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

CONTENTS

SECTION A. General description of the project

A.1. Title of the project:

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Zaklady Azotowe Kedzierzyn Nitrous Oxide Abatement Project
Version 2.1
22 January 2010

A.2. Description of the project:

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Nitrous oxide (N_2O) is an undesired by-product gas from the manufacture of nitric acid. Nitrous oxide is formed during the catalytic oxidation of ammonia. Over a suitable catalyst, a maximum 98% (typically 92-96%) of the ammonia fed is converted to nitric oxide (NO). The remainder participates in undesirable side reactions that lead to the production of nitrous oxide, among other compounds.

Waste N_2O from nitric acid production is typically released into the atmosphere, as it does not have any economic value or toxicity at typical emission levels. N_2O is an important greenhouse gas which has a high global warming potential (GWP) of 310.

The project activity involves the installation of a secondary catalyst to abate N_2O inside the reactor once it is formed.

The baseline scenario is determined to be the release of N_2O emissions to the atmosphere at the currently measured rate, in the absence of regulations to restrict N_2O emissions. If regulations on N_2O emissions are introduced during the crediting period, the baseline scenario shall be adjusted accordingly.

The baseline emission rate will be determined by measuring the N_2O emission factor (kg N_2O/tonne HNO_3) during a *complete* production campaign before project implementation. To ensure that the data obtained during the initial N_2O measurement campaign for baseline emission factor determination are representative of the actual GHG emissions from the source plant, a set of process parameters known to affect N_2O generation and under the control of the plant operator will be controlled from historical data.

Baseline emissions will be dynamically adjusted from activity levels on an ex-post basis through monitoring the amount of nitric acid production. Project N_2O emissions will be monitored directly in real time. Additional N_2O monitoring and recording facilities will be installed to measure the amount of N_2O emitted by the project activity.

Project additionality is determined using the most recent version of the “tool for demonstration and assessment of additionality”, approved by the CDM Executive Board.

The project activity will reduce N_2O emissions and will neither increase nor decrease direct emissions of other air pollutants.

The project will not impact on the local communities or access of services in the area. The project activity will not cause job losses at ZAK S.A.’s plant.

ZAK S.A. (hereinafter ZAK) Nitrous Oxide Abatement Project has the potential to be replicated by other nitric acid plants in other countries.

A.3. Project participants:

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Party involved	**Legal entity project participant (as applicable)**	**Please indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Poland	ZAK S.A. Private entity Project Developer	No
Sweden	MGM Carbon Portfolio, S.a.r.l (private)	No

In over 50 years of its history, ZAK has been one of leaders among the group of Polish producers of nitrogen fertilizers and other chemical products. It was the first Polish company to commercialize the processes for the production of such basic chemicals as urea, phthalic anhydride, maleic anhydride and oxo alcohols.

In 1987, the company started up the unit for mechanical granulation of nitro-chalk. The product had unique strength and performance properties, and it was given the trade name of Salmag. That brand name became one of the symbols of its works. Moreover, a few environmental projects were implemented in that decade, for example a safe storage yard for toxic waste products. In the early 1990s, the first production lines of consumer goods were set up: dishwashing liquid and textile rinsing liquid.

The 1990s was the decade of numerous changes for ZAK as it was the period of transformation processes taking place in the Polish economy. Hence, the need emerged to adjust the way of operating the company to the requirements of market conditions. On January 1, 1992, the legal status of the company was changed: it became no longer a state-owned enterprise but a sole stock company of the State Treasury with the name of Zakłady Azotowe Kędzierzyn, Spółka Akcyjna [“Kędzierzyn” Nitrogen Works, Joint-stock Company]. In 2009 the company’s name was changed to ZAK S.A. (or ZAK Spółka Akcyjna).

A modern ammonia plant was started up which replaced 17 outdated production units. The plant was equipped with a new and modern (at that time) computer-based process control system. Also, new and modern arrangements were adopted within the process itself and the process equipment. An ammonia storage tank was added which made it possible to operate the ammonia plant in a more flexible way, following the current market situation and the demand profile.

The company has joined the “Responsible Care” program and, due to its successful performance with regard to environmental protection, health protection and occupational safety, met with approval – it was given the right to use the logo of that program. A new nitric acid plant substituted the old plant which was responsible for environmental and workplace pollution, and an essential modification was made in the complex sewage treatment system: the rain-water stream was recycled and utilized for the production of industrial water.

The firm managed to implement the quality system which qualified for the certificate confirming its conformity with the requirements of the standard PN ISO 9002. After many years’ efforts in minimizing the environmental impacts of its production processes, ZAK was struck off the list of the most environmentally noxious companies.

A.4. Technical description of the project:

A.4.1. Location of the project:

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A.4.1.1. Host Party(ies):

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Figure 1: Map of Poland.

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

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Opole Silesia Region

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

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Kedzierzynie-Kozle

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

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The project is located at Zaklady Azotowe Kedzierzyn Nitric Acid Plant, Ul. Mostowa 30 A, skr. Pocztowa 163 47-220, Kedzierzynie-Kozle, Opole Silesia

The GPS coordinates of the plant are:

50°18'18" N latitude and
18°15'42" E longitude.

Figure 2: ZAK plant location

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

The Ostwald process

Nowadays, all commercial nitric acid is produced by the oxidation of ammonia and subsequent reaction of the oxidation products with water, through the Ostwald process.

The basic Ostwald process involves 3 chemical steps:

A) Catalytic oxidation of ammonia with atmospheric oxygen, to yield nitrogen monoxide (or nitric oxide)

(1) $4\,NH_3 + 5\,O_2 \rightarrow 4\,NO + 6\,H_2O$

B) Oxidation of the nitrogen monoxide to nitrogen dioxide or dinitrogen tetroxide

(2) $2\ NO + O_2 \rightarrow 2\ NO_2 \rightarrow N_2O_4$

C) Absorption of the nitrogen oxides in water to yield nitric acid

(3) $3\ NO_2 + H_2O \rightarrow 2\ HNO_3 + NO$

Reaction 1 is favored by lower pressure and higher temperature. Nevertheless, at excessively high temperature, secondary reactions take place that lower yield (affecting nitric acid production); thus, an optimum is found between 850 and 950 degrees C, affected by other process conditions and catalyst chemical composition (Figure 2)[1]. Reactions 2 and 3 are favored by higher pressure and lower temperatures.

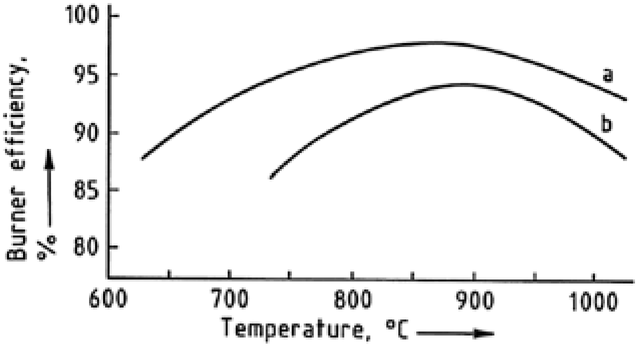

Figure 3: Conversion of ammonia to nitrogen monoxide on platinum gauze as a function of temperature at a) 100 kPa; (b) 400 kPa [1]

The way in which these three steps are implemented characterizes the various nitric acid processes found throughout the industry. In mono pressure or single pressure processes ammonia combustion and nitrogen oxide absorption take place at the same working pressure. In dual pressure or split pressure plants the absorption pressure is higher than the combustion pressure.

Nitrous oxide formation

Nitrous oxide is formed during the catalytic oxidation of ammonia. Over a suitable catalyst, a maximum 98% (typically 92-96%) of the ammonia fed is converted to nitric oxide (NO) according to reaction (1) above. The remainder participates in undesirable side reactions that lead to nitrous oxide (N_2O), among other compounds.

Side reactions during oxidation of ammonia:

(4) $4\ NH_3 + 4\ O_2 \rightarrow 2\ N_2O + 6\ H_2O$ (nitrous oxide formation).

(5) $4\ NH_3 + 3\ O_2 \rightarrow 2\ N_2 + 6\ H_2O$

(6) $2\ NO \rightarrow N_2 + O_2$

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[1] Thieman et al., “Nitric Acid, Nitrous Acid, and Nitrogen Oxides”, *Ullmann’s Encyclopedia of Industrial Chemistry 6th Edition*, Wiley-VCH Verlag GmbH & Co. KGaA. All rights reserved.

(7) $4 NH_3 + 6 NO \rightarrow 5 N_2 + 6 H_2O$

N_2O abatement technology classification

The potential technologies (proven and under development) to treat N_2O emissions at nitric acid plants have been classified as follows, on the basis of process location of the control device:

Primary: N_2O is prevented from forming in the oxidation gauzes.
Secondary: N_2O, once formed, is eliminated anywhere between the outlet of the ammonia oxidation gauzes and the inlet of the absorption tower.
Tertiary: N_2O is removed at the tail gas, after the absorption tower and before the expansion turbine.
Quaternary: N_2O is removed following the expansion turbine and before the stack.

Selected technology for the project activity

General description

The current project activity involves the installation of a new (not previously installed) catalyst below the oxidation gauzes (a “secondary catalyst”) whose sole purpose is the decomposition of N_2O. The secondary approach has the following advantages:

- The catalyst does not consume electricity, steam, fuels or reducing agents (all sources of leakage) to eliminate N_2O emissions; thus, operating costs are negligible and the overall energy balance of the plant is not affected.
- Installation is relatively simple and does not require any new process unit or re-design of existing ones (the reactor basket needs some modifications to accommodate the new catalyst).
- Installation can be done simultaneously with a primary gauze changeover; thus, the loss in production due to incremental downtime will be limited.
- Considerably lower capital cost when compared to other approaches.

The secondary abatement technology has been tested in several industrial trials in which it has proven to be reliable in reducing N_2O and environmentally safe. Especially, its implementation does not lead to increased NO_x emissions. Nor is the environment directly or indirectly harmed in any other way.
The selected technology has been developed by several catalyst suppliers; e.g. W.C. Heraeus, Johnson Matthey/Yara, INS, Umicore and BASF. All of them have developed a secondary catalyst that decomposes N_2O gas without affecting the nitric acid production either in efficiency or in quality. Typically the secondary catalyst has a very high activity; the suppliers assure at least 85% conversion efficiency.

ZAK has selected INS (Poland) as technology provider. INS guarantees conversion efficiency more than 85%. ZAK will re-evaluate performance and cost advantages of the INS system with those available then in the market, and may eventually switch to another secondary catalyst supplier, in order to assure the best available technology is utilized for the project. Nevertheless, this decision will not in any way affect the project activity as described in this PDD.

Once installed, the catalyst itself and the AMS will be operated by the local ZAK employees. All project participants will work together on training ZAK workers to reliably supervise the effective operation of the catalyst technology, apply the installed monitoring system to measure the emission levels and collect the data in a manner that allows the successful completion of each verification procedure.

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

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The project activity consists of the installation of a secondary catalyst, inside the ammonia burner and beneath the primary catalyst, whose sole purpose is to reduce the N_2O emissions.

Due to high temperature and the presence of the secondary catalyst, the N_2O formed earlier is converted into N_2 and O_2.

N_2O is typically released into the atmosphere as common practice in the industry, since it does not have any economic value or toxicity at typical emission levels.

Currently, there are no national regulations or legal obligations in Poland concerning N_2O emissions. It is unlikely that any such limits on N_2O emissions will be imposed in the near future.

From what was said above, it is concluded that N_2O would not be removed in the absence of the proposed project activity.

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

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Length of the crediting period	12 years
Year	**Annual estimated emission reduction in tonnes of CO_2e**
2008	12,841
2009	358,635
2010	358,635
2011	358,635
2012	358,635
Subtotal (1st Kyoto commitment period)	**1,447,381**
2013	358,635
2014	358,635
2015	358,635
2016	358,635
2017	358,635
2018	358,635
2019	358,635
Subtotal[2]	**2,510,445**
Total estimated reductions (tonnes of CO_2e)	**3,957,826**
Total number of crediting years	12
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**329819**

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[2] The crediting period can extend beyond 2012 subject to the approval by the host Party. The status of emission reductions generated by JI projects after the end of the first commitment period may be determined by any relevant agreement under the UNFCCC (Guidelines for users of the JI PDD form, Ver. 03, page 14).

A.5. Project approval by the Parties involved:

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This section will be complete after receiving the LoA.

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

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Following JI criteria for baseline setting and monitoring methodologies adopted during the fourth meeting of the Joint Implementation Supervisory Committee (JISC) that took place in Bonn, Germany, during 13-15 September, 2006; an approved methodology for CDM project activities can be applicable for JI project activities.
AM0034 is the baseline and monitoring methodology chosen to develop the project activity. Thus, the baseline scenario will be chosen following the procedures of AM0034 (Version 3.4).

The proposed project activity meets the applicability conditions required by the methodology AM0034:

- ZAK's plant limits the application of this project activity to existing nitric acid production installed no later than 31 December 2005. The nitric acid production line started its operation on 29 December 1995.
- Currently ZAK's plant does not have any N_2O destruction or abatement facility or equipment that could be affected by the project activity.
- The project activity will not affect the level of nitric acid production.
- There are currently no regulatory requirements or incentives to reduce levels of N_2O emissions from nitric acid plants in Poland.
- The secondary catalyst technology to be installed as project activity has been tested in several industrial trials and it has been demonstrated that its installation does not increase NO_x emissions.
- ZAK's plant has no non-selective catalytic reduction (NSCR) $DeNO_X$ abatement system installed.
- 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.
- Continuous real-time measurements of N_2O concentration and total gas volume flow can be carried out in the stack:
  - Before 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.

The baseline methodology application first involves an identification of possible baseline scenarios and eliminating those that would not qualify. The procedures followed for baseline scenario selection correspond to AM0028 "Catalytic N_2O destruction in the tail gas of Nitric Acid and Caprolactam Production Plants" version 04.2 (EB 41) as is specified in the selected AM0034, version 3.4; for more details see the following link at the UNFCCC website:

http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

The analysis of baseline scenarios involves five steps:

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

The first step in determining the baseline scenario is to analyze all options available to project participants. These include the business-as-usual case, considering sectoral policies and circumstances to determine whether this case corresponds to the continuation or not of the current operation of the nitric acid industry, the project scenario, and any other scenarios that might be applicable. This *first step* can be further broken down into two sub-steps:

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

- Continuation of *status quo.* The continuation of the current situation, where there will be no installation of technology for the destruction or abatement of N_2O;
- Switch to an alternative production method not involving the ammonia oxidation process;
- Alternative use of N_2O, such as:
  - Recycling N_2O as a feedstock;
  - Use of N_2O for external purposes;
- The installation of an N_2O destruction or abatement technology:
  - Primary approach;
  - Secondary approach;
  - Tertiary approach, including non-selective catalytic reduction (or NSCR $DeNO_X$)[3].

The options include the JI project activity not implemented as a JI project.

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, since some NO_x technical solutions could also have an effect on N_2O emissions. The alternatives include:

- The continuation of the current situation, whether a $DeNO_X$ unit is installed or not;
- Installation of a selective catalytic reduction (SCR) $DeNO_X$ unit;
- Installation of a new non-selective catalytic reduction (NSCR) De NO_X unit;
- Installation of a combined NO_x /N_2O abatement unit (e.g. UHDE's Envinox process).

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

Currently, there are no national regulations or legal obligations in Poland concerning N_2O emissions. It is unlikely that any such limits on N_2O emissions will be imposed in the near future. In fact, given the cost and complexity of suitable N_2O destruction and abatement technologies, it is unlikely that a limit would be introduced in Poland, considering it has ratified the Kyoto Protocol and actively participates in JI.

In accordance with ZAK IPPC permit (Decision SR.III-MJ-6610-1-28/06 issued 29 Desember 2006) the approved emissions level of the NO_x is 19.8 kg/h.

ZAK's plant complies with the local NO_x regulations. Therefore the continuation of the status quo is a valid baseline alternative.

None of the baseline alternatives can be eliminated in this step because they are all in compliance with legal and regulatory requirements.

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

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

The identified barriers are:

- Investment barriers, inter alia:

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[3] NSCR: A NSCR $DeNO_X$-unit will reduce N_2O emissions as a side reaction to the NO_x reduction. Consequently, a new NSCR installation can be considered as an alternative N_2O reduction technology.

  - Debt funding is not available for this type of innovative project activity;
  - Limited access to international capital markets due to real or perceived risks associated with domestic or foreign direct investment in the country where the project activity is to be implemented;

- Technological barriers, inter alia:
  - Technical and operational risks of alternatives;
  - Technical efficiency of alternatives (e.g. N_2O destruction, abatement rate);

- Barriers due to prevailing practice, inter alia:
  - No barriers in this category were found.

Sub-Step 3b: We shall show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed JI project activity).

- Switch to an alternative production method not involving the ammonia oxidation process: This is not an option because there is no other commercially viable alternative to produce nitric acid.

- The use of N_2O for external purposes: This is technically not feasible at ZAK's plant, as the quantity of gas to be treated is extremely high compared to the amount of nitrous oxide that could be recovered. The use of N_2O for external purposes is practiced neither in Poland nor anywhere else.

- Recycling N_2O as a feedstock: We may discard recycling N_2O as a feedstock for the nitric acid plant. This is because nitrous oxide is not a feedstock for nitric acid production. Nitrous oxide is not recycled at nitric acid plants in Poland or anywhere else.

- Primary abatement technology: Currently, there is no technology from the primary approach group that reaches high enough removal efficiency, so as to represent a potential N_2O abatement solution in itself.

- Tertiary abatement technology: Available tertiary approaches include NSCR (non-selective catalytic reduction) and the EnviNO$_X$® process commercialized by Uhde GmbH (Germany). Both systems are not selective towards N_2O abatement, and also actuate over acidic species (NO_x). Although Uhde's process is more efficient than the traditional NSCR system, both technologies have significant requirements regarding space and downtime for installation, and consume reducing agents (natural gas and/or ammonia) to attain N_2O abatement (high operating costs). Furthermore, additional natural gas consumption for heating the tail gases from temperatures below 130ºC (the current condition at ZAK's stack) to the reaction temperature (above 350ºC) leads to higher operational costs. Recently, new catalysts for the heterogeneous decomposition of N_2O in tertiary conditions have been made available on the market. At present, these alternatives lack extensive plant-scale experience (hence the technological risk involved is higher); furthermore, these options require high tail gas temperatures (operational at temperatures > 450°C), hence their application at facilities that do not meet this requirement (as is the case of ZAK) entails considerable fuel consumption and indirect GHG emissions. Thus, the baseline scenario that involves the installation of such a technology is also not viable.

Therefore the following baseline alternatives are not eliminated in this step:

- The continuation of the *status quo;*
- Installation of a new selective catalytic reduction (SCR) DeNO$_x$ unit;
- Installation of a secondary catalytic DeN$_2$O system.

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

To conduct the investment analysis, the following sub-steps are used:

Sub-step 4a: Determine appropriate analysis method:

Since the project alternatives generate no financial or economic benefits other than JI-related income, simple cost analysis should be applied.

Sub-step 4b: Apply simple cost analysis:

The possible alternatives listed in Step 1a above, and not discarded in the barrier analysis stage, involve the installation of some form of secondary or tertiary N_2O destruction or abatement technology and the installation of a selective catalytic reduction (SCR) $DeNO_X$ unit.
The installation of secondary or tertiary N_2O destruction approaches involve substantial investment, and would need to provide benefits other than JI revenue in order to qualify as valid baselines. Furthermore, tertiary technologies have significant running costs since they consume incremental fuel and/or reducing agents (such as ammonia) to operate.

No income from any kind of potential product or by-product except ERUs is able to pay back investment costs and running costs for the installation of any available secondary or tertiary abatement systems as no marketable products or by-products are generated by these N_2O treatment methods.

According to the baseline methodology,

> *"If all alternatives do not generate any financial or economic benefits, then the least costly alternative among these alternatives is pre-selected as the most plausible baseline scenario."*

As a result the only feasible baseline is a continuation of the *status quo*, which meets current regulations, and requires neither additional investments nor additional running costs.

Sub-step 4c is not applied, since a simple cost analysis is adequate for this project.

Sub-step 4d: Sensitivity analysis

Since the economic analysis is based on simple cost analysis, the baseline methodology does not require a sensitivity analysis: the results are not sensitive to such factors as inflation rate and investment costs, since there are no economic benefits.

Step 5: Re-assessment of baseline scenario in the course of proposed project activity lifetime:

At the start of a crediting period, a re-assessment of the baseline scenario due to new or modified NO_x or N_2O emission regulations in Poland will be executed as follows.

Sub-step 5a: New or modified NO_x emission regulations

If new or modified NO_x emission regulations are introduced after the project start, determination of the baseline scenario will be re-assessed at the start of a crediting period. Baseline scenario alternatives to be analyzed will 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 the baseline scenario.

For the determination of the adjusted baseline scenario, the baseline determination process will be applied as stipulated above (Steps 1–5)

Sub Step 5b: New or modified N_2O emission regulations

If legal regulations on N_2O emissions are introduced or changed during the crediting period, the baseline emissions will be adjusted at the time the legislation is legally implemented.
The methodology is applicable if the procedure to identify the baseline scenario results in that the most likely baseline scenario is the continuation of emitting N_2O to the atmosphere, without the installation of N_2O destruction or abatement technologies, including technologies that indirectly reduce N_2O emissions (e.g. NSCR DeNOx units).

Key information and data used to establish the baseline:

a) Data and parameters not monitored and those required to confirm applicability conditions:

Data/Parameter:	**OT_{normal} (Normal Operating Temperature)**
Data unit:	ºC
Description:	Normal range of oxidation temperature of the ammonia reactor
Time of determination/monitoring	Operating temperature was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data (to be) used:	Historical data was used. Calculated on the basis of operating temperature during operating condition campaigns.
Value applied (for ex ante calculations/determinations):	890ºC-897ºC
Justification of the choice of data or description of measurement methods and procedures actually applied:	ZAK has adequate historical records for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal oxidation temperature. Temperature in the reactor is measured by thermoelectrical sensors based on NiCr-NiAl thermocouples (with 0-1100 C^o limit, and L=800mm). Meets PL-EN60751+A2 Standard requirements.
QA/QC procedures (to be) applied	Not applicable
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**OP_{normal} (Normal Operating Pressure)**
Data unit:	Pa
Description:	Normal range of oxidation pressure of the ammonia reactor
Time of determination/monitoring	The parameter was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data (to be) used:	Historical data were used. Pressure at the oxidation reactors is not a process control parameter and isn’t monitored on a routine basis. Air pressure to the reactor was measured during the 1.5 campaigns before the baseline campaign and earlier than 07.04.2003.
Value applied (for ex ante calculations/determinations):	362– 416 kPa
Justification of the choice of data or description of	Since oxidation pressure after the mixer is not measured in the plant the compressor (air) pressure data is used to determine normal operating

measurement methods and procedures actually applied:	pressure. It is not possible to use oxidation pressure from operating manual since compressor in the plant is very old and couldn't ensure pressure values mentioned in technical documentation. Data of compressor (air) pressure in ZAK is available only for the period after AMS installation (02.09.2007), and for campaigns before 07.04.2003. During 6 campaigns from 07.04.2003 to 02.09.2007 the pressure had not been recorded (the plant decided to stop monitoring it because it is irrelevant for operation). I For normal operating pressure determination historical data from the moments of AMS installation to the date of baseline campaign start and data of 4 campaigns before 07.04.2003 are used. It is measured by transmitter type RPT 94137, with measuring limits 0-0.8 MPa, class 1.
QA/QC procedures (to be) applied	Not applicable
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**AFR_{max} (Maximum Ammonia Flow Rate)**
Data unit:	Nm^3 NH_3/hour
Description:	Maximum value of ammonia flow rate to the ammonia oxidation reactor
Time of determination/monitoring	The parameter was monitored during operating condition campaigns and will be verified during the verification visit.
Source of data used:	Historical data was used.
Value applied (for ex ante calculations/determinations):	8533 Nm^3 NH_3/hour
Justification of the choice of data or description of measurement methods and procedures actually applied:	ZAK has adequate historical records for operating parameters; thus, historical data of the previous 5 campaigns is used to determine the maximum ammonia flow rate. The flow is measured by a differential pressure type transmitter type 94137 with measuring limits 0-0.6 MPa class 1.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**$AIFR_{max}$ (Maximum Ammonia to Air Flow Ratio)**
Data unit:	%, $Nm^3NH_3/(Nm^3NH_3 + Nm^3\ Air)*100$
Description:	Maximum ammonia to ammonia+air ratio
Time of determination/monitoring	Monitored during operating condition campaigns and will be verified during the verification visit
Source of data used:	Historical data was used. Calculated on the basis of ammonia and air flow to oxidation reactor.
Value applied (for ex ante calculations/determinations):	10.415 %
Justification of the choice of data or description of measurement methods and procedures actually applied:	ZAK has adequate historical records for operating parameters; thus, historical data of the previous 5 campaigns is used to determine the maximum ammonia to air flow ratio. Air flow to the oxidation reactor is measured by a differential pressure type transmitter type RPT 94137 with measuring limits 0-0.6 MPa class 1. The ammonia to air ratio is calculated on the basis of the actual flow analysis from the individual streams (ammonia and air).

QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**CL_{normal} (Normal Campaign Length)**
Data unit:	tonnes 100% HNO_3
Description:	Total number of tonnes of nitric acid at 100% concentration produced between two consecutive gauze changes
Time of determination/monitoring	Monitored during operating condition campaigns and will be verified during the verification visit
Source of data used:	Historical data was used. Calculated from nitric acid production data as the average of operating condition campaign lengths.
Value applied (for ex ante calculations/determinations):	105,569 tonnes 100% HNO_3
Justification of the choice of data or description of measurement methods and procedures actually applied:	ZAK has adequate historical records for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal campaign length.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**GS_{normal} (Normal Gauze Supplier)**
Data unit:	-
Description:	Gauze supplier during normal operating condition campaigns (the previous five campaigns)
Time of determination/monitoring	The parameter was monitored during historical campaigns and will be verified during the verification visit.
Source of data used:	Historical data of nitric plant procurement office was used.
Value applied (for ex ante calculations/determinations):	Johnson Matthey and Mennica Polska
Justification of the choice of data or description of measurement methods and procedures actually applied:	ZAK has adequate historical records for operating parameters; thus, historical data of the previous 5 campaigns is used to determine the normal gauze supplier.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**GC_{normal} (Normal Gauze Composition)**
Data unit:	%
Description:	Gauze composition during normal operating condition campaigns (the previous five campaigns)
Time of determination/monitoring	The parameter was monitored during historical campaigns and will be verified during the verification visit.
Source of data used:	Historical process data from nitric acid plant procurement office was used.
Value applied (for ex ante	Pt 71or 87% , Rh 4 or 5 % , Pd 25 or 8 %

calculations/determinations):	
Justification of the choice of data or description of measurement methods and procedures actually applied:	ZAK has adequate historical records for operating parameters; thus, historical data of the previous 5 campaigns is used to determine normal gauze composition. The composition of the ammonia oxidation catalyst to operate during the baseline campaign will be the same as that of gauzes used for the previous 5 historical campaigns.
QA/QC procedures (to be) applied	Not necessary
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

b) Data and parameters monitored

These parameters are listed in chapter D.1.1.3. (page 26)

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

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ZAK Nitrous Oxide Abatement Project involves the installation of secondary catalysts whose only purpose and effect is the decomposition of nitrous oxide once it is formed.

Following the selected methodology project emissions are determined from N_2O measurements in the stack gas of the nitric acid plant:

Baseline emissions are calculated from an emission factor measured before the implementation of the project activity (the installation of a secondary catalyst). Thus, the baseline will be determined by measuring the N_2O baseline emission factor (kg N_2O/tonne HNO_3) during a *complete* production campaign, called “initial N_2O measurement campaign for baseline determination”, before project implementation.

To ensure that data obtained during such initial campaign are representative of the actual GHG emissions from the source plant, a set of process parameters known to affect N_2O generation and (to some extent) under the control of the plant operator are monitored and compared to limits or ranges called “normal operating conditions”.

Normal operating conditions are defined on the basis of historical plant operating conditions and plant design data. A range or maximum value for any given parameter has been established considering the specific control capabilities of ZAK’s nitric acid plant. In order to properly characterize baseline emission rates, operation during such initial campaign is controlled within the specified limit (a maximum or range has been established for each parameter). Only those N_2O measurements taken when the plant is operating within the permitted range will be considered in the calculation of baseline emissions. The level of uncertainty determined for the N_2O monitoring equipment will be deducted from the baseline emission factor.

The ZAK plant carried out campaign for baseline emission factor determination. The emission factor is determined from measurements presented for crediting of emission reductions.

The additionality of the project activity is demonstrated and assessed using the latest version of the "Tool for demonstration and assessment of additionality". It will be demonstrated that the baseline scenario is the continuation of the status quo and N_2O emissions are not reduced by any N_2O destruction or abatement technology at the ZAK nitric acid plant.

Step 1 of the tool can be avoided since the selection of alternative scenarios was already covered in analysis carried out in Section B.1 above.

Step 2. Investment analysis:

Sub-step 2a. Determine appropriate analysis method:

As catalytic N_2O destruction facilities generate no financial or economical benefits other than JI-related income, a simple cost analysis is applied.

Sub-step 2b. – Apply simple cost analysis:

Project scenario: No income from any kind of potential product or by-product except ERUs is able to pay back investment costs and running costs for the installation of the secondary catalyst as no marketable product or by-product exists.

The investment (excluding potential financing costs) consists of the engineering, construction, shipping, installation and commissioning of the secondary catalyst and the measurement equipment. The running costs consist of the regular change of the catalysts and personnel costs for the supervision and the measurement equipment.

Baseline scenario: The baseline scenario "The continuation of the current situation" will neither require any additional investments costs nor any additional running costs.

Therefore, the proposed JI project activity is, without the revenues from the sale of ERUs, obviously less economically and financially attractive than the baseline scenario.

Step 3. Barrier analysis is not used for demonstrating additionality in this project.

Step 4. Common practice analysis

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

The proposed project activity (or any other form of nitrous oxide abatement technology) is not common practice since no similar project at nitric acid plants is identified in Poland. (3 projects in addition to the ZAK project are now in the process of development in Poland (Zaklady Azotowe Anwil S.A. Wloclawek, Zaklady Azotowe w Tarnowie-Moscicach S.A., Zaklady Azotowe Pulawy S.A.) and all these projects are being developed under the aegis of the Kyoto Protocol.)
The nitric acid industry typically releases into the atmosphere the N_2O generated as a by-product, as it does not have any economic value or toxicity at typical emission levels. N_2O emissions through the stack gas can be considered the business-as-usual activity as it is a widespread practice around the country. No nitric acid plant in Poland has been using secondary catalyst (or any other type of N_2O abatement technology) as business-as-usual activity.

Since similar project activities are not observed the proposed project activity is additional.

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

No similar projects are occurring in Poland (except the projects that are being developed under the aegis of the Kyoto Protocol).

Conclusion:

Currently, there are no national regulations or legal obligations in Poland concerning N_2O emissions. It is unlikely that any such limits on N_2O emissions will be imposed in the near future. In fact, given the cost and complexity of suitable N_2O destruction and abatement technologies, it is unlikely that a limit would be introduced by Poland, which has ratified the Kyoto Protocol and actively participates in JI.

ZAK has no need to invest in any N_2O destruction or abatement technology. Nor are there any national incentives or sectoral policies to promote similar project activities.

Without the sale of the ERUs generated by the project activity the NPV and IRR of the project would be negative, no revenue would be generated and the technology would not be installed. The secondary catalyst technology when installed will reduce the nitrous oxide emissions by up to 85% below what they would otherwise be without the catalyst technology installed.

The proposed JI project activity is undoubtedly additional, since it passes all the steps of the “Tool for demonstration and assessment of additionality (V.05.2)”, approved by the CDM Executive Board.

The approval and registration of the project activity as a JI activity, and the attendant benefits and incentives derived from the project activity, will offset the substantial cost of the catalyst and any plant modifications and will enable the project activity to be undertaken.

On the basis of *ex-ante* estimation of N_2O emission reductions, it is expected that the income from the selling of ERUs of the registered JI project activity is at least as high as the investment, financing and running costs. Therefore ZAK is willing to finance the project activity under the condition of the registration of the JI project activity.

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

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The project boundary encompasses the physical, geographical site of the ZAK nitric acid plant and equipment for the complete nitric acid production process from the inlet to the ammonia burner to the stack. The only GHG emission relevant to the project activity is N_2O contained in the waste stream exiting the stack. The abatement of N_2O is the only GHG emission under the control of the project participant.

The secondary catalyst utilizes the heat liberated by the highly exothermal oxidation reaction (that occurs on the precious metal gauzes of the primary catalyst) to reach its effective operating temperature. Once the operating temperature is reached, no incremental energy is necessary to sustain the reaction.

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

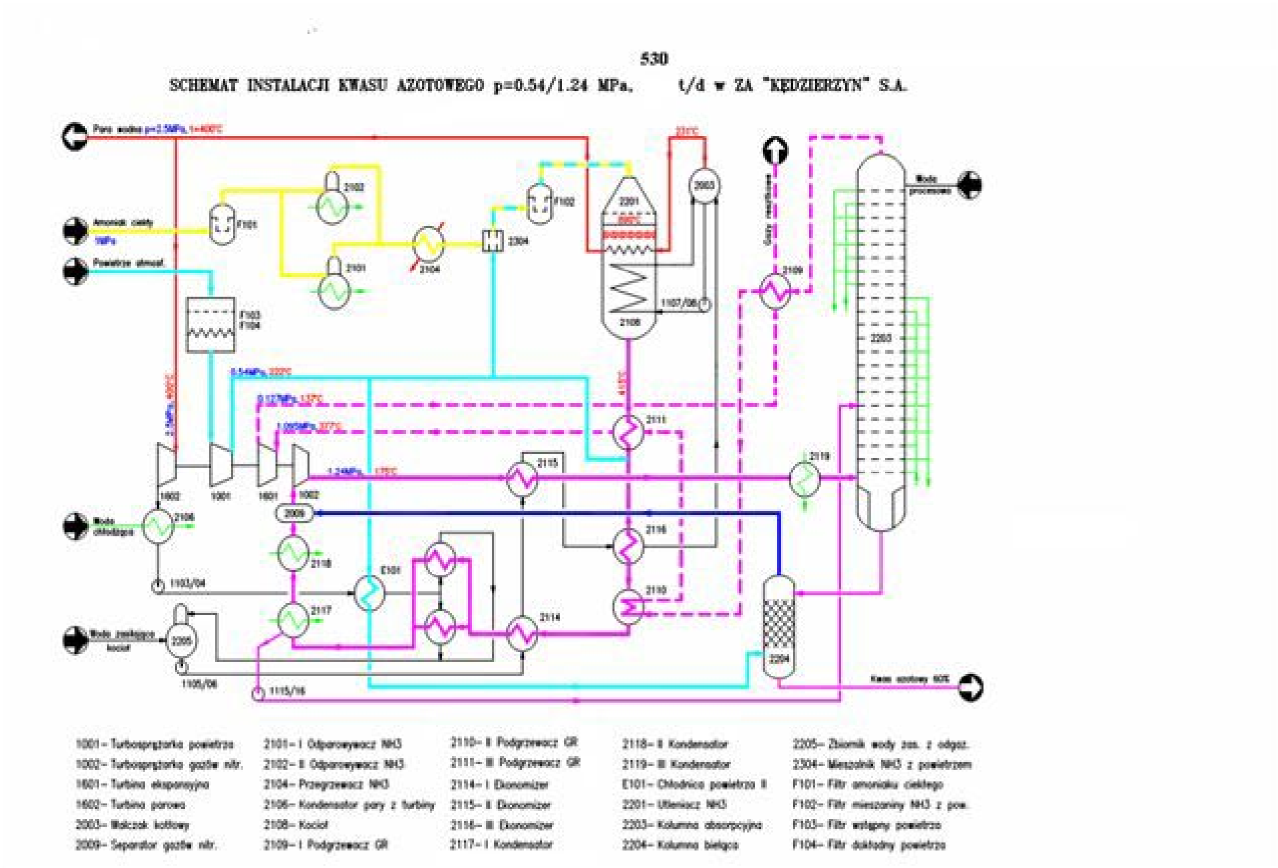

Figure 4: Project boundary of ZAK plant

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

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Date of baseline setting: September, 2009
The baseline and monitoring methodology has been applied by:
Walter Hügler, Nuria Zanzottera and María Inés Hidalgo, MGM International Group LLC. (not project participant).
Tel: +54-11-5219-1230
e-mail: whugler@mgminter.com; nzanzottera@mgminter.com; ihidalgo@mgminter.com.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

>>

07 June 2007- Date of stack gas flow meter purchase

C.2. Expected operational lifetime of the project:

>>

21 years.

C.3. Length of the crediting period:

>>

12 years, starting date of the crediting period 19/12/2008 (the date for the first reduction of emissions)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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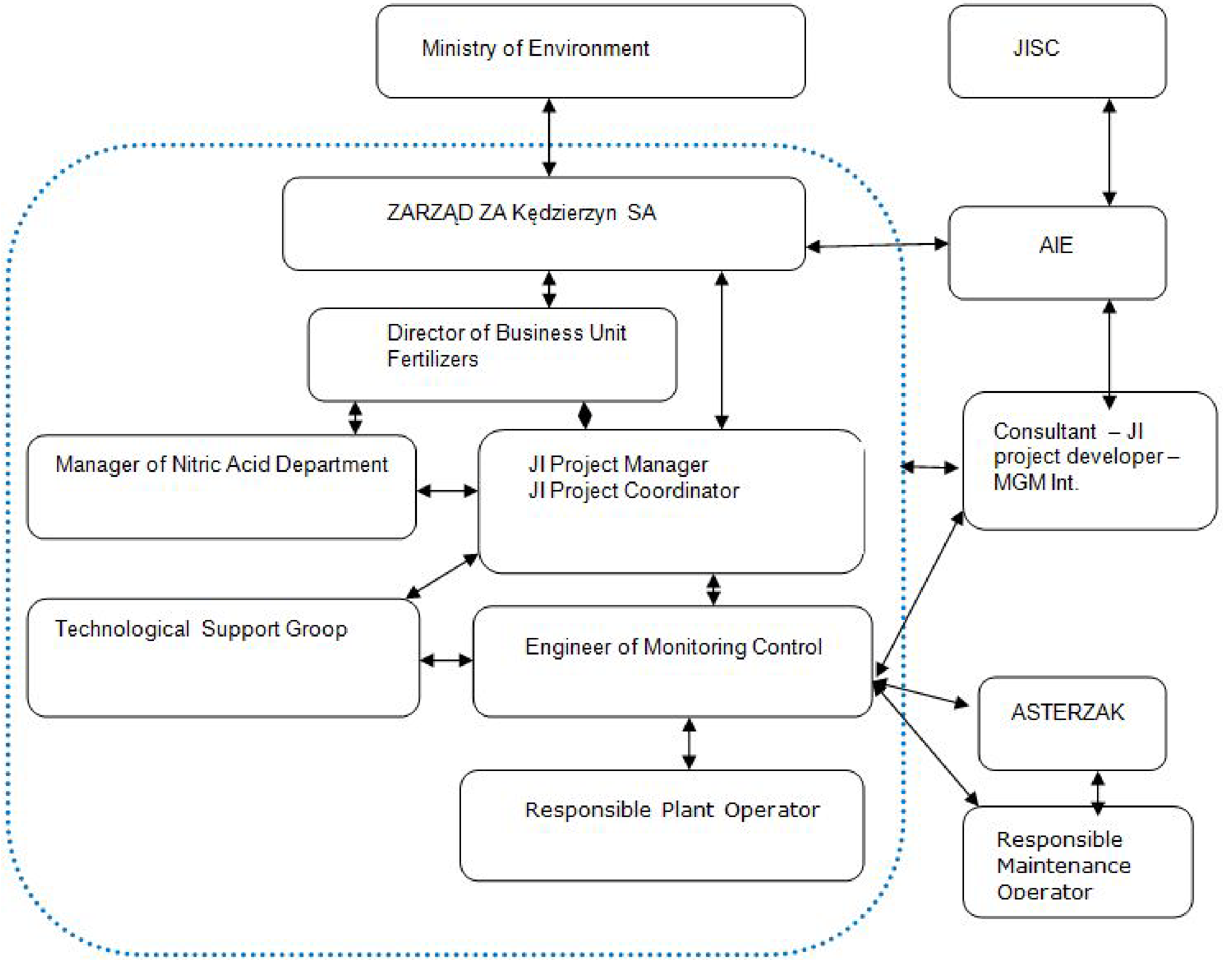
The ZAK nitric acid plant is operated by a centralized automated control system, so staff is qualified for and experienced in operating technical equipment to a high level of quality standards. The plant has access to specialized technical services.
The plant manager will be responsible for the ongoing operation and maintenance of the N_2O monitoring system. Operation, maintenance, calibration and service intervals are according to the manufacturer's specifications and international standards (see QA/QC section below), and incorporated into the management structure of ISO 9000 standard procedures.

The proposed JI project is closely monitored, metered and recorded. The management and operation of the proposed nitrous oxide abatement project is the responsibility of the ZAK plant. The emission reductions are verified at least annually by an independent entity, which will be an Accredited Independent Entity (AIE). A regular (annual) reporting of the emission reductions generated by the project will be sent to the owner of the ERUs.

An illustrative scheme of the operational and management structure that will monitor the proposed JI project activity is as follows:



Note: the dashed line shows the operational and management structure boundaries of the proposed project.

The relation between the project operational and management structure and other actors of the proposed JI project activity is described as follows:

- Responsible Plant Operator is an employee of the Nitric Acid Department, which is responsible for the plant performance in the term of normal operation. His duties involve: control of normal plant operating conditions and industrial safety measures, keeping the Manager of the Nitric Acid Department informed about any deviations in plant operation process (taking into account deviations that influence JI project performance), and transfer of important information to the Monitoring Engineer.

- Responsible Maintenance Operator: An ASTERZAK company employee who is responsible for operation of measuring equipment of nitric acid production including monitoring equipment which is used for the JI project. ASTERZAK Company is in charge of the maintenance of control and measuring equipment in ZAK. ASTERZAK performs continuous control of performance of industrial automation and monitoring equipment that is used for JI project related tasks. He is responsible for: calibration of all measuring equipment in accordance with the schedule, calibration of the analyzer in accordance with the schedule, control of availability of sample gas that is necessary for calibration, proper service of the AMS and DAS.

- Engineer of Monitoring Control is an employee of the Fertilizer Business Unit. He is responsible for technical issues related to the DEMS2000 system Fanuc, Wago, and together with ASTERZAK for system maintenance and programming, cooperation with the Project Developer in terms of data analysis and guaranteeing of compliance with specified procedure in the process of report preparation, guaranteeing of access to special services at any time, in case of malfunctions that are reported by the Responsible Maintenance Operator.

- JI Project Manager and JI Project Coordinator is an employee of ZA Kędzierzyn who is responsible for guaranteeing the project development in accordance with the PDD and other applicable documentation on the enterprise level, reporting every day to the company management concerning the progress in JI Project related issues, ensuring performing of routine compliance audits, forwarding of reports in the form of spreadsheets with monitoring results upon request to the ERU owner.

- JI Project Coordinator is an employee of the Fertilizer Business Unit who is responsible for ensuring project development in the Business Unit in accordance with methodology AM0034 and the monitoring plan that is represented in the PDD. He is responsible for ensuring that compliance with the methodology is completely guaranteed at any time, cooperation with Project Developer in terms of data analysis and guaranteeing compliance with specified procedures in the process of preparation of reports.

- Consultant - Project Developer is an experienced consultant hired as third party service provider in order to aid in the implementation and monitoring of the JI project and support the ZAK team during the JI project development. On the basis of monitoring spreadsheets that are revised by employees comprising the Technological Support Group, the developer calculates baseline emissions, project emission reductions, and other checks/calculations, ensuring procedures are followed according to the approved methodology being applied. The Consultant drafts the monitoring report on a regular basis (when each full campaign has finished at ZAK) in close collaboration with the monitoring engineer and Technological Support Group and sends the monitoring reports to the verification AIE according to instructions of the ZAK team, and collaboration with the verification team to provide further clarifications, coordinate site visits, etc.

- The Technological Support Group consists of the persons that are permanently responsible for processing of data that is collected by the AMS and DAS and for transfer of these data to the proper subdivision. They are responsible for collecting monitoring data for JI project needs, e.g. plant operational data in log book – control of correctness; reporting to the Manager of the Nitric Acid Department about malfunctions and suggestions for corrective actions, acquisition of suitable operational data from the Responsible Plant Operator, input of this data to special calculation sheets to process them in accordance with monitoring needs (monitoring sheets), submission of monitoring sheets and generated daily reports through the data acquisition system to the Project Coordinator, informing the Manager of the Nitric Acid Department about any malfunctions that are detected during the plant operation (including as well malfunctions that could have an influence on JI projects).

- The AIE will then send the corresponding verification report to the JI Supervisory Committee in order to evaluate it and enable the issuance of the ERUs.

Shareholders of ZAK will receive annually from the plant manager the same report as is sent to the AIE.

Considering the arguments and the schematic illustration above, compliance with the monitoring methodology and the monitoring plan will be completely guaranteed.

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

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

Data/Parameter:	**NCSG (N_2O Concentration in the Stack Gas)**
Data unit:	mgN_2O/m^3 at normal conditions (101.325 kPa, 0 deg C).(converted from ppm if necessary)
Description:	N_2O concentration in the stack gas during a project campaign
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit. The values are scanned continuously and used for calculation of one minute averages.
Source of data to be used:	N_2O analyzer. The values are scanned every second and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	The values are scanned continuously and used for calculation of one minute averages.
Justification of the choice of data or description of measurement methods and procedures actually applied:	N_2O concentration is measured by a URAS26 -EL3020 online analyzer (non dispersive infrared principle). A gas stream is continuously drawn from the stack by the sampling system under proper conditions, and driven to the infrared cell.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**VSG (Volume Flow of the Stack Gas)**
Data unit:	m^3/h
Description:	Volume flow rate of the stack gas during a project campaign. It should be stated for normal conditions (101.325 kPa, 0 deg C).
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit
Source of data to be used:	Gas volume flow meter. The values are scanned every second and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	The values are scanned continuously and used for calculation of one minute averages.
Justification of the choice of data or description of	Ultra-sound Flowsick FLSE 100 gas volume flow meter measurements are applied.

measurement methods and procedures actually applied:	
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**TSG (Temperature of the Stack Gas)**
Data unit:	ºC
Description:	Temperature of the stack gas during a project campaign
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit
Source of data to be used:	Temperature probe. The values are scanned every second and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for $VSG_{project}$ normalization.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Thermocouple sensor with microprocessor based temperature transmitter TxRail (Limatherm). Measuring limit (0-100°C). Class of accuracy +/-0,5% Better than 0,3% of maximum range for thermocouples and 0,2% for Pt100 and voltage
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**PSG (Pressure of the Stack Gas)**
Data unit:	Pa
Description:	Pressure of the stack gas during the baseline and project campaigns
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit
Source of data to be used:	Probe (part of gas volume flow meter). The values are scanned every second and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for VSG normalization.
Justification of the choice of	Stack pressure is measured by the pressure transmitter of P121 type with dry sensor, analog output and pressure measuring range

data or description of measurement methods and procedures actually applied:	0.8-1.2 bar. Class of accuracy +/0,5%. Accuracy < 0,2% F.S.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**OH (Operating Hours)**
Data unit:	Hour
Description:	Operating hours during a project campaign
Time of determination/monitoring	Over the period of project campaigns and will be verified during the verification visit
Source of data to be used:	Plant automated control system and production log. Monitored daily.
Value of data applied (for ex ante calculations/determination)	Will be calculated for each project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Plant operating status is determined on the basis of present thresholds for oxidation temperature.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	Compiled for each entire campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**NAP (Nitric Acid Production)**
Data unit:	$tHNO_3$
Description:	Nitric acid production (100% concentrated) during each project campaign or vintage year
Time of determination/monitoring	Monitored daily over the period of the project campaigns and will be verified during the verification visit. Completed for each entire campaign.
Source of data to be used:	Production log
Value of data applied (for ex ante calculations/determination)	For the vintage years: 2009 – 6,262 tonnes, 2010-2018 – 174,900 tonnes. For the first project campaigns - 92,782 tonnes (CL_{normal}). The final figure will be calculated for each project campaign.
Justification of the choice of	Daily production is measured by mass balance calculations.

data or description of measurement methods and procedures actually applied:	
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	Compiled for each entire campaign. Total production over project campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**$GS_{project}$ (Project Gauze Supplier)**
Data unit:	Name of gauze supplier
Description:	Normal gauze supplier for the project campaigns
Time of determination/monitoring	To be obtained during the operating condition campaigns and will be verified during the verification visit
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Johnson Matthey. We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets the methodology requirements.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Cover of supply contract or bill for gauzes for operating condition campaigns, or equivalent document to prove commercial transaction
QA/QC procedures to be applied:	None
Any comment:	To be obtained during the operating condition campaigns. The information will be stored in electronic records and on paper for the crediting period. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project

Data/Parameter:	**$GC_{project}$ (Project Gauze Composition)**
Data unit:	% precious metals
Description:	Normal gauze composition for the operating condition campaigns
Time of determination/monitoring	During project campaigns and will be verified during the verification visit

Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Pt 71% , Rh 4r 5 % , Pd 25 %
Justification of the choice of data or description of measurement methods and procedures actually applied:	Section of supply contract for gauzes that specifies the technical characteristics agreed during the baseline campaign
QA/QC procedures to be applied:	None
Any comment:	To be obtained during the operating condition campaigns. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**PE_n (N_2O Emission of nth Project Campaign)**
Data unit:	t N_2O
Description:	N_2O emission for a project campaign
Time of determination/monitoring	Calculated at least once after each campaign
Source of data to be used:	Calculated from monitored data
Value of data applied (for ex ante calculations/determination)	130, 42 t N_2O. Estimated amount which is calculated using the estimated value of N_2O baseline emissions, considering an N_2O abatement efficiency of 85% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from monitored data
QA/QC procedures to be applied:	No QA/QC procedure is needed.
Any comment:	N_2O project emission will be calculated on the basis of measurements of stack gas flow rate, N_2O concentration, and the operating hours. All parameters will be measured during a complete project campaign to properly characterize N_2O project emissions.

Data/Parameter:	**EF_n (Project Emission Factor)**
Data unit:	t N_2O/t 100% HNO_3
Description:	Project emission factor calculated from monitored data for each project campaign
Time of determination/monitoring	Calculated at least once after each project campaign
Source of data to be used:	Calculated from monitored data
Value of data applied (for ex ante calculations/determination)	0.00124 t N_2O/t 100% HNO_3. Estimated amount which is calculated using the estimated value of N_2O baseline emission, considering an N_2O abatement efficiency of 85% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from monitored data on the basis of the methodology
QA/QC procedures to be applied:	No QA/QC procedure is needed.
Any comment:	Project emission factor will be calculated on the basis of measurements of the nitric acid production, stack gas flow rate and N_2O concentration.

Data/Parameter:	**EF_{reg} (Emission Factor Set by Regulation)**
Data unit:	Not applicable
Description:	Emission level set by incoming policies or regulations
Time of determination/monitoring	During the whole project period
Source of data to be used:	Monitored
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions.
Justification of the choice of data or description of measurement methods and procedures actually applied:	ZAK has personnel that verify changes in the relevant Polish legislation.
QA/QC procedures to be applied:	None
Any comment:	Updated when new regulation comes into force

Data/Parameter:	**$EF_{ma,n}$ (Moving Average Emission factor)**
Data unit:	tonne N_2O / tonne 100% HNO_3
Description:	Moving average of emission factor calculated as the average of the emission factors of all previous project campaigns
Time of determination/monitoring	Calculated at the end of each project campaign
Source of data to be used:	Calculated from campaign emissions factors
Value of data applied (for ex ante calculations/determination)	0.00124 t N_2O/t 100% HNO_3. Estimated amount which is calculated using the estimated value of N_2O baseline emission, considering an N_2O abatement efficiency of 85% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated as the average of the emission factors of each project campaign.
QA/QC procedures to be applied:	None
Any comment:	None

Data/Parameter:	**EF_p (Emission factor used to determine emission reductions)**
Data unit:	tonne N_2O / tonne 100% HNO_3
Description:	Emission factor used to calculate the emission from the particular campaign.
Time of determination/monitoring	Calculated at the end of each project campaign
Source of data to be used:	Calculated using campaign emission factors.
Value of data applied (for ex ante calculations/determination)	0.00124 t N_2O/t 100% HNO_3. Estimated amount which is calculated using the estimated value of N_2O baseline emission, considering an N_2O abatement efficiency of 85% and using an estimated value of operating hours during the project campaign.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated using campaign emission factors. EF_p will be determined as the higher of $EF_{ma,n}$ and EF_n.
QA/QC procedures to be	None

applied:	
Any comment:	None

b) Data and parameters not monitored and those required to confirm applicability conditions:

These parameters are listed in chapter B.1 (page 14)

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

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Actual project emissions will be determined during the project activity from continuous measurements of N_2O concentration and total flow rate in the stack gas of the nitric acid plant.

Project measurements are subjected to exactly the same procedure as the baseline measurements in order to be coherent.

Estimation of campaign-specific project emissions

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

The mean values of N_2O concentration and total flow rate are used in the following formula (Eq. 3 from AM0034) to calculate project emissions:

$$PE_n = VSG_n \cdot NCSG_n \cdot 10^{-9} \cdot OH_n$$

Where

PE_n Total project emissions of the nth campaign, in tN_2O

VSG_n	Mean stack gas volume flow rate for the nth project campaign, in Nm^3/h
$NCSG_n$	Mean concentration of N_2O in the stack gas for the project campaign, in mg N_2O/Nm^3
OH_n	Number of operating hours in the project campaign, in h

Derivation of a moving average emission factor

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

Step1: estimate the campaign specific emission 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 the *nth* campaign the campaign specific emission factor would be:

$$EF_n = \frac{PE_n}{NAP_n}$$

Where

EF_n	Emission factor calculated for the *nth* campaign, in $tN_2O/tHNO_3$
PE_n	Total project emissions of the *nth* campaign, in tN_2O
NAP_n	Nitric acid production in the *nth* campaign, in t100% HNO_3

Step 2: estimate a moving average emission factor calculated at the end of the *nth* project campaign as follows:

$$EF_{ma,n} = \frac{\sum_n EF_n}{n}$$

This process will be repeated for each campaign such that a moving average, $EF_{ma,n}$ is established over time, becoming more representative and precise with each additional campaign.

To calculate the total emission reductions achieved in the *nth* campaign, the higher of the two values $EF_{ma,n}$ and EF_n shall be applied as the emission factor relevant for that particular campaign (EF_p).

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

Minimum project emission factor

A campaign specific emission factor shall be used to cap any potential long-term trend towards decreasing N_2O emissions that may result from a potential build-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 an EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall use EF_{min} and not EF_n.

Project campaign length

a. Longer project campaign

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

b. Shorter project campaign

If $CL_n < CL_{normal}$, 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.

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

a) Data and parameters monitored

Data/Parameter:	**$NCSG_{BC}$ (Baseline N_2O Concentration in the Stack Gas)**
Data unit:	mgN_2O/m^3 under normal conditions (101.325 kPa, 0 deg C).(converted from ppm if necessary)
Description:	Mean concentration of N_2O in the stack gas during the baseline campaign
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit. Since $CL_{BL} > CL_{normal}$ N_2O values that were measured beyond the length of CL_{normal} had been eliminated from the calculation of EF_{BL}.
Source of data to be used:	N_2O analyzer. The values for $NCSG_{BC}$ calculation are scanned every second and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	2179 mgN_2O/m^3
Justification of the choice of data or description of measurement methods and procedures actually applied:	N_2O concentration is measured by a URAS26 -EL3020 online analyzer (non dispersive infrared principle). A gas stream is continuously drawn from the stack by the sampling system under proper conditions, and driven to the infrared cell.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**VSG_{BC} (Baseline Volume Flow of the Stack Gas)**
Data unit:	m^3/h
Description:	Mean gas volume flow rate at the stack in the baseline measurement period. Should be stated for normal conditions (101.325 kPa, 0 deg C).
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Flow meter. The values are scanned every second and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	80,498 Nm^3/h
Justification of the choice of data or description of measurement methods and procedures actually applied:	Ultra-sound Flowsick FLSE 100 gas volume flow meter
QA/QC procedures to be	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in

applied:	monitoring procedures.
Any comment:	The data output from the analyzer will be processed using an appropriate software program. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**TSG (Temperature of the Stack Gas)**
Data unit:	ºC
Description:	Temperature of the stack gas
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit.
Source of data to be used:	Temperature probe. The values are scanned every second and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for VSG$_{BC}$ and VSG normalization.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Thermocouple sensor with microprocessor based temperature transmitter TxRail (Limatherm) measuring limit (0-100^{o}C). Class of accuracy +/-0,5%. Better than 0,3% of maximum range for thermocouples and 0,2% for Pt100 and voltage
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. The values are scanned each second and used for calculation of one minute averages.

Data/Parameter:	**PSG (Pressure of the Stack Gas)**
Data unit:	Pa
Description:	Pressure of stack gas
Time of determination/monitoring	Over the period of the baseline and project campaigns and will be verified during the verification visit
Source of data to be used:	Pressure probe. The values are scanned every second and used for calculation of one minute averages.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this data only for VSG$_{BC}$ and VSG normalization.
Justification of the choice	Stack pressure is measured by a pressure transmitter of P121 type with dry sensor, analog output and pressure measuring range 0.8-

of data or description of measurement methods and procedures (to be) applied:	1.2 bar. Class of Accuracy +/-0,5% Accuracy < 0,2% F.S.
QA/QC procedures to be applied:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181). Staff will be trained in monitoring procedures.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. The values are scanned each second and used for calculation of one minute averages.

Data/Parameter:	**OH_{BC} (Baseline Operating Hours)**
Data unit:	Hour
Description:	Total operating hours during the baseline campaign
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit
Source of data to be used:	Plant automated control system and production log. Recorded daily, compiled for the entire campaign.
Value of data applied (for ex ante calculations/determination)	5061 hours
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Plant operating status is determined on the basis of present thresholds for oxidation temperature.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**NAP_{BC} (Nitric Acid Production)**
Data unit:	$tHNO_3$
Description:	Total nitric acid production (100% concentrated) during the baseline campaign
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit
Source of data to be used:	Production log. Calculated on the basis of recorded daily values, compiled for the entire campaign.

Value of data applied (for ex ante calculations/determination)	107,972 $tHNO_3$
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Daily production is measured by mass balance calculations.
QA/QC procedures to be applied:	Critical instruments are checked on a routine basis according to the plant's maintenance program.
Any comment:	Total production over the baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**AFR (Ammonia Flow Rate to the Oxidation Reactor)**
Data unit:	Nm^3 NH_3/hour
Description:	Ammonia flow rate to the ammonia oxidation reactor
Time of determination/monitoring	Over the period of the baseline campaign and will be verified during the verification visit
Source of data to be used:	Monitored by plant automated control system. Recorded every hour.
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied: :	Ammonia flow to the oxidation reactor is measured by a differential pressure type transmitter type RPT 94141 with measuring limits 0-4 kPa. Class 1
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. The information will be stored in electronic records and on paper for at least 2 years. Monitored continuously.

Data/Parameter:	**UNC (Overall Uncertainty of the Monitoring System)**
Data unit:	4,52 %
Description:	Overall measurement uncertainty of the monitoring system
Time of determination/monitoring	Defined on the basis of the report of the QAL2 test performed during the baseline campaign and uncertainty of methods and equipment used in nitric acid production calculations. The report will be verified during the verification visit.
Source of data to be used:	Calculation of the combined uncertainty of the applied monitoring equipment Calculated once after the monitoring system is commissioned.
Value of data applied (for ex ante calculations/determination)	%
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	The overall uncertainty is calculated as the combined uncertainty of the flow meter, the uncertainty of the N_2O concentration measurements, and the uncertainty of the nitric acid production measurement based on the the mass balance method.
QA/QC procedures to be applied:	QAL2 was performed by an ISO 1705 accredited lab.
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**AIFR (Ammonia to Air Ratio)**
Data unit:	%, $Nm^3 NH_3/(Nm^3 NH_3 + Nm^3$ Air)*100
Description:	Ammonia to ammonia+air ratio
Time of determination/monitoring	Recorded every hour over the period of the baseline campaign and will be verified during the verification visit
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	The ammonia to air ratio is calculated on the basis of the actual flow analysis from the individual streams (ammonia and air). Air flow to the oxidation reactor is measured by a differential pressure type transmitter type RPT 94137 with measuring limits 0-0.6 Mpa.
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant’s maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in

	electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**CL_{BL} (Baseline Campaign Length)**
Data unit:	107, 972 $tHNO_3$
Description:	Campaign length is defined as the total number of tonnes of nitric acid at 100% concentration produced with one set of gauzes.
Time of determination/monitoring	Production recorded daily over the period of the baseline campaign and will be verified during the verification visit
Source of data to be used:	Calculated from nitric acid production data
Value of data applied (for ex ante calculations/determination)	107,972 tonnes of nitric acid. (The normal campaign length has been set as 105,569 tonnes 100% HNO_3. Since $CL_{BL} > CL_{normal}$ N_2O values that were measured beyond the length of CL_{normal} had been eliminated from the calculation of EF_{BL}.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Daily production is calculated on the basis of mass balance.
QA/QC procedures to be applied:	Not applied
Any comment:	Baseline campaign length is calculated once at the end of the baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**OT_h (Oxidation Temperature for Each Hour)**
Data unit:	ºC
Description:	Oxidation temperature for each hour
Time of determination/monitoring	Recorded every hour over the period of the baseline campaign and will be verified during the verification visit
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Temperature in the reactor is measured by two thermoelectrical sensors based on NiCr-NiAl thermocouples (with 0-1100 C^o limit, and L=800mm). Meets PL-EN60751+A2 Standard requirements.
QA/QC procedures to be	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.

applied:	
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**OP_h (Oxidation Pressure for Each Hour)**
Data unit:	Pa
Description:	Oxidation pressure for each hour
Time of determination/monitoring	Recorded every hour during the baseline campaign and will be verified during the verification visit
Source of data to be used:	Monitored (plant automated control system)
Value of data applied (for ex ante calculations/determination)	Not applicable. We do not use this parameter to estimate expected emission reductions. We use this parameter only to eliminate baseline data that is measured during hours when the operating conditions are outside the permitted range.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	To determine normal oxidation pressure air pressure data is used, since oxidation pressure after the mixer is not measured. It is measured by a transmitter type RPT 94137, with measuring limits 0-0.8 Mpa. Class 1
QA/QC procedures to be applied:	Critical instruments are calibrated on a routine basis according to the plant's maintenance program.
Any comment:	To be compared with normal operating conditions during the entire baseline campaign. This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project. Air pressure is available to compare with OP_{normal} too and it is processed in the same way as OP_h.

Data/Parameter:	**GS_{BL} (Gauze Supplier)**
Data unit:	Name of gauze supplier
Description:	Gauze supplier for the baseline campaign
Time of determination/monitoring	Once for the baseline campaign and will be verified during the verification visit
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Johnson Matthey. We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets the methodology requirements. Recorded once.
Justification of the choice of data or description of	Cover of supply contract or bill for gauzes for baseline campaign, or equivalent document to prove commercial transaction

measurement methods and procedures (to be) applied:	
QA/QC procedures to be applied:	None
Any comment	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**GC_{BL} (Gauze Composition)**
Data unit:	% precious metals
Description:	Gauze composition for the baseline campaign
Time of determination/monitoring	Once for the baseline campaign and will be verified during the verification visit
Source of data to be used:	Nitric acid plant procurement office on the basis of delivery documents
Value of data applied (for ex ante calculations/determination)	Pt71%, Rh4%, Pd25%. We do not use this parameter to estimate expected emission reductions. We use it to verify the gauze supplier, to evaluate whether it meets the methodology requirements.
Justification of the choice of data or description of measurement methods and procedures (to be) applied:	Section of supply contract for gauzes that specifies the technical characteristics agreed during the baseline campaign
QA/QC procedures to be applied:	None
Any comment:	This information will be available in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Data/Parameter:	**BE_{BC} (N_2O Emission of Baseline Campaign)**
Data unit:	t N_2O
Description:	N_2O emission for the baseline campaign
Time of	Calculated at least once after the baseline campaign

determination/monitoring	
Source of data to be used:	Calculated from baseline monitored data
Value of data applied (for ex ante calculations/determination)	887,93 tN_2O
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from monitored data
QA/QC procedures to be applied:	No QA/QC procedure is needed.
Any comment:	N_2O baseline emissions will be calculated on the basis of measurements of stack gas flow rate, N_2O concentration, and the operating hours. All parameters will be measured during the complete baseline campaign to properly characterize N_2O baseline emissions.

Data/Parameter:	**EF_{BL} (Baseline Emission Factor)**
Data unit:	$t\ N_2O/t$ 100% HNO_3
Description:	Baseline emission factor calculated from monitored data for the baseline campaign. Since $CL_{BL} > CL_{normal}$ N_2O values that were measured beyond the length of CL_{normal} had been eliminated from the calculation of EF_{BL}.
Time of determination/monitoring	Calculated at least once after the baseline campaign
Source of data to be used:	Calculated from monitored data
Value of data applied (for ex ante calculations/determination)	0.00785 $t\ N_2O/t$ 100% HNO_3
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated from monitored data on the basis of the methodology

QA/QC procedures to be applied:	No QA/QC procedure is needed.
Any comment:	Baseline emission factor will be calculated on the basis of measurements of the nitric acid production, stack gas flow rate, N_2O concentration, and the operating hours.

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

>>

Baseline emission procedure

Following AM0034 the baseline shall be 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 before project implementation.

The schematic of the procedure is as follows:

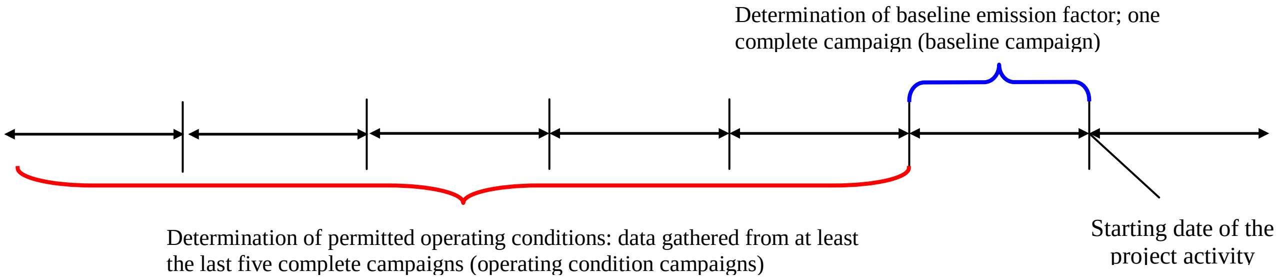

Figure 5: Determination of the permitted operating conditions of the nitric acid plant to avoid overestimation of baseline emissions

Oxidation temperature and pressure

“Permitted range for oxidation temperature” and “permitted range for oxidation pressure” are determined on the basis of historical data.

Historical ammonia oxidation temperature data of the last 5 campaigns has been used to determine the limits, and the information will be available during the determination process.

Since oxidation pressure after the mixer is not measured in the plant, compressor (air) pressure data is used to determine normal operating pressure. Data of compressor (air) pressure in ZAK is available only for the period after AMS installation (02.09.2007), and for campaigns before 07.04.2003. During 6 campaigns from 07.04.2003 to 02.09.2007 the pressure had not been recorded (the plant decided to stop monitoring it because it is irrelevant for operation).
Hence data of the latest campaign and 4 campaigns from May 1999 to April 2003 and one and a half of the last campaigns after installation of the AMS in August 2008 to the date of baseline campaign start has been used for calculations.

Statistical analysis of historical data to define “permitted range for oxidation temperature” and “permitted range for oxidation pressure” will be available for the determination process of the project activity.

Ammonia gas flow rates and ammonia to air ratio input into the ammonia oxidation reactor

The upper limits for ammonia flow and ammonia to air ratio are calculated on the basis of historical data of the last 5 campaigns in accordance with methodology AM0034.

2 - Determination of baseline emission factor: measurement procedure for N_2O concentration and gas volume flow

For the determination of the baseline emission factor N_2O concentration and gas volume flow will be monitored throughout the baseline campaign. 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) will be taken. Error readings (e.g. downtime or malfunction) and extreme values will be eliminated from the output data series.

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 and to the data series for gas volume flow. The statistical procedure will be applied to data obtained after eliminating data measured for periods when 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)).

Then, the average mass of N_2O emissions per hour is estimated as the product of the NCSG and VSG. The N_2O emissions per campaign are estimated as the product of N_2O emissions per hour and the total number of complete hours of operation of the campaign using the following Eq. 5 from AM0034:

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

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
OH_{BC}	Number of operating hours in the baseline measurement period, in h

The plant specific baseline emission 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 measurement uncertainty of the monitoring system,expressed as a percentage (*UNC*), will be used to reduce the N_2O emission factor per tonne of nitric acid produced in the baseline period (EF_{BL}) as follows:

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}\left(1 - \frac{UNC}{100}\right)$$

Where

EF_{BL}	Baseline emission factor, in tN_2O/ $tHNO_3$
NAP_{BC}	Nitric acid production during the baseline campaign, in $tHNO_3$
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

Impact of regulations

Should N_2O emission regulations that apply to nitric acid plants be introduced in Poland or the jurisdiction covering the location of the nitric acid plant, such regulations shall be compared to the calculated baseline emission factor (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 emission factor cap (max. allowed $tN_2O/tHNO_3$) is to be derived from the regulatory level. If the regulatory limit is lower than the baseline factor determined for the project activity, the regulatory limit shall become the new baseline emission factor, that is.

If $EF_{BL} > EF_{reg}$, then $EF_{BL} = EF_{reg}$ for all the calculations.

Composition of the ammonia oxidation catalyst

The ZAK plant uses Johnson Matthey ammonia oxidation catalyst of the following composition:

Johnson Matthey		
Catalytic gauze composition		
	g	%
Pt	33000	71
Rh	2000	4
Pd	12000	25
Catchment gauzes		
Pd	14500	95
Au		
Ni	750	5

Figure 6: Preliminary catalyst composition

.

Campaign length

In order to take into account the variations in campaign length and their 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 tonnes of nitric acid at 100% concentration produced with one set of gauzes.

Historic campaign length

For the ZAK nitric acid plant the average historic campaign length (CL_{normal}), defined as the average campaign length for the historic campaigns used to define operating conditions (the previous campaigns), will be used as a cap on the length of the baseline campaign.

If the baseline campaign length (CL_{BL}) *is lower* than CL_{normal}, 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 where the plant was operating outside of the "permitted range").

"If the baseline campaign length (CL_{BL}) is higher than CL_{normal}, all 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}."

Parameters to be monitored for composition of the catalyst are as follows:
GS_{normal} Gauze supplier for the operating condition campaigns
GS_{BL} Gauze supplier for the baseline campaign
$GS_{project}$ Gauze supplier for the project campaigns
GC_{normal} Gauze composition for the operating condition campaigns
GC_{BL} Gauze composition for the baseline campaign
$GC_{project}$ Gauze composition for the project campaigns

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

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Not applicable

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

>>

The emission reductions of the project activity, *ER*, expressed in tonnes of CO_2 equivalent per year (tCO_2e/yr), are given by the following equation (Eq. 7 from AM0034):

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O}$$

Where

ER_n	Emission reductions for the *nth* campaign , tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
EF_p	Project emission factor, in $tN_2O/tHNO_3$
NAP_n	Nitric acid production during the *nth* campaign of the project activity, in $tHNO_3$
GWP_{N_2O}	Global warming potential of N_2O, set as 310 tCO_2e/tN_2O for the 1st commitment period

Note. The nitric acid production used to calculate emission reductions should not exceed the design capacity (nameplate) of the nitric acid plant.

Documentation to prove design capacity (nameplate) of the nitric acid plant should be available for the validation process of the project activity.[4]

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

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[4] Nameplate (design) implies the total yearly capacity (considering 365 days of operation per year) according to the documentation of the plant technology provider (such as the Operation Manual). If the plant has been modified to increase production, and such de-bottleneck or expansion projects were completed before December 2005, then the new capacity is considered nameplate, provided proper documentation of the projects is available (such as, but not limited to: properly dated engineering plans or blueprints, engineering, materials and/or equipment expenses, or third party construction serviceswee.).

No leakage calculation is required.

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

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No leakage calculation is required.

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

>>

To calculate EF_{BL} firstly we calculate

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

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
OH_{BC}	Number of operating hours in the baseline measurement period, in h

and after that

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}(1 - \frac{UNC}{100})$$

Where

EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
NAP_{BC}	Nitric acid production during the baseline campaign, in $tHNO_3$
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the

combined uncertainty of the applied monitoring equipment

To calculate EF_p firstly we calculate

$$PE_n = (VSG_{BC} \cdot NCSG_{BC}) * (1 - R_{Eff}) / 100 \cdot 10^{-9} \cdot OH$$

Where

PE_n	Estimated N_2O emission for the project campaign, tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
R_{Eff}	Secondary catalyst efficiency, %
OH	Estimated number of operating hours in the project campaign, in h

and after that

$$EF_p = \frac{PE_n}{Cl_{normal}}$$

Where

EF_p	Estimated project emission factor, in $tN_2O/tHNO_3$
PE_n	Estimated N_2O emission for the project campaign, in tN_2O
Cl_{normal}	Project campaign length, in $tHNO_3$

Then we can calculate ER_n:

$$ER_n = (EF_{BL} - EF_p) \cdot NAP \cdot GWP_{N_2O}$$

Where

ER_n	Emission reductions for the *nth* campaign, in tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
EF_p	Estimated project emission factor, in $tN_2O/tHNO_3$
NAP_n	Estimated nitric acid production during the *nth* project campaign
GWP_{N2O}	Global warming potential of N_2O, set as 310 tCO_2e/tN_2O for the 1st commitment period

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

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D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

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Not applied. QC/QA procedures are described directly in the tables for each data and parameter.

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

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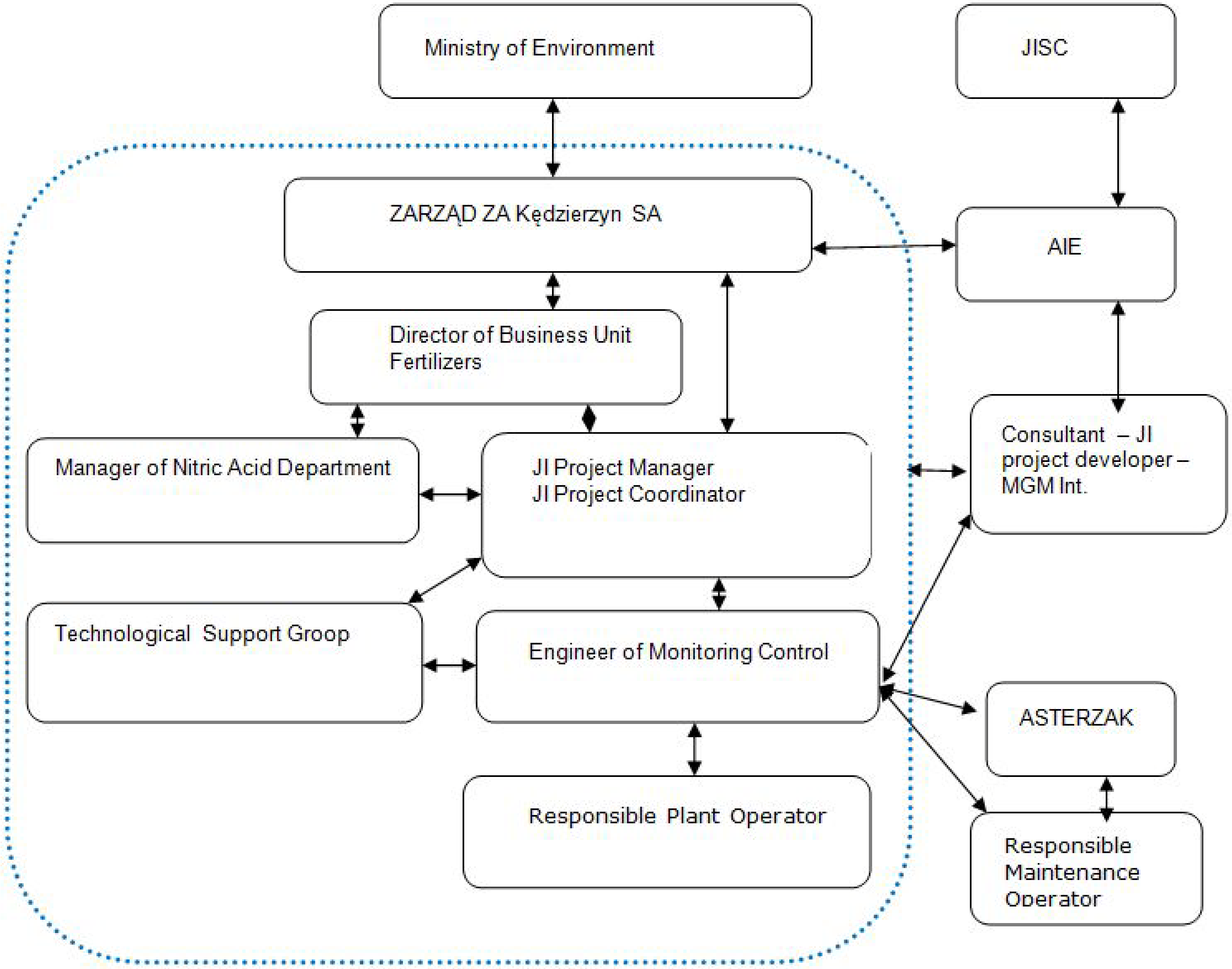
An illustrative scheme of the operational and management structure that will monitor the proposed JI project activity is depicted below.


Ministry of Environment
JISC
ZARZĄD ZA Kędzierzyn SA
AIE
Director of Business Unit Fertilizers
Manager of Nitric Acid Department
JI Project Manager
JI Project Coordinator
Consultant – JI project developer – MGM Int.
Technological Support Groop
Engineer of Monitoring Control
ASTERZAK
Responsible Plant Operator
Responsible Maintenance Operator

Note: the dashed line shows the operational and management structure boundaries of the proposed project.

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

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The baseline and monitoring methodology has been applied by:
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SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

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Ex-ante estimation of emission reductions

For completing this PDD with the estimation of project emissions the following assumptions are used:

- Nitric acid production is assumed to be constant, so that project emissions do not vary from year to year. For the annual production the maximum permitted by the Environmental Permit, 175000 t, is used.
- The potential technology providers (BASF, INS) indicate that the estimated reduction efficiency to be achieved as a consequence of project implementation is 85%.
- All other conditions were measured and calculated in accordance with the methodology on the basis of historical and baseline campaign data.

On the basis of the baseline data from Annex 1 of this PDD we can calculate:

1) $BE_{BC} = VSG_{BC} \cdot NCSG_{BC} \cdot 10^{-9} \cdot OH_{BC}$

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
OH_{BC}	Number of operating hours in the baseline measurement period, in h

$$BE_{BC} = 80{,}498 \cdot 2{,}179 \cdot 10^{-9} \cdot 5{,}061 = 887.725tN_2O$$

2) $EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}(1 - \frac{UNC}{100})$

Where

EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
BE_{BC}	Total baseline emissions in the baseline measurement period, in tN_2O
NAP_{BC}	Nitric acid production during the baseline campaign, in $tHNO_3$
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

$$EF_{BL} = \frac{887.725}{107{,}972}(1 - \frac{4.52}{100}) = 0.00785tN_2O/tHNO_3$$

3) $PE_n = (VSG_{BC} \cdot NCSG_{BC}) * (1 - R_{Eff}) / 100 \cdot 10^{-9} \cdot OH$

Where

PE_n	Estimated N_2O emission for the project campaign, tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
R_{Eff}	Secondary catalyst efficiency, %
OH	Estimated number of operating hours in the project campaign, in h

$$PE_n = 80{,}498 \cdot 2{,}179 \cdot (1 - 0.85)/100 \cdot 10^{-9} \cdot 4{,}957 = 130.423 tN_2O$$

4) $EF_p = \frac{PE_n}{Cl_{normal}}$

Where

EF_p	Estimated project emission factor, in $tN_2O/tHNO_3$
PE_n	Estimated N_2O emission for the *nth* project campaign, tN_2O
Cl_{normal}	Normal campaign length, in $tHNO_3$

$$EF_p = \frac{130.42}{105{,}569} = 0.00123543 tN_2O / tHNO_3$$

5) $PE_{annual} = EF_p \cdot NAP_{annual} \cdot GWP_{N_2O}$

Where

PE_{annual}	Estimated annual N_2O emissions for the vintage year, tN_2O
EF_p	Estimated project emission factor, in $tN_2O/tHNO_3$
NAP_{annual}	Nitric acid production during the *nth* year of the project activity, in $tHNO_3$
GWP_{N2O}	Global warming potential of N_2O, set as 310 tCO_2e/tN_2O for the 1st commitment period

$$PE_{annual} = 0.00123543 \cdot 174{,}900 \cdot 310 = 66{,}984 tCO_2e / year$$

E.2. Estimated leakage:

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Not applicable

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

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As there is no leakage the sum of E.1 and E.2 is equal to E.1.

E.4. Estimated baseline emissions:

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Baseline emissions are estimated according to the following assumptions:

- Nitric acid production is assumed to be constant, so that project emissions do not vary from year to year.
- An N_2O emission factor (EF_{BL}) is calculated from monitored data available at the moment of submitting this PDD. The final baseline emission factor will be calculated after the completion of baseline campaign measurements.

$BE_n = EF_{BL} \cdot NAP_{annual} \cdot GWP_{N_2O}$

Where

BE_{annual}	Baseline emissions during the vintage year of the project activity, tCO_2
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$

NAP_{annual}	Nitric acid production during the vintage year of the project activity, in $tHNO_3$
GWP_{N_2O}	Global warming potential of N_2O

$$BE_{annual} = 0.00785 \cdot 174,900 \cdot 310 = 425,619 tCO_2e / year$$

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

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$$ER_{annual} = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O}$$

Where

ER_{annual}	Emission reductions for the *nth* year , tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/tHNO_3$
EF_p	Project emission factor, in $tN_2O/tHNO_3$
NAP_{annual}	Nitric acid production during the vintage year of the project activity, in $tHNO_3$
GWP_{N_2O}	Global warming potential of N_2O

$$ER_{annual} = (0.00785 - 0.00123543) \cdot 174,900 \cdot 310 = 358,635 tCO_2e / year$$

358,635

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

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Years	**Estimated project activity emissions (tonnes of CO_2 equivalent)**	**Estimated leakage (tonnes of $CO_{2\,e}$ equivalent)**	**Estimated baseline emissions (tonnes of CO_2 equivalent)**	**Estimated emission reductions (tonnes of CO_2 equivalent)**
2008	2,398	-	15,239	12,841
2009	66,984	-	425,619	358,635
2010	66,984	-	425,619	358,635
2011	66,984	-	425,619	358,635
2012	66,984	-	425,619	358,635
2013	66,984	-	425,619	358,635
2014	66,984	-	425,619	358,635
2015	66,984	-	425,619	358,635
2016	66,984	-	425,619	358,635
2017	66,984	-	425,619	358,635
2018	66,984	-	425,619	358,635
2019	66,984	-	425,619	358,635
Total	**739,222**	**-**	**4,697,048**	**3,957,826**

SECTION F. Environmental impacts

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

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It is not obligatory for ZAK to develop an EIA.

The Decree of the Board of Ministers of 9 November 2004 lists all activities that should be accompanied by an EIA and all cases in which EIA should be carried out. Particularly in § 2, all investments which should be accompanied by an EIA are listed. The present project is outside the scope of the paragraph's demands.

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

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SECTION G. Stakeholders' comments

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

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As was mentioned in Paragraph F.1, the Decree of the Board of Ministers of 9 November 2004 lists all the kinds of investments that are to be supported by the report of an EIA together with the stakeholders' comments.

ZAK's project does not fall within the requirements of the abovementioned paragraph. Therefore it is not necessary to carry out an EIA for this project.

Annex 1

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Annex 2

ANNEX 2

BASELINE INFORMATION

Baseline emissions will be calculated from an emission factor measured during a complete campaign before the implementation of the project activity, under normal operating conditions.

Ex-ante estimates of the key baseline parameters are listed in the following table:

Parameter	Estimated value for ZAK Plant
Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h (VSG_{BC})	80,498
Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3 ($NCSG_{BC}$)	2,179
Baseline emission factor, in $tN_2O/tHNO_3$ (EF_{BL})	0.00785
Nitric acid production during the baseline campaign, in $tHNO_3$ (NAP_{BC} $tHNO_3$)	107,972
Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment, % (UNC)	4.52
Number of operating hours in the baseline measurement period, in h (OHGWP_{N_2O})	5,061
Estimated number of operating hours in the project campaign, in h (OH)	4,957
Project campaign length, in $tHNO_3$ (estimated to be CL_{normal})	105,569
Nitric acid production during the vintage year of the project activity, tHNO3/year (NAP_{annual})	174,900
Secondary catalyst efficiency, % (R_{Eff})	85
N_2O global warming potential tCO_2e/tN_2O (GWP_{N_2O})	310

Annex 3

MONITORING PLAN

The current JI project “Nitrous Oxide Abatement Project at ZAK” requires measurement on a quasi-continuous basis (uninterrupted sampling of flue gases with concentration and normalized flow analysis in short, discrete time periods) of the N_2O mass flow leaving the nitric acid plant through an automated measuring system (AMS[5]) using technologies and procedures in accordance with AM0034: “Catalytic reduction of N_2O inside the Ammonia burner of nitric acid plants”.

The plant is currently ISO 9001/2000 and ISO 14001/2004 certified; certification documents are available for review. The monitoring procedures (deployed in accordance with the current monitoring plan and being an integral part of it) will be fully integrated into ZAK’s Quality and Environmental Management System.

The plant is operated by a centralized automated control system, hence staff is qualified for and experienced in operating technical equipment to a high level of quality standards. Furthermore, the plant has been operating stack emission units (e.g. NO_x) for a number of years. The plant has access to specialized technical services available from the ZAK Technology Group.

Operation, maintenance, calibration and service intervals will be according to the manufacturer’s specifications and international standards (see QA/QC section below), and incorporated into the management structure of ISO 9000 standard procedures.

The proposed JI project will be closely monitored, metered and recorded. The management and operation of the proposed nitrous oxide abatement project will be the responsibility of the plant. The emission reductions will be verified at least annually by an Accredited Independent Entity (AIE). A regular (annual) reporting of the emission reductions generated by the project will be sent to the owner of the ERUs, coincidentally with the AIE’s determination.

An illustrative scheme of the operational and management structure that will monitor the proposed JI project activity is as follows:

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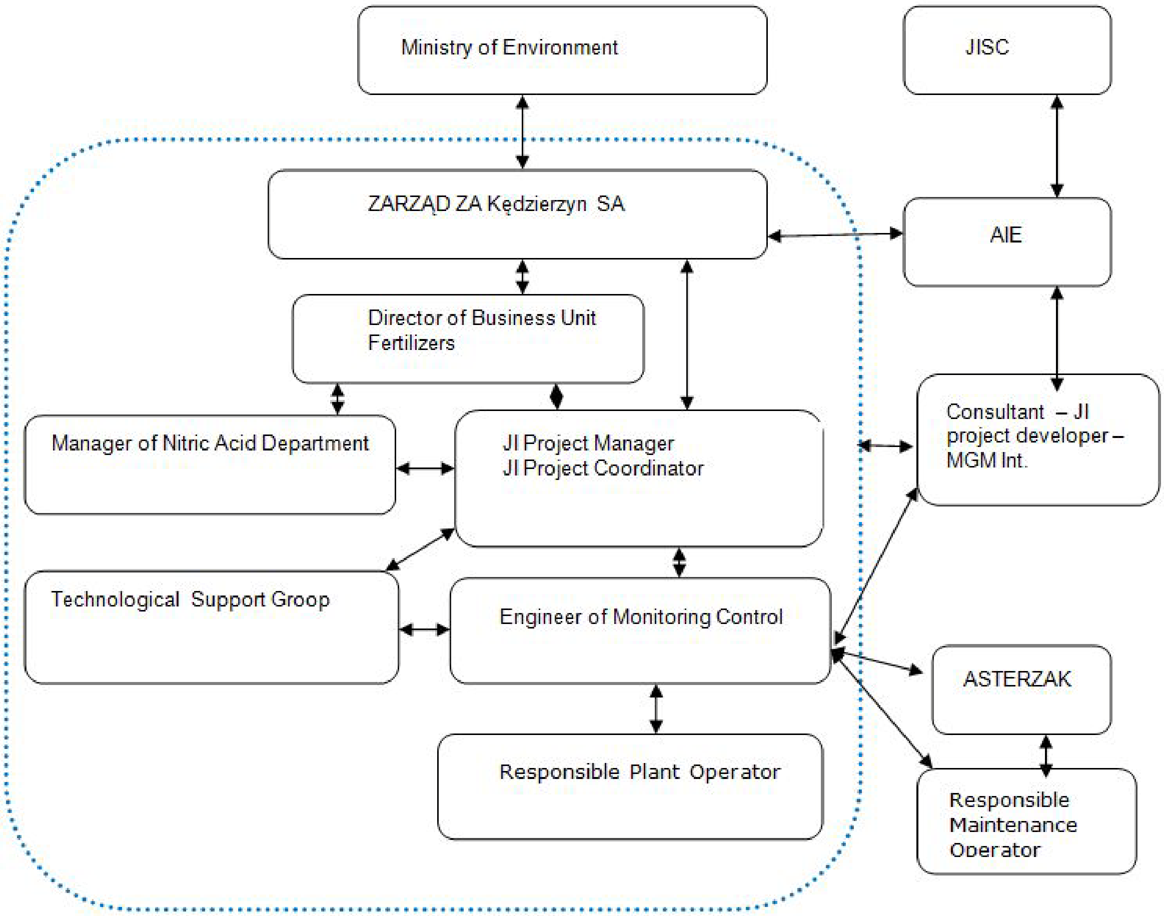
[5] According to “Terms and definitions” of EN 14181:2004 (E), an AMS is a measuring system permanently installed on site for continuous monitoring of emissions. An AMS is a method which is traceable to a reference method. Apart from the analyzer, an AMS includes facilities for taking samples and for sample conditioning. This definition also includes testing and adjusting devices that are required for regular functional checks.



Note: the dashed line shows the operational and management structure boundaries of the proposed project.

The relation between the project operational and management structure and other actors of the proposed JI project activity is described as follows:

- The Plant Operator will be responsible for the plant performance in normal operation. His duties involve: control of normal plant operating conditions and of industrial safety measures, informing the Manager of the Nitric Acid Department about any deviations in the plant operation process (taking into account deviations that influence JI project realization), transfer of important information to the Monitoring Engineer.
- Responsible Maintenance Operator is an ASTERZAK company employee who is responsible for operation of the measuring equipment for nitric acid production, including monitoring equipment which is used for the JI project. ASTERZAK Company is charged with maintenance of control

and measuring equipment in ZAK. ASTERZAK performs continuous control of performance of industrial automation and monitoring equipment that is used for JI project related tasks. He is responsible for: calibration of all measuring equipment in accordance with the schedule, calibration of the analyzer in accordance with the schedule, control of availability of sample gas that it is necessary for calibration, proper service of the AMS and DAS.

- The Monitoring Engineer is an employee of the Fertilizer Business Unit. He is the employee who is responsible for technical issues related to the DEMS2000 system Fanuc, Wago, and together with ASTERZAK for system maintenance and programming. He is responsible for: cooperation with the Project Developer on data analysis and guaranteeing of compliance with specified procedures in the process of report preparation, guaranteeing of access to special services at any time, in case of malfunctions that are reported by the Responsible Maintenance Operator.

- The JI Project Manager is an employee of ZA Kędzierzyn who is responsible for guaranteeing project development in accordance with the PDD and other applicable documentation on the enterprise level. He is responsible for: reporting every day to the company management concerning the progress in JI project related issues, ensuring that routine compliance audits are carried out, forwarding of reports in the form of spreadsheets with monitoring results upon request to the ERU owner.

- The JI Project Coordinator is an employee of the Fertilizer Business Unit who is responsible for ensuring project development in the Business Unit in accordance with the methodology AM0034 and the monitoring plan that is presented in the PDD. He is responsible for: ensuring that compliance with the methodology is completely guaranteed at any time, cooperation with the Project Developer on data analysis and guaranteeing compliance with specified procedures in the process of preparation of reports.

- Technological Support Group. These are the persons who are permanently responsible for processing of data that is collected by the AMS and DAS and for transfer of these data to the proper subdivision. They are responsible for: collection of monitoring data for JI project needs, e.g. plant operational data in the log book – control of correctness, reporting to the Manager of the Nitric Acid Department about malfunctions and suggestions about corrective actions, acquisition of suitable operational data from the Responsible Plant Operator, input of this data to spacial calculation sheets to process them in accordance with monitoring needs (monitoring sheets), submission of monitoring sheets and generated daily reports through the data acquisition system to the Project Coordinator, informing the Manager of the Nitric Acid Department about any malfunctions that are detected during the plant operation (including as well malfunctions that could have an influence on JI projects).

- Consultant - Project Developer is an experienced consultant hired as third party service provider in order to aid in the implementation and monitoring of the JI project and support the ZAK team during the JI project development. On the basis of the monitoring spreadsheets that are revised by employees comprising the Technological Support Group, the developer calculates baseline emissions, project emission reductions, and other checks/calculations ensuring procedures are followed according to the approved methodology being applied; the Consultant prepares the monitoring report on a regular basis (when each full campaign has finished at ZAK) in close collaboration with the Monitoring Engineer and the Technological Support Group, sends the monitoring reports to the verification AIE according to the instructions of the ZAK team, and collaborates with the verification team to provide further clarifications, coordinate site visits, etc.

- The AIE will then send the corresponding determination report to the JI Supervisory Committee in order to evaluate it and enable the issuance of the ERUs.

Shareholders of ZAK will receive annually from the Director of the Fertilizer Business Unit the same report as is sent to the AIE.

Tables in Section D.1.1.1 and D.1.1.3 of the PDD describe the parameters to be acquired and recorded according to the current monitoring plan, for both the baseline campaign and the project campaigns. Furthermore, the baseline methodology requires that certain process parameters are monitored (to be compared with the permitted operating conditions) during the baseline campaign; such process parameters are also described in the abovementioned tables. Only those N_2O measurements taken when the plant is operating within the permitted range will be considered during the calculation of baseline emissions.

The data mentioned above are recorded every second, and after that minutely, hourly and daily averages are generated, and recorded in daily and monthly reports of the DEMS-2000CDM system. Integrity of the recorded data is protected by avoiding any influence on the written data.

The module of the workstation is represented by personal computers which are located in Buildings 408 and 704. The system offers the possibility of continuous visualization of the data on the PC monitor.
Daily reports are printed every day by a dedicated person and stored in the safe dedicated for these purposes placed in Building 408. The generated monthly reports are printed once per month by a dedicated person and stored in the safe dedicated for these purposes placed in Building 408.

Data are recorded and written in the external memory of a computer which is situated in Building 704. In addition data is written in the physical back-up drive DEMS2000 RED HDD which is situated in Building 408, and which ensures additional security of the data storage. The external back-up memory size offers the possibility of recording the data for 10 years.

In addition the active module D -EMS 2000 allows transmission of the data to a server on the Internet to give information about current and historical measurements.

All parameters are registered and recorded at the same time by the systems GE Fanuc and Wago, followed by printing in the shape of daily reports and storing in a safe dedicated place, which further secures the data. The person responsible for technical affairs of the system is the Chief Specialist of the Automation Department, who works together with ASTERZAK in matters concerning service and programming of the system.

All parameters measured during project campaigns will be archived in electronic and paper format for at least two years after the last transfer of ERUs for the project.

Emission reduction calculations

The amount of mass (tonnes) of N_2O that the project actually avoids being vented to the atmosphere during each production campaign, expressed as carbon dioxide equivalent (or tCO_2e), will be calculated by applying the following formulas:

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

Where

BE_{BC}	Total baseline emissions in the baseline measurement period, iny tN_2O
VSG_{BC}	Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
$NCSG_{BC}$	Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg

	N_2O/Nm^3
OH_{BC}	Number of operating hours in the baseline measurement period, in h

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}}(1-\frac{UNC}{100})$$

Where

EF_{BL}	Baseline emission factor, in $tN_2O/\ tHNO_3$
NAP_{BC}	Nitric acid production during the baseline campaign, in $tHNO_3$
UNC	Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

Project emissions are calculated from mean values of N_2O concentration and total flow rate:

$$PE_n = VSG_n \cdot NCSG_n \cdot 10^{-9} \cdot OH_n$$

Where

PE_n	Total project emissions of the nth campaign, in tN_2O
VSG_n	Mean stack gas volume flow rate for the nth project campaign, in Nm^3/h
$NCSG_n$	Mean concentration of N_2O in the stack gas for the project campaign, in mg N_2O/Nm^3
OH_n	Number of operating hours in the project campaign, in h

For the *nth* campaign, the campaign specific emission factor would be:

$$EF_n = \frac{PE_n}{NAP_n}$$

Where

EF_n	Emission factor calculated for the *nth* campaign, in kg $N_2O/t\ HNO_3$
PE_n	Total project emissions of the *nth* campaign, in tN_2O
NAP_n	Nitric acid production in the *nth* campaign, in t 100% HNO_3

Then

$$ER_n = (EF_{BL} - EF_p) \cdot NAP_n \cdot GWP_{N_2O}$$

Where

ER_n	Emission reductions of the project for the *nth* campaign, tCO_2e
EF_{BL}	Baseline emission factor, in $tN_2O/\ tHNO_3$
EF_p	Project emission factor, applicable to the *nth* campaign, in $tN_2O/\ tHNO_3$
NAP_n	Nitric acid production during the *nth* campaign of the project activity, in $tHNO_3$
GWP_{N_2O}	Global warming potential of N_2O, set as 310 tCO_2e/tN_2O for the 1st commitment period

Following AM0034, several restrictions and adjustments will be applied to the formulas (above), among others:

1. All data series are filtered to eliminate mavericks and outliers.

The monitoring system will provide separate readings for N_2O concentration and gas flow for a defined period of time (e.g. every hour of operation, i.e. an average of the measured values of the past 60 minutes). Error readings (e.g. downtime or malfunction) and extreme values are eliminated from the output data series. 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.

2. NAP (nitric acid production) cannot exceed nameplate capacity of the plant.

Nitric acid production is calculated on the base of mass balance approach. For these calculations we use formula on the base of formula:

$$HNO_3 = NH_3 *(63/17) * (\eta/100)$$

η efficiency of combustion , % m/m.
NH_3 (gaseous) - Feedstock consumption of NH_3, ton per day

Efficiency of combustion defined by measuring of NH3 concentration before oxidation reactor and NO_x concentration after AOR.

Plant performs measurements by flowmeter at the same time, but these measurements are less accurate since plant use mass balance data as the standard to develop the formula for flowmeter data processing, but flow meter data still differ from mass balance data on 5-7%

Nitric acid production will be compared to nameplate capacity. If nitric acid production in a given campaign is larger than nameplate, then emission reductions will be calculated ignoring data generated after production exceeds nameplate.

3. A moving average of the emission factors (EF_{ma}) must be calculated.

The campaign specific emission factor (EF_n) for each campaign during the project's crediting period is compared to a moving average emission factor calculated as the average emission factor of the factors generated in the previous campaigns ($EF_{ma,n}$).

To calculate the total emission reductions achieved in the *nth* campaign, the higher of the two values $EF_{ma,n}$ and EF_n shall be applied as the emission factor relevant for that particular campaign (EF_p).

4. A minimum project emission factor should also be determined (EF_{min}), defined as the lowest among the emission factors of the 10 first campaigns.

After the first ten campaigns of the crediting period of the project, the lowest emission factor (EF_n) observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in an EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall use EF_{min} and not EF_n.

5. The emission factor to be applied for a particular campaign calculation (EF_p) must be the higher between the abovementioned moving average and the specific campaign emission factor (and not lower than the minimum emission factor after 10 campaigns).

   This will be checked according to procedures detailed in Steps 4 and 5 above.

6. The level of uncertainty (*UNC*) determined for the AMS installed must be deducted from the baseline emissions factor.

   The overall measurement uncertainty (*UNC*), calculated by summing in an appropriate manner (using the Gauss law of error propagation) all the relevant uncertainties arising from the individual performance characteristics of the AMS components, will be used to reduce the baseline emission factor. The following formulae will be applied:

$$EF_{BL} = EF_{BC} * (1 - \frac{UNC}{100})$$

7. If production in a given campaign is lower than normal (CL_{Normal}), then the baseline is recalculated by ignoring the data generated after production exceeds normal campaign length.

   The production in a given campaign will be compared to normal campaign length (CL_{Normal}). If the length of any individual project campaign CL_n is shorter than the average historic campaign length, then EF_{BL} will be re-calculated by eliminating those N_2O values that were obtained during the production of tonnes of nitric acid beyond CL_n (i.e. the last tonnes produced) from the calculation of EF_n.

8. 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 in the campaign has been applied for the downtime period for the baseline emission factor, and highest measured value in the campaign will be applied for the downtime period for the campaign emission factor
   In case of volume of stack gas flow (VSG) the last measured value in the campaign has been applied for the downtime period for the baseline emission factor, and highest measured value in the campaign will be applied for the downtime period for the campaign emission factor .

Description of the AMS

The ZAK plant has installed continuous gas analyzers from the supplier ABB, model EL3020, while the specific module to measure N_2O uses the non-dispersive infrared principle and is called URAS 26.

Below are the instrument specifications according to the manufacturer.

Infrared Photometer Uras26

Measurement Principle

Non-dispersive infrared absorption in the $\lambda = 2.5–8\ \mu m$ wavelength range

Photometer to measure up to 4 components with 1 or 2 beam paths and 1 or 2 receivers per beam path in one gas path or two separate gas paths.

Sample Components and Measurement Ranges

The analyzer has one physical measurement range per sample component. The smallest measurement ranges are shown in the following table.

Sample Component	Smallest Measurement Range
CO	0–100 ppm
CO_2	0–100 ppm
NO	0–150 ppm
SO_2	0–100 ppm
N_2O	0–100 ppm
CH_4	0–100 ppm

Measurement Range Limits
0–500 (NO: 750) / 1000 / 3000 ppm, 0–1 / 3 / 10 / 30 / 100 Vol.-%
The measurement ranges are freely adjustable within a range ratio of max. 1:5. An individual measurement range can be factory-set on request. Measurement ranges should not be set within ignition limits.

Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant.

Linearity Deviation
≤ 1 % of span

Repeatability
≤ 0.5 % of span

Zero Drift
≤ 1 % of span per week

Sensitivity Drift
≤ 1 % of measured value per week

Output Fluctuation ($2\ \sigma$)
≤ 0.2 % of span at electronic T90 time (static / dynamic) = 5 / 0 sec

Detection Limit ($4\ \sigma$)
≤ 0.4 % of span at electronic T90 time (static / dynamic) = 5 / 0 sec

Influence Effects

Flow Effect
Flow rate in the 20–100 l/h range: Within detection limits

Associated Gas Effect / Cross Sensitivity
The knowledge of the sample gas composition is necessary for the analyzer configuration.
Selectivity measures to reduce associated gas effect (optional): Incorporation of interference filters or filter cells, internal electronic cross-sensitivity correction for one sample component by other sample components measured with the gas analyzer.

Temperature Effect
Ambient temperature in permissible range
- At zero-point: ≤ 2 % of span per 10 °C
- On sensitivity without thermostat: ≤ 3 % of measured value per 10 °C
- On sensitivity with thermostat (optional): ≤ 2 % of measured value per 10 °C
  Thermostat temperature = 55 °C

Air Pressure Effect
- At zero-point: No effect
- On sensitivity with pressure correction by means of integral pressure sensor: ≤ 0.2 % of measured value per 1 % barometric pressure change

The pressure sensor is located in the sample gas path if hoses are used as the internal gas lines.
If tubing is used for internal gas lines the pressure sensor is routed to the outside via a hose.
Pressure sensor working range: p_{abs} = 600–1250 hPa

Power Supply Effect
Voltage and frequency in the permissible range: No effect

Infrared Photometer Uras26

Dynamic Response

Warm-Up Time
Approx. 30 minutes without thermostat; approx. 2 hours with thermostat

90% Response Time
T_{90} = 2.5 sec for measurement cell length = 175 mm, sample gas flow = 60 l/h and electronic T90 time (static/dynamic) = 5/0 sec.

Calibration

Zero-Point Calibration
With inert gas, e.g. N_2, or with ambient air that is free of the sample component.

End-Point Calibration
With gas-filled calibration cells (optional) or with test gas mixtures. It is recommended to verify the calibration cell set values once a year.

Materials in Contact with the Sample Medium

Analyzer (Sample Cells)
Tubing: Aluminum; Window: CaF_2 or BaF_2; Connectors: Stainless steel 1.4305

Gas Lines and Connectors
FPM (Fluorocarbon rubber) hoses, PVDF connectors; Option: Stainless steel tubes 1.4571, stainless steel connectors 1.4305

Gas Inlet Conditions

The analyzer must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

Temperature
The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Inlet Pressure
p_e = 2–500 hPa
Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

Outlet Pressure
Atmospheric pressure

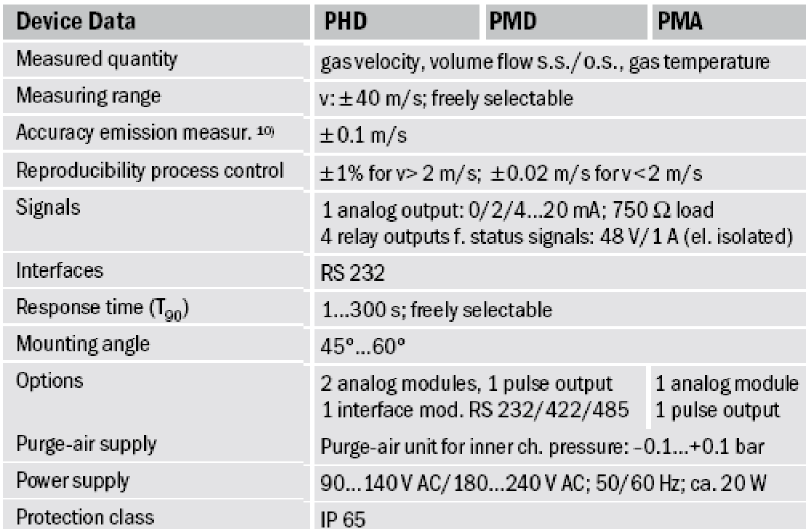
Flow Rate
20–100 l/h

Corrosive Gases
Highly corrosive associated gas components, e.g. chlorine (Cl_2) and hydrogen chloride (HCl), as well as gases or aerosols containing chlorine must be cooled or undergo prior absorption.

Flammable Gases
In the version with gas lines and connectors made of stainless steel the analyzer is suitable for measuring flammable gases in general purpose environment. Please observe the special conditions (see operator's manual).

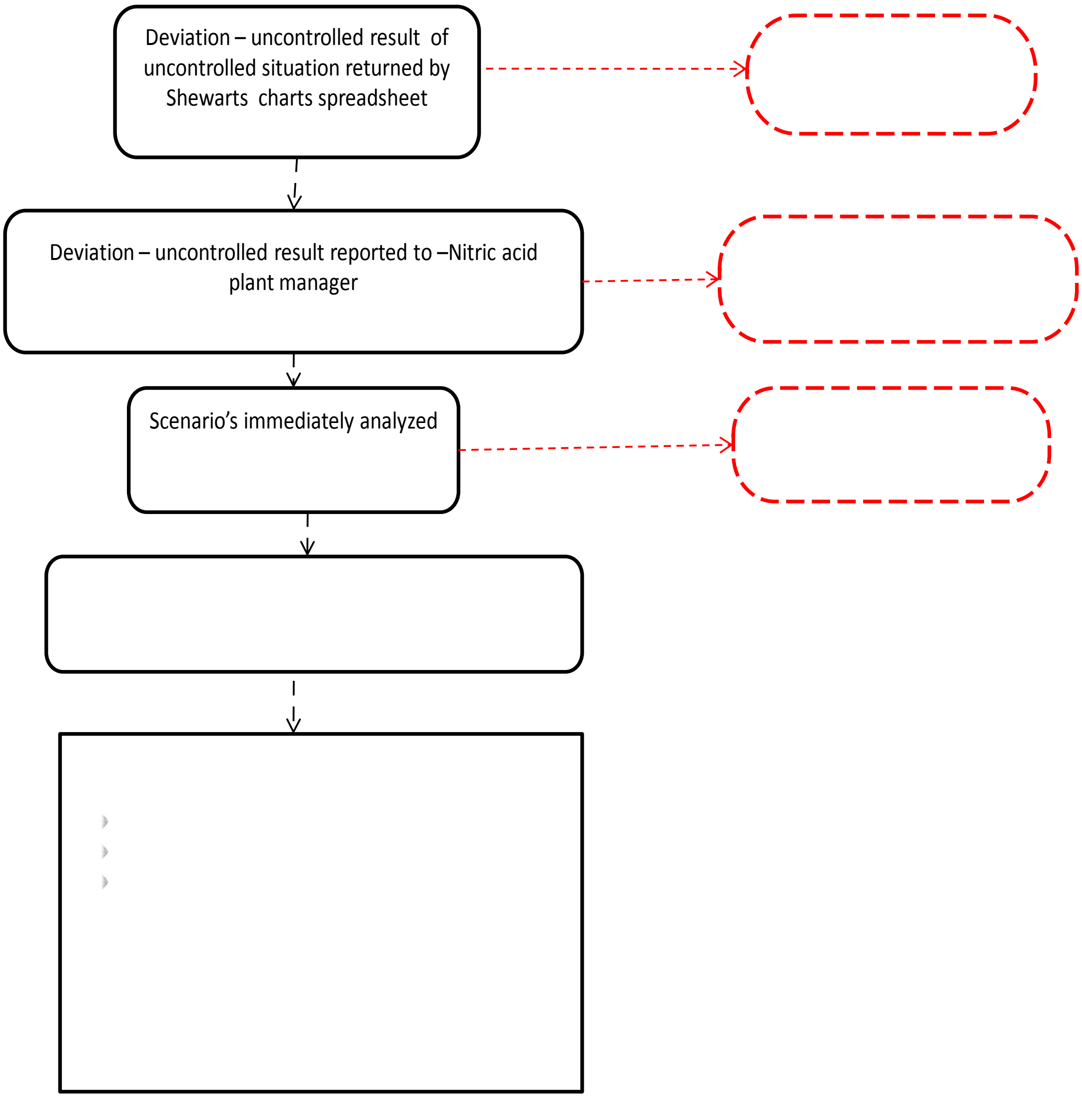
Gas Connections
see page 16

For stack flow measurement, the ZAK plant installed an ultrasound principle unit, model Flowsick 100 PMA, manufactured by Sick AG (Germany). The Flowsick series are also TÜV certified and comply with relevant regulations in Germany such as 13th and 17th BlmSchV. The table below summarizes some performance characteristics of the unit:



Device Data	PHD	PMD	PMA
Measured quantity	gas velocity, volume flow s.s./o.s., gas temperature		
Measuring range	v: ±40 m/s; freely selectable		
Accuracy emission measur. 10)	±0.1 m/s		
Reproducibility process control	±1% for v> 2 m/s; ±0.02 m/s for v<2 m/s		
Signals	1 analog output: 0/2/4...20 mA; 750 Ω load 4 relay outputs f. status signals: 48 V/1 A (el. isolated)		
Interfaces	RS 232		
Response time (T_{90})	1...300 s; freely selectable		
Mounting angle	45°...60°		
Options	2 analog modules, 1 pulse output 1 interface mod. RS 232/422/485		1 analog module 1 pulse output
Purge-air supply	Purge-air unit for inner ch. pressure: -0.1...+0.1 bar		
Power supply	90...140 V AC/180...240 V AC; 50/60 Hz; ca. 20 W		
Protection class	IP 65		

An illustrative scheme of the basic operational procedure that will identify and eliminate any possible deviation of the gas monitoring instruments as part of the JI project activities at the ZAK plant is as follows:


Deviation – uncontrolled result of uncontrolled situation returned by Shewarts charts spreadsheet
Deviation – uncontrolled result reported to –Nitric acid plant manager
Scenario's immediately analyzed

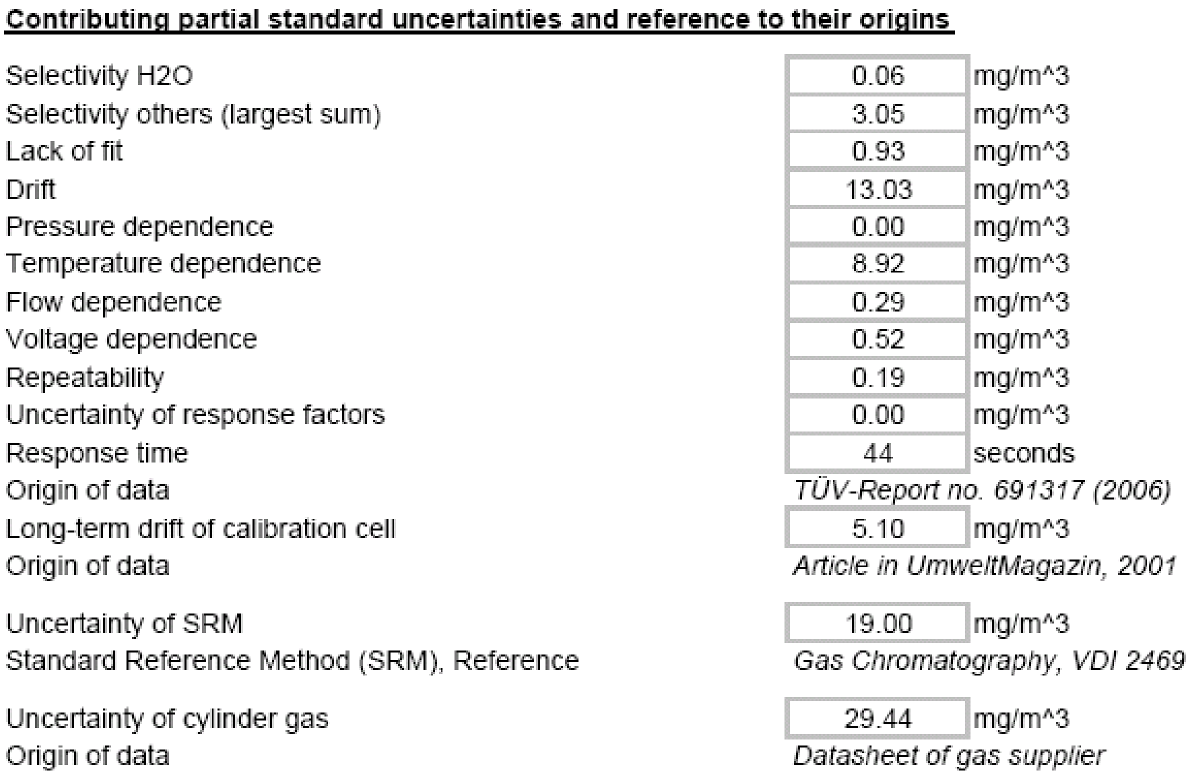
Good monitoring practice and performance characteristics

Regarding QA/QC, the European Norm EN 14181:2004, which is recommended as guidance regarding the selection, installation and operation of the AMS under Monitoring Methodology AM0034, stipulates three Quality Assurance Levels (QALs), and one Annual Surveillance Test (AST):

QAL1: Suitability of the AMS for the specific measuring task

The evaluation of the suitability of the AMS and its measurement procedure are described in ISO 14956:2002 “Air quality – Evaluation of the suitability of a measurement procedure by comparison with a required measuring uncertainty”. Using this standard, it shall be proven that the total uncertainty of the results obtained from the AMS meets the specification for uncertainty stated in the applicable regulations (e.g. EU Directives 2000/76/EU or 2001/80/EU). Since European regulations do not yet cover the measurement of N_2O at nitric acid plants, there is no official specification for uncertainty available. Hence, considering official specification of uncertainties defined for equivalent pollutants (e.g. NO_x, SO_2) according to EU regulations, 20% of the ELV (Emission Limit Value, in this case taken as the actual test concentration or calibration gas) has been considered by the equipment manufacturer as the required measurement quality for N_2O, for the purpose of expanded uncertainty calculations. The specific performance characteristics of the monitoring system chosen by the project shall be listed in the Project Design Document, in accordance with AM0034. The tables below indicate such characteristics according to the corresponding QAL 1 report.

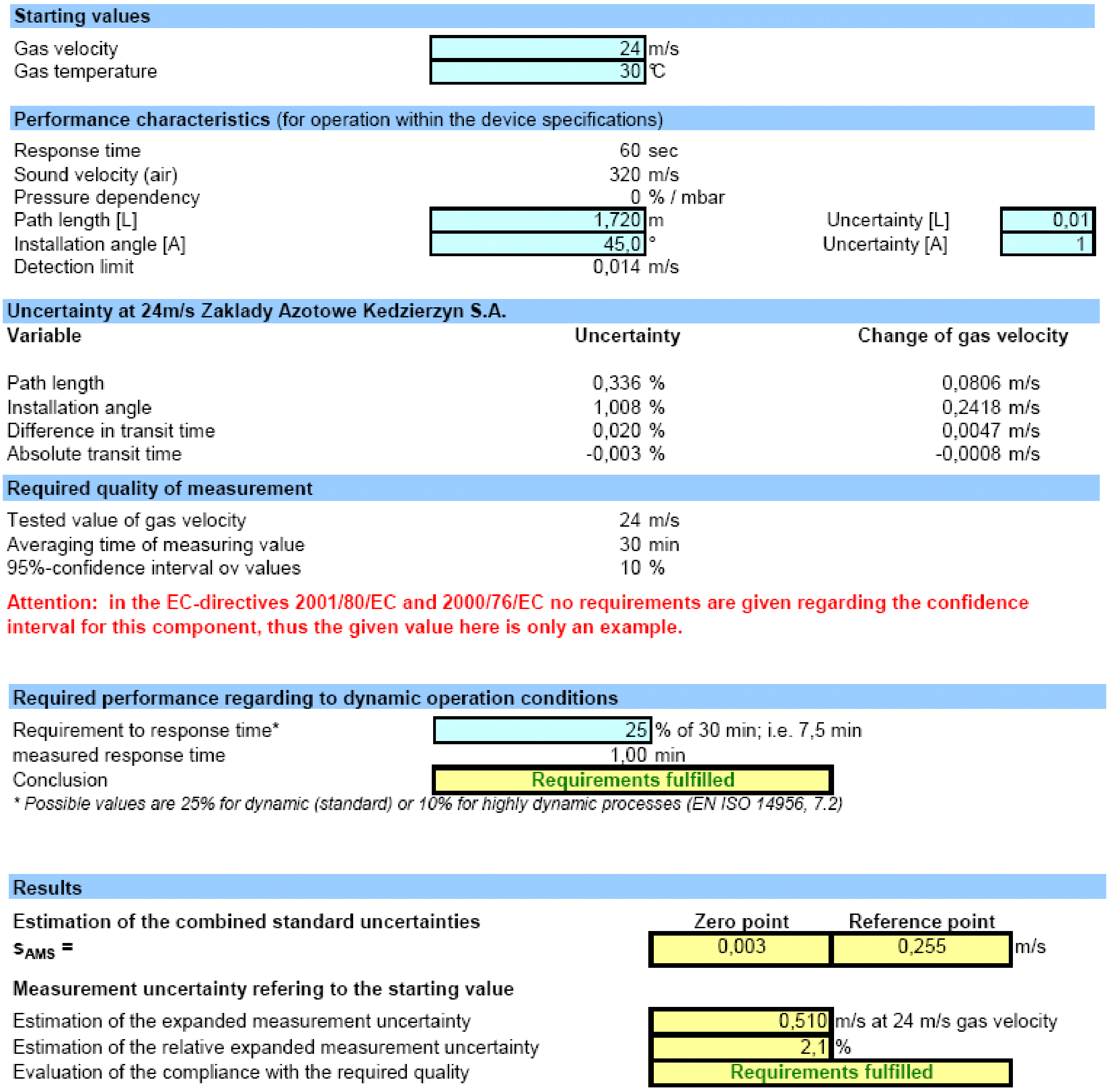
Specific performance characteristics for N_2O analyzer (ABB, EL3020 URAS 26)



Contributing partial standard uncertainties and reference to their origins

Selectivity H2O	0.06	mg/m^3
Selectivity others (largest sum)	3.05	mg/m^3
Lack of fit	0.93	mg/m^3
Drift	13.03	mg/m^3
Pressure dependence	0.00	mg/m^3
Temperature dependence	8.92	mg/m^3
Flow dependence	0.29	mg/m^3
Voltage dependence	0.52	mg/m^3
Repeatability	0.19	mg/m^3
Uncertainty of response factors	0.00	mg/m^3
Response time	44	seconds
Origin of data	*TÜV-Report no. 691317 (2006)*	
Long-term drift of calibration cell	5.10	mg/m^3
Origin of data	*Article in UmweltMagazin, 2001*	
Uncertainty of SRM	19.00	mg/m^3
Standard Reference Method (SRM), Reference	*Gas Chromatography, VDI 2469*	
Uncertainty of cylinder gas	29.44	mg/m^3
Origin of data	*Datasheet of gas supplier*	

Specific performance characteristics for stack flow meter (Flowsick 100 PMA)



Starting values

Gas velocity	24	m/s
Gas temperature	30	°C

Performance characteristics (for operation within the device specifications)

Response time	60	sec		
Sound velocity (air)	320	m/s		
Pressure dependency	0	% / mbar		
Path length [L]	1,720	m	Uncertainty [L]	0,01
Installation angle [A]	45,0	°	Uncertainty [A]	1
Detection limit	0,014	m/s		

Uncertainty at 24m/s Zaklady Azotowe Kedzierzyn S.A.

Variable	Uncertainty	Change of gas velocity
Path length	0,336 %	0,0806 m/s
Installation angle	1,008 %	0,2418 m/s
Difference in transit time	0,020 %	0,0047 m/s
Absolute transit time	-0,003 %	-0,0008 m/s

Required quality of measurement

Tested value of gas velocity	24	m/s
Averaging time of measuring value	30	min
95%-confidence interval ov values	10	%

Attention: in the EC-directives 2001/80/EC and 2000/76/EC no requirements are given regarding the confidence interval for this component, thus the given value here is only an example.

Required performance regarding to dynamic operation conditions

Requirement to response time*	25	% of 30 min; i.e. 7,5 min
measured response time	1,00	min
Conclusion	Requirements fulfilled	

** Possible values are 25% for dynamic (standard) or 10% for highly dynamic processes (EN ISO 14956, 7.2)*

Results

Estimation of the combined standard uncertainties	Zero point	Reference point	
s_{AMS} =	0,003	0,255	m/s

Measurement uncertainty refering to the starting value

Estimation of the expanded measurement uncertainty	0,510	m/s at 24 m/s gas velocity
Estimation of the relative expanded measurement uncertainty	2,1	%
Evaluation of the compliance with the required quality	Requirements fulfilled	

The complete EN 14181: 2004 QAL1 reports are provided by the equipment manufacturers considering the performance characteristics as measured by a qualified Technical Inspection Authority (such as the German TÜV) and the specific installation characteristics and site conditions at each plant. The QAL1 report confirms the N_2O analyzer is suitable for performing the indicated analysis (N_2O concentration), and provide a conservative estimate (meaning actual performance would be better) for expanded uncertainty. The complete QAL1 report is available for determination.

The overall measurement uncertainty (*UNC*) is calculated by summing in an appropriate manner (using the Gauss law of error propagation) all the relevant uncertainties arising from the individual performance characteristics of the AMS components (UNC = ((N_2O analyzer uncertainty)^2 + (Flow meter uncertainty)^2)$^{1/2}$). The overall measurement uncertainty is available for the determination of the project activity.

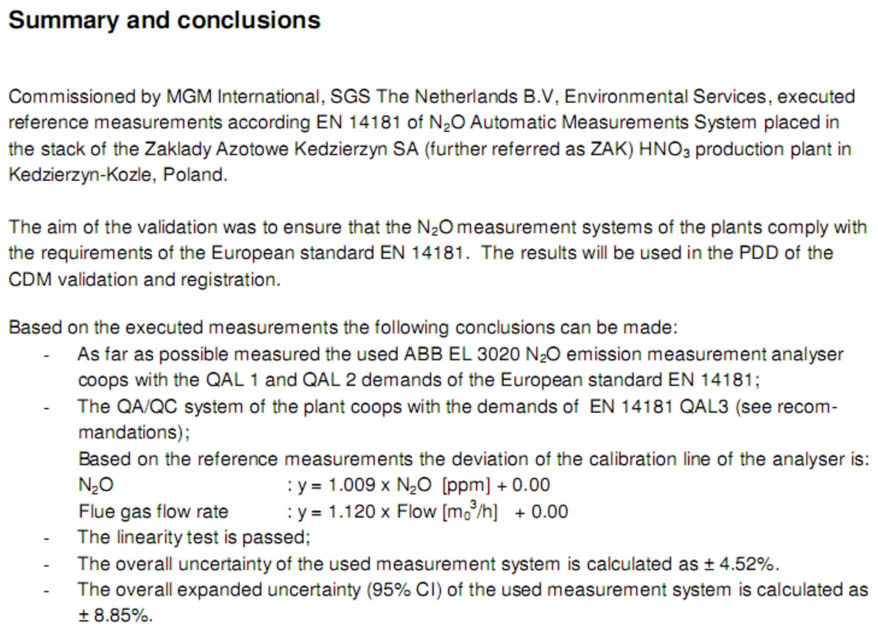
QAL2: Validation of the AMS following its installation

The next level of quality assurance prescribed in EN14181:2004 (QAL2) describes a procedure for the determination of the calibration function and its variability, by means of certain number of parallel measurements (meaning simultaneously with the AMS), performed with a Standard Reference Method (which should be a proven and accurate[6] analytical protocol according to relevant norms or legislation). The variability of the measured values obtained with the AMS is then compared with the uncertainty given by the applicable legislation. If the measured variability is lower than the permitted uncertainty, it is concluded the AMS has passed the variability test. Since (as explained above), official uncertainty is not available, an appropriate level is determined on the basis of those that do exist for similar pollutants and techniques (in this case 20% of ELV). According to international standards, there are two potentially suitable Standard Reference Methods: 1) bench scale gas chromatography according to VDI standard 2469 or 2) Non-dispersive Infrared Method, according to ISO 21258 (draft).

The testing laboratories performing the measurements with the Standard Reference Method shall have an accredited quality assurance system according to EN ISO/IEC 17025 or relevant (national) standards. SGS certifidy lab had conducted QAL2 test in ZAK. The QAL2 report from SGS is available for the determination process. Any data collected before the receipt of the QAL2 lab report was corrected through proper application of the calibration function.

As condition precedent for a QAL2 test, it is required that the AMS has been correctly installed and commissioned, considering (for example) that the AMS is readily accessible for regular maintenance and other necessary activities and that the working platform to access the AMS allows for parallel sampling. The AMS unit was installed by qualified contractors under the direct supervision of the equipment manufacturers, considering both relevant Polish and international standards. The Plant Manager, as well as members of ZAK Technology Engineering Support Group, actively supervised all phases of installation, from system design to commissioning.

Here are the conclusions of the QAL2 test in ZAK:



Summary and conclusions

Commissioned by MGM International, SGS The Netherlands B.V, Environmental Services, executed reference measurements according EN 14181 of N_2O Automatic Measurements System placed in the stack of the Zaklady Azotowe Kedzierzyn SA (further referred as ZAK) HNO_3 production plant in Kedzierzyn-Kozle, Poland.

The aim of the validation was to ensure that the N_2O measurement systems of the plants comply with the requirements of the European standard EN 14181. The results will be used in the PDD of the CDM validation and registration.

Based on the executed measurements the following conclusions can be made:

- As far as possible measured the used ABB EL 3020 N_2O emission measurement analyser coops with the QAL 1 and QAL 2 demands of the European standard EN 14181;
- The QA/QC system of the plant coops with the demands of EN 14181 QAL3 (see recommandations);
  Based on the reference measurements the deviation of the calibration line of the analyser is:
  N_2O : $y = 1.009 \times N_2O$ [ppm] + 0.00
  Flue gas flow rate : $y = 1.120 \times$ Flow $[m_0^3/h]$ + 0.00
- The linearity test is passed;
- The overall uncertainty of the used measurement system is calculated as ± 4.52%.
- The overall expanded uncertainty (95% CI) of the used measurement system is calculated as ± 8.85%.

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[6] Considering that EN 14181 does not specify what SRM to use for each specific compound, there is controversy as to which method is suitable as SRM for N_2O, since the best available technology (and hence the most accurate instrument) is the actual online instrument which is the subject of calibration by this method.

QAL3: Ongoing quality assurance during operation

Procedures described in QAL3 of EN 14181: 2004 checks for drift and precision, in order to demonstrate that the AMS is in control during its operations so that it continues to function within the required specification for uncertainty. This is achieved by conducting periodic zero and span checks on the AMS, and evaluating results obtained using control charts. Zero and span adjustments or maintenance of the AMS may be implemented as a result of such evaluation. The implementation and performance of the QAL3 procedures given in this standard are the responsibility of the plant (or AMS) owner.

The standard deviation according to QAL3 has been calculated by the equipment manufacturer on the basis of equipment performance characteristics and field conditions for the ZAK nitric acid plant. Calculation spreadsheets from the suppliers are available for determination. The data is used to monitor that the differences between measured values and true values of zero and span reference materials are equal to or smaller than the combined drift and precision value of the AMS multiplied by a coverage factor of 2 (2 times standard deviation of AMS, as described in QAL3 section of EN14181) on a weekly basis, with the aid of Shewart charts. Documented calibration procedure for weekly zero and span checks and resulting Shewart charts will be available on site for future determinations.

All monitoring equipment is serviced and maintained according to the manufacturer’s instructions and international standards by qualified personnel. Maintenance and service logs are well kept at the ZAK plant and are available for auditing purposes.

AST: Annual Surveillance Test (ongoing quality assurance).

The AST is a procedure to evaluate whether the measured values obtained from the AMS still meet the required uncertainty criteria, as evaluated during the QAL2 test. Like the QAL2, it also requires a limited number of parallel measurements using an appropriate Standard Reference Method. An AST should be performed. at least once every 3 years, considering that the total expected uncertainty of the AMS is well below the selected required uncertainty, provided ongoing quality assurance (QAL3) and equipment maintenance is proven to be well implemented (according to the current monitoring plan) during the annual determination audits.