CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Anhui Huainan chemical N_2O Abatement Project at nitric acid plant Line 4

Version: 01

Date: 28/01/2008

A.2. Description of the project activity:

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Anhui Huainan Chemial Group Co., Ltd.(hereafter called" Huainan chemical") mainly products urea, concentrated nitric acid and ammonium nitrate.

Currently Huainan chemical has six nitric acid production plants (Line 1-3: the normal pressure plant and Line 4-6: the medium pressure plant).

The aim of the project activity is to reduce N_2O emissions by installation of a secondary catalyst inside the ammonia oxidation reactor (AOR) at Line 4 for the medium pressure plant, which the commercial production was started in 2001.

The design capacities of nitric acid production for Line 4 is 425 t HNO_3/day (100% nitric acid base)and nitrous oxide (N_2O), which is an undesired by-product of the nitric acid production process, emitted from this plant is about 950 tN_2O/yr.

The high-quality secondary catalyst will be selected, and it is expected that the secondary catalyst can decompose more than 80% of the N_2O, which is formed by the ammonia oxidation catalyst. (Estimated annual GHG emission reductions: approximately 234,000 tCO_2e/yr).

The contribution of sustainable development for the local society, the host country and the globe expected by the project activity are as follows:

(1) The technology, secondary catalyst will be introduced to the project, which will be beneficial to further promote the application of the advanced technology, which is not yet widely commercialized even in the industrialized countries, for the reduction of N_2O emissions in the nitric acid tail gas in China. (2) The implementation of the project activity includes the training course for accurate monitoring, which will provide the staffs of Huainan chemical with an opportunity to learn new technology and improve their skills. (3) In accordance with the stipulation of "Measures for Operation and Management of Clean Development Mechanism Projects in China" which is currently in force, the project activity will contribute 30% of CERs revenues to the funds of China Clean Development Mechanism, which will be used for the relevant activities of climate change and make contribution to the sustainable development of China.

A.3. Project participants:

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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)
The People's Republic of China (host)	**Huainan chemical Group Company Ltd.** [owner and operator of the nitric acid plant]	No
Japan	**Marubeni Corporation** [developer and financer]	No
Japan	**Toyo Engineering Corp.** [technical advisor]	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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The People's Republic of China

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

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Huainan city, Anhui province

A.4.1.3. City/Town/Community etc:

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Quanshan, Huainan city, Anhui province

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

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Huainan chemical is located on a suburb area about 3 km from Huainan city center in the east part of China.

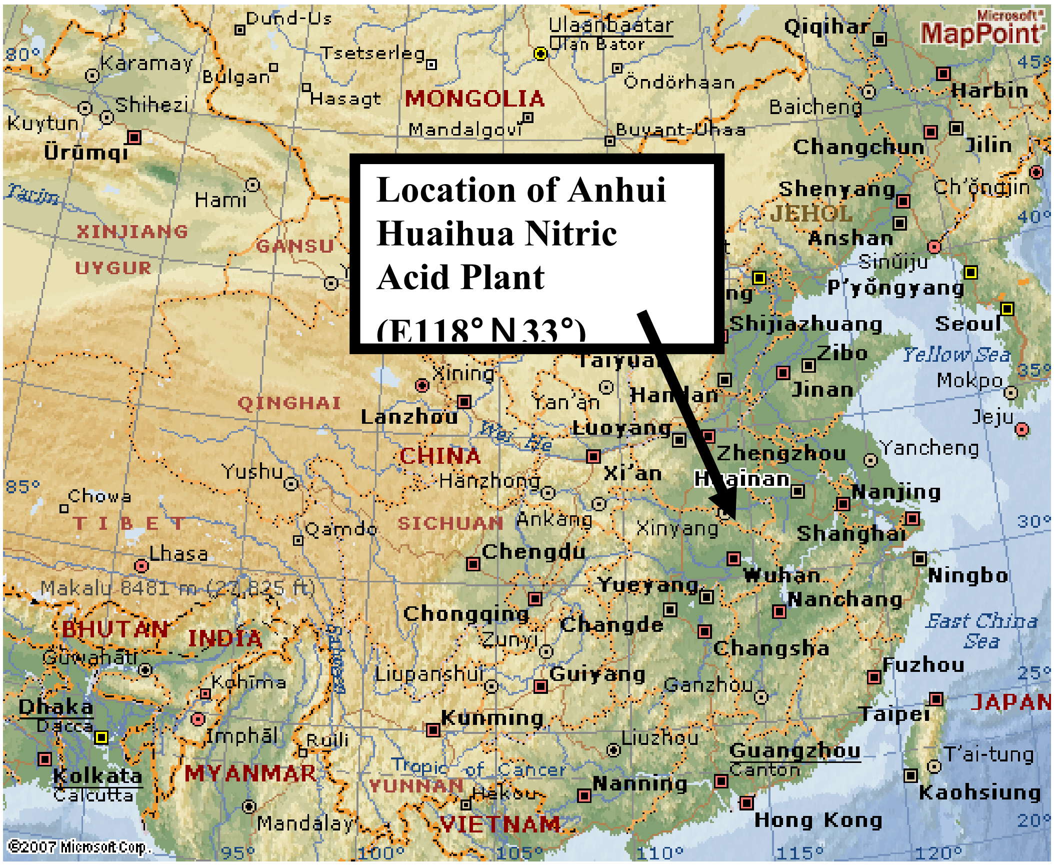

Figure 1: Location of Huainan City, Anhui province, China

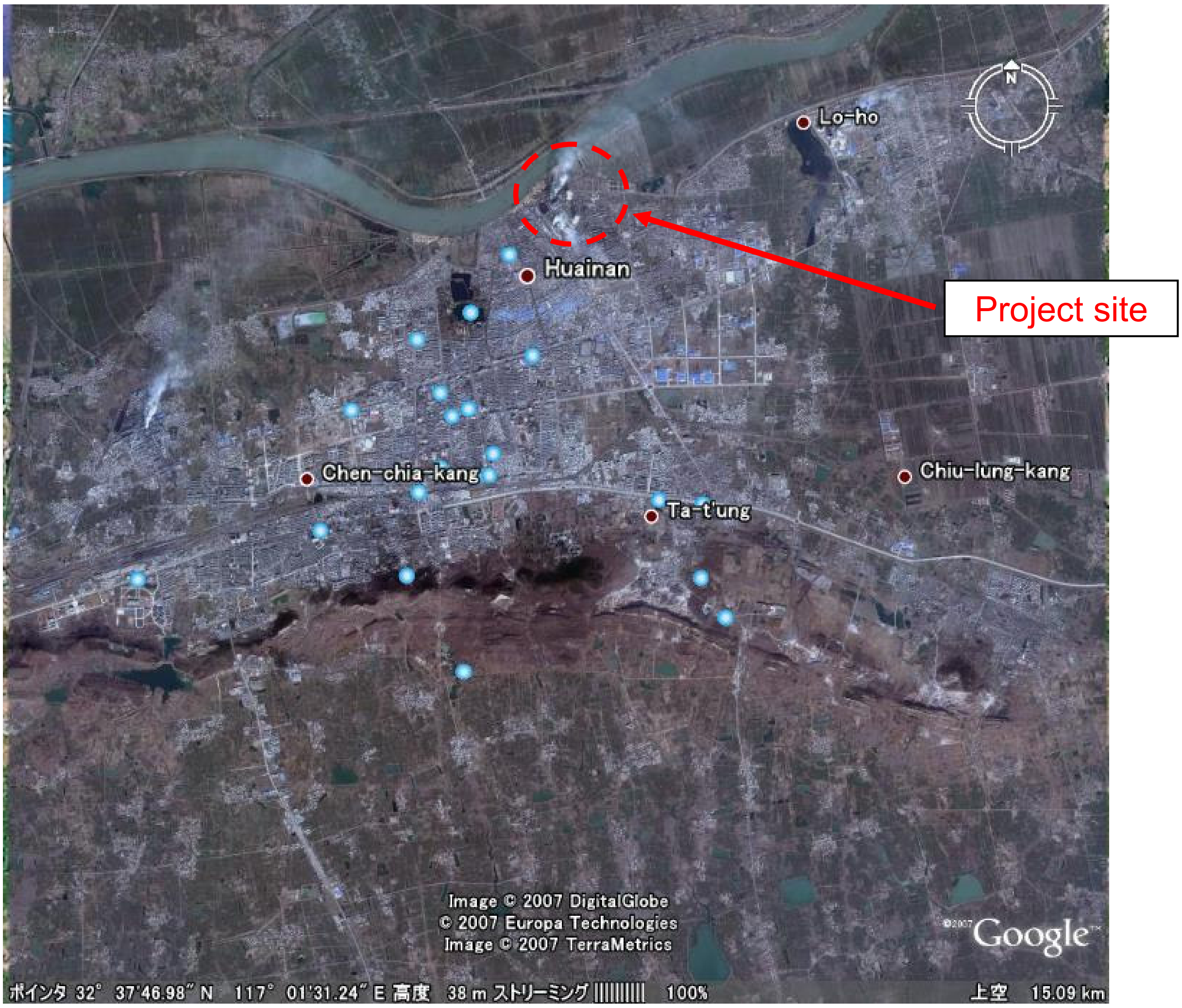

Figure2: Physical location of the Project

A.4.2. Category(ies) of project activity:

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Category 5: Chemical industries.

A.4.3. Technology to be employed by the project activity:

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The N_2O abatement technology is to introduce a secondary catalyst inside the ammonia oxidation reactor (AOR) at nitric acid production process and is called secondary method.[1]

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[1] There are three group of methods to reduce N_2O emissions from HNO_3 production process:

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

N_2O is decomposed through the following process.

$$N_2O \rightarrow N_2 + (1/2)\,O_2$$

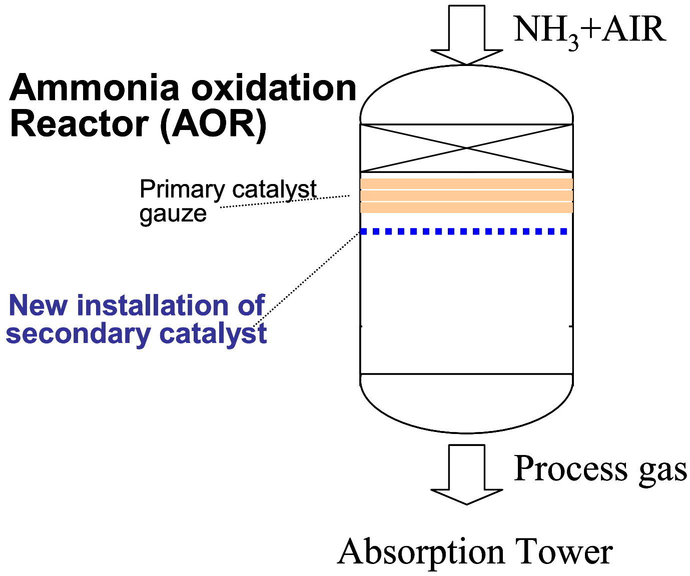

Figure3: Configuration of the N_2O abatement system

The preferred position for the catalyst is in the basket directly after the catalyst gauze.

There are four potential suppliers of the secondary catalyst in the market, from which project participants will chose final the catalyst supplier. The catalyst supplier will also be responsible for the designing and installation of the catalyst basket.

It is expected that the secondary catalyst can decompose more than 80% of the N_2O, which is formed by the ammonia oxidation catalyst.

Then, the secondary method has merits such as no new equipment requirement, minimum modifications to the basket, minimum maintenance of the catalyst, minimum costs in operation and maintenance of the catalyst, no consumption of additional energy.

The high-quality secondary catalyst will be selected, because it has higher N_2O decomposition rate and negligible risk to decrease HNO_3 production and the operation of the equipment, and total cost is lower than other technologies. It is a proven technology but has not been applied only for other purposes than abatement of N_2O. Toyo Engineering Corporation (Japan) technically supports evaluation of the catalyst and N_2O gas automated monitoring system.

Furthermore, the DeN_2O catalyst does not increase NO_X emissions.

- Secondary method: N_2O, once formed, is removed anywhere between the outlet of the ammonia oxidation gauzes and the inlet of the absorption tower.
- Tertiary method: N_2O is removed from the tail gas downstream of the absorption tower by catalytic destruction (either by catalytic decomposition or by catalytic reduction).

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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Ex-ante estimation for GHG emission reductions during the first crediting period are as follows;

Year	Annual estimation of emission reductions in tonnes of CO_2e
2008(Jul.-Dec.)	117,164
2009(Jan.-Dec.)	234,328
2010(Jan.-Dec.)	234,328
2011(Jan.-Dec.)	234,328
2012(Jan.-Dec.)	234,328
2013(Jan.-Dec.)	234,328
2014(Jan.-Dec.)	234,328
2015(Jan.-Jun.)	117,164
Total estimated reductions (7 years)	1,640,296
Crediting years	7 years
Annual average over the first crediting period	234,328

A.4.5. Public funding of the project activity:

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No development aid funds from the Annex-I countries of the UNFCCC are involved in the project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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AM0034 version02

“ Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants” and Tool for the demonstration and assessment of additionally (Version 3). Please refer to http://CDM.unfccc.int for details.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The applicability conditions specified in the methodology (*italic in a box*) and the explanation whether the conditions are applicable to the proposed project activity are as follows:

Condition 1:
The applicability is limited to the existing production capacity measured in tonnes of nitric acid, where the commercial production had began no later than 31 December 2005. Definition of “existing” production capacity is applied for the process with the existing ammonia oxidization reactor where N_2O is generated and not for the process with new ammonia oxidizer. Existing production“ capacity” is defined as the designed capacity, measured in tons of nitric acid per year.

Huainan chemical has started commercial production for Line 4 which is the object nitric acid plant for this project in October 2001. The production capacity of Line 4 (425t/day based on 100% HNO_3) has not been changed since the installation.

Therefore, the proposed project activity satisfies the applicability condition 1.

Condition 2:
The project activity will not result in the shut down of any existing N_2O destruction or abatement facility or equipment in the plant;.

Huainan chemical currently does not install any N_2O destruction or abatement technologies, hence meeting the requirements of its own accord.

Condition 3:
The project activity shall not affect the level of nitric acid production.

The project activity has no influence on the plant’s nitric acid production levels.

Condition 4:
There are currently no regulatory requirements or incentives to reduce levels of N_2O emissions from nitric acid plants in the host country.

Currently, there are no regulations or legal obligations in China concerning N_2O emissions. Therefore, without CERs, Huainan chemical will not be able to have an incentive to reduce N_2O emissions.

Condition 5:
No N_2O abatement technology is currently installed in the plant.

In Huainan chemical, no N_2O abatement technology is currently installed

Condition 6:
The project activity will not increase NOX emissions.

The secondary catalyst does not increase NOx emissions.

Condition 7:
NO_X abatement catalyst installed, if any, prior to the start of the project activity is not a Non-Selective Catalytic Reduction (NSCR) $DeNO_X$ unit.

There is no DeNOx-unit for Line 4, because NOx emission level for Line 4 (the medium pressure plant) is low.

Condition 8:
Operation of the secondary N_2O abatement catalyst installed under the project activity does not lead to any process emissions of greenhouse gases, directly or indirectly.

For this project, additional energy is not needed.

Condition 9:
Continuous real-time measurements of N_2O concentration and total gas volume flow can be carried out in the stack:

- **Prior to the installation of the secondary catalyst for one campaign, and**
- **After the installation of the secondary catalyst throughout the chosen crediting period of the project activity**

In this project, continuous real-time measurement of N_2O concentration will be carried out at the tail gas duct after the tail gas turbine and before the stack and continuous real-time measurement of total gas volume flow will be carried out at the tail gas duct after the tail gas heater (after the absorption tower) and before the tail gas turbine and before the stack for one campaign prior to the installation of the secondary catalyst, and throughout the chosen crediting period of the project activity after the installation of the secondary catalyst.

For this project, the N_2O concentration will be monitored at the tail gas duct after the tail gas turbine and before the stack and the tail gas flow volume will be monitored at the tail gas duct after the tail gas heater (after the absorption tower) and before the tail gas turbine and before the stack.

B.3. Description of the sources and gases included in the project boundary

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The spatial extent of the project boundary cover the facility and equipment for the complete nitric acid production process from the inlet to the ammonia oxidation reactor to the stack in Line4 (the medium plant) of Huainan chemical. This includes compressor, tail gas expander turbine installed. The process gas is blown into an absorption tower, where nitric acid is formed.
The only greenhouse gas to be included is the N_2O contained in the waste stream exiting the stack.

As specified in the methodology, the project boundary covers:

	Source	Gas	Included?	Explanations
Baseline	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	Excluded	The project does not lead to any change in CO_2 and CH_4 emissions, and, therefore, these are not included.
		CH_4	Excluded	
		N_2O	Included	
Project activity	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	Excluded	The project does not lead to any change in CO_2 and 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	

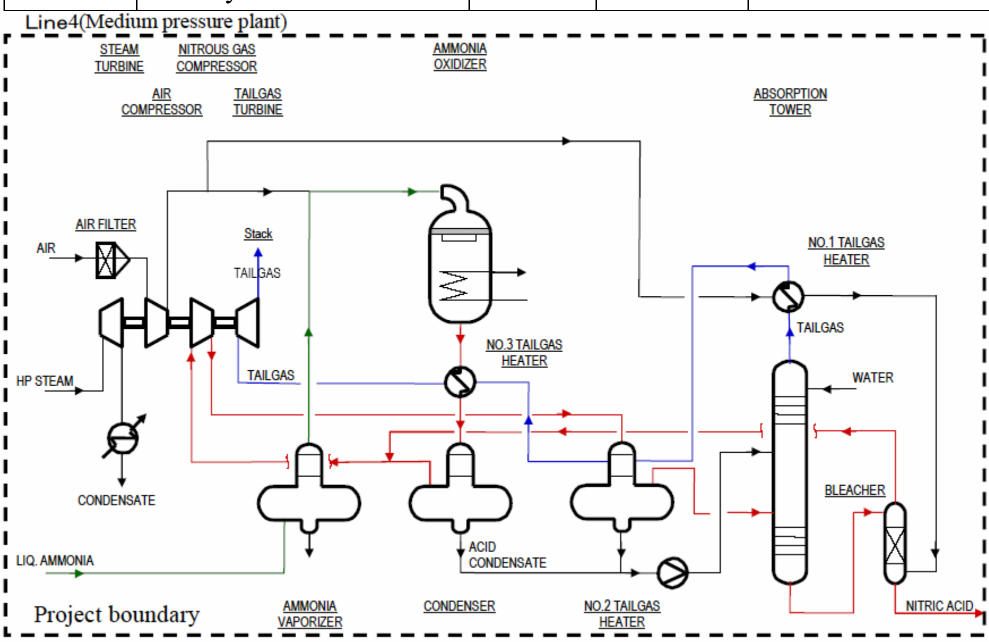

Figure 4: Nitric acid plant Block Flow Diagram for Line4 in Huainan chemical

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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As required by AM0034/version02, the baseline scenario is identified using procedure for Identification of the baseline scenario described in the approved methodology AM0028/Version 4.1 “Catalytic N_2O destruction in the tail gas of Nitric Acid Plants”.
AM0028/Version 4.1 requires five steps in identifying the baseline scenario, which is traced as follows.

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.

Sub-step 1a: The baseline scenario alternatives should include all possible options that are technically feasible to handle N_2O emissions. These options listed on the methodology are:

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

2) Switch to alternative production method not involving ammonia oxidation process

3) Alternative use of N_2O such as:

   a) Recycling of N_2O as a feedstock for the plant;
   b) The use of N_2O for external purposes.

4) Installation of Non-Selective Catalytic Reduction (NSCR) $DeNO_X$ unit

5) The installation of an N_2O destruction or abatement technology

   a) Primary abatement measure
   b) Secondary abatement measure (incl. project activity without CER);
   c) Tertiary or Quaternary abatement measures

For now, alternative use of N_2O is not technically feasible either, due to the following reason;

First, the use of N_2O for external purposes, the quantity of the tail gas to be treated is enormous compared to the amount of nitrous oxide that could be recovered.
(The N_2O concentration of the tail gas in Huainan Chemical is not more than 0.1-0.2%.)
Next, as for recycling of N_2O as a feedstock for the plant, nitrous oxide is not a feedstock for nitric acid production.
Therefore, these technologies have not been commercially proven and there are no markets or technologies to utilize N_2O directly or indirectly in China.

Next, switch to alternative production method not involving ammonia oxidation process is not prevailing and is not available to Huainan Chemical. Currently the method using ammonia oxidation process (Ostwald process) is predominant for manufacturing nitric acid although here had been other production methods in history.

Therefore, neither option 2) nor option 3) is a baseline scenario alternative.

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

6) The continuation of the current situation (a $DeNO_X$-unit is not installed);
7) Installation of a new Selective Catalytic Reduction (SCR) $DeNO_X$ unit;
8) Installation of a new Non-Selective Catalytic Reduction (NSCR) $DeNO_X$ unit;
9) Installation of a new tertiary measure that combines NO_X and N_2O emission reduction.

Option 8) is omitted because it is the same as baseline scenario alternative 4) of Sub-step 1a.

And Currently, the NOx emissions for Line 4 (without a $DeNO_X$-unit) as well as other nitric acid plants in Huainan Chemical meet the NOx regulation (please see Step 2 of this section).

Therefore, neither option 7) nor option 9) is a baseline scenario alternative.

As above, option 1), 4), 5) and 6) are baseline scenario alternatives.

<u>Step 2</u>: Eliminate baseline alternatives that do not comply with legal or regulatory requirements:

Currently, there are no regulations or legal obligations in China concerning N_2O emissions and recycle of byproduct waste N_2O.

And then currently, NO_X regulation requires to limit the emissions below 1,400mg/m^3.

On the other hand, NO_X emission in the tail gas for Line 4 (without an NH_3-SCR) is below 200 ppmv and is in compliance with the NO_X regulation (as well as Line1-3).

All named baseline alternatives are in compliance with all relevant legal and regulatory requirements on N_2O and NOx emissions. Therefore none of baseline alternatives (baseline scenario alternative 1), 4), 5) and 6)) are eliminated at step 2.

<u>Step 3</u>: Eliminate baseline alternatives that face prohibitive barriers (barrier analysis):

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

<u>Investment barriers:</u>

It is not clear whether the following barriers listed on the methodology exist or not.

- Debt funding is not available for this type of innovative project activity;
- No access to international capital markets due to real or perceived risks associated with domestic or foreign direct investment in China.

However, the following barriers could be said.

- Installation of any new N_2O abatement technology facility (primary, secondary or tertiary) needs considerable investment. There is no economical incentive for the investment except for CER.
- Huainan chemical is in compliance with the NOx regulations, and NSCR-type DeNOx unit cannot be a more economically feasible option than SCR-type, because it consumes larger amount of natural gas (and emits larger amount of CO_2) as well as higher initial cost.

Technological barriers:

All of the technologies specified in the options in Step 1 are established ones in industrialized countries. As for technological barriers, the following barriers listed on the methodology exist or not, or we cannot say anything except that there may be.

- Technical and operational risks of alternatives
- Technical efficiency of alternatives (e.g. N_2O destruction, abatement rate)
- Skilled and/or properly trained labour to operate and maintain the technology is not available and no education/training institution in the host country provides the needed skill, leading to equipment disrepair and malfunctioning;
- Lack of infrastructure for implementation of the technology

Barriers due to prevailing practice:

- NSCR-type $DeNO_X$ equipment is a typical tail gas treatment in the USA and Canada with less application in other parts of the world and hardly the case in China.
- N_2O abatement activity is the "first-of-this-kind" in China except for the CDM project (as well as other many countries), because there are no regulations or legal obligations concerning N_2O emissions.

Therefore, baseline scenario alternative 4) and 5) are eliminated.

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

It can be concluded that the continuation of current practice (baseline scenario alternative 1) and 6)) would be a unique baseline scenario, since it does not face any barriers, while others face such barriers as described in sub-step 3a.

Step 4: Identify the most economically attractive baseline scenario alternative:

Sub-step 4a: *Determine appropriate analysis method:*

Simple cost analysis is applied since the proposed project activity has only one source of economic return (sales proceeds of CERs)

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

All alternatives including the proposed project activity but except for the continuation of the current practice require substantial investment, and corresponding returns cannot be anticipated except for CER, besides there will be technological barriers and barriers due to prevailing practice. Thus, continuation of current practice is apparently the most economically attractive baseline scenario.

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

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

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

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

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

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

***Sub Step 5b**: New or modified N_2O-regulation*

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

Therefore, it is concluded that "continuation of current practice" is the baseline scenario at least until the time of the legislation legally implemented.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

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This project activities use the latest version of "Tool for assessment and demonstration of additionality (version 04)" to perform the analysis of additionality.

Step 1
[**Identification of alternatives to the project activity consistent with current laws and regulations**]

As specified in the methodology, it can be quoted directly from the conclusion of B.4 Sub-step 4b that the "continuation of the current practice is in consistent with the current laws and regulations.

Step 2 [**Investment analysis**]

Sub-step 2a. Determine appropriate analysis method

Simple cost analysis (option I) is applied.

Although installation of a new secondary catalyst for N_2O destruction needs considerable investment, this does not make benefit except for CER. (Rough cost of investment is to be shown to a validator at on-site audit because of confidentiality.)

Sub-step 2b. Apply simple cost analysis

Under no additional regulatory requirements, continuation of current practice is apparently the most attractive course of action because other options need considerable investment cost.

Step 3 [**Barrier analysis**]

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity

Barriers that would prevent the implementation of the proposed CDM project are described in Sub-Step 3a of Section B4.

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

The continuation of the current practice, where there will be no installation of technology for the destruction or abatement of N_2O, would not be prevented by barriers due to prevailing practice.

Step 4[**Common practice analysis**]

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

Although N_2O is not a toxic substance, most countries do not have regulations or incentives to abate N_2O.As for the host country, like most other countries, there is no regulation or incentive to eliminate N_2O emissions for nitric acid plants. Consequently, the current situation for the nitric acid industry in the host country is that N_2O gases generated from these plants are directly released to the atmosphere as a by product without any further treatment. No similar activities to the proposed project activity have been observed to be implemented in the host country so far, and many other companies in the host country are currently planning or developing similar CDM project activities.

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

Since there is not a local regulation to restrict N_2O emissions, there are not any similar options occurring in Anhui Province and thus the project is not a common practice.

Furthermore, the contract of CDM project development for N_2O Abatement was made by Huainan chemical and Marubeni Corp. on May 24, 2006.

As the result, the project is concluded to deliver *additional* GHG emission reductions since it would not be implemented without this project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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A plant-specific baseline emissions factor ($tN_2O/t\ HNO_3$) is determined by measuring N_2O concentration and total flow rate in the tail gas of the nitric acid plant for the duration of one entire

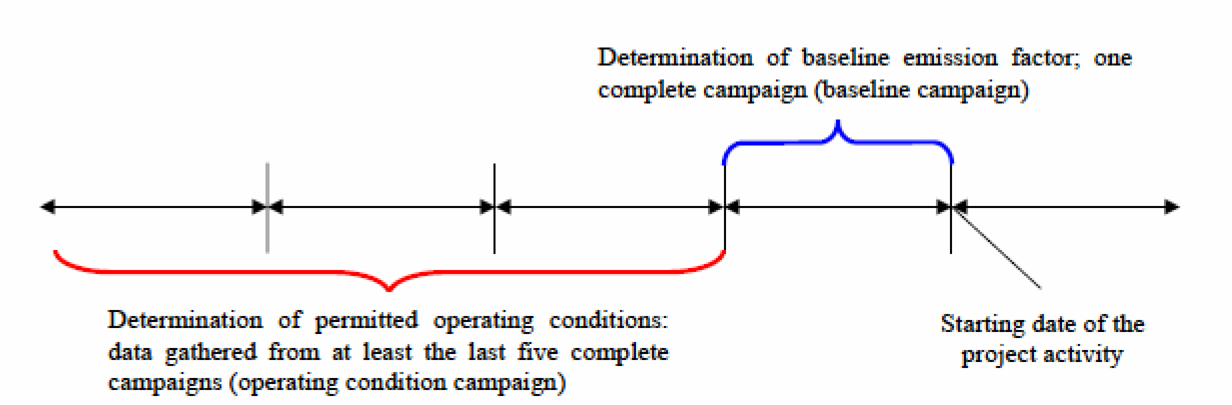
campaign. Permitted range for parameters that influence the level of N_2O formation (e.g., ammonia, ammonia-air input, temperature and pressure) is established based on the data for previous 5 campaigns) to define the permitted range for which emission reduction credits can be claimed during the crediting period. These permitted ranges must also be demonstrated to be within the specifications of the plant.

During the project activity, the measurements of N_2O and other parameters are carried out on a continuous basis and new emissions factors are established for each project campaign.

Total emission reductions for the project for a specific campaign are calculated by subtracting the project emissions factor from the baseline emissions factor and multiplying the result by the number of tonnes of nitric acid produced in each particular campaign.

According AM0034 version02, the baseline emission factor are established through continuous monitoring of both N_2O concentration and gas flow volume in the stack of the nitric acid plant for one complete campaign prior to project implementation.
For this project, the N_2O concentration will be monitored at the tail gas duct after the tail gas turbine and before the stack and the tail gas flow volume will be monitored at the tail gas duct after the tail gas heater (after the absorption tower) and before the tail gas turbine and before the stack.

The schematic of the procedure is as follows:



1. Determination of the permitted operating conditions of the nitric acid plant to avoid overestimation of baseline emissions:

In order to avoid the possibility that the operating conditions of the nitric acid production plant are modified in such a way that increases N_2O generation during the baseline campaign, the normal ranges for operating conditions will be determined for the following parameters: (i) oxidation temperature; (ii) oxidation pressure; (iii) ammonia gas flow rate, and (iv) air input flow rates. The permitted range will be established using the procedures described below.

<u>i. Oxidation temperature and pressure:</u>

Process parameters to be monitored are the following:

$OT_{h,}$: Oxidation temperature of each ammonia oxidation reactor (AOR) for each hour (°C)
$OP_{h,}$: Oxidation pressure of each AOR for each hour (MPa)
$OT_{normal,}$: Normal range of each AOR for oxidation temperature (°C)
$OP_{normal,}$: Normal range of each AOR for oxidation pressure (MPa)

The "permitted range" for oxidation temperature and pressure is to be determined using one of the following sources:

a) Historical data for the operating range of temperature and pressure from the previous five campaigns (or fewer, if the plant has not been operating for five campaigns); or, then
b) If no data on historical temperatures and pressures is available, the range of temperature and pressure stipulated in the operating manual for the existing equipment; or,
c) If no operating manual is available or the operating manual gives insufficient information, from an appropriate technical literature source.

For this project, the "permitted range" for oxidation temperature and pressure is determined by historical data analysis based on the previous five campaigns. (Option a) is chosen.)

<u>ii. Ammonia gas flow rates and ammonia to air ratio input into the ammonia oxidation reactor (AOR):</u>

Process parameters to be monitored are the following:

AFR: Ammonia gas flow rate to each AOR (Nm^3/h)
$AFR_{max,}$: Maximum ammonia gas flow rate to each AOR (Nm^3/h)
AIFR: Ammonia to air ratio of each AOR (%)
$AIFR_{max,}$: Maximum ammonia to air ratio of each AOR (%)

The upper limits for ammonia flow and ammonia to air ratio shall be determined using one of the following three options, in preferential order:

a) Historical maximum operating data for hourly ammonia gas and ammonia to air ratio for the previous five campaigns (or fewer, if the plant has not been operating for five campaigns; excluding abnormal campaigns; or,
b) If no data is available, calculation of the maximum permitted ammonia gas flow rates and ammonia to air ratio as specified by the ammonia oxidation catalyst manufacturer or for typical catalyst loadings; or,
c) If information for (b) above is not available, based on a relevant technical literature source.

For this project, the upper limits for ammonia flow and ammonia to air ratio are determined by historical maximum operating hourly data for them based on the previous five campaigns. (Option a) is chosen.)

2. Determination of baseline emission factor: measurement procedure for N2O concentration and gas volume flow

N_2O concentration and gas volume flow will be monitored throughout the baseline campaign by the automated measurement system consisting of the automated extractive gas analyzer system using non dispersive infrared absorption and the gas volume flow meter using pressure differential, that is installed under the supervision of manufacturers. This monitoring system provides separate readings for N_2O concentration and gas flow volume for a defined period of time (e.g. every hour of operation, it provides an average of the measured values for the previous 60 minutes). Error readings (e.g. downtime or malfunction) and extreme values are to be automatically eliminated from the output data series by the monitoring system.

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. The statistical procedure will be applied to data obtained after eliminating data measured for periods where the plant operated outside the permitted ranges:

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 (volume of stack gas (VSG) and N_2O concentration of stack gas (NCSG))

The average mass of N_2O emissions per hour is estimated as product of the NCSG and VSG. The N_2O emissions per campaign are estimates product of N_2O emission per hour and the total number of complete hours of operation of the campaign.

$$BE_{BC} = VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC} \qquad (tN2O) \qquad (1)$$

where

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

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

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

where

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

NOTE: Under certain circumstances, the operating conditions during the measurement period used to determine baseline N_2O emission factor may be outside the permitted range or limit corresponding to normal operating conditions. For instance, temperature, pressure, ammonia flow rate or ammonia to air ratio may be outside the permitted condition. Any N_2O baseline data that is measured during hours where the operating conditions are outside the permitted range will be eliminated from the calculation of the baseline emissions factor.

The baseline campaign is not valid and will be repeated if the plant operates outside of the permitted range for more than 50% of the duration of the baseline campaign.
In order to further ensure that operating conditions during the baseline campaign are representative of normal operating conditions, statistical tests will be performed to compare the average values of the permitted operating conditions with the average values obtained during the baseline determination period.
If it can be concluded with 95% confidence level, in any of the tests, that the two values are different, then the baseline determination will be repeated

Impact of regulations:

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

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

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

if $EF_{BL} > EF_{reg}$,

then the baseline N_2O emission factor shall be EF_{reg} for all calculations.

where:

EF_{BL}:	Baseline emissions factor ($tN_2O/tHNO_3$)
EF_{reg}:	Emissions level set by newly introduced policies or regulations ($tN_2O/tHNO_3$). Such EF_{reg} shall be determined according to the nature of the regulation (e.g. in terms of absolute emission, by-product rate, concentration in stack gas), as described in the approved methodology AM0028.

The composition of the ammonia oxidation catalyst:

The composition of the ammonia oxidation catalyst used for the baseline campaign and after the implementation of the project is planned to be identical to that used in the campaign for setting the operating conditions (previous five campaigns), therefore no limitations will be set on N_2O baseline emissions.

If there is any change in the composition of the ammonia oxidation catalyst in the baseline campaign to a composition other than that used in the previous five campaigns, no limitation will be set on the N_2O baseline emissions if the following conditions are met
(i) The baseline catalyst composition is considered as common practice in the industry, or
(ii) The change in catalyst composition is justified by its availability, performance, relevant literature etc. Otherwise, the baseline emission factor will be set to the conservative IPCC default emission factor for N_2O from nitric acid plants which have not installed N_2O destruction measures ($4.5kgN_2O/tHNO_3$).

Otherwise, the project proponent will either:

1) Repeat the baseline campaign to determine a new baseline emissions factor ($tN_2O/tHNO_3$), compare it to the previous baseline emissions factor and adopt the lower figure as EF_{BL}, or
2) Set the baseline emissions factor to the conservative IPCC default emission factor for N_2O from nitric acid plants which have not installed N_2O destruction measures ($4.5kgN_2O/tHNO_3$).

Parameters to be monitored for composition of the catalyst are as follows:

GS_{normal}:	Gauze supplier of each AOR for the operation condition campaigns
GS_{BL}:	Gauze supplier of each AOR for baseline campaign
$GS_{project}$:	Gauze supplier of each AOR for the project campaign
$G_{normal,N}$:	Gauze composition of each AOR for the operation condition campaigns
GC_{BL}:	Gauze composition of each AOR for baseline campaign
$GC_{project}$:	Gauze composition of each AOR for the project campaign

Campaign Length

In order to take into account the variations in campaign length and its influence on N_2O emission levels, the historic campaign lengths and the baseline campaign length will be determined and compared to the project campaign length. Campaign length is defined as the total number of metric tonnes of nitric acid at 100% concentration produced with one set of gauzes.

Historic Campaign Length

The average historic campaign length (CL_{normal}) defined as the average campaign length for the historic campaigns used to define operating condition (the previous five campaigns), will be used as a cap on the length of the baseline campaign.

Baseline Campaign Length (CL_{BL})

If $CL_{BL} \leq CL_{normal}$

all N_2O values measured during the baseline campaign will be used for the calculation of EF_{BL} (subject to the elimination of data that was monitored during times where the plant was operating outside of the "permitted range").

If $CL_{BL} > CL_{normal}$

N_2O values that were measured beyond the length of CL_{normal} during the production of the quantity of nitric acid (i.e. the final tonnes produced) will be eliminated from the calculation of EF_{BL}.

Project Emissions:

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 temperature and pressure of ammonia gas flow and ammonia-to-air ratio, will be measured continuously.
For this project, the N_2O concentration will be monitored at the tail gas duct after the tail gas turbine and before the stack and the tail gas flow volume will be monitored at the tail gas duct after the tail gas heater (after the absorption tower) and before the tail gas turbine and before the stack.

Estimation of campaign-specific project emissions

A monitoring system will be installed and will provide separate readings for N_2O concentration and gas flow volume for a defined period of time (e.g. every hour of operation, i.e. an average of the measuring values of the past 60 minutes). Error readings (e.g. downtime or malfunction) and extreme values are automatically eliminated from the output data series by the monitoring system. Next, the same statistical evaluation that was applied to the baseline data series will be applied to the project data series:

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

$$PE_n = VSG * NCSG * 10^{-9} * OH \quad (tN2O) \qquad (3)$$

where

PE_n:	Total N_2O emissions during the n^{th} project campaign (tN_2O)
VSG:	Mean stack gas volume flow rate of each AOR for the project campaign (m^3/h)
NCSG:	Mean concentration of N_2O in each stack gas for the project campaign (mgN_2O/m^3)
OH:	Operating hours of each AOR in the specific monitoring period (h)

Derivation of a moving average emission factor

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

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

For example, for campaign n the campaign specific emission factor would be:

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

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

$EF_{ma,n} = (EF_1 + EF_2 + \ldots + EF_n) / n$ $(tN_2O/tHNO_3)$ (5)

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

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

where

EF_n:	Emission factor calculated for a specific project campaign $(tN_2O/tHNO_3)$
NAP_n:	Nitric acid production during a specific project campaign $(tHNO_3)$.
$EF_{ma,n}$:	Moving average emission factor of after n^{th} campaigns, including the current campaign $(tN_2O/tHNO_3)$
n:	Number of campaigns to date
EF_p:	Emissions factor that will be applied to calculate the emissions reductions from this specific campaign (i.e. the higher of EF_x and EF_n) $(tN_2O/tHNO_3)$

<u>Minimum project emission factor</u>

A campaign-specific emissions factor will be used to cap any potential long-term trend towards decreasing N_2O emissions that may result from a potential built up of platinum deposits. After the first ten campaigns of the crediting period of the project, the lowest EF_n observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in a EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall used EF_{min} and not EF_n.

where:

EF_{min}:	Is equal to the lowest EF_n observed during the first 10 campaigns of the project crediting period $(tN_2O/tHNO_3)$

Project Campaign Length

<u>a. Longer Project Campaign</u>

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

<u>b. Shorter Project Campaign</u>

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

Leakage

No leakage calculation is required.

Emission Reductions

The emission reductions for the project activity over a specific campaign are determined by deducting the campaign-specific emission factor from the baseline emission factor and multiplying the result by the production output of 100% concentrated nitric acid over the campaign period and the GWP of N_2O:

$$ER = (EF_{BL} - EF_P) * NAP * GWP_{N2O} \quad (tCO_2e) \qquad (7)$$

where:

ER:	Emission reductions of the project for the Project campaign (tCO_2e)
NAP:	Nitric acid production for the Project campaign ($tHNO_3$). The maximum value of NAP shall not exceed the design capacity.
EF_{BL}:	Baseline emissions factor ($tN_2O/tHNO_3$)
EF_P:	Emissions factor used to calculate the emissions from this particular campaign (i.e. the higher of $EF_{ma,n}$ and EF_n).

The nitric acid production used to calculate emission reduction should not exceed the design capacity (nameplate) of the nitric acid plant. Documentation to prove design capacity (nameplate) of the nitric acid plant will be provided to the DOE for the validation process of the Project activity.

B.6.2. Data and parameters that are available at validation:

The parameters to be determined monitored *ex ante* or as the default values are listed below.

Data / Parameter:	AFR_{max} (B.11)
Data unit:	Nm^3/h
Description:	Maximum ammonia gas flow rate to the AOR
Source of data used:	Plant records (Historical operating data in AOR)
Value applied:	6,652Nm^3/hr
Justification of the choice of data or description of measurement methods and procedures actually	This parameter is determined by historical maximum hourly value based on the previous five campaigns.

applied:	
Any comment:	No.

Data / Parameter:	$AIFR_{max}$ (B.15)
Data unit:	% volume
Description:	Maximum ammonia to air ratio
Source of data used:	Plant records (Historical operating data in AOR)
Value applied:	13.17 %
Justification of the choice of data or description of measurement methods and procedures actually applied:	This parameter is determined by historical maximum hourly value based on the previous five campaigns.
Any comment:	No.

Data / Parameter:	$OT_{,normal}$ (B.17)
Data unit:	°C
Description:	Normal range for oxidation temperature
Source of data used:	Plant records (Historical operating data in AOR)
Value applied:	860–887 °C
Justification of the choice of data or description of measurement methods and procedures actually applied :	The permitted range of operating temperature is set based on the previous five campaigns. The lower limit is 2.5 % lower value of these available data and the upper limit is 2.5 % upper value of them.
Any comment:	No.

Data / Parameter:	$OP_{,normal}$ (B.19)
Data unit:	MPa
Description:	Normal range for oxidation pressure
Source of data used:	Plant records (Historical operating data in AOR)
Value applied:	0.329–0.417 MPa (G)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The permitted range of operating pressure is set based on the previous five campaigns. The lower limit is 2.5 % lower value of these available data and the upper limit is 2.5 % upper value of them.
Any comment:	No.

Data / Parameter:	$CL_{,normal}$ (B.14)
Data unit:	$tHNO_3$
Description:	Normal campaign length (Campaign length is defined as the total number of metric tonnes of nitric acid

	at 100% concentration produced with one set of gauzes.)
Source of data used:	Plant records
Value applied:	65,072 $tHNO_3$
Justification of the choice of data or description of measurement methods and procedures actually applied :	This parameter was set by average campaign length of the previous five campaigns and is used to define operating condition is used as a cap on the length of the baseline campaign.
Any comment:	In order to take into account the variations in campaign length and its influence on N_2O emission levels, the historic campaign lengths and the baseline campaign length are to be determined and compared to the project campaign length. Campaign length is defined as the total number of metric tonnes of nitric acid at 100% concentration produced with one set of gauzes.

Data / Parameter:	GS_{normal} (B.20)
Data unit:	-
Description:	Normal gauze supplier for the operation condition campaigns
Source of data used:	Plant records (Historical operating data) or the supplier
Value applied:	Name of the supplier: Shanghai Chengkai-Paite
Justification of the choice of data or description of measurement methods and procedures actually applied:	Specified in the methodology.
Any comment:	No.

Data / Parameter:	GC_{normal} (B.23)
Data unit:	-
Description:	Normal gauze composition for the operation condition campaigns
Source of data used:	Plant records (Historical operating data) or the supplier
Value applied:	Pt,Rh,Pd (TFC system, plane weave wire)
Justification of the choice of data or description of measurement methods and procedures actually applied:	Specified in the methodology.
Any comment:	No.

B.6.3 Ex-ante calculation of emission reductions:

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According to the nitric acid production data in 2006, the production amount for Line 4 was 124,000 ton 100% HNO_3/yr.

Here, for the project period, we estimate the emission reductions for nitric acid production of 124,000 ton 100% HNO_3/yr in Line 4, which is the operating condition of the production record in 2006.

For the project period, we estimate the emission reductions based on nitric acid production in 2006.

As described in Section B6 .1, the emission reduction during project campaign is given by

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

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

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

$EF_n = PE_n / NAP_n$

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

For ex-ante estimation of emission reductions during the yearly period is rewritten as follows;

$ER_y = BE_y – PE_y = (EF_{BL} – EF_P)* Minimum(NAP_{,y} , NAP_{y,max}) *GWP_{N2O}$

Where,

$NAP_{y,max}$: Existing design capacity for the nitric acid production

$NAP_{,y}$: Nitric acid production for the project campaign

(NAP_y is capped by $NAP_{y,,max}$)

The result is shown below:

		Line4	unit
Nitric acid production over the baseline campaign	NAP_{BC}	65,072	t HNO_3/campaign
Operating hours of the baseline campaign	OH_{BC}	4,354	hr/campaign
Volume flow rate of the stack gas during the baseline campaign	VSG_{BC}	50,196	Nm^3/hr
N_2O concentration in the stack gas during the baseline campaign	$NCSG_{BC}$	2,357	mg/Nm^3
Overall uncertainty of the monitoring system	UNC	3	%
Emissions factor for baseline period	EF_{BL}	7.679	$*10^{-3}$ t N_2O/t HNO_3
Nitric acid production for the project campaign	NAP	65,072	t HNO_3/campaign
Operating hours of the project campaign	OH	4,354	hr/campaign
DeN_2O ratio	X	80	%

Ex-ante volume flow rate of the stack gas during the project campaign	VSG	50,196	
Ex-ante N_2O concentration in the stack gas during the project campaign	NCSG	471	mg/Nm^3
Ex-ante emissions factor for the project campaign	EF_P	1.58	$*10^{-3}$ t N_2O/t HNO_3
GWP_N_2O		310	tCO_2e/tN_2O
Nitric acid production during a year y	NAP_y	124,000	t HNO_3/yr
Baseline Emissions through a year y	BE_y	295,192	t CO_2e/yr
Project Emissions through a year y	PE_y	60,864	
Emission Reductions through a year y	ER_y	234,328	

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Ex ante estimation is given as follows:

Year(Month)	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2008(Jul.-Dec.)	30,432	147,596	0	117,164
2009(Jan.-Dec.)	60,864	295,192	0	234,328
2010(Jan.-Dec.)	60,864	295,192	0	234,328
2011(Jan.-Dec.)	60,864	295,192	0	234,328
2012(Jan.-Dec.)	60,864	295,192	0	234,328
2013(Jan.-Dec.)	60,864	295,192	0	234,328
2014(Jan.-Dec.)	60,864	295,192	0	234,328
2015(Jan.-Jun.)	30,432	147,596	0	117,164
Total (tonnes of CO_2 e)	426,048	2,066,344	0	1,640,296

B.7 Application of the monitoring methodology and description of the monitoring plan:

The monitoring points for key parameters are shown below:

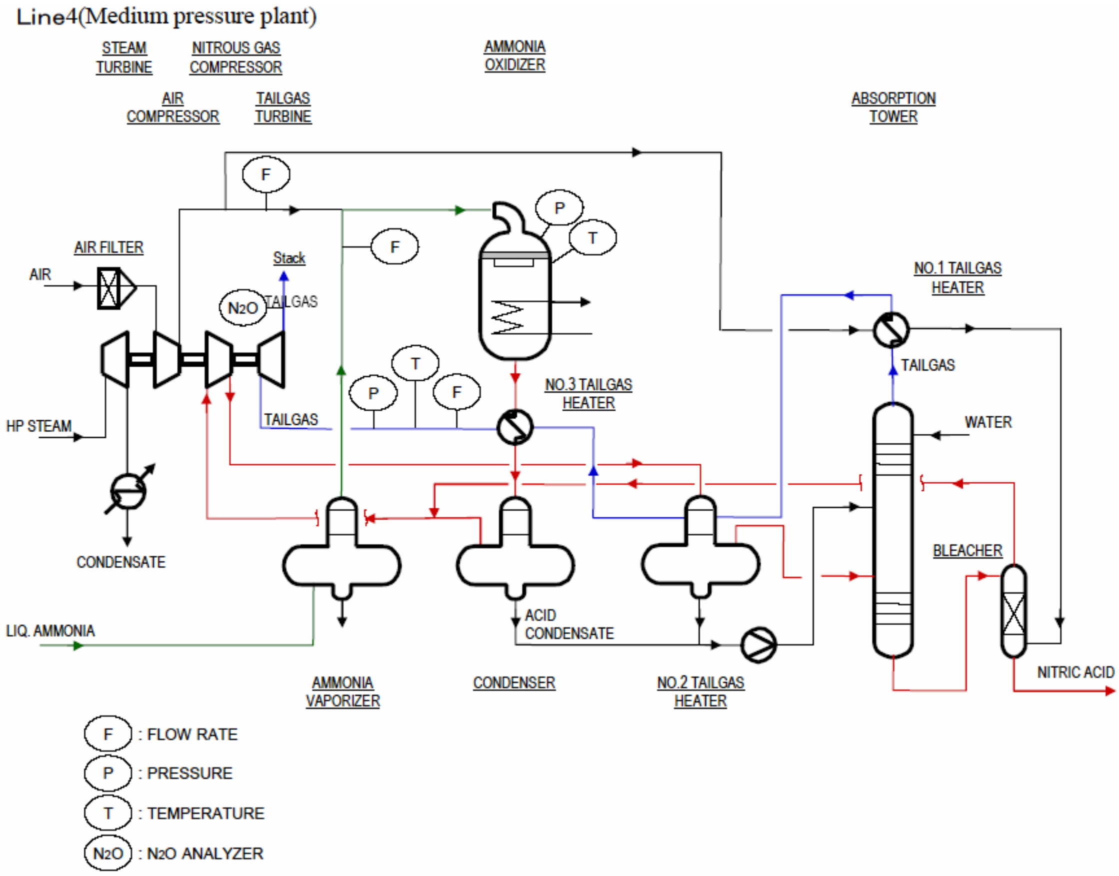

Figure 5: Monitoring points for key parameters

B.7.1 Data and parameters monitored:

Data / Parameter:	VSG_{BC} (B.2)
Data unit:	m^3/h
Description:	Volume flow rate of the stack gas during the baseline campaign
Source of data used:	Flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50,196 Nm^3/hr
Description of measurement methods and procedures to be applied:	For now, this parameter is set based on rough estimation from monitoring records in the middle of the baseline campaign. After monitoring of the baseline campaign, the data is subjected to a statistical analysis according to the AM0034/Version02 requirements (please see B.6.1) and this value will be replaced. Monitoring conditions are as follows;

	• Measuring device : New orifice plate • Recording frequency : Every 2 seconds • Measuring point : Inlet line of tail gas turbine • Data record : New logging system • Measuring range: 0–70,000Nm^3/hr • Estimated total uncertainty: Please see Annex 4 Flow metering systems for both lines will automatically record continuously volume flow converted to standard temperature and pressure by temperature (TSG) and pressure measurements (PSG).
QA/QC procedures to be applied:	Regular calibrations according to vendor instruction. Staffs are trained in monitoring procedures
Any comment:	No.

Data / Parameter:	TSG
Data unit:	°C
Description:	Temperature of stack gas during the baseline campaign
Source of data used:	Thermo-couple
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Recording frequency : Every 2 seconds • Measuring point : Inlet line of tail gas turbine • Data record : New Logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration
Any comment:	No.

Data / Parameter:	PSG
Data unit:	Pa
Description:	Pressure of stack gas during the baseline campaign
Source of data used:	Pressure transmitter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Recording frequency : Every 2 seconds • Measuring point : Inlet line of tail gas turbine • Data record : New Logging system

QA/QC procedures to be applied:	Maintenance and testing regime including calibration
Any comment:	No.

Data / Parameter:	$NCSG_{BC}$ (B.1)
Data unit:	mgN_2O/m^3 (converted from ppmv if necessary)
Description:	N_2O concentration in the stack gas during the baseline campaign
Source of data used:	N_2O analyzer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4,911mg/Nm^3 (1,200ppmv)
Description of measurement methods and procedures to be applied:	For now, this value is set based on rough estimation from monitoring records in the middle of the baseline campaign. After monitoring of the baseline campaign, the data is subjected to a statistical analysis according to the AM0034/Version02 requirements (please see B.6.1) and this value will be replaced. Monitoring conditions are as follows; • Measuring device : Non-dispersion infrared absorption analyzer (NDIR) • Recording frequency : Every 2 seconds • Measuring point : The tail gas duct after the tail gas turbine and before the stack • Data record : New logging system • Measuring range :0–2,000 ppmv • Estimated total uncertainty: Please see Annex 4
QA/QC procedures to be applied:	Regular calibrations will be conducted according to vendor specifications and recognised industry standards (EN14181 or another good industrial practice whichever practically feasible in the region). Staffs are trained in monitoring procedures. Refer to Annex 4.
Any comment:	No.

Data / Parameter:	OH_{BC} (B.4)
Data unit:	Hours
Description:	Operating hours of the baseline campaign
Source of data used:	Production log
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4,354 hours/campaign
Description of measurement methods	For now, this parameter is set based on historical production log. After monitoring of the baseline campaign, this value is replaced.

and procedures to be applied:	• Recording frequency : Daily, compiled for entire campaign
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	NAP_{BC} (B.5)
Data unit:	$tHNO_3$
Description:	Nitric acid (100% concentrated) during the baseline campaign
Source of data used:	Flow meter and laboratory concentration analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	65,072 $tHNO_3$
Description of measurement methods and procedures to be applied:	For now, this parameter is set as the same values of CL_{normal} After monitoring of the baseline campaign, this value is replaced. Monitoring conditions are as follows; • Measuring device: New installation of magnetic type flow meter and the laboratory concentration analysis based on national requirement. • Measuring point : After the absorption tower for only Line 4 • Recording frequency: Flow rate measurement: Continuously HNO_3 concentration analysis: Every 6 hours • Measuring range: Flow rate measurement: 0–35m^3/hr • Accuracy : Flow rate measurement:: ±0.1% HNO_3 concentration analysis: ±0.2% • Data record : Flow rate measurement:: DCS system HNO_3 concentration analysis: Hand writing
QA/QC procedures to be applied:	•For flow meter, maintenance and testing regime including calibration (as part of ISO9001 procedures) •Mass balance of the productions of nitric acid, ammonium nitrate and ammonia input is checked based on ISO 9001
Any comment:	No.

Data / Parameter:	UNC (B.9)
Data unit:	%
Description:	Overall uncertainty of the monitoring system, calculated as the combined uncertainty of the applied monitoring equipment
Source of data used:	Flow meter supplier and NDIR supplier (Calculation of the combined uncertainty of the applied monitoring equipment)
Value of data applied	3 %

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	For now, this value is set by ex-ante uncertainty assessments (Please see Annex 4.)
QA/QC procedures to be applied:	After a series of reference measurements under the guidance of QAL2, this value is determined by the vendor.
Any comment:	No.

Data / Parameter:	CL_{BL} (B.13)
Data unit:	$tHNO_3$
Description:	Baseline campaign length (Campaign length is defined as the total number of metric tonnes of nitric acid at 100% concentration produced with one set of gauzes.)
Source of data used:	Plant records (Calculated from nitric acid production data)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	65,072 $tHNO_3$
Description of measurement methods and procedures to be applied:	For now, this value is set as the same value of CL_{normal}. After monitoring of the baseline campaign, this value is replaced. ● If $CL_{BL} \leq CL_{normal}$ then, All N_2O values measured during the baseline campaign can be used for the calculation of EF_{BL} (subject to the elimination of data that was monitored during times when the plant was operating outside of the “permitted range”). ● If $CL_{BL} > CL_{normal}$ then, N_2O values that were measured beyond the length of CL_{normal} during the production of the quantity of nitric acid (i.e. the final tonnes produced) are to be eliminated from the calculation of EF_{BL}. Where: CL_{normal} is “normal” campaign length which is defined in B.6.2.
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	AFR (B.10)
Data unit:	Nm^3/hr
Description:	Ammonia gas flow rate to the AOR during baseline campaign
Source of data used:	Orifice flow meter
Value of data applied for the purpose of calculating expected	Not needed.

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Measuring device : Orifice flow meter with differential pressure transmitter • Measuring point : In ammonia pipe before NH_3-air mixer • Recording frequency : Continuously • Data record : New logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration (as part of ISO9001 procedures)
Any comment:	This parameter is continuously monitored to check whether "normal" operation is undertaken. For the baseline campaign, any baseline data measured when the ammonia volume flow rate is over the upper limit (AFR_{max}) is eliminated from the calculation of the baseline emissions factor.

Data / Parameter:	AIFR (B.12)
Data unit:	% volume
Description:	Ammonia to air ratio during baseline campaign
Source of data used:	Orifice flow meters for ammonia mass flow and air mass flow
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions for NH_3 volume flow rate are as follows; • Measuring device : Orifice flow meter with differential pressure transmitter • Measuring point : In ammonia pipe before NH_3-air mixer • Recording frequency : Continuously • Data record : New logging system Monitoring conditions for air volume flow rate are as follows; • Measuring device : Orifice flow meter with differential pressure transmitter • Measuring point : In air pipe before NH_3-air mixer • Recording frequency : Continuously • Data record : New logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration (as part of ISO9001 procedures)
Any comment:	This parameter is continuously t monitored to check whether "normal" operation is undertaken. For the baseline campaign, any baseline data that is measured when the ammonia to air ratio is over the upper limit ($AIFR_{max}$) is eliminated from the calculation of the baseline emissions factor.

Data / Parameter:	OT_h (B.16)
Data unit:	°C

Description:	Operating temperature during baseline campaign
Source of data used:	Thermo-couple
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Measuring device : Thermo-couple • Measuring point : Inside AOR • Recording frequency : Continuously • Data record : New logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration (as part of ISO9001 procedures)
Any comment:	This parameter is continuously monitored to determine "normal" operating temperature and check whether "normal" operation is undertaken. During the baseline campaign, any N_2O baseline data that is measured during hours where the operating temperature for any AOR is outside the permitted range (OT_{normal}) is eliminated from the calculation of the baseline emissions factor.

Data / Parameter:	OP_h (B.18)
Data unit:	MPa
Description:	Operating pressure for the baseline campaign
Source of data used:	Pressure transmitter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Measuring device : Pressure transmitter • Measuring point : Inside AOR • Recording frequency : Continuously • Data record : New logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration (as part of ISO9001 procedures)
Any comment:	This parameter is continuously monitored to determine "normal" operating temperature and check whether "normal" operation is undertaken. For the baseline campaign, any N_2O baseline data that is measured during hours where the operating pressure are outside the permitted range (OP_{normal}) is eliminated from the calculation of the baseline emissions factor.

Data / Parameter:	BE_{BC} (B.3)
Data unit:	tN_2O
Description:	Total N_2O emissions during the baseline campaign
Source of data to be	Calculated from monitoring data.

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	515 tN_2O/ campaign
Description of measurement methods and procedures to be applied:	Calculated by the following equation. $BE_{BC}= VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC}$
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	EF_{BL} (B.8)
Data unit:	$tN_2O/tHNO_3$
Description:	Emissions factor for baseline period
Source of data used:	Calculated from measured data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$7.679*10^{-3}$ tN_2O /$tHNO_3$
Description of measurement methods and procedures to be applied:	This parameter is calculated as follows; $BE_{BC} = VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC}$ $EF_{BL} = (BE_{BC} / NAP_{BC}) (1 – UNC/100)$ $=(VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC}/ NAP_{BC}) (1 – UNC/100)$ For now, this parameter is set based on ex-ante estimations. After monitoring of the baseline campaign, this value is replaced.
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	GS_{BL} (B.21)
Data unit:	-
Description:	Gauze supplier for baseline campaign
Source of data used:	Plant records (Historical operating data) or the supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Name of the supplier : Shanghai Chengkai-Paite
Description of	Specified in the methodology.

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	GC_{BL} (B.24)
Data unit:	-
Description:	Gauze composition during baseline campaign
Source of data used:	Plant records (Historical operating data) or the supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Approximate Pt.65%.Rh4%Pd.31% (TFC system, plane weave wire)
Description of measurement methods and procedures to be applied:	Specified in the methodology.
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	VSG (P.2)
Data unit:	m^3/h
Description:	Volume flow rate of the stack gas for the project campaign
Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50,196Nm^3/hr For now, the same value as VSG_{BC} is set provisionally.
Description of measurement methods and procedures to be applied:	The data is subjected to a statistical analysis according to the AM0034/Version02 requirements (please see B.6.1). Monitoring conditions are as follows; • Measuring device : New orifice plate • Recording frequency : Every 2 seconds • Measuring point : Inlet line of tail gas turbine • Data record : New logging system • Measuring range: 0–70,000Nm^3/hr • Estimated total uncertainty: Please see Annex 4 Flow metering systems for both lines will automatically record continuously

	volume flow converted to standard temperature and pressure by temperature (TSG) and pressure measurements (PSG).
QA/QC procedures to be applied:	Regular calibrations according to vendor instruction. Staffs are trained in monitoring procedures
Any comment:	No.

Data / Parameter:	TSG (P.6)
Data unit:	°C
Description:	Temperature of stack gas for the project campaign
Source of data to be used:	Thermo-couple
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Recording frequency : Every 2 seconds • Measuring point : Inlet line of tail gas turbine • Data record : New Logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration
Any comment:	No.

Data / Parameter:	PSG (P.7)
Data unit:	Pa
Description:	Pressure of stack gas for the project campaign
Source of data to be used:	Pressure transmitter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Recording frequency : Every 2 seconds • Measuring point : Inlet line of tail gas turbine • Data record : New Logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration
Any comment:	No.

Data / Parameter:	NCSG (P.1)
Data unit:	mgN_2O/m^3 (converted from ppmv if necessary)
Description:	N_2O concentration in the stack gas during the project campaign
Source of data to be	Non-dispersion infrared absorption analyzer (NDIR)

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	471 mgN_2O/Nm^3 (240 ppmv) For now, this parameter is set as follows; NCSG = $NCSG_{BC}$ * DeN_2O ratio For now, DeN_2O ratio is 0.8 (set as the specifications of the technology provider)
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Measuring device : Non-dispersion infrared absorption analyzer (NDIR) • Recording frequency : Every 2 seconds • Measuring point : The tail gas duct after the tail gas turbine and before the stack • Data record : New logging system • Measuring range :0–500 ppmv • Estimated total uncertainty: Please see Annex 4
QA/QC procedures to be applied:	Regular calibrations will be conducted according to vendor specifications and recognised industry standards (EN14181 or another good industrial practice whichever practically feasible in the region). Staffs are trained in monitoring procedures. Refer to Annex 4.
Any comment:	No.

Data / Parameter:	OH (P.4)
Data unit:	Hours
Description:	Operating hours of the project campaign
Source of data to be used:	Production log
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4,354 hours/campaign For now, the same value as OH_{BC} is set provisionally.
Description of measurement methods and procedures to be applied:	For determination of project emission factor • Recording frequency : Daily, compiled for entire campaign
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	NAP (P.5)
Data unit:	$tHNO_3$
Description:	Nitric acid (100% concentrated) for the project campaign
Source of data to be used:	Flow meter and laboratory concentration analysis
Value of data applied for the purpose of calculating expected	65,072 $tHNO_3$ For now, this is set as the same values of NAP_{BC}.

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	For now, this parameter is set as the same value of CL_{normal} Monitoring conditions are as follows; • Measuring device: New installation of magnetic type flow meter and the laboratory concentration analysis based on national requirement. • Measuring point : After the absorption tower for only Line 4 • Recording frequency: Flow rate measurement: Continuously HNO_3 concentration analysis: Every 6 hours • Measuring range: Flow rate measurement: 0–35m^3/hr • Accuracy : Flow rate measurement:: ±0.1% HNO_3 concentration analysis: ±0.2% • Data record : Flow rate measurement:: DCS system HNO_3 concentration analysis: Hand writing The existing production capacity for this plant is 425 $tHNO_3$/day (100% HNO_3 base). So, in case that NAP exceeds the existing capacity for the project campaign (425 [$tHNO_3$/day] /24[hr/day] * OH[hr/campaign]), the associated incremental N_2O which exceed the existing capacity is not claimed for CERs even if it would be destroyed.
QA/QC procedures to be applied:	•For flow meter, maintenance and testing regime including calibration (as part of ISO9001 procedures) •Mass balance of the productions of the concentrated nitric acid and ammonium nitrate is checked based on ISO 9001
Any comment:	No.

Data / Parameter:	CL_n (P.12)
Data unit:	$tHNO_3$
Description:	The project campaign length for the n^{th} campaign (Campaign length is defined as the total number of metric tonnes of nitric acid at 100% concentration produced with one set of gauzes.)
Source of data to be used:	Plant records (Calculated from nitric acid production data)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	65,072 $tHNO_3$ For now, this is set as the same values of CL_{normal}.
Description of measurement methods and procedures to be applied:	● If $CL_{normal} \leq CL_n$ (Longer Project Campaign), then All N_2O values measured during the baseline campaign can be used for the calculation of EF_n (subject to the elimination of data from the Ammonia/Air analysis). ● If $CL_{normal} > CL_n$ (Shorter Project Campaign), then

	Recalculate EF_{BL} by eliminating those N_2O values that were obtained during the production of tonnes of nitric acid beyond the CL_n (i.e. the last tonnes produced) from the calculation of EF_n. Where CL_{normal} is "normal" campaign length which is defined in B.6.2
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	PE_n (P.3)
Data unit:	tN_2O
Description:	Total N_2O emissions during the n^{th} project campaign
Source of data to be used:	Calculated from monitoring data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	103 tN_2O/ campaign
Description of measurement methods and procedures to be applied:	Calculated by the following equation. $PE_n = VSG * NCSG * 10^{-9} * OH$
QA/QC procedures to be applied:	Not necessary
Any comment:	No.

Data / Parameter:	EF_n (P8)
Data unit:	$tN_2O/tHNO_3$
Description:	Emissions factor calculated for the n^{th} campaign
Source of data to be used:	Calculated from measured data For Project Emission calculation
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$1.58*10^{-3}$ tN_2O /$tHNO_3$ This parameter is calculated by equation (4) of B.6.2. below: $EF_n = PE_n / NAP_n$ ($tN_2O/tHNO_3$) However, for estimation, here they are calculated as follows $EF = (BE_{BC} / NAP_{BC})$ (1-X) $=(VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC} / NAP_{BC})$ (1-X/100) Where; X : DeN_2O ratio for this project (is expected to be 80 % by the specifications of the technology provider)
Description of measurement methods and procedures to be	This parameter will be calculated based on measurements of the nitric acid production, stack gas flow rate, N_2O concentration, and the operating hours, before the project implementation.

applied:	
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	$EF_{ma,n}$ (P.9)
Data unit:	$tN_2O/tHNO_3$
Description:	Moving average (ma) emission factor of after n[th] campaigns, including the current campaign
Source of data to be used:	Calculated from campaign emissions factors For Project Emission calculation
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable. $EF_{ma,n} = (EF_1 + EF_2 + \ldots + EF_n) / n$ $(tN_2O/tHNO_3)$
Description of measurement methods and procedures to be applied:	In order to take into account possible long-term emissions trends over the duration of the project activity and to take a conservative approach a moving average emission factor will be estimated.
QA/QC procedures to be applied:	Not needed.
Any comment:	For the first campaign EF and EF_x will be equal.

Data / Parameter:	EF_p (P.13)
Data unit:	$tN_2O/tHNO_3$
Description:	Emissions factor used to determine emissions reductions
Source of data to be used:	Calculated from campaign emissions factors
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable. To calculate the total emission reductions achieved in a campaign in formula (7) of section B.6.1, the higher of the two values $EF_{ma,n}$ and EF_n will be applied as the emission factor relevant for the particular campaign to be used to calculate emissions reductions (EF_p). If $EF_{ma,n} > EF_n$ then $EF_p = EF_{ma,n}$ If $EF_{ma,n} < EF_n$ then $EF_p = EF_n$
Description of measurement methods and procedures to be applied:	In order to take into account possible long-term emissions trends over the duration of the project activity and to take a conservative approach a moving average emission factor will be estimated.
QA/QC procedures to be applied:	Not needed.
Any comment:	For the first campaign EF and EF_x will be equal.

Data / Parameter:	EF_{min} (P.14)
Data unit:	$tN_2O/tHNO_3$

Description:	Minimum emissions factor after 10 campaigns
Source of data to be used:	Determined from campaign emissions factors
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable.
Description of measurement methods and procedures to be applied:	A campaign-specific emissions factor will be used to cap any potential long-term trend towards decreasing N_2O emissions that may result from a potential built up of platinum deposits. After the first ten campaigns of the crediting period of the project, the lowest EF_n observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in a EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall used EF_{min} and not EF_n. In practice this will mean that, if the assumption that platinum deposits do have a reducing effect on N_2O emissions is correct, then an increasing adoption of EF_{min} instead of EF_n would be experienced as the project progresses through its crediting period.
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	EF_{BL} (B.8)
Data unit:	$tN_2O/tHNO_3$
Description:	Baseline emissions factor for the project campaign
Source of data to be used:	Calculated from measured data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7.679×10^{-3} $tN_2O /tHNO_3$ For now, this value is set as the same value for the baseline campaign
Description of measurement methods and procedures to be applied:	● If $CL_{normal} \leq CL_n$ (Longer Project Campaign), then Baselines emissions factor specified for the baseline campaign is allpied for the project campaign without adjustment. ● If $CL_{normal} > CL_n$ (Shorter Project Campaign), then Baseline emissions factor for the project campaign is recalculated by eliminating those N_2O values that were obtained during the production of tonnes of nitric acid beyond the CL_n (i.e. the last tonnes produced) from the calculation of EF_n.
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	$GS_{project}$

Data unit:	-
Description:	Gauze supplier for the project campaign
Source of data to be used:	Plant records (Operating data for the project campaign) or the supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Name of the supplier : Shanghai Chengkai-Paite
Description of measurement methods and procedures to be applied:	As in past years, Huainan chemical will use above-mentioned supplier's gauzes for project campaigns. However, the supplier's information will be monitored.
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	$GC_{project}$
Data unit:	-
Description:	Gauze composition for the project campaign
Source of data to be used:	Plant records (Operating data for the project campaign) or the supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Approximate Pt,Rh,Pd (TFC system, plane weave wire)
Description of measurement methods and procedures to be applied:	As in past years, during project campaigns, Huainan chemical will use above-mentioned gauzes which is common practice in the region and supplied by a reputable manufacturer or which composition is reported as being in use in the relevant literature. However, the gauze composition will be monitored.
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

Data / Parameter:	AFR (B.10)
Data unit:	Nm^3/hr
Description:	Ammonia gas flow rate to the AOR during the project campaign
Source of data to be used:	Orifice flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of	Monitoring conditions are as follows;

measurement methods and procedures to be applied:	• Measuring device : Orifice flow meter with differential pressure transmitter • Measuring point : In ammonia pipe before NH_3-air mixer • Recording frequency : Continuously • Data record : New logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration (as part of ISO9001 procedures)
Any comment:	No.

Data / Parameter:	AIFR (B.12)
Data unit:	% volume
Description:	Ammonia to air ratio during the project campaign
Source of data used:	Orifice flow meters for ammonia mass flow and air mass flow
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions for NH_3 volume flow rate are as follows; • Measuring device : Orifice flow meter with differential pressure transmitter • Measuring point : In ammonia pipe before NH_3-air mixer • Recording frequency : Continuously • Data record : New logging system Monitoring conditions for air volume flow rate are as follows; • Measuring device : Orifice flow meter with differential pressure transmitter • Measuring point : In air pipe before NH_3-air mixer • Recording frequency : Continuously • Data record : New logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration (as part of ISO9001 procedures)
Any comment:	No.

Data / Parameter:	OT_h (B.16)
Data unit:	°C
Description:	Operating temperature during the project campaign
Source of data used:	Thermo-couple
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be	Monitoring conditions are as follows; • Measuring device : Thermo-couple • Measuring point : Inside AOR

applied:	• Recording frequency : Continuously • Data record : New logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration (as part of ISO9001 procedures)
Any comment:	No.

Data / Parameter:	OP_h (B.18)
Data unit:	MPa
Description:	Operating pressure for the project campaign
Source of data used:	Pressure transmitter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not needed.
Description of measurement methods and procedures to be applied:	Monitoring conditions are as follows; • Measuring device : Pressure transmitter • Measuring point : Inside AOR • Recording frequency : Continuously • Data record : New logging system
QA/QC procedures to be applied:	Maintenance and testing regime including calibration (as part of ISO9001 procedures)
Any comment:	No.

Data / Parameter:	EF_{reg} (B.26)
Data unit:	$tN_2O/tHNO_3$
Description:	Emissions level set by incoming policies or regulations (on N_2O and NOx emissions)
Source of data to be used:	Local and National Regulations
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Currently, there are no regulations on N_2O emissions in China. However, If N_2O emissions regulations that apply to nitric acid plants would be introduced in the host country or jurisdiction covering the location of the project activity and the regulatory limit is lower than the baseline factor determined for theproject, the regulatory limit shall serve as the new baseline factor.
Description of measurement methods and procedures to be applied:	Three kinds of legislation on N_2O emissions are assessed: ● An absolute cap on the total volume of N_2O emissions for a set period ● A relative limit on N_2O emissions expressed as a quantity per unit of output ● A threshold value for specific N_2O mass flow in the stack
QA/QC procedures to be applied:	Not needed.
Any comment:	No.

B.7.2 Description of the monitoring plan:

>>

Organization Structure with Management & Operation Process

In order to ensure the successful operation of the project and the creditability and verifiability of the CERs achieved, the project will have a well-defined management and operational system.

An illustrative scheme of the operational and management structure is as follows:

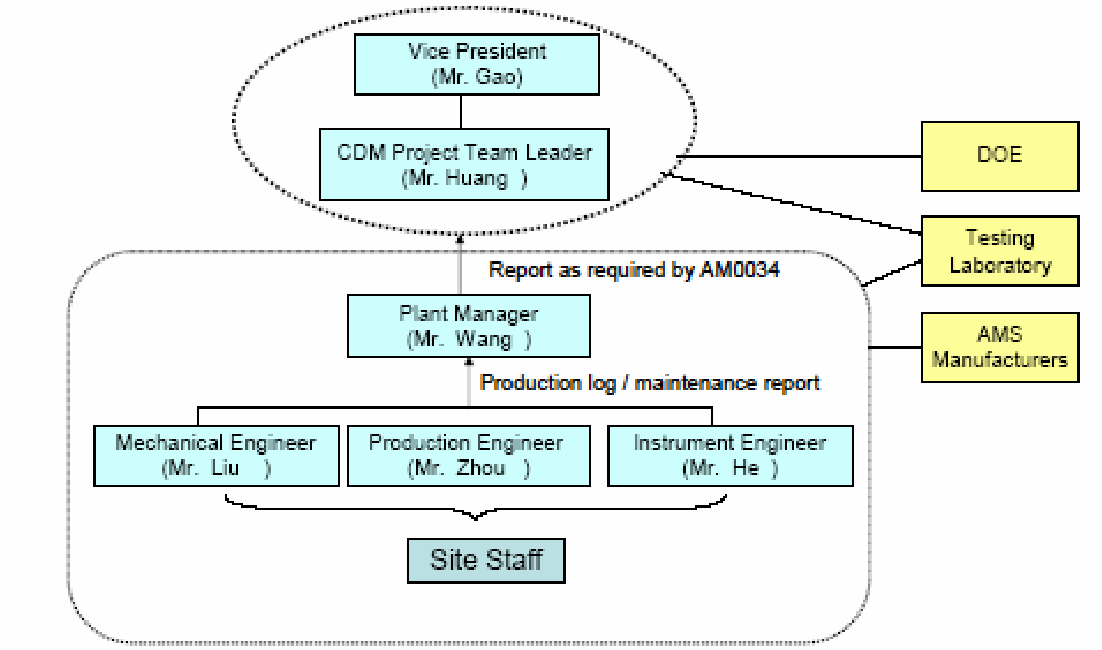

Figure 6. Monitoring Organization in Huainan chemical

Huainan chemical has implemented Quality Standard ISO9001-2000 and has been operating the nitric acid plants since the commissioning of the plant and has sufficient and well-experienced staffs.

Measuring instruments will be calibrated by the monitoring engineer in accordance with the requirements of the instrument suppliers. Huainan chemical will train the staff selected for the operation of N_2O and monitoring systems. The Process and Equipment engineer of the nitric acid plant is responsible for the daily operation and maintenance of the systems.

The monitoring of the N_2O for the project and the preparation of the monitoring report will be responsible of CDM project Team Leader and the operation and maintenance of the N_2O Monitoring system will be incorporated based on the documented procedures. The Monitoring of the relevant data will be done automatically by the N_2O Monitoring system and recorded onto the electronic media.

Furthermore, the internal audit will be conducted and the monitoring data is periodically checked.

In case deviation in the Monitoring data is found, the monitoring engineer will study the operating parameters of nitric acid plants to identify the reason for the deviation and take remedial measures. If there are no changes in the operating parameters of nitric acid plant, the monitoring system will be examined and a sampling by gas chromatography will be conducted by Instrument Engineer to counter check the performance of the monitoring system. Once the default is identified, Instrument Engineer will introduce a correction to the default. The Monitoring will report such irregular event to Plant manage through daily report.

Frequency of Monitoring and storage of the data

Data storage and data security are considered to be one of the most important part of the MP. The system is designed to be operated automatically. No operator is required for the daily operation of the system. However, monitoring engineer will ensure that the system is in normal operation and take necessary action to follow the MP.

Flow rate is measured continuously by the flow meter. Data will be recorded every 2 second. Data will be compiled into hourly and daily and stored in electronic media. Data will be compiled into hourly and daily and stored electronic media.

N_2O concentration is measured continuously by NDIR. Data will be recorded every 2 second. Data is compiled into hourly and daily data and kept in the electronic media. Data will be compiled into hourly and daily and stored electronic media.

Other parameters are monitored periodically and recorded into electronic media to suite the requirement of the CDM monitoring activity.

Quality assurance

Quality controls
Accuracy of the N_2O emissions monitoring results is to be ensured by installing a monitoring system that has been certified to meet or exceed the requirements of the prevailing best industry practice or monitoring standards in terms of operation, maintenance and calibration. For N_2O analyzers QAL2, AST and QAL3 of EN14181 or another good industrial practice whichever practically feasible in the region are taken account as the basis.
Please see Annex 4 in detailed information.

Training
A NDIR system was introduced well in advance prior to the baseline campaign for the purpose of the training and preparation of the monitoring.

The Supplier of the NDIR system and Toyo Engineering Corporation provided complete training to the monitoring engineers on the operation and maintenance of the monitoring system.

Downtime of Automated Measuring System

In the event that the monitoring system is down, the lowest between the conservative IPCC (4.5 kg N_2O/ton nitric acid) 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.

Data Logging and Emissions System

The measured values are transferred to the existing distributed control system, the newly installed data recorder and the newly installed logging system dedicated for the project
The logging system which is programmed by Toyo Engineering Corporation according to AM0034 Version 2, displays, calculates, evaluates, prints out and stores the measure data.

The calculation includes calculation of flow rate at standard conditions (0 °C and 1 atm.) by measuring pressure and temperature.

The system also calculates mass flow rates of N_2O by using measured N_2O concentration and volume flow rate of stack gas.
The logging data and all reports printed out from the system are kept for the period required by AM0034 Version 2.

- Main project emissions parameters: Electronic and paper for at least 2 years
- Main baseline emissions parameters: Electronic and paper for the entire crediting period
- AOR operation parameters related to baseline emissions: Electronic and paper for at least 2 years
- Ammonia oxidation gauze's parameters related to baseline emissions: For project crediting period

Calibration of Monitoring Equipment

Please see Annex 4.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

Completion date: 28/01/2008

Marubeni Corporation (Project Participant)
Mr. Kaname Toh (toh-k@marubeni.com)
Ms. Liu Li (liu-li@marubeni.com)

Toyo Engineering Corp. (Project Participant)
Mr. Yasuhiko Kojima (y-kojima@ga.toyo-eng.co.jp)
Mr. Zenji Matsuyama (Matsuyama-z@ga.toyo-eng.co.jp)

Climate Experts Ltd. (Climate Experts Ltd. is not a project participant)
Dr. Naoki Matsuo (n_matsuo@climate-experts.info)
Mr. Kunihiro Ueno (k_ueno@climate-experts.info)

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

24/05/2006 (The date when the contract of CDM project development for N_2O Abatement was made by Huainan chemical and Marubeni Corp.)

C.1.2. Expected operational lifetime of the project activity:

>>

21 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

01/07/2008

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

n.a.

C.2.2.2. Length:

>>

n.a.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

Environmental impacts of waste gas, wastewater, solid waste and noises etc. of the proposed CDM project are briefly analyzed as below:

Environmental impacts of waste gas

The amount of waste gases after destructing N_2O for Line 4 is totally more than 50,000 Nm^3/hr, which the main waste gases are: N_2O (<200 ppmv for Line1-3), NO_x 250 ppmv for Line4). The waste gas for Line 4 is emitted through high chimney. Line 4 which is the medium pressure plant, NO_X emission in the tail gas is low to a satisfactory extent without an NH_3-SCR.

The concentration and flow rate of the waste gas satisfies GB16297-1996. N_2O emissions are reduced especially by this project, so air quality is obviously improved.

Environmental impacts of waste water and solid waste

There are no waste water and solid waste yielded during the project operation period. The solid wastes caused during the construction period are collected and transported out in time, resulting in very light environmental impacts.

Environmental impacts of noises

There is no impact for noises of the project come from the installation of secondary catalyst.

Anhui Environment Protection Bureau approved the environment impact assessment (EIA) report of the proposed project and agreed the construction and operation of the project.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

As the proposed project itself is indeed an environmental protection project to reduce N_2O emission, it has no obvious impacts on surrounding environment according to the EIA report.

However, NOx is measured to ensure compliance with environmental regulations. There are no other environmental indicators and sustainable development indicators than above-mentioned documents to be required by the host government or local authorities.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

Huainan chemical held a local stakeholder meeting at meeting room in Huainan Chemical on Nov. 9, 2007, to collect stakeholders' comments on Huainan chemical CDM project (See Figure xx). Key stakeholders are invited, including residential representatives, staff of Huainan Chemical etc. Mr. Huang Shao, CDM Project Manager of Huainan chemical moderated the meeting and introduced the development strategies of Huainan chemical, especially the Green Environmental Protection Strategy and the efforts and fulfillments it has obtained so far.

Attendant list is as follows;

Name	Organization etc.,	Title
Huang Shao	Huainan Chemical	CDM Project Manager
Chen Lin	Huainan Chemical	CDM Technical Manager
Zhu Zhifeng	Huainan Chemical	staff
Zhang Zhao	Huainan Chemical	staff
Gong Maojia	Huainan Chemical	staff
Zong Dongsheng	Huainan Chemical	staff
Hu Lisong	Huainan Chemical	staff
Shi Dehuai	Huainan Chemical	staff
Liu Xian'an	Huainan Chemical	staff
Tian Fuxia	Huainan Chemical	local residential
Wu Xiaoyan	Huainan Chemical	local residential
Yu Lu	Huainan Chemical	local residential
Zhang Yi	Huainan Chemical	staff
Ren Wei	Huainan Chemical	staff
Niu Shoukun	The Third Chemical Engineering Construction Company of China (TCC)	staff
Wu Qingjun	The Third Chemical Engineering Construction Company of China (TCC)	staff

Figure 7 Local stakeholder meeting

Huainan chemical released an announcement on Huainan chemical N_2O destruction CDM project at the “Huainan Chemical News” on Nov. 19, 2007 to demand any opinions and comments from any local stakeholders broadly with mass media.

E.2. Summary of the comments received:

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The questions raised by the stakeholders attending the meeting are briefly summarized as followings:

(Question 1):
How is the CDM Project progressing?

(Question 2):
When will the first CER be issued?

(Question 3)
How many N2O will be reduced per year?

E.3. Report on how due account was taken of any comments received:

>>

On behalf of Huainan chemical, Mr. Huang Shao, the CDM Project Manager and Mr. Chen Lin, the CDM Technical Manager answered the questions raised by the participants as detailed as possible, the answers are briefed as below:

(Answer 1 by Huang Shao, CDM Project Manager)

- May 24, 2006: Entering into contract of CDM project development made by Huainan Chemical and Marubeni.
- Nov.22, 2006: Entering into contract for Supply of Equipment of CDM project made by Huainan Chemical and Toyo Engineering Corporation and Marubeni.
- July, 2006 : Starting the Baseline of Project.

(Answer 2 by Chen Lin, CDM Technical Manager)
According to CDM Project Schedule, the first CER is estimated to issue by the end of 2008.

(Answer 3 by Chen Lin, CDM Technical Manager)
It is estimated that more than 30 million tonnes (t-CO2 equivalent) per year N2O will be reduced.

		Environmental Impact			Employment Opportunities			Development of Local Economy			Development of Social Community			Attitute of local residental			Implement of the project		
No.	Name	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative
1	Zhu Zhifeng	√				√		√			√			√			√		
2	Zhang Zhao	√			√			√			√			√			√		
3	Gong Maojia	√			√			√			√			√			√		
4	Zong Dongsheng	√			√			√			√			√			√		
5	Hu Lisong	√			√			√			√			√			√		
6	Shi Dehuai	√			√			√			√			√			√		
7	Liu Xian'an	√			√			√			√			√			√		
8	Tian Fuxia	√			√			√			√			√			√		
9	Wu Xiaoyan	√			√			√			√			√			√		
10	Yu Lu	√			√			√			√			√			√		
11	Zhang Yi	√			√			√			√			√			√		
12	Ren Wei	√				√		√			√			√			√		
14	Niu Shoukun	√				√		√			√			√			√		
15	Wu Qingjun	√			√			√			√			√			√		
Percentage		100%	0%	0%	80%	20%	0%	100%	0%	0%	100%	0%	0%	100%	0%	0%	100%	0%	0%

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funds are used for this project activity.

Annex 3

BASELINE INFORMATION

Line 4

Campaign No. (Previous No)	Campaign length [$tHNO_3$/campaign] (100% concentrated)	Operating hours [hr]	Average load [$tHNO_3$/day]	Period
1st	66,715	4,494	356.4	06.01.2007-17.07.2007
2nd	61,589	4,308	343.1	26.06.2006-05.01.2007
3rd	65,504	4,442	353.9	19.12.2005-24.06.2006
4th	63,541	4,296	355.0	06.06.2005-16.12.2006
5th	68,011	4,230	385.9	08.12.2004-05.0620.05
Average	65,072	4,354	358.7	

Normal operating conditions for AOR (based on previous five campaigns)

Line4 (Medium pressure plant)

Items		Unit	Line4
Maximum ammonia gas flow rate to the AOR	AFR_{max}	Nm^3/hr	6,652
Maximum ammonia to air ratio	$AIFR_{max}$	%	13.17
Normal range for oxidation temperature	OT_{norma}	℃	860-887
Normal range for oxidation pressure	OP_{norma}	MPa(G)	0.329-0.417

Parameters used to estimate emission reductions

		Line4	unit
Nitric acid production over the baseline campaign	NAP_{BC}	65,072	t HNO_3/campaign
Operating hours of the baseline campaign	OH_{BC}	4,354	hr/campaign

Volume flow rate of the stack gas during the baseline campaign	VSG_{BC}	50,196	Nm^3/hr
N_2O concentration in the stack gas during the baseline campaign	$NCSG_{BC}$	2,357	mg/Nm^3
Overall uncertainty of the monitoring system	UNC	3	%
Emissions factor for baseline period	EF_{BL}	7.679	$*10^{-3}$ t N_2O/t HNO_3
Nitric acid production for the project campaign	NAP	65,072	t HNO_3/campaign
Operating hours of the project campaign	OH	4,354	hr/campaign
DeN_2O ratio	X	80	%
Ex-ante volume flow rate of the stack gas during the project campaign	VSG	50,196	
Ex-ante N_2O concentration in the stack gas during the project campaign	NCSG	471	mg/Nm^3
Ex-ante emissions factor for the project campaign	EF_P	1.58	$*10^{-3}$ t N_2O/t HNO_3
GWP_N_2O		310	tCO_2e/tN_2O

Annex 4

MONITORING PLAN

1. Monitoring Parameters and Monitoring Equipment

Tail gas flow:
Flow meter (orifice plate) is used to measure this important parameter before the tail gas turbine. Differential pressure is measured with differential pressure transmitters. The flow rate is converted to the one at the standard conditions by temperature and pressure measured by thermocouple and pressure transmitters.

(Uncertainties of measurement)

The uncertainty of the volumetric flow measurement with the orifice is to be calculated with the formula given in ISO 5167-1 :2003.

$(\delta q_v/q_v)$
$=\{(\delta C/C) + (\delta\varepsilon/\varepsilon) + (2\beta^4/(1-\beta^4))^2(\delta D/D)^2 + (2/(1-\beta^4))^2 (\delta d/d)^2 + (\delta\Delta p/\Delta p)^2/4 + (\delta\rho 1/\rho 1)^2/4 \}$^1/2

where
$\delta C/C$ = uncertainty of discharge coefficient,
$\delta\varepsilon/\varepsilon$ = uncertainty of expansion factor,"
$\delta D/D$ = uncertainty of tube entrance diameter,
$\delta d/d$ = uncertainty of throat diameter,
$\delta\Delta p/\Delta p$ = uncertainty of differential pressure measurement,
β = Ratio of diameters
$\delta\rho 1/\rho 1$ = uncertainty of density measurement with temperature/pressure compensation.
$= \{(\delta\rho 1_d/\rho 1_d)^2 + (\delta T/T)^2 + (\delta P/P)^2\}$^1/2
$\delta\rho 1_d/\rho 1_d$ = uncertainty of density (fluctuation of actual from design)
$\delta T/T$ = uncertainty of temperature measurement
$\delta P/P$ = uncertainty of pressure measurement
The uncertainty of the volume flow $\delta q_v/q_v$ is mainly governed by the terma of;
$\delta C/C$, which is to be assumed to be 0.75 % according to ISO 5167-2:2003, and
$\delta\rho 1_d/\rho 1_d$ which is 1.0 % according to the historical data
The other factors contribute only little:
$\delta\varepsilon/\varepsilon$ = 0.11% acc. to ISO 5167-2:2003.
$\delta D/D$ = 0.4 % acc. to ISO 5167-2:2003.
$\delta d/d$ = 0.1 % acc. to ISO 5167-2:2003.
$\delta\Delta p/\Delta p$ = 0.25 % acc. to manufacturer's specification,
$\delta T/T$ = 0.25 % acc. to manufacturer's specification.
$\delta P/P$ = 0.25 % acc. to manufacturer's specification.
Numerical evaluation of the formula above results in a total uncertainty of the flow measurement of 2.5% of the range.

Continuous Analysis of the tail gas
The Project employs the latest state-of-art Non-Dispersive Infrared photometry system (NDIR) to measure the concentration for the baseline campaign and the project campaign which is the key

parameter of the Project. NDIR will have measurement range of 0 – 2,000 ppmv for the baseline campaign and 0 –500 ppmv for the project campaign.

(Uncertainties of measurement)

The manufacturer specifies a relative accuracy of 1 % of the measuring range, assuming that zero and span adjustment is performed regularly as requested in instrument documentation.

This accuracy refers to the applied calibration standard, which again has an uncertainty. Best commercially available test gases for calibration have an uncertainty of 1 %. So, using the gaussian law of error propagation, the accuracy of the analysers is;

$(\delta c/c) = \{(\delta a/a)^2 + (\delta g/g)^2\}$^1/2 = 1.41% of the range.
where
$\delta c/c$ = uncertainty of concentration measurement
$\delta a/a$ = uncertainty of analyser
$\delta g/g$ = uncertainty of test gas.

Therefore the estimated uncertainty is 1.4% of the measuring concentration.

Uncertainty assessment for baseline emission factor

According to IPCC Goood Practice Guidance and Uncertainty in National Greenhouse Gas Inventries, section 6.3, Equation 6.4, the estimated combined uncertainty is expressed as:

$UNC = (U_{VSG}^2 + U_{NCSG}^2)^{1/2}$

Where:

UNC : Overall combined uncertainty in the baseline emission factor in %,
U_{VSG} : Uncertainty in the flow measurement in % and the estimated figure,
U_{NCSG} : Uncertainty in the concentration measurement,

$UNC = (2.52\%^2 + 1.41\%^2)^{1/2} = 2.9\% \rightarrow 3\%$

2. Quality assurance for AMS (N_2O concentration analyzer)

According to AM0034/Version02, three levels of quality assurance tests (QAL1, 2 & 3) and one annual surveillance test (AST) for AMS are recommended to be used as guidance regarding the selection, installation and operation of the AMS by the latest applicable European standards and norms (EN 14181).

The three quality assurance levels (QALs) are as follows:

1) QAL1: Quality assurance of tested AMS.

AMS must have performance certificate (e.g. MCERTS), with calculation of uncertainty before installation according to approved methods such as ISO 14956 including:

a) Standard deviation; b) Lack of fit (linearity); c) Repeatability at zero and reference points; d) Time-dependent zero and span drift; e) Temperature dependence; f) Voltage fluctuation; g) Suitability test; h) Cross sensitivity to likely components of the stack gas; i) Influence of variations in flow rate on extractive Automated Measuring Systems; j) Response time; k) Detection limit; l) Influence of ambient conditions on zero and span readings; m) Performance and accuracy; n) Availability; o) Susceptibility to physical disturbances.

However, even to date, only one type of analyser has been finally certified to comply with the requirements of EN 14181 QAL 1 in accordance with ISO 14956 for N_2O measurements.
For this project, the Servomex Xentra 4900 is used. It was designed and built with a view to comply with the requirements of QAL1 and Servomex is currently considering to have the instrument QAL1 certified.

The analyzers and flow meters were calibrated by the suppliers prior to shipment and installation in the nitric acid plant.

2) QAL2: Quality assurance of installation and calibration of the AMS

QAL2 parallel with the Standard Reference Method (SRM) shall be conducted in order to determination of the measurement uncertainty/variability of the AMS and inspection of the compliance with the prescribed measurement uncertainties. Such tests must be carried out by organizations that have an accredited quality assurance system such as one according to ISO/IEC 17025 or relevant standards. Items to be considered include the following:

a. Selection of the location of measurement;
b. Duly installation of the monitoring equipment;
c. Correct choice of measurement range;
d. Calibration of the AMS using the Standard-Reference-Method (SRM) as guidance;
e. Calibration curve either as linear regression or as straight line from absolute zero to centre of a scatter-plot;
f. Calculation of the standard deviation at the 95% confidence interval;
g. Inspection every three years.

For this project, being carried out by paralleled measurement with a SRM, the calibration procedure will be certified by organizations that have an accredited quality assurance system such as one according to ISO/IEC 17025 or relevant standards.

3) QAL 3: Continuous quality assurance through the local operator/manager (drift and accuracy of the AMS, verification management and documentation).

a. Permanent quality assurance during the plant operation by the operating staff;
b. Assurance of reliable and correct operation of the monitoring equipment (maintenance evidence);
c. Regular controls: zero point, span, drift, meet schedule of manufacturer maintenance intervals;
In addition, annual surveillance test including SRM measurements to check for uncertainties in the data measured by the AMS. a. Annual confirmation of the calibration curve;
b. Validity proof of calibration curves;
c. Back-setting of excess meter of invalid calibration range.
For this project this procedure is achieved by conducting periodic zero and span checks on the

AMS and then evaluating the results obtained using control charts in accordance with the manufacturer's instructions.

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