentation*	*13.1*	*Used to determine periods where the plant was operating outside the trip point values during the project.*

P.3	OT_{range} *Trip point value range for the operating temperature in the AORs*	*˚C*	*Plant documentation*	*780- 900*	*Used to determine periods where the plant was operating outside the trip point values during the project.*

Annex 3

MONITORING PLAN

Background on EN14181

The objective is to achieve the highest practically possible level of accuracy in conducting those measurements and transparency in the evaluation process.

While EN14181 provides the most advanced procedures, its practical application is currently limited for the following reasons:

- Specific procedures for N_2O are not yet defined in EN14181;
- Only very limited experience exists with monitoring systems for N_2O emissions;
- In the context of conducting some of the calculations and tests of EN14181, no applicable regulatory N_2O levels exist in the EU (or elsewhere).

Therefore, it is currently not possible to fully comply with the letter of EN14181, neither in the EU, nor in a non-Annex 1 country to the Kyoto Protocol.

Despite all this, EN14181 provides very useful guidance in conducting a logical, step-by-step approach to selecting, installing, adjusting and operating the N_2O AMS for CDM and JI projects.

The monitoring procedures developed for this project aim to provide workable and practical solutions that take into account the specific situation at each nitric acid plant. Wherever possible, EN14181 is applied as guidance for the development and implementation of the monitoring procedures for this JI project in order to achieve highest possible measuring accuracy and to implement a quality control system that assures transparency and credibility.

Scope of EN 14181

This European Standard specifies procedures for establishing quality assurance levels (QAL) for automated measuring systems (AMS) installed at industrial plants for the determination of the flue gas components and other flue gas parameters.

This standard is designed to be used after the AMS has been accepted according to the procedures specified in EN ISO 14956 (QAL1).

EN14181 specifies:

- a procedure (QAL2) to calibrate the AMS and determine the variability of the measured values obtained by it, so as to demonstrate the suitability of the AMS for its application, following its installation;
- a procedure (QAL3) to maintain and demonstrate the required quality of the measurement results during the normal operation of an AMS, by checking that the zero and span characteristics are consistent with those determined during QAL1;
- a procedure for the annual surveillance tests (AST) of the AMS in order to evaluate (i) that it functions correctly and its performance remains valid and (ii) that its calibration function and variability remain as previously determined.

This standard is restricted to quality assurance (QA) of the AMS, and does not include the QA of the data collection and recording system of the plant.

For a full description of the AMS to be installed at YARA Köping S2 nitric acid plant, as well as details on the quality assurance and control procedures to be undertaken, see section D.1 above.