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 Tertre Uhde 2 abatement project in Belgium
Version: 06/12/2011 (Version #4)

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 Uhde 2 nitric acid plant at Tertre in the Walloon region of Belgium.

The nitric acid plant was designed by Uhde. Commercial nitric acid production started in1976. It is a 5.5/10 bar dual pressure plant with a daily design production output of 750 metric tonnes of HNO_3 (100% conc.)[1]. The plant's design campaign length is 318 days. Providing no unusual events take place, the plant is operated for an average of around 355 days per year, resulting in an annual production output of up to 266,250 $tHNO_3$.

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 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. The acid at Uhde 2 is produced at both 60% and 69% concentrations. 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[2]. Without any N_2O abatement technology, the plant currently emits an average of $8.07kgN_2O/tHNO_3$ which means that the continued operation of the plant without any N_2O abatement technology could entail emissions of around $666ktCO_2e$ annually[3]. Until the end of December 2012, this is considered to be the business as usual scenario[4].

The project activity involves the installation of a new N_2O abatement technology: a pelleted catalyst that will be installed inside the ammonia oxidation reactor, underneath the precious metal gauzes. It is expected that this catalyst will reduce approximately 90% of current N_2O emissions on average over its lifetime. This estimate from the supplier is based on the catalyst performance at other JI projects at similar medium pressure plants in Europe.

The N_2O abatement catalyst applied to the proposed project has been developed by YARA. Industrial trial runs have been undertaken at various YARA plants (mainly in France) over the last several years. By now, the technology has been proven as an effective method of reducing N_2O emis-

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[1] As stated in the Uhde 2 operating manual. All nitric acid amounts are provided in metric tonnes of 100% concentrated HNO_3, unless otherwise indicated.

[2] 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.

[3] This statement is based on an annual production output of 266,250 $tHNO_3$ (750t/day for 355 days / year). N_2O emissions reported to the government for the year 2009 were $8.07kgN_2O/tHNO_3$, based on daily average N_2O concentration measurements taken throughout 2009.

[4] See section A.4.3.1 and B.2 for detailed information.

sions and is installed in many plants around the world in Clean Development Mechanism (CDM) and Joint Implementation (JI) projects. No N_2O abatement catalyst has previously been installed in the Yara Tertre plants.

For tracking the N_2O emission levels, YARA Tertre will install an Automated Monitoring System according to EU standards[5].
YARA Tertre adheres to ISO 9001 / 14001 management standards[6] and will implement procedures for monitoring, regular calibrations and QA/QC in line with the requirements of these standards.

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)
Belgium (host)	YARA Tertre SA/NV (Belgium)	No
France (investor)	N.serve Environmental Services GmbH (Germany)	No

This JI project will be developed as a Track 1 party verified activity in accordance with UNFCCC decision 9/CMP.1, paragraph 23 by the host country Belgium.

A.4. Technical description of the project:

A.4.1. Location of the project:

A.4.1.1. Host Party(ies):

Belgium (Walloon Region)

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

Hainaut

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

Tertre

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

[6] All quality management documents 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):

Yara Tertre SA/NV
Rue de la Carbo 10
B-7333
Tertre, Belgium

The picture below illustrates the location of the plant and the position of the tail gas stack and the ammonia oxidation reactor.

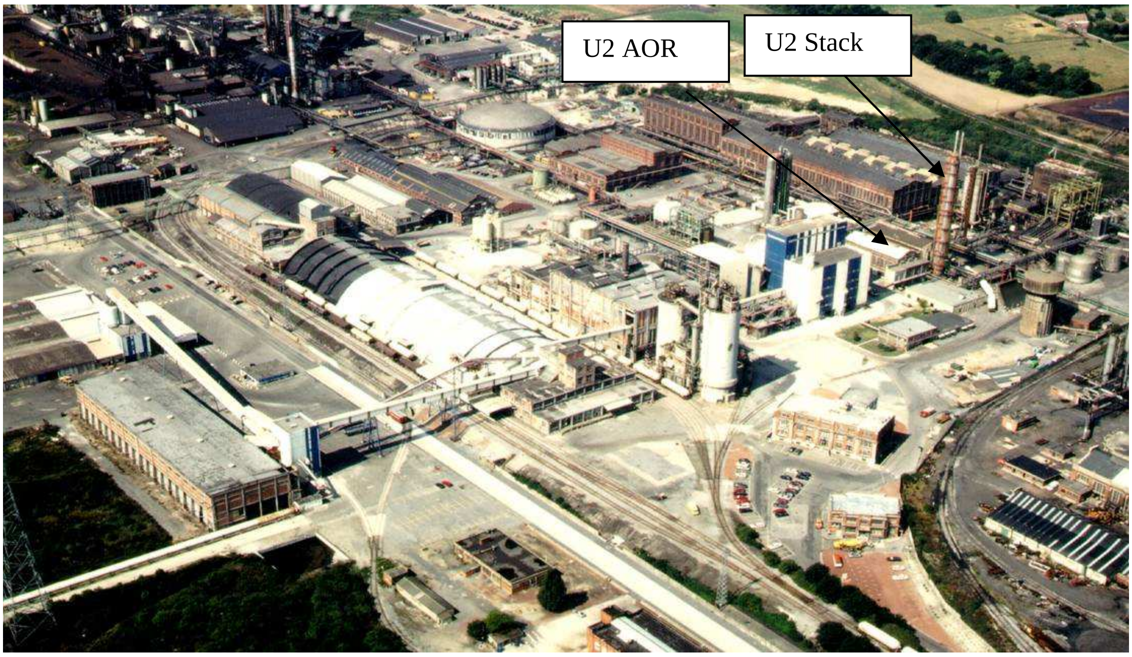

Figure 1: Location of YARA Tertre Uhde 2 plant

Coordinates:
Stack: 50°28’53.02”N and 3°48’00.20”E
AOR: 50°28’51.60”N and 3°48’00.03”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 ammonia burner inside which the ammonia oxidation reaction takes place, the absorption tower where the gas mix from the burner is led through water in order to form nitric acid and the stack through which the off-gasses are vented into the atmosphere.

The precious metal gauze pack – i.e. the primary catalyst required for the actual production of nitric acid – is currently supplied by KAR Rasmussen located in Norway.

The project activity entails the implementation of:

- N_2O abatement technology, until recently only applied on industrial trial level within the European Union, that is inserted into the ammonia oxidation reactor; and
- Specialised monitoring equipment installed at the stack (detailed information on the AMS is contained in section D.1).

Catalyst Technology

A number of N_2O abatement technologies have become commercially available in the past few 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 were naturally 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 had not invested in N_2O abatement devices. However, with the introduction of the JI at the beginning of 2008, many operators are now taking advantage of the incentives offered by this mechanism and secondary catalyst has been more widely employed within Europe in the last couple of years. YARA International ASA conducted long term industrial trial runs of its self-developed catalyst system YARA58 Y 1 ® in various plants in France since 2005. However, these trials have since been completed.

The plants operated by YARA Tertre have not been part of any catalyst industrial trial programmes. Thus, the proposed JI project activity entails a first time installation of secondary catalyst technology at the plant.

Figure 2: Installation of secondary catalyst

Following two meetings with representatives from the Walloon DFP during summer 2010, the government confirmed that it intended to accept JI projects on its territory. On the 22/10/2010, the project participants received an official confirmation that JI projects at Tertre would be accepted by the Walloon government.

YARA Tertre installed the YARA 58 Y 1® catalyst system the plant shutdown on 08/12/2010. The YARA 58 Y 1® system is an additional base metal catalyst that is positioned below the standard precious metal gauze pack in the ammonia burner.

A 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 58 Y 1® abatement catalyst is made of cylindrical pellets containing cobalt as an active ingredient. The abatement efficiency has been shown to be more than 90% in the following reaction:

$$2\,N_2O \rightarrow 2N_2 + O_2$$

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

The YARA 58 Y 1® abatement catalyst has been proven by industrial testing not to affect plant production levels[7]. Also, only traces of the catalyst material at concentrations of parts per billion could be found in the nitric acid product[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.

Basket modifications and Heat Shield design

Most nitric acid plants have some sort of basket structure that gives structural support to the precious metal gauzes. The ammonia oxidation reaction in Tertre's Uhde 2 nitric acid plant normally operates at temperatures between 780 and 930°C, which causes the basket assembly to expand compared to when the plant is not operational (i.e. during installation of the catalyst).

This effect increases the basket diameter by 1 to 1.5%. The ammonia oxidation reactor of the plant has a diameter of 3820 mm that expands by around 35 to 60 mm when in operation. The pelleted ceramic abatement catalyst does not expand in the same fashion and therefore a gap at the perimeter of the catalyst may occur under normal operation, which would significantly reduce the efficiency of the abatement catalyst. To counter this occurrence, the old basket was replaced with a new design to better support the secondary catalyst installation and the gauze pack. This allows the containment of the pelleted bed in a manner that prevents preferential gas flow at the circumference and optimises the N_2O abatement efficiency of the catalyst.

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[7] 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 152 therein. This source states that NO yields for the ammonia oxidation reaction remain unchanged when operating secondary N_2O abatement catalysts.

[8] This has been proven in industrial testing. The underlying information is commercially sensitive and will be made available to the DOE mandated with the determination procedure upon request. General information on this question is contained in 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 152 therein (available for downloading under http://eippcb.jrc.ec.europa.eu/pages/FActivities.htm)

N_2O abatement catalyst installation

The secondary catalyst itself can easily be installed during a routine plant shut-down and gauze change. The pellets are poured into the new support basket and levelled. The gauze pack is then installed above the levelled catalyst pellets.

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

YARA's Uhde 2 nitric acid plant at Tertre operates at a pressure of around 5.5 bars inside the ammonia oxidation reactor. 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 very small reduction in nitric acid output. In practice, this loss of production is likely to be insignificant.

Technology operation and safety issues

As mentioned before, the secondary abatement technology has been tested in several industrial trials and has proven to be a reliable and environmentally safe method of reducing N_2O.
The catalyst and the AMS will be operated, maintained and supervised by the employees of YARA Tertre according to standards that are normally used in European industry[9]. Due to the long-term catalyst development phase, and also the undertaking of JI projects at its plants in other European countries, there is expert know-how readily available within the YARA group. Therefore, YARA Tertre 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 thorough training sessions for the YARA employees involved.

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, present emission levels would have remained unchanged until the end of December 2012, because:

- there is no legal requirement for YARA Tertre to reduce the emissions of its plant before 01/01/2013;
- implementing N_2O reduction catalyst technology requires significant investments
- implementing N_2O catalyst technology does not yield any other benefits besides potential revenues from ERU sales.

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:

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[9] See section D.3 below

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

Nitric acid production and factual emissions

The 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, emission reductions are determined per unit of product measured in metric tonnes of 100% concentrated nitric acid produced.

At YARA Tertre, the nitric acid production is monitored by two Emerson mass flow meters for continuous HNO_3-flow and concentration measurement. The concentration measurement is cross-checked once per day with results from the central laboratory. As displayed in table 1, the historic production ranges from 235,153 (unusually low production due to an explosion at the plant and a 4-yearly maintenance shutdown) to 273,744 $tHNO_{3.}$

Yara Tertre has been reporting calculated annual N_2O emissions based on measured daily average values to the local environmental authorities of the Walloon region (the *'Direction Générale des Ressources Naturelles et de l'Environnement'*). Between 2004 and 2009, yearly N_2O emissions ranged between 1,678 (min) and 2,220 (max) tN_2O. Based on the annual nitric acid production[10] between 2004 and 2009, pre-project emissions factors have been calculated to range between 6.33 (min) and 8.11 (max) $kgN_2O/tHNO_3$ (see table 1).

Year	Nitric Acid production [$tHNO_3/y$]	Annual emissions (tN2O)	Pre-project emissions N2O [$kg/tHNO_{3]}$	Pre-project emissions [tCO2e]
2004	273,744	2,220	8.11	688,200
2005	262,843	1,988	7.56	616,280
2006	264,016	1,806	6.84	559,860
2007	264,904	1,678	6.33	520,180
2008	265,210	1,926	7.26	597,060
2009	235,153	1,897	8.07	588,070

Table 1: Uhde 2 historic nitric acid production and annual emissions, based on values that were reported to the local environmental authorities of the Walloon region.

Daily average N_2O measurements have been collected during the past few years at the Uhde 2 plant with an ABB 'URAS 2G' IR monitoring system. The measurements gathered during 2009 show that a total of 1,897t N_2O were emitted. Considering that the HNO_3 production for that year was 235,153 tonnes, the average emissions factor for 2009 is calculated to be $8.07kgN_2O/tHNO_3$. This is the figure that was reported to the environmental authorities.

One of the main purposes for establishing a pre-project emissions factor for the project activity is to prove that the historic plant emissions are indeed higher than the highest benchmark value, as described in section A.5 below.

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[10] The nitric acid production is monitored with two Emerson mass flow meters.

This pre-project emissions factor, in conjunction with the predicted abatement efficiency of the catalyst (90%), will be used in order to make assumptions on the emissions factor that might be expected during the project activity.

Table 2 displays the budgeted production amounts for the years 2010 to 2012 and the estimated N_2O emissions.

Year	**Budgeted nitric acid production ($tHNO_3/y$)**	**tN_2O (baseline / business as usual emissions)**	**Emissions factor ($kgN_2O/tHNO_3$)**
2010	272,000	2195.0	8.07
2011	272,000	2195.0	8.07
2012	273,600	2208.0	8.07
Following years	273,600	2208.0	8.07

Table 2: Planned nitric acid production and estimated N_2O emissions at the Uhde 2 plant

Estimation of the emissions reductions eligible to receive ERUs

Deviating from AM0034, factual (historic) emission reductions will not serve as a basis for determining the amount of ERUs issued[11] to the Project Participants for their free use.

For the reasons described in section A.5 below, a benchmark value will be applied by the Wallonian DFP (Walloon Air and Climate Agency)[12]. Accordingly, the **following assumptions** apply to the establishment of the emissions reductions eligible for ERUs:

- The project activity starts on 08/12/2010;
- YARA Tertre produces the amounts of nitric acid according to the production budget provided above, each year's production being equally distributed throughout the period;
- Factual emissions from the plant without catalyst would be higher than the highest benchmark level specified by the Wallonian DFP ($2.5kgN_2O/tHNO_3$);
- 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 0.807kgN2O/tHNO3)
- The ERU figures included in this PDD are *estimations* only. ERUs will therefore finally be awarded for those factual emissions reductions achieved below the applicable benchmark emissions factor and subsequently verified by the responsible AIE, and not in accordance with the preliminary estimations provided in this PDD.

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[11] See section A5 & E.6 below for detailed information.

[12] Agence Wallonne de l'Air et du Climat (http://airclimat.wallonie.be)

- This PDD applies the benchmark values of: 2.5 kgN_2O/tHNO_3 throughout 2010 and 2011 and 1.85kgN_2O/tHNO_3 from 01/01/2012, in accordance with an official letter from the Walloon government, dated 22/10/2010.

The following tables 3 and 4 display the emissions reductions expected during the crediting period.

Crediting Period (years)	Nitric Acid Production [tHNO3]	Emission Reductions [tCO_2e]
2010 (from 8th Dec)	17,378	9,120
2011	272,000	142,754
2012	273,600	88,463
Subtotal (estimated)	**562,978**	**240,337**
Average per year (until end 2012)	**272,775**	**116,449**

Table 3 (part A): Estimated emission reductions with applied benchmark factor until 2012

Crediting Period (years)	Nitric Acid Production [tHNO3]	Emission reductions [tCO_2e]
2013	273,600	85,039
2014	273,600	85,039
2015	273,600	85,039
2016	273,600	85,039
2017	273,600	85,039
2018	273,600	85,039
2019	273,600	85,039
2020 (Jan to Nov)	256,120	79,606
Total number of crediting years		**10**
Total estimated (2010 to 2020)	**2,734,298**	**915,214**
Annual average (2010 to 2020)	**273,430**	**91,521**

Table 4 (part B): Estimated emission reductions with applied benchmark factor from 2013 onwards.

* Due to the likely inclusion of N_2O emissions emanating from nitric acid production into the EU ETS from 01/01/2013 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 31/12/ 2012 and emissions reductions generated from 01/01/ 2013 onwards.

A.5. Project approval by the Parties involved:

For Belgium, the 'National Climate Commission' was appointed as Focal Point and Designated National Authority and takes responsibility for approving all projects being implemented *outside* Belgium.

However, the responsibility for approval of projects hosted on Belgian territory is divided between the regional administrations of the Walloon and Flemish governments. The Flemish administration has taken the decision not to allow JI projects on its territory.

However, Yara Tertre is located in the Walloon region. Following two meetings with representatives from the Walloon DFP during summer 2010, the administration confirmed that it intended to accept JI projects on its territory, but that the exact rules and procedures were still to be finalised. On 22/10/2010, the project participants received an official confirmation that such JI projects would be accepted by the Walloon government. The procedures for approval of these domestic JI projects have now been incorporated into the Arrêté of the Walloon government, dated 08/07/2010, on the 'eligibility criteria and approval procedures for projects implemented under the Kyoto Protocol's flexible mechanisms'[13].

A decision on approval of the Yara Tertre Uhde 2 JI project will be taken at the end of the official project approval procedures, which will be initiated upon the submission of the full project dossier.

The project proponents will apply the approved CDM baseline & monitoring methodology AM0034, version 05, "Catalytic reduction of N2O inside the ammonia burner of nitric acid plants" to the intended project activity. However, some amendments were made in order to take into account the project-specific context. The most decisive deviation is the implementation of a benchmark value used for calculating the emission reductions for which ERUs will be awarded. The project proponents will only receive ERUs in so far as the project activity achieves emission levels below that benchmark value. All emission reductions achieved from the business-as-usual emission level down to the benchmark value result in freed AAUs, which count towards the Belgian Kyoto target[14]. The concept of a benchmark value is outlined in the illustration below.

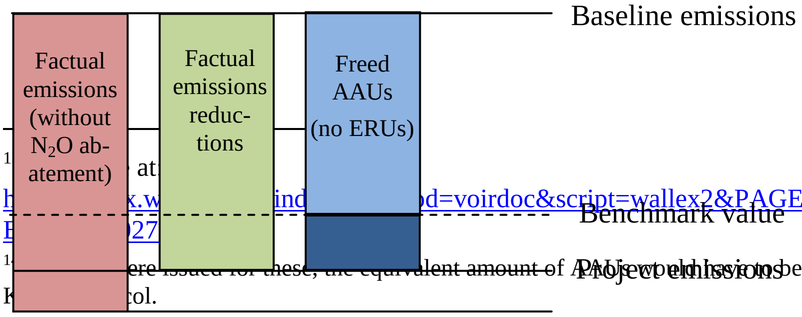

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Illustration: Benchmark value

The applicable benchmark emissions factors for N_2O abatement projects in Walloon nitric acid plants were confirmed by the Wallonian DFP on 22/10/ 2010 and are as follows:

2010	2011	2012
2.5kg	2.5kg	1.85kg

Table: applicable JI project benchmark emissions factors for Walloon nitric acid plants

If the above values are revised during the course of the project activity, the project proponents explicitly reserve the right to apply such new benchmark values for the respective project periods.

In addition, the project proponents understand that they may have to apply for an additional host country LoA if ERUs are to be claimed for the crediting period from 2013 onwards, depending on whether or not a JI Project would be viable under any new applicable legislation.

SECTION B. Baseline

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

Regulatory framework

The regulatory framework for implementing JI projects in Belgium 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[15], the Linking Directive[16] and

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[15] 2003/87/EC, published in the internet under http://ec.europa.eu/environment/climat/emission/implementation_en.htm

[16] 2004/101/EC, published in the internet under http://ec.europa.eu/environment/climat/emission/implementation_en.htm

various JI relevant decisions by EU bodies[17]. Besides acts of law of direct relevance, there are also Directives that have an indirect influence on JI implementation such as the IPPC Directive[18].

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.

The procedures for approval of domestic JI projects in the Walloon region have now been incorporated into the Arrêté of the Walloon government, dated 08/07/2010, on the ‘eligibility criteria and approval procedures for projects implemented under the Kyoto Protocol’s flexible mechanisms’[19].

The JI SC has specified that JI project proponents may choose between two options when implementing JI projects: they may either (i) use a multi project emission factor (ii) or establish a project specific baseline[20]. Due to the significant variances typically observable in different nitric acid plants, it would not be appropriate to derive a multi-project emission factor. Instead, the project proponents apply a pre-project-emission factor as defined in section A.5.

Explanation and Justification for deviations from AM0034

The following aspects of the approved CDM baseline & monitoring methodology AM0034, version 05, “Catalytic reduction of N2O inside the ammonia burner of nitric acid plants” are either not applied or applied in a modified manner:

Project Implementation Aspect	AM0034	Adjustment in JI project specific context	Explanation / Justification
Applicability criteria	Applicability criteria include one aspect which is not relevant in the JI context	One applicability criterion has been, in part, not applied.	*‘Continuous real time measurements of N_2O concentration and gas volume flow can be carried out in the stack prior to the installation of the secondary catalyst for one campaign’.* This criterion is not applicable in the case where a historic baseline is not being measured and where a JI benchmark value is being applied instead.
Baseline campaign	Baseline emissions established	Benchmark factors are used for	Establishing a baseline on a set of pre-catalyst campaign data (i.e. the base-

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

[18] 2008/1/EC, published in the internet under http://ec.europa.eu/environment/air/pollutants/stationary/ippc/index.htm

[19] See footnote 13

[20] The requirements for this approach are outlined in the 4th JI SC Meeting Report, Annex 6 “Guidance in the Criteria for Baseline Setting and Monitoring” (Version 01), section B; paragraphs 18 ff. (see the internet under http://ji.unfccc.int/Sup_Committee/Meetings/index.html for reference).

	based on distinct baseline campaign.	determining reference case emissions.	line approach) is not used in the context of the proposed JI project activity. Instead, a benchmark of 2.5 kgN_2O/tHNO_3 will be applied by the Walloon government during 2010 and 2011, lowering to 1.85kgN_2O/tHNO_3 in 2012. However, in order to prove that historic plant emissions are higher than the applicable benchmark emissions factors, a 'pre-project emissions factor' will be defined. See section A.5.
Baseline Emissions	Baseline Emissions are based on the factual business as usual emissions.	For this project, a benchmark value is applied for assessing the amount of emission reductions for which free ERUs will be allocated.	This approach for establishing the assumed reference case scenario is based on European standards (such as the IPPC directive), even though compulsory national legislative caps on N_2O emissions from nitric acid production are not generally in force in the European Union.
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 used, but emission reductions are calculated based on conservative Benchmark Emissions Factors instead, there is no possibility for the operator for "baseline gaming" and hence, there is no need to establish a permitted range of operational parameters.
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	Baseline data is not subject to statistical analysis.	As no baseline campaign is undertaken, there is no baseline campaign data that could be subject to statistical analysis. However, the project emissions data will still be subject to a full statistical analysis.

	plant operation.		
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 non-measured benchmark values instead. Applying uncertainty is not appropriate, as the benchmark emissions factors are 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.	EF_{BL} is not being applied.	Because emission reductions are not assessed based on factual emissions, this measure is not needed.
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), 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.	AM0034 uses this measure to account for the possible effect that platinum deposits, formed downstream of the ammonia oxidation reactor, would have had on N_2O concentrations in the off-gas in the identified baseline scenario (assuming that the plant would have been operated without any N_2O abatement devices in the absence of the proposed project activity). In effect, this step aims to include platinum deposit-related changes to the baseline emissions. Because emission reductions are not assessed based on factual emissions (i.e. a baseline campaign), this step is no longer necessary.
Minimum project emissions	No project emissions factor after	This restriction does not apply.	AM0034 uses this measure to account for the possible effect that platinum

factor after 10th campaign	the 10th project campaign may be lower than the lowest recorded during these campaigns.		deposits, formed downstream of the ammonia oxidation reactor, would have had on N_2O concentrations in the off-gas in the identified baseline scenario (assuming that the plant would have been operated without any N_2O abatement devices in the absence of the proposed project activity). In effect, this step aims to include platinum deposit-related changes to the baseline emissions. Because emission reductions are not assessed based on factual emissions (i.e. a baseline campaign), this step is no longer necessary.
AMS downtime	AM0034 states: In the event that the monitoring system is down, the lowest between the conservative 4.5 $kgN_20/tHNO_3$ IPPC 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 the highest value measured during the whole of the relevant verification period. The assessment should be based on values measured during periods of standard AMS operation and recording after elimination of mavericks. ‘Mavericks’ shall be defined as any values lying outside the 95% confidence interval. This replacement of missing data will be done on the	Firstly there is no distinction between downtime during the baseline and downtime during the project, since no baseline is being measured. Secondly, the default factor contained in AM0034 would not be appropriate in the case where the benchmark factor being applied is the same as, or lower than, the default value. In addition, 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.

		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.	
Recording and storage interval for the parameters NCSG, VSG, TSG and	AM0034 requires the use of a recording frequency of 2 seconds for these	A recording frequency of 5 seconds will be applied for the Dr Foedisch ana-	Due to the stable operating conditions in the plant and very low variations of N_2O emission values, an interval of 5 seconds is sufficient in order to establish high quality hourly mean values

PSG	parameters.	lyser, while a 2-minute frequency will be applied for the ABB analyser.	from the Dr Foedisch analyser. A higher density of recorded values is not necessary. The lower frequency of 2 minutes, recorded with the ABB analyser at the beginning of the project, will be compensated for by application of a suitable uncertainty factor to the measurement results.

Applicability of AM0034 taking into account the above modifications

The methodology is applicable to project activities aiming to install secondary N_2O abatement at a nitric acid plant. YARA Uhde 2 consists of one ammonia burner feeding into one absorption tower and the off-gasses are emitted through one stack. The secondary N_2O catalyst system was inserted into the ammonia reactor during a shutdown; the abatement system is installed underneath the primary catalyst gauzes. This corresponds to the defined scope of the methodology. Also, the project activity does not lead to the shutdown of any N_2O abatement devices already installed. There was no N_2O abatement technology in place prior to the implementation of the project activity.

Moreover, the project activity will not increase NO_X emissions. The secondary catalyst technology installed has no effect on NO_X emission levels. This has been scrutinised in industrial testing over extended industrial process application[21]. In addition, the regular and compulsory NO_X tests conducted by YARA under the supervision of the responsible local environmental authority would reveal any changes in NO_X emission levels.

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:

Identification of the baseline scenario

The approved baseline methodology AM0034 (Version 05) refers to AM0028 (Version 05) with regard to the identification of the baseline scenario. These methodologies were adapted to the JI specific context as described in section B.1 above. Furthermore, the following steps are based on the "Combined Tool to identify the baseline scenario and demonstrate additionality" (Version 02.2)[22].

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;

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[21] 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. This source states that NO yields for the ammonia oxidation reaction remain unchanged when operating secondary N_2O abatement catalysts.

[22] 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

- 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) De-NOx 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 present situation, the 'Status Quo'

There has been no N_2O abatement technology installed in the plant prior to the implementation of the project activity. Therefore, all scenario alternatives dealing with continuing the operation of N_2O abatement catalysts already installed do not apply in the context of this project.

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

  The use of N_2O for external purposes is not practised anywhere in the world, because N2O cannot be put to any economic use at the concentrations at which it occurs in the stack gas of nitric acid plants. The average N_2O concentration in the tail gas of the Uhde 2 plant during standard operation is around 1300 ppmv, 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 Tertre 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) NO_X catalyst unit is uneconomic, because YARA Tertre is already in compliance with the prevailing NO_X regulations[23]. 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. Having passed through the absorption tower, the gas mix has been cooled to a temperature level below that required for NSCR abatement catalysts to function[24]. Because of this, an NSCR abatement system would only work if the stack gas mix is re-heated[25].

Since the absorption tower at Uhde 2 has been specially designed to produce very low NOx emissions, Uhde 2 is currently achieving emission levels (116 ppm) below the applicable limit of 204 ppm. The regulatory levels would therefore need to be significantly lower in order to enforce any additional adaptation requirements upon YARA Tertre.

As the existing absorption tower is already very efficient at abating NOx, there would be no point in also installing NSCR, even if this technology was 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 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[26].

Step 1b: In addition to the baseline scenario alternatives of Step 1a, all possible options that are technically feasible to handle NOx emissions should be considered. The installation of a NSCR

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[23] Article 21, §1 on page 45 of the environmental permit dated 23/09/ 2010

[24] 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.

[25] 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).

[26] Footnotes 24 and 25 also tend to apply to tertiary catalysts, depending on the exact type.

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;

  The absorption tower at Uhde 2 has been specially designed to produce very low NOx emissions and therefore no additional de-NOx unit is necessary

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

  As mentioned above in section 1.4 of Step 1a, the absorption tower is functioning efficiently enough to satisfy the plant's applicable NOx regulations. The plant would therefore not consider the installation of an additional de-NOx 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 both uneconomical and unnecessary, 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 requirements for YARA Tertre in Belgium to reduce its N_2O emissions. However, page 12 of the environmental permit issued in September 2010 notes that in 3 years' time Yara Tertre will be forced to reduce its N_2O emissions, since this gas will be covered by the EU Emissions Trading Scheme from 2013 and the plant will have to comply with whatever regulatory value is imposed at that point.

NO_X-emissions are regulated by an environmental permit for the YARA Tertre plants. According to article 21, §1, on page 45 of the permit dated 23/09/2010[27], the permitted level is 400mg/m^3 as a daily average value, which equates to 204 ppm. According to continuous measurements taken at the Uhde 2 plant throughout 2009, the average NOx emissions were 0.72kg/$tHNO_3$, which equates to approximately 116 ppm[28]. The plant is therefore in compliance with its emission requirements.

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[27] The environmental permit for the plant was made available for inspection by the AIE during the on-site Determination.

[28] NO_X-readings will be provided to the AIE during the on-site Determination.

Uhde 2's NO_X emissions will remain constant and in compliance with the regulatory limit also after the installation of the secondary catalyst. This is safeguarded by the fact that NO_X emissions are monitored by the responsible local environmental authority.

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.

However, any operator willing to install and thereafter operate such technology faces significant investment and additional operating costs:

The proposed project activity aims to install and operate 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 catalyst material and a suitable AMS, Yara Tertre 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 for.

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 these reasons, the only alternative that does not face significant investment barriers is the "continuation of the status quo".

Technological barriers

All of the available N_2O abatement technologies have to be integrated in the nitric acid plant. Primary and secondary abatement technologies are 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.

It is unlikely that any plant operator would 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).

For these reasons, all the above scenarios, with the sole exception of the continuation of the status quo, face significant technological barriers.

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 use ERU revenues gained by participating in the JI, and can thus overcome the identified barriers by using the additional financial means available, are not to be taken into account.

Before the implementation of JI projects within Europe, secondary catalyst technology had 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 will be included in the European Union Emissions Trading Scheme ("EU ETS")[29] or otherwise regulated. Both aspects provided some incentive for developing N_2O abatement technology.

However, now that research and development has been completed and secondary catalyst technology is being employed successfully in many CDM projects worldwide, plant operators would no longer be willing to incur the costs associated with the continued operation of such technology. 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 are currently being developed across the EU in countries such as Poland, Lithuania, Hungary, Romania, Bulgaria, France, Finland, Sweden and Germany.

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

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[29] On 23/01/2008, 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).

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.

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 NO_x 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 scenario shall be re-assessed at the time the legislation has to be legally implemented.

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 devices shall also be regarded as being within the project boundary.

The flow chart below provides an overview on the plant’s process design:

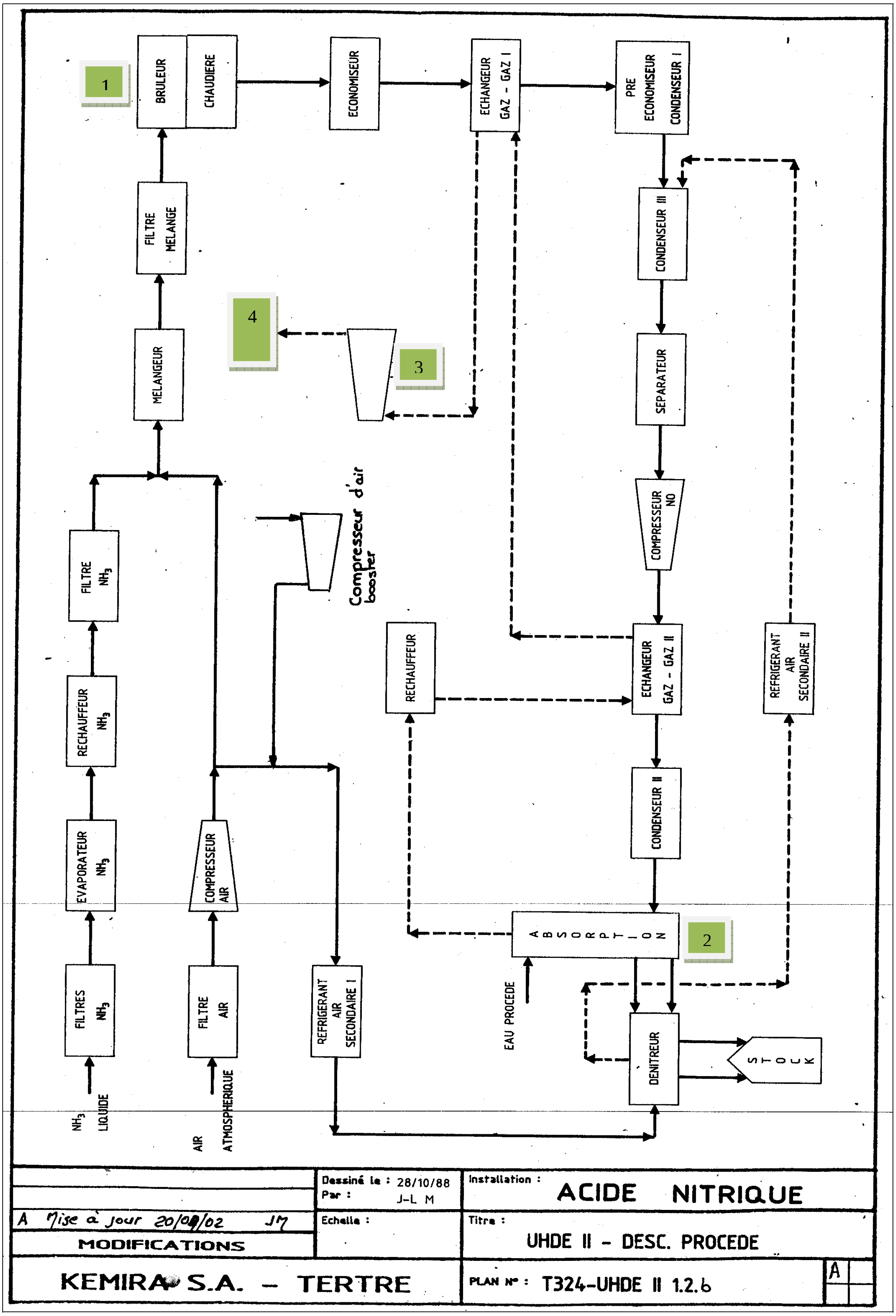

Illustration: Flow chart for the YARA Tertre Uhde 2 nitric acid plant.

1 = Ammonia Oxidation Reactor (AOR)

2 = Absorption Column

3 = Tail gas turbine

4 = Tail gas stack

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

	Source	**Gas**	**Included?**	**Justification / Explanation**
Baseline	Benchmark Emissions Factor set by government	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	
		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: 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:

The baseline scenario is that, given the absence of any N_2O regulations at the plant, Uhde 2 would not install any N_2O reduction technology and would continue emitting N_2O at the current levels until the introduction of the nitric acid sector into the EU ETS from January 2013 onwards. This baseline scenario was established on 15/10/2010 by Mrs Rebecca Cardani-Strange of N.serve Environmental Services GmbH.

In the absence of a measured historic baseline emissions factor, a ‘pre-project’ emissions factor has been established, as described in section A.4.3.1 above. The historic, pre-catalyst emissions of the plant are calculated to be 8.07kgN_2O/tHNO_3 for 2009. This figure is based on daily average values of N_2O concentration over a period of 12 months. N_2O data was obtained using an ABB ‘URAS 2G’ IR analyser. The value of 8.07kgN_2O/tHNO_3 has been used for estimating the expected factual emission reductions that will result from the project activity if it is successful.

This pre-project emissions factor was calculated by Mrs Rebecca Cardani-Strange of N.serve Environmental Services GmbH on 06/10/2010.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Project start date: 08/12/2010.

The N_2O abatement catalyst can only be installed during a plant shut-down. At the Uhde 2 plant, a shut-down only takes place every 10-11 months in order to exchange the primary catalyst gauzes or for maintenance purposes. A shut-down took place at the beginning of December and so the official starting date of the project is 08/12/2010, when the plant re-started production with the abatement catalyst installed. Since the official approval of the Walloon government will be received only in early-mid 2011, the project proponents would have had to delay the installation of the N_2O abatement catalyst until the next scheduled shut-down in late 2011. If Tertre had not taken this opportunity to install the abatement catalyst, a JI project would hardly be viable with less than 1.5 years in which to generate ERUs.

Thus, in accordance with the standard procedures for JI and CDM projects, the Project Participants will claim ERUs for emission reductions achieved from the installation of the catalyst onwards (retroactive ERUs), even if the final approval of the JI project is received at a later date.

C.2. Expected operational lifetime of the project:

Since the expected lifetime of the catalyst is three years, it will probably need to be replaced in December 2013. The total anticipated duration of the project's operational life is therefore 3 years.

In reality however, the project is expected to run for only 2 years and 1 month (until the end of December 2012), since it is almost certain 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 every 3 years for the total operational lifetime of the plant, which is expected to be approximately another 15 years.

C.3. Length of the crediting period:

The Project Participants herewith apply for a crediting period of 10 years. The JI project will be terminated earlier, if there is a legal requirement to do so. All laws relevant for this project[31] will be complied with at all times during the chosen crediting period.

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[30] See footnote 29

[31] See section B.1 & B.2 above for more detailed information.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The emission reductions achieved by the project activity will be monitored using the approved monitoring methodology AM0034, ver.05, as prepared by N.serve Environmental Services GmbH, Germany. It is the appropriate monitoring methodology to be used in conjunction with the baseline methodology AM0034, ver.05, “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. Please see section B.1 “Explanation and Justification for deviations from AM0034” for the project-specific deviations that are being applied to the above-mentioned methodology.

AM0034 requires the use of the European Norm EN14181 (2004) *“Stationary source emissions - Quality assurance of automated measuring systems”*[32] as a guidance for installing and operating the Automated Monitoring System (AMS) in 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 analyzer 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 the Tertre Uhde 2 nitric acid plant.

1. General Description of the AMS

Since the end of 2007, YARA Tertre `s Uhde 2 plant has been equipped with an ABB ‘URAS 2G’ infrared analyser, measuring gas concentration at the tail gas stack. This ABB analyser will be used for approximately the first month of the project period, until the installation of a new analyser (see paragraph below). The data will be verified by performing a QAL2 test and retroactively applying the relevant correction factors. Data has been collected by a Honeywell PHD (Plant History Database) system that is capable of measuring at a very high sampling rate. Two Emerson mass flow meters are used for measuring continuous HNO_3-flow and HNO_3- concentration.

However, in mid January 2011, the Uhde 2 plant will be equipped with a 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. A Dr. Födisch FMD 99 Stack Gas Flow

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[32] This standard describes the quality assurance procedures needed to assure that an Automated Measuring System (AMS) installed to measure emissions to air are 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.

meter will also be installed for measuring gas volume flow in the stack. The plant will continue to use its existing data collection system for the duration of the project activity.

Since this nitric acid plant has been in operation since 1976, YARA Tertre's staff is accustomed to operating technical equipment adhering to high quality standards.

The Yara Tertre Site Manager and Process Engineer are responsible for the ongoing operation of the project. The analyser and instrumentation specialists are responsible for quality assurance and maintenance of the N_2O monitoring system installed at the plant. Operation, maintenance and calibration intervals will be 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 by the supplier of the AMS. YARA is in the process of developing an AMS checking procedure schedule for the duration of the crediting period, strictly adhering to the named standards[33].

All monitoring procedures at YARA are also conducted and recorded in accordance with the procedures under ISO 9001 and ISO 14001, which is regularly audited by an independent auditing organisation accredited for ISO 9001 certification.

2. Sample points

The sample points are chosen in accordance with the AMS requirements, EN 14181 requirements and the plant design specifications to allow an optimum of data collecting quality. The sample points for the N_2O (NCSG) and VSG (gas volume flow) measurements must be located downstream of all process equipment. To ensure homogeneity of gas flow at the sample points, it is recommended that there is an undisturbed straight length of pipe before the sampling points, of around 5 times the diameter of the stack, and that the measurements are taken at a point where the tail gas temperature is less than 300C (N_2O is unstable at temperatures above 300C). These points should also be at a suitable distance from the calibration ports to ensure no interference occurs during the reference measurements.

3. Analyser

An ABB 'URAS 2G' infrared analyser will be used for the project measurements for approximately the first month of the project period, until the installation of a new Dr. Födisch MCA 04 Continuous Emissions Analyser in mid January 2011. The data from the ABB analyser will be verified by performing a QAL2 test and retroactively applying the relevant correction factors. The analysis system MCA 04 is an extractive, continuous measuring system. The analysis system MCA 04 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.

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[33] These procedures will be made available during the first verification.

According to EN 14181 the Analyser is QAL1[34] 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: N_2O, CO, NO, SO_2, HCL, NH_3, H_2O and the test was successfully completed in October 2009. A QAL2 audit will be performed on both the ABB and the Dr Foedisch analysers in early 2011 by an independent laboratory with EN ISO/IEC 17025 accreditation.

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

For approximately the first month of the project period, before the installation of the new Dr Foedisch FMD99 flow meter, the tail gas volume flow will be calculated by means of a Mass Balance Calculation. Details of this calculation will be made available to the verifying AIE.

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[35] 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 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 Tertre nitric acid plant is equipped with a Honeywell PHD (Plant History Database) data acquisition system that collects and stores all the values for NCSG, VSG, TSG, PSG as well as different status signals of the AMS. The maximum and minimum oxidation temperature trip points and the maximum ammonia to air flow ratio are considered as the status signals that define whether or not the plant is in operation.

Data that is directly related to plant operation, such as oxidation temperature, oxidation pressure, ammonia flow rate, ammonia to air ratio and nitric acid producti on rate, is stored in the same data logging system.

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

[35] 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).

7. Data evaluation

The nitric acid plant operator derives hourly averages for all of the monitored parameters from the data management system. This data is exported to EXCEL-format and delivered by email or CD from the plant operator to N.serve. N.serve 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. N.serve's monitoring specialists are responsible for the correct handling and processing of the monitoring data, as well as the calculation of respective emission reductions and preparation of monitoring reports.

After a first plausibility-check, the data is transferred to a special data bank system. All necessary calculations and necessary steps of data analysis of the monitoring data according to AM0034 regulations, as well as other regulations outlined in this PDD, are carried out by N.serve using the data bank tool.

The results of the data analysis are transferred to an Excel – spreadsheet. The results are used for definition of the 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

In accordance with EN14181 an AMS shall 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 [36] 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: N_2O, CO, NO, SO2, HC1, NH3, H2O, and the test was successfully completed in October 2009.

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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[36] 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[37].

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.

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. According to EN14181, the QAL2 test including the SRM need to be conducted by an independent “testing house” or laboratory which has to be accredited to EN ISO/IEC 17025. A QAL2 test will be conducted on both the ABB and the Dr Foedisch analysers in early 2011.

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 is 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. 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.

N_2O-Analyser Zero Calibration

Conditioned ambient air is used as reference gas for zero calibration. The zero calibration is conducted automatically every 24 hours. Manual calibrations are done at least once per month (the calibration frequency might be adjusted if necessary).

N_2O-Analyser Span calibration

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[37] 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

Manual span calibrations are done with certified calibration gas at least once per month (the calibration frequency might be adjusted if necessary).

The calibration 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:

Please note that only the monitoring of the emissions in the project scenario is applicable since a benchmark value will be applied and not a baseline emissions factor.

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

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P.1	$NCSG_n$ *Hourly average* N_2O *concentration in the tail gas.*	N_2O *analyser (part of AMS)*	mgN_2O/Nm^3	*Measured*	*Hourly average value based on a monitoring frequency of 5 seconds for the Dr Foedsich analyser and 2 minutes for the ABB analyser.*	*100%*	*Electronic*	*The lower measurement frequency of the ABB analyser will be compensated for by application of a suitable uncertainty factor to the measurement results.*

P.2	*VSG_n* *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 monitoring frequency of 5 seconds. Volume flow will be calculated by means of a MBC for the first month of the project.*	*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.9) and PSG (P.10) data.*
P.3	*PE_n* *N_2O emissions during project Verification Period n.*	*Calculation from measured data.*	*tN_2O*	*calculated*	*Calculated after Verification Period has been defined by the project proponents*	*100%*	*Electronic*	

P.4	*OH_n* *Total operating hours of Verification Period*	*Production Log, plant status signal*	*Hours*	*Recorded*	*Daily, compiled for entire verification period*	*100%*	*Electronic*	*Electronically recorded, based on plant status signal*
P.5	*NAP_n* *Metric tonnes of 100% concentrated nitric acid produced during any Verification Period from two separate HNO_3 production lines (60% and 69%)*	*Two nitric acid flow meters*	*$tHNO_3$*	*Measured*	*Hourly average value based on a monitoring frequency of 30 seconds for each of the two different acid concentrations.*	*100%*	*Electronic*	*In case of downtime of the equipment (e.g. during calibration), NAP may be determined by other means (e.g. additional volume flow meter or mass balance calculation)*
P.6	*OT_h* *Oxidation temperature in the ammonia oxidation reactor (AOR).*	*Thermocouples inside the AOR*	*°C*	*Measured, if applicable (see comments).*	*Hourly average value based on a monitoring frequency of 30 seconds.*	*none*	*Electronic*	
P.7	*AFR* *Ammonia Flow rate to the ammonia oxidation reactor (AOR)*	*Ammonia flow meter*	*$kgNH_3/h$*	*Measured, if applicable (see comments).*	*Hourly average value based on a monitoring frequency of 30 seconds or less.*	*none*	*Electronic*	

P.8	*AIFR* *Ammonia to air ratio going into the ammonia oxidation reactor (AOR)*	*Ammonia & Air flow meters*	*%*	*Calculated, if applicable (see comments)*	*Hourly average value based on a monitoring frequency of 30 seconds.*	*none*	*Electronic*	
P.9	*TSG* *Temperature of tail gas*	*Probe (part of the AMS gas volume flow meter).*	*°C*	*Monitored.*	*Hourly average value based on a monitoring frequency of 5 seconds.*	*100%*	*Electronic*	*Used for normalization of VSG measurement to standard conditions see P.2*
P.10	*PSG* *Pressure of tail gas*	*Probe (part of the AMS gas volume flow meter).*	*Pa*	*Monitored.*	*Hourly average value based on a monitoring frequency of 5 seconds.*	*100%*	*Electronic*	*Used for normalization of VSG measurement to standard conditions see P.2*
P.11	EF_n *Emissions factor calculated for project Verification Period n*	*Calculated from measured data*	$tN_2O / tHNO_3$	*Calculated*	*After each Verification Period*	*100%*	*Electronic*	
P.12	EF_{BM} *Emissions Factor Benchmark that will be applied to calculate the emissions reductions from a specific Verification Period*	*Determined according to host country approval*	$kgN_2O / tHNO_3$	*Not applicable*	*Continuous*	*100%*	*Paper*	*To be determined for each verification period in accordance with the host country approval* *See section A.5*

P.13	*EF_{reg}* *Emissions cap for N_2O from nitric acid production set by government or local regulation*	*Belgian 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):

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The project emissions will not be estimated, but monitored using the parameters described above in D.1.1.

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

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

\>>

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

Not applicable

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

Estimation of Verification Period specific project emissions

The project emission factor is assessed based on N_2O concentration ($NCSG_n$) and gas volume flow (VSG_n) 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 ERUs issued, the methodology does not need to provide measures against any abusive practices. Project operators will be sufficiently incentivised to run their plants at emission levels as low as possible in order not to lose ERU-revenues. In case a plant is emitting more N_2O than the Benchmark 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[38] 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.

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[38] For the avoidance of doubt, ERU reductions for production periods with emission levels above the applicable Benchmark Emissions Factor DO NOT apply!

Measuring of N_2O data sets for the calculation of project emissions

Throughout the project's crediting period, N_2O concentration ($NCSG_n$) and volume flow in the stack gas (VSG_n) are to be monitored. The monitoring system provides separate hourly average values for $NCSG_n$ and VSG_n based on 5-second interval readings. These N_2O data sets (consisting of $NCSG_n$ and VSG_n 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) as recorded by the plant's process control system and the nitric acid production output (NAP_n) are required for calculating the project emissions.

Because the reference Benchmark Value (EF_{BM}) (unlike the Emissions Factor Baseline EF_{BL} in AM0034) 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.

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 the highest of the remaining valid values measured during the whole of the relevant verification period. The assessment should be based on values measured during periods of standard AMS operation and recording after elimination of mavericks. 'Mavericks' shall be defined as any values lying outside the 95% confidence interval. 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 for 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. Status signals from the plant operation system (AOR temperature range and maximum ammonia to air ratio) will be constantly monitored in order to decide automatically whether the plant is in operation or not. The trip point range for AOR temperature is 780°C (min) to 930°C (max), while the maximum ammonia to air ratio is 12.2%.

Consequently, any NCSG and VSG data sets that were recorded at times when plant was shut down are automatically excluded from the derivation of EF_n. The number of operating hours (OH_n) will be reduced accordingly.

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, are not automatically applied to the raw data recorded by the data storage system at the plant. They will be applied to the determined VSG and NCSG values during the statistical analysis of the data. .

As a first step of data handling and evaluation, implausible results are removed from the data sets: For all NCSG hourly average data and VSG hourly average data, a separate plausibility check is conducted. Any negative NCSG or VSG results are defined as implausible. All implausible NCSG or VSG hourly average data is replaced according to the procedures for analyser downtime, as detailed above.

Measurement results can be distorted before and after periods of downtime or malfunction of the monitoring system and can lead to mavericks. To eliminate such extremes and to ensure a conservative approach, the following statistical evaluation is to be applied to the complete data series of N_2O concentration, as well as to the data series for gas volume flow:

(a) Calculate the sample mean (x);

(b) Calculate the sample standard deviation(s);

(c)Calculate the 95% confidence interval (equal to 1.96 times the standard deviation);

(d) Eliminate all data that lie outside the 95% confidence interval;

(e) Calculate the new sample mean from the remaining values. Use the mean value of VSG for the verification period (VSG_n) in equation 1. However, for the calculation of the mean value of NCSG ($NCSG_n$), use equation 2, by taking the result of the hourly measurements ($NSCG_{xp}$ and VSG_{xp}), corrected by the above statistical procedure.

Calculation of the EF_n-value

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 N2O mass-flow is calculated on the basis of the hourly average results, in accordance with the following equation:

$$PE_n = VSG_n \times NCSG_n \times OH_n \times 10^{-9} \qquad (tN_2O) \qquad \textbf{(1)}$$

Where:

PE_n = Total N_2O emissions of the project Verification Period (tN_2O)

VSG_n= Mean stack gas volume flow rate for the project verification period (m^3/h)

$NCSG_n$= Mean concentration of N_2O in the stack gas for the project verification period (mgN_2O/m^3) (To be calculated using equation 2 below)

OH_n = Number of hours of operation in the project Verification period (h)

$NCSG_n$ shall be calculated using the following equation:

$$NCSG_n = \frac{\sum_{xp=1}^{xp=vmp} NCSG_{xp} \times VSG_{xp}}{\sum_{xp=1}^{xp=vmp} VSG_{xp}} \qquad \textbf{(2)}$$

Where:

xp = Each measurement interval during the verification period (1h)

vmp = Verification measurement period

$NCSG_{xp}$= Hourly average concentration of N_2O in the stack gas in each measurement time interval of 1 hour during the verification measurement period (vmp), excluding the outliers as determined using the statistical procedure above (mgN_2O/m^3)

VSG_{xp} = Hourly average stack gas volume flow rate in each measurement time interval of 1 hour during the verification measurement period (vmp), excluding the outliers as determined using the statistical procedure above (m^3/h)

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 the Verification Period (EF_n) shall then be calculated as follows:

$$EF_n = (PE_n / NAP_n) \qquad (tN_2O/tHNO_3) \qquad \textbf{(3)}$$

where:

Variable	Definition
EF_n	Emissions factor used to calculate the emissions from the defined Verification Period n ($tN_2O/tHNO_3$)
PE_n	total specific N_2O emissions during the Verification Period (tN_2O)
NAP_n	Nitric acid production during the Verification Period ($tHNO_3$)

Allocation of ERUs

The **emission reductions based on which ERUs will be issued** for the project activity are determined by deducting the project-specific emission factor from the Benchmark Value and multiplying the result by the production output of 100% concentrated nitric acid over the period for which ERUs are to be claimed and the GWP of N_2O, as follows:

$$ERU = (EF_{BM} - EF_n)/1000 \times NAP \times GWP_{N2O} \qquad (tCO_2e) \qquad \textbf{(4)}$$

Where:

Variable	Definition
ERU =	Emission reductions awardable to the project for the specific Verification Period (tCO_2e)
NAP =	Nitric acid production for the Verification Period ($tHNO_3$).

EF_{BM} = Benchmark Emissions factor according to host country approval ($kgN_2O/tHNO_3$); see section A.5 (last paragraph) of the PDD for further information.

EF_n = Emissions factor used to calculate the emissions from the defined Verification Period n ($kgN_2O/tHNO_3$).

GWP_{N2O} = 310 tCO_2e/tN_2O

For the avoidance of doubt, ERU reductions for production periods with emission levels above the applicable Benchmark Emissions Factor DO NOT apply!

No leakage calculation is required.

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 achieved by the project:

$$EF_{Pest} = EF_{PP} * (1- AE) \qquad (kgN_2O/tHNO_3) \qquad \textbf{(5)}$$

Where:

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

$$ERU_{PIS} = (EF_{BM} – EF_{Pest}) \times NAP_{yr} / 1000 \times GWP_{N2O} \qquad (tCO2e) \qquad \textbf{(6)}$$

ERU_{PIS} =	Estimated number of ERUs to be issued to the project (tCO2e)
EF_{BM} =	Benchmark Emissions factor according to host country approval ($kgN_2O/tHNO_3$); see section A.5 (last paragraph) of the PDD for further information.
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, P9, P10*	*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.: *P3,P11*	*low*	Calculated values included in evaluation by third party AIE
D.1.1.1.: *P4, P5, P6, P7, P8*	*low*	Included in plant internal Quality Assurance program as validated by third party during ISO 9001/ ISO 14001 audit
D.1.1.1.: *P12, P13*	*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:

General Responsibilities

Yara level project coordination

- TPO Nitric Acid
  - General coordination
- Catalyst department
  - Catalyst development

N-Serve

- Project Manager
  - Project implementation and official project documentation
- Monitoring Expert
  - Data analysis from hourly averages

Site management

- Plant Manager
- Production manager
- HESQ manager
  - Environmental permit responsibilities

Nitric acid operation and local project responsibility

- Process Engineer (Nitric acid production & overall project responsibility)

Monitoring:

- Analyser Specialist/Development Engineer
  - Calibrations for analyzers, QAL3 procedures
  - Analyser reliability

- Instrumentation specialist
    - Instrumentation calibration procedures
    - DCS-systems

Data handling:

- data handling specialist
    - raw data handling
    - data collection technique follow up
- Monitoring experts (N-Serve) - statistical analysis & data calculations

Operation, maintenance, calibration and service intervals are 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 Tertre will define an AMS checking procedure schedule for the duration of the crediting period, strictly adhering to the named standards. A training schedule for JI-associated tasks at the plant shall also be integrated into the internal training procedures. All monitoring procedures at YARA Tertre 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.

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

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 08/12/2010.

Please note that all the figures in these tables link into a more complex excel spreadsheet with a greater number of decimal places, so the total figures may not accord completely.

Crediting Period (years)	**Nitric Acid Production [tHNO3]**	**Project Emissions [tCO_2e]**
2010 (from 8th Dec)	17,378	4,347
2011	272,000	68,046
2012	273,600	68,447
Total estimated (until end 2012)	**562,978**	**140,840**
Annual average (until end 2012)	**272,775**	**68,240**

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

Crediting Period (years)	**Nitric Acid Production [tHNO3]**	**Project emissions [tCO_2e]**
2013	273,600	65,797
2014	273,600	65,797
2015	273,600	65,797
2016	273,600	65,797
2017	273,600	65,797
2018	273,600	65,797
2019	273,600	65,797
2020 (Jan to Nov)	256,120	61,593
Total number of crediting years		**10**
Total estimated (2010 to 2020)	**2,734,298**	**663,012**
Annual average (2010 to 2020)	**273,430**	**66,301**

Table 6 (part B): Hypothetic 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:

Benchmark emissions

Please note that emissions reductions eligible for ERUs will be calculated from the applicable Benchmark Emissions Factor[39] and not from the business as usual emissions. These benchmark emissions are displayed in tables 7 and 8. Please note that 1.85kg $N_2O/tHNO_3$ has been used to calculate the Benchmark Emissions Factor from January 2013 onwards.

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[39] See section A.5 for additional information.

Crediting Period (years)	Nitric Acid Production [tHNO3]	Benchmark Emissions [tCO_2e]
2010 (from 8th Dec)	17,378	13,468
2011	272,000	210,800
2012	273,600	156,910
Subtotal (estimated)	**562,978**	**381,177**
Average per year (until end 2012)	**272,775**	**184,689**

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

Crediting Period (years)	Nitric Acid Production [tHNO3]	Benchmark Emissions [tCO_2e]
2013	273,600	150,836
2014	273,600	150,836
2015	273,600	150,836
2016	273,600	150,836
2017	273,600	150,836
2018	273,600	150,836
2019	273,600	150,836
2020 (Jan to Nov)	256,120	141,199
Total number of crediting years		**10**
Total estimated (2010 to 2020)	**2,734,298**	**1,578,226**
Annual average (2010 to 2020)	**273,430**	**157,823**

Table 8 (part B): Hypothetic business as usual emissions from 2013 onwards.

* Due to the likely inclusion of N_2O emissions emanating from nitric acid production into the EU ETS from 01/01/2013 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 31/12/2012 and emissions reductions generated from 01/01/2013 onwards..

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

Emission reductions eligible for earning ERUs

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

PDD. 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 Uhde 2, documentation from the plant shows a daily production capacity of 750tHNO_3, which means that ERUs can therefore only be claimed for a maximum of 273,750 tonnes of nitric acid produced in any one year.

The below tables show the estimated emission reductions taking into account the benchmark emissions factors that will be applied.

Crediting Period (years)	**Nitric Acid Production [tHNO3]**	**Emission Reductions [tCO_2e]**
2010 (from 8th Dec)	17,378	9,120
2011	272,000	142,754
2012	273,600	88,463
Subtotal (estimated)	**562,978**	**240,337**
Average per year (until end 2012)	**272,775**	**116,449**

Table 9 (part A): Emissions reductions until 2012 (taking into account the benchmark value)

Crediting Period (years)	**Nitric Acid Production [tHNO3]**	**Emission reductions [tCO_2e]**
2013	273,600	85,039
2014	273,600	85,039
2015	273,600	85,039
2016	273,600	85,039
2017	273,600	85,039
2018	273,600	85,039
2019	273,600	85,039
2020 (Jan to Nov)	256,120	79,606
Total number of crediting years		**10**
Total estimated (2010 to 2020)	**2,734,298**	**915,214**
Annual average (2010 to 2020)	**273,430**	**91,521**

Table 10 (part B): Emission reductions from 2013 onwards (taking into account the benchmark value)

* Due to the likely inclusion of N_2O emissions emanating from nitric acid production into the EU ETS from 01/01/2013 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 on-

wards 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 31/12/ 2012 and emissions reductions generated from 01/01/ 2013 onwards.

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

Please note that all the figures in these tables link into a more complex excel spreadsheet with a greater number of decimal places, so the total figures may not accord completely.

Crediting Period [years]	Project Emissions [tCO$_2$e]	Benchmark Emissions [tCO$_2$e]	Leakage [tCO$_2$e]	Emission Reductions entitled to ERUs [tCO$_2$e]
2010 (from 8th Dec)	4,347	13,468	-	9,120
2011	68,046	210,800	-	142,754
2012	68,447	156,910	-	88,463
Subtotal (estimated)	**140,840**	**381,177**	**-**	**240,337**
Average per year (until end 2012)	**68,240**	**184,689**	**-**	**116,449**

Table 11 (part A): Summary of calculation of emissions reductions entitled to ERUs until 2012

Crediting Period (years)	Project Emissions [tCO$_2$e]	Benchmark Emissions [tCO$_2$e]	Leakage [tCO$_2$e]	Emission Reductions entitled to ERUs [tCO$_2$e]
2013	65,797	150,836	-	85,039
2014	65,797	150,836	-	85,039
2015	65,797	150,836	-	85,039
2016	65,797	150,836	-	85,039
2017	65,797	150,836	-	85,039
2018	65,797	150,836	-	85,039
2019	65,797	150,836	-	85,039
2020 (Jan to Nov)	61,593	141,199		79,606
Total number of crediting years				**10**
Total estimated (2010 to 2020)	**663,012**	**1,578,226**	**-**	**915,214**
Annual average (2010 to 2020)	**66,301**	**157,823**	**-**	**91,521**

Table 12 (part B): Summary of calculation of 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 01/01/ 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 31/12/ 2012 and emissions reductions generated from 01/01/ 2013 onwards.

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 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. Also, there is no impact on the efficiency of resource utilization.

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:

>> not applicable

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, a local stakeholder consultation has not been undertaken.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

Annex 3

MONITORING INFORMATION

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.

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 Tertre's Uhde 2 nitric acid plant, as well as details on the quality assurance and control procedures to be undertaken, see section D.1 above.