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

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Annexes

SECTION A.   General description of project activity

A.1   Title of the project activity:

Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the nitric acid plant at Fertilizers & Chemicals Ltd., Haifa, Israel ("F&C").

Version 2.0

Date of Completion: 18 January 2007

A.2.   Description of the project activity:

The sole purpose of the proposed project activity is to significantly reduce current levels of N_2O emissions from the production of nitric acid at F&C's nitric acid plant in Haifa, Israel. The single burner high pressure plant nitric acid plant was designed by Weatherly and commissioned in 1959.

F&C is a business unit of ICL Fertilizers and the largest supplier to Israel's agricultural market of high-grade fertilizer products. It caters for the Israeli agriculture with products including nitrogen, phosphate, potash fertilizers, liquid compound and granulated NPK fertilizers, as well as specialty fertilisers.

To produce nitric acid, ammonia (NH_3) is reacted with air over precious metal – normally a platinum-rhodium (Pt-Rh) alloy – catalyst gauze pack in the ammonia oxidation reactor of nitric acid plants. The main product of this reaction is NO, which is metastable at the conditions present in the ammonia oxidation reactor and therefore reacts with the available oxygen to form NO_2, which is later absorbed in water to form HNO_3 – nitric acid. Simultaneously, undesired side reactions yield nitrous oxide (N_2O), nitrogen and water. N_2O is a potent greenhouse gas with a Global Warming Potential (GWP) of 310[1]. The project activity involves the installation of a new N_2O abatement technology; a pelletised catalyst that will be installed inside the ammonia oxidation reactor, underneath the precious metal gauzes. It is expected that this catalyst will reduce between 80% and 90% of current N_2O emissions.

The project transfers a new, clean technology to Israel that is not even common industrial practice in Annex 1 countries. Also, the project will lead to an enhancement of skills as employees will be trained to operate both the N_2O abatement catalyst and the Automated Monitoring System.

The financial benefits from the sale of Certified Emission Reductions ("CERs") will be used to offset the capital and operating costs of the project to provide for its continued operation throughout the crediting period. Through the sale of CERs, F&C will also be able to improve its profitability and ensure employment, contribute to economic prosperity in the region as well as invest in further clean technologies to improve its environmental performance.

In these aspects, the project contributes to Israel's Sustainable Development goals[2].

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[1] IPCC Second Assessment Report (1995)

[2] Government decision no. 246, dated 14th May 2003 ("Strategic Plan for Sustainable Development in Israel"); English version to be found under http://www.un.org/esa/agenda21/natlinfo/countr/israel/strategic_plan.pdf.

A.3.	Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Israel (host)	Fertilizers & Chemicals Ltd., Israel (Private)	No
Germany	N.serve Environmental Services GmbH, Germany (Private)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4.	Technical description of the project activity:

A.4.1.	Location of the project activity:

A.4.1.1.	Host Party(ies):

Israel

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

Haifa

A.4.1.3.	City/Town/Community etc:

Kiriat Ata (32° 48' 2" N and 35° 6' 23" E)

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

The F&C production facilities are located on an industrial site 6 km outside Haifa in the North of Israel. The plant is bordered by the rivers Zipori in the South and Kishon to the west. The production site's postal address is P.O. Box 1428, Haifa 31013, Israel. A regional map is shown below:

Photograph of F&C's Nitric Acid Plant:

Regional map:

Location of F&C's Nitric Acid plant

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

Sectoral Scope 5: Chemical Industry

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

The project activity entails a transfer of
- state-of-the art N_2O abatement technology which is not even commonly applied in Annex I countries.
- special monitoring equipment
- training of staff for installation, operation and maintenance of catalyst and monitoring equipment, etc.

A number of N_2O abatement technologies have become available in the past 2 years after some 10 years of research, development and industrial testing. Only now that N_2O regulation is going to be introduced in the EU by 2007 and with the incentives provided by the Kyoto Protocol nitric acid plant operators are considering adopting these technologies. N_2O abatement technology is now commercially available from a number of catalyst manufacturers, mainly from Germany and the UK. These technologies are proprietary and will be sold or leased to nitric acid plants. The financing of this technology is facilitated by the CDM. Hence, the CDM will enable nitric acid plants in non-Annex 1 countries to become the pioneers of N_2O abatement of the global nitric acid industry.

F&C is determined to install a secondary abatement catalyst upon the successful registration of its plant as a CDM project.

Catalyst Technology

F&C has contracted with Johnson Matthey plc to install its Amoxis Hybrid® RN20/101 catalyst system that consists of a standard precious metal gauze pack with an additional base metal catalyst.

The precious metal gauze pack – i.e. the primary catalyst required for the actual production of nitric acid – has been supplied to F&C by Johnson Matthey for a number of years. The design, composition and weight of that gauze pack will remain unchanged during the crediting period.

A secondary catalyst will reduce N_2O levels in the gas mix resulting from the primary ammonia oxidation reaction. A wide range of metals (e.g. Cu, Fe, Mn, Co and Ni) have shown to be of varied effectiveness in N_2O abatement catalysts. The Amoxis Hybrid® RN20/101 abatement catalyst is made of clover leave shaped pellets containing a Lanthanum-Cerium-Cobalt-Perovskite. The catalyst has been tried and tested in a number of nitric acid plants in Europe. The abatement efficiency has been shown to be 80% in the following reaction:

$$2N_2O \rightarrow 2N_2 + O_2$$
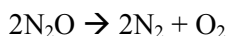
The Amoxis Hybrid® RN20/101 abatement catalyst does not contaminate the nitric acid produced in the respective nitric acid plant, neither with Cobalt nor with any of the other catalyst materials[3].

It does not require additional heat or other energy input, because the temperature levels present inside the Ammonia Oxidation Reactor suffice to ensure its optimum abatement efficiency. There are no additional greenhouse gases or other emissions generated by the reactions on at the N_2O abatement catalyst.

Basket modifications and Heat Shield design

Most nitric acid plants have some sort of basket structure that gives structural support to the precious metal gauzes. The ammonia oxidation reaction in F&C's nitric acid plant normally operates at between 910 and 920°C, which causes basket assembly to expand compared to when the plant is not operational (i.e. during installation of the catalyst).

This effect increases the basket diameter by 1 - 1.5%. The ammonia reactor of the F&C plant has a diameter of 980 mm that expands by 10 - 20 mm when in operation. This results in a gap of an average of 7.35 mm between the pelleted bed and the burner's outside wall. This gap will be of significantly lower ΔP than the pelleted bed. Hence an increase in gas flow will emerge equilibrating the ΔP throughout the system. The preferential gas flow through this gap can easily increase tenfold due to this effect.

To counter this occurrence, the basket which supports the gauze pack will have to be modified and an additional heat shield will have to be installed inside the existing basket to provide containment of the pelleted bed in a manner which prevents preferential gas flow at the perimeter.

N_2O abatement catalyst installation

The secondary catalyst itself is easily installable during a routine plant shut-down and gauze change. The pellets are poured into the support basket / heat shield arrangement and raked level. The gauze pack is then installed above this bed using the support mechanism provided by the heat shield.

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[3] This has been proven in industrial testing. The underlying information is commercially sensitive and will be made available to the CDM EB / the validator upon request.

The N_2O abatement catalyst is supplied to F&C by Johnson Matthey on a lease basis, which requires Johnson Matthey to take back the catalyst at the end of its useful life and refine, recycle or dispose of it according to EU regulations, hence fulfilling sustainability standards.

F&C's nitric acid plant operates at high pressure of 11.7 bar inside the ammonia oxidation reactor. Through the introduction of the secondary catalyst into the ammonia reactor, a slight pressure drop (ΔP) of <100 mbar is expected to occur. This ΔP may lead to a very slight reduction in ammonia conversion efficiency and hence a very small reduction in nitric acid output. In practice, this loss of production will be insignificant.

Technology transfer and safety issues

As mentioned before, 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. Neither is the environment directly or indirectly harmed in any other way.

The N_2O abatement catalyst is supplied to F&C by Johnson Matthey on a lease basis, which requires Johnson Matthey to take back the catalyst at the end of its useful life and refine, recycle or dispose of it according to EU regulations, hence fulfilling sustainability standards.

Once installed, the catalyst itself and the AMS ought to be operated by the local F&C-employees. All project participants will work together on training the F&C 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 a successful completion of each verification procedure.

A.4.4 Estimated amount of emission reductions over the chosen <u>crediting period</u>:

To estimate the amount of GHG emission reductions that the project activity will generate over the chosen crediting period, prospective future nitric acid production levels have to be taken into account.

Nitric acid is an intermediate product required for the production of high grade fertilisers. F&C's nitric acid plant is a high pressure, single reactor Weatherly plant which was commissioned in 1987 and is expected to operate for at least another 15 years. The plant is designed to operate campaigns of 83 days length and a production output of more than 14,000 $tHNO_3$. Depending on fertiliser demand, F&C operates between two and tree campaigns each year often with a longer shut-down over the winter months when storage tanks are full but fertiliser demand is low. Since 2000 inclusively, the F&C plant has been operated for an average of 198 days (equalling 2.38 campaigns).

F&C has produced an annual average of 35,046 $tHNO_3$ between the beginning of 2000 and the end of 2005: an average of 2.38 campaigns of 83 days each (adding up to of 198 days per year) with an average daily output of 177 $tHNO_3$ have been operated. However, there is a trend of increasing demand and for 2007 for example, F&C expects to produce at least 42,000 tonnes.

A complete Automated Monitoring System to monitor the mass emissions of N_2O at the stack of F&C's nitric acid plant has been installed and operated since November 5th, 2005. From the data collected during the baseline campaign an N_2O emissions factor (EF_{BL}) of 6.66 kg/$tHNO_3$ has been established.

Assuming an average annual production of 45,000 tHNO3 per year for the next 10 years, a 90% abatement efficiency of the N_2O abatement catalyst, the estimated emission reductions would be 83,554 tonnes of CO_2 equivalent per year.

Year	Annual estimation of emission reductions in tonnes of CO_2
2007	48,740
2008	83,554
2009	83,554
2010	83,554
2011	83,554
2012	83,554
2013	83,554
2014	83,554
2015	83,554
2016	83,554
2017	34,814
Total estimated reductions	835,540
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tCO_2/e)	83,554

A.4.5 Public funding of the project activity:

No public funding will has been or will be received for the development, the implementation or the operation of this project. The complete financing of the project will be borne by the Project Participants.

SECTION B.   Application of a baseline and monitoring methodology

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

This project is based on Approved Baseline and Monitoring methodologies AM0034 (Version 02): "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants".

Furthermore, the project draws on approved baseline methodology AM0028 (Version 04) for the baseline scenario selection and employs the "Tool for the demonstration and assessment of additionality" (Version 02).

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

The chosen baseline methodology AM0034 is applicable to project activities that install a secondary abatement catalyst inside the ammonia burner of a nitric acid plant, underneath the precious metal gauze pack. This corresponds with the proposed project activity.

The use of the chosen methodology is applicable because:

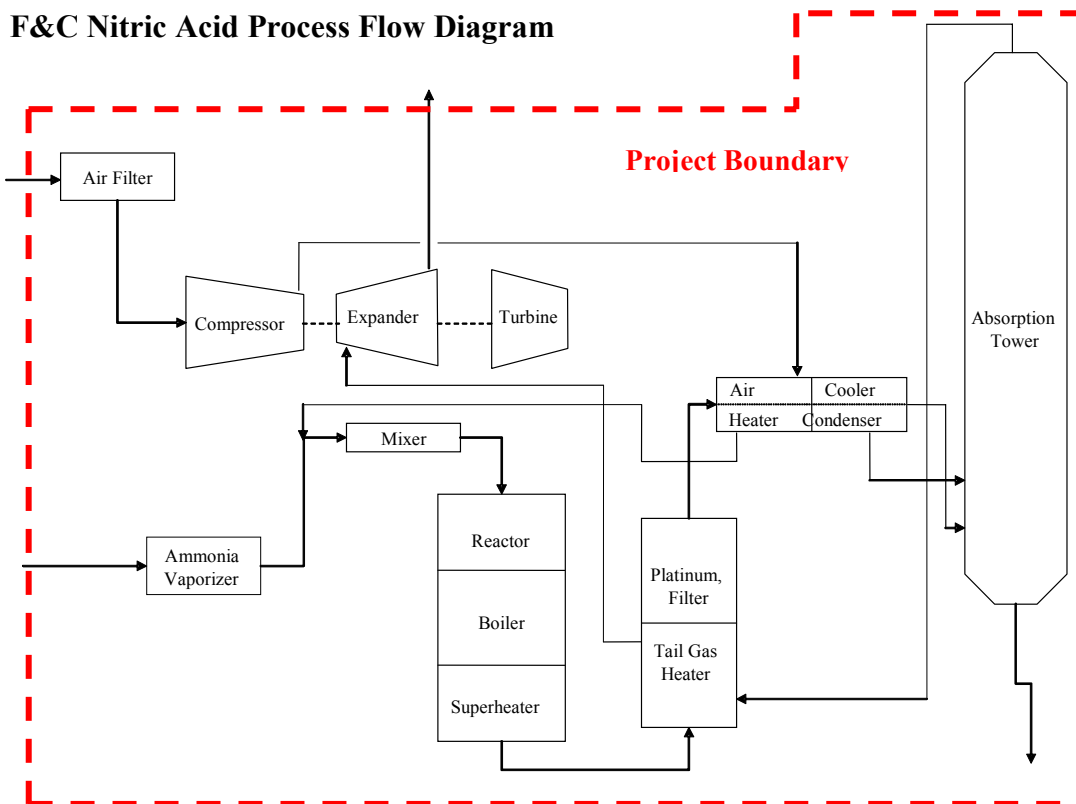1. The proposed project activity will be applied to an existing production facility installed prior to the 31st December 2005. The plant has been commissioned and is in operation since 1987.

2. Currently, the plant does not have any N_2O destruction or abatement facilities that could be affected by the project activity.

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

4. The host country does not have any legal requirements to reduce N_2O emissions from nitric acid plants.

5. Presently, no N_2O abatement technology is installed in the plant.

6. The project activity will not increase in NOx emissions.

7. There is no NSCR DeNOx-unit installed in the plant.

8. The installation of the secondary N_2O abatement catalyst will not lead to any additional direct or indirect GHG emissions within the project boundary.

9. A complete Automated Monitoring System (AMS), comprised of an N_2O analyser and a volume flow meter have been installed in the stack in November 2005. The AMS has been operated continuously to collect the baseline data and will continue to be operated to measure concentration and total gas volume flow in the stack during the plant's operation throughout the crediting period of the project activity.

This baseline methodology shall be used in conjunction with the approved monitoring methodology AM0034 ("Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants").

B.3.   Description of the sources and gases included in the project boundary
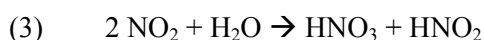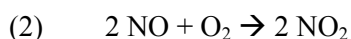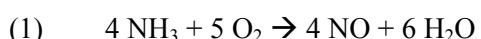
The following flow-chart displays the nitric acid plant on which the project activity is to be applied. It also indicates the location, where the secondary N_2O abatement mechanism is to be installed.

**F&C Nitric Acid Process Flow Diagram**

The gases relevant to the proposed project activity (and the nitric acid production plant which is subject to it) originate from the ammonia oxidation process that takes place at 910 to 920°C and 11.7 bar at the precious metal gauzes which are installed in the plant's ammonia oxidation reactor.

The main product of this reaction is NO created by oxidising ammonia (NH_3) with atmospheric oxygen (O_2) (reaction 1). NO readily oxidises further to form NO_2 (reaction 2) and thereafter put to react with water to form a mix of nitric and nitrous acid (reaction 3). Finally, nitrous acid is also transformed into nitric acid (reaction 4), entailing an emission of NO, which is partially oxidised to NO_2 (reaction 2). These intended chemical reactions (main reactions) are the following:

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

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

$$(3) \quad 2\ NO_2 + H_2O \rightarrow HNO_3 + HNO_2$$

$$(4) \quad 3\ HNO_2 \rightarrow HNO_3 + NO + H_2O$$

The ammonia oxidation process (see reaction 1 above) yields the desired NO molecules with a 95 to 97% probability, depending on the maintenance of the accurate temperature and pressure parameters inside the ammonia burner.

However, the operation of nitric acid plants entails several unwanted gaseous by-products that usually are emitted into the atmosphere. The undesired by-products are formed by the following reactions (side reactions) that also occur in the ammonia oxidation process:

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

$$(b) \quad 4\ NH_3 + 4\ O_2 \rightarrow 6\ H_2O + 2\ N_2O$$
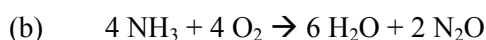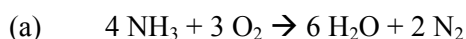
Side reaction (a) is irrelevant as it only results in the formation of water vapour and nitrogen, both present in the atmosphere in abundance. Reaction (b), however, leads to the emission of N_2O.

On leaving the ammonia oxidation reactor some of the N_2O generated may decompose

- In the high temperature homogenous gas phase inside the ammonia oxidation reactor (especially if the heat exchanger coils are inefficient or may be placed not directly underneath the ammonia oxidation section)

- At platinum deposits downstream of the ammonia oxidation reactor, provided that temperatures and contact time are sufficient and provided that any significant quantities of platinum are deposited in the first place

- In sections of the plant downstream of the ammonia oxidation reactor where temperatures are above 300°C when N_2O is thought to spontaneously decompose.

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

	Source	Gas	Included?	Justification / Explanation
Base-line	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	No	The process does not lead to any CO_2 or CH_4 emissions
		CH_4	No	
		N_2O	Yes	
Project Activity	Nitric Acid Plant (Burner Inlet to Stack)	CO_2	No	The process does not lead to any CO_2 or CH_4 emissions
		CH_4	No	
		N_2O	Yes	
	Leakage emissions	CO_2	No	No leakage emissions are expected.
		CH_4	No	
		N_2O	No	

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

The approved baseline methodology AM0034 requires the application of the procedures for baseline scenario identification as per AM0028 (in its most recent version). The following steps are taken from this methodology, adapted to the project activity in question and applied in a four-step-procedure: after the identification of all principally viable alternatives to the proposed project alternative (step 1), those that would not comply with applicable legal standards are eliminated (step2). After conducting a barrier analysis (step 3a) the most likely "business as usual" scenario is assessed. This is the assumed baseline scenario.

Step 1: Identification of all realistic, credible and technically feasible baseline scenario alternatives to the project alternative.

> *The AM0028-procedure suggests assessing N_2O and NO_x abatement scenarios separately. This is omitted, because NO_X abatement options are only relevant if the NO_X– regulations in Israel would require an amendment of the plant. F&C is in compliance with Israel's NO_X regulations by adding chilled water to the absorption column thereby reducing the amount of NO_X emitted through the stack.*

Currently the regulator NO_X emissions limit for F&C's nitric acid plant is 500mg/m^3. F&C does not exceed NO_X emission levels of 440 mg/m^3 even without having any tail gas NO_X abatement system installed. Instead F&C uses chilled water in the final stages of the NO_2 absorption process, which brings NO_X emission levels to well below the regulatory threshold in Israel.

The baseline scenario alternatives should include all possible options that are technically feasible to handle N_2O emissions. For the F&C plant, the principally debatable options are:

1) Status quo: The continuation of the current situation, without installing any N_2O abatement technology in the plant

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

3) Alternative use of N_2O such as:

    a) recycling of N_2O as feedstock for the plant;

    b) The use of N_2O for external purposes.

4) Installation of a Non-Selective Catalytic Reduction (NSCR) De NO_x -unit[4]

5) Installation of an N_2O abatement or reduction technology

    a) Primary or tertiary measures to prevent the formation or reduce N_2O

    b) A secondary facility to reduce N_2O (proposed project activity)

These options should also include the CDM project activity not implemented as CDM project.

The following options are technically not feasible:

Baseline scenario alternative 2) is not an option, because there is no other commercially viable alternative for producing nitric acid. In history, there have been other methods for producing nitric acid:

The *Birkland & Eyde* method applied electrical discharge on air to produce small quantities of NO_2 that could be reacted with water for equally small amounts of nitric acid. This procedure requires large amounts of electricity. It was applied for industrial production in Norway between 1902 and 1930. This method did not prevail as it entails significant production costs.

The same is to be said for nitric acid production according to the *Glauber* methodology. This was the main procedure used before now predominant Ostwald procedure was introduced. In entailed reacting saltpetre with sulphuric acid and required large amounts of both to match current production levels. Even if one considered these methods as viable options, amending an existent nitric acid production facility to operate using another process would not be possible. Thus, F&C could not switch to an alternative production method without building a completely new plant.

The use of N_2O as a feedstock for the F&C plant is technically not practicable as it is not possible to produce nitric acid from N_2O. The recovery of N_2O for the sake of gaining feedstock for the production process is not practiced in any known nitric acid plant.

The use of N_2O for external purposes is economically not viable as the quantity of gas to be filtered would be enormous compared to the amount of nitrous oxide that could be recovered. The N_2O concentration in the tail gas of F&C's plant is between 900 and 1200 ppmv.

The installation of a Non-Selective Catalytic Reduction (NSCR) De NO_X unit is not economically viable since F&C is already in compliance with the prevailing NO_X regulations. Should these NO_X regulations change in a way that would require F&C to install a NO_X abatement unit, the installation of an outdated technology (NSCR) cannot be conceived as a viable alternative to installing a state-of-the-art Selective Catalytic Reduction (SCR) DeNO$_X$ unit. Moreover, NSCR units require additional natural gas to achieve sufficient tail gas temperatures and/or the right reducing environment inside the catalyst. Israel is a major net importer of natural gas and ammonia (which is also produced from natural gas) and therefore it is highly unlikely that F&C would choose a technology that would require it to purchase even more natural gas.

Therefore, the baseline alternatives 2), 3) a) and b) as well as 4) can be excluded from further assessment.

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[4] NSCR: As a NSCR DeNO$_x$ -unit would reduce N_2O emissions as a side reaction to the NO_x -reduction, a new NSCR installation can be regarded as an alternative N_2O reduction technology.

Step 2: Elimination of all baseline scenario alternatives that are not in compliance with applicable legal or regulatory requirements. This step may also include laws and regulations that have another objective than GHG reduction, such as national or local NO_x regulations.

As stated in Step 1 above, current NO_X regulations in Israel allow for the continued operation of F&C's nitric acid plant in its current state. There is no legal limit for N_2O emissions in Israel.

Currently, there are no laws or regulations in place that would be applicable to any of the named scenario alternatives.

Therefore, this step does not lead to the exclusion of any of the aforementioned baseline scenario alternatives.

Step 3: Identification of those baseline scenario alternatives that face prohibitive barriers (step 3a) and naming of the most likely scenario alternative (step 3b).

Step 3a of the baseline identification process, all baseline scenario alternatives that face prohibitive barriers (investment related, technical or incompatibility with the prevailing practice) are to be eliminated.

- **Investment barriers (economic/financial)**

None of the N_2O destruction facilities (including NSCR) are expected to generate any financial or economic benefits other than CDM related income. Their operation does not create any marketable products or by-products. However, any operator willing to install and thereafter operate such technology faces significant investment costs. The legislative and regulatory environment in Israel does not require any investment in N_2O abatement technology. Thus, any investment would be an entirely voluntary financial burden.

Therefore, any baseline scenario alternatives implementing catalysts will entail considerable investment barriers. Only the project activity scenario may not be hindered due to investment requirements if one assumes that CER revenues outstrip investment costs.

- **Technical barriers**

Any of the available N2O abatement technologies are installed in a way that they will become part of the nitric acid production plant. Primary and secondary abatement technologies are installed inside the ammonia oxidation reactor of the nitric acid plant where they may, if not correctly designed and installed, interfere with the nitric acid production process which may cause a deterioration of product quality or loss of production output. Tertiary measures require the installation of a complete catalyst container between the absorption column and the stack which may cause significant downtime of the plant during construction and commissioning.

It is unlikely that any plant operator would install such technologies on a voluntary basis without the incentive of any regulatory (emissions caps) or financial benefits (CERs).

- **Barriers due to prevailing practice**

The installation of N_2O abatement technology currently is neither industrial practice in Israel nor in the Middle East region.

The first installation of N_2O abatement technology in a nitric acid plant in the region is currently taking place at Abu Qir in Egypt. Also, F&C Ltd. which is located nearby of the F&C plant is in the process of developing a CDM project comprised of the installation of secondary N_2O abatement catalysts.

These three projects are "first of their kind" not only in the Middle East Region but even around the world.

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

Under step 3a it was demonstrated that those baseline scenario alternatives entailing the installation of N_2O abatement catalysts face considerable obstacles.

The only baseline alternative that is not prevented by any one of the barriers and that is in full compliance with the prevailing laws and regulations in Israel is the status quo: The continuation of the current situation, without installing any N_2O abatement technology in the plant. Therefore, this is identified as the applicable baseline scenario for the proposed project activity.

All other alternatives are eliminated and Step 4 (Identify the economically most attractive baseline alternative) can therefore be omitted.

The table below summarises the findings of this section B.4.:

Baseline Scenario Alternative	Legal / Technical preclusion	Identified barriers			Probability
		Investment related	Technical	Common practice related	
Continued plant operation without change	No	No	No	No	Very Low
External use of N_2O	Yes (Technical)	Irrelevant	Irrelevant	Irrelevant	Excluded
N_2O re-cycling as feedstock for production	Yes (Technical)	Irrelevant	Irrelevant	Irrelevant	Excluded
Installation of a NSCR DeNO$_X$ unit	No	Yes	Yes	Yes	Very Low
Installation of an SCR DeNO$_X$ unit	No	Yes	No	Yes	Low
Proposed project activity not implemented as a CDM project	No	Yes	No	Yes	Very Low
Proposed project activity	No	No (if CER revenues ≥ investment)	No	Yes	

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

This section employs the "Tool for the demonstration and assessment of additionality" (Version 02) as agreed by the CDM Executive Board and published on 28th November 2005 ("Additionality Tool").

Step 1: As suggested by AM0034 (Version 01), step 1 of procedure proposed by the Additionality Tool has been omitted. The identification of scenarios in alternative to the project activity has been conducted within the baseline scenario identification process (see B.4. above).

Steps 2 and 3: To establish additionality, the Additionality Tool requires an investment or a barrier analysis, focussing on the comparison of the proposed project activity with the baseline scenario. Alternatively project applicants can select to do both.

Here, an investment analysis is chosen to carry out this part of the procedure. This corresponds with step 2 of the Additionality Tool; thus, step 3 comprising the option of a barrier analysis is omitted.

Step 2a: At first, the appropriate investment evaluation methodology has to be chosen.

As demonstrated above (B.4.), neither the project activity nor the identified baseline scenario generate any additional financial or economic benefits besides those obtainable from the sale of CERs, which implies the applicability of a simple cost analysis. This evaluation method is chosen here.

Step 2b – Option I. Simple Cost Analysis:

The proposed project activity will lead to significant investment costs for the installation of a modified basket and a new heat-shield in addition to the regular lease costs payable for the installation and regular replacements of the N_2O abatement catalyst. The total investment and operating/lease costs of the project activity (excluding the CDM related costs like Monitoring System, Validations etc.) are estimated to be approximately EUR 470,000 up until 2012[5]. There may be increased energy costs associated with the slight pressure drop inside the ammonia oxidation reactor resulting from the introduction of the catalyst.

The chosen baseline scenario alternative – the continuation of the current situation, operating the nitric acid plant without an N_2O abatement catalyst – does not incur any additional costs.

Therefore, the proposed project activity is financially and economically less attractive than the baseline scenario.

Step 4 (Step 3, Barrier Analysis is omitted, see above):

Step 4 has the purpose to assess the common industrial practice in the area, where the project activity is to be implemented and thus verify the results obtained in the previous steps. If the technology that is to be installed already is the common industrial practice in the region, this would be a counter-indication for the assumption that there are financially and economically more attractive alternatives and / or considerable barriers for its implementation.

Market studies (e.g. by EFMA, EU IPPC, US EPA, IPCC) show that N_2O abatement technologies have not yet spread out into the nitric acid industry in Annex 1 countries, apart from occasional industrial testing. The main reason for this is a lack of regulation / incentive to reduce N_2O emissions.

The research and development work done so far have been driven by a general expectation that industrialised countries – especially the EU, USA, Japan and Canada – may eventually introduce N_2O emission caps. EU legislation initiating such a limit is under way already and will probably enter into force in 2007.

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[5] More detailed confidential information on investment and operation costs can be disclosed to the DOE upon request during the validation process.

The installation of N_2O abatement technology currently is neither industrial practice in Israel nor anywhere else in the Middle East region. The common practice in the area is to operate such facilities without any N_2O abatement technology. However, currently all nitric acid producers in the region (e.g. in Israel and Egypt) are pursuing the implementation of secondary or tertiary N_2O abatement technologies in order to participate in the CDM.

Therefore, the analysis of the common industrial practice indicates that the proposed project activity is additional to the baseline scenario.

Step 5:

At step 5, it is to be demonstrated that the registration of the project activity as a CDM project can help to alleviate the economic and financial hurdles identified in Step 2 and thus enable the project activity to be undertaken.

As shown above, the proposed project activity will not generate any additional income other than CER-related revenues. Therefore, in order for F&C to carry out the project, it has to generate at least enough revenues from the sale of CERs in order to cover the costs of implementing and operating the project.

Assuming a conservative CER market value of EUR 6.00, the project is expected to generate CER related revenues of approximately EUR 5.01 m throughout the crediting period. This is more than the expected investment and operating costs for the project for the same period. Therefore, a CDM-registration would pave the way for the installation of a secondary N_2O abatement catalyst at the F&C's nitric acid plant in Haifa, Israel.

The financial benefit of the revenue obtained by selling CERs will alleviate the economic and financial hurdles identified in Sub-step 2b above. Therefore, the registration as a CDM project activity and the resulting expected revenues from the sale of CERs will enable the management of F&C to commit to investing in the proposed project activity.

B.6.	Emission reductions:

	B.6.1.	Explanation of methodological choices:

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

In order to avoid the possibility that the operating conditions of the nitric acid production plant are modified in such a way that increases N2O generation during the baseline campaign, the normal ranges for operating conditions shall be determined for the following parameters: (i) oxidation temperature; (ii) oxidation pressure; (iii) ammonia gas flow rate, and (iv) air input flow rates. The permitted range shall be established using the procedures described below. Note that data for these parameters is routinely logged in the process control systems of the plant.

i. Oxidation temperature and pressure:

Process parameters monitored:
OTh Oxidation temperature for each hour (°C)
OPh Oxidation pressure for each hour (Pa)
OTnormal Normal range for oxidation temperature (°C)
OPnormal Normal range for oxidation pressure (Pa)

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

Parameters monitored:
AFR Ammonia gas flow rate to the AOR (tNH3/h)
AFRmax Maximum ammonia gas flow rate to the AOR (tNH3/h)
AIFR_ Ammonia to air ratio (%)
AIFRmax_ Maximum ammonia to air ratio (%)

For the determination of the permitted operating conditions, the historic operating data for OTh, OPh, AFR and AIFR were recorded by the process control system for the previous 5 campaigns and analysed by using the hourly average values.

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

N_2O concentration and gas volume flow are to be monitored throughout the baseline campaign by an Automated Monitoring System (AMS) which is to be installed and operated using European Norm 14181 (2004) as guidance where applicable. The AMS provides separate readings for N_2O concentration (NCSG) and gas volume flow (VSG) continuously. Error readings (e.g. downtime or malfunction) and extreme values are to be automatically eliminated from the output data series by the monitoring system.

Measurement results can be distorted before and after periods of downtime or malfunction of the monitoring system and can lead to mavericks. To eliminate such extremes and to ensure a conservative approach, the following statistical evaluation is to be applied to the complete data series of N2O concentration as well as to the data series for gas volume flow. The statistical procedure will be applied to data obtained after eliminating data measured for periods where the plant operated outside the permitted ranges:

    a) Calculate the sample mean (x)
    b) Calculate the sample standard deviation (s)
    c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation)
    d) Eliminate all data that lie outside the 95% confidence interval
    e) Calculate the new sample mean from the remaining values (volume of stack gas (VSG) and N2O concentration of stack gas (NCSG))

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

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

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

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

In the absence of any national or regional regulations for N_2O emissions in Israel, the resulting EF_{BL} will be used as the baseline emission factor.

The gauze supplier and gauze composition during the baseline campaign is the same as during the historic campaigns used to establish the permitted operating conditions. Therefore, the EF_{BL} derived is valid.

The plant was operating within the permitted range of normal operating conditions for more than 50% of the time, therefore the baseline campaign is valid and the resulting EFBL can be applied to calculate the resulting emission reductions of the project.

Campaign Length

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

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

If $CL_{BL} \leq CL_{normal}$, then all N_2O values measured during the baseline campaign can be used for the calculation of EF_{BL} (subject to the elimination of data that was monitored during times where the plant was operating outside of the "permitted range").

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

Statistical Tests comparing Baseline Campaign with "normal" operating conditions

In accordance with AM0034, statistical tests should be performed to compare the average values of the permitted operating conditions with the average values obtained during the baseline campaign.

Since no specific statistical tests are prescribed in AM0034, the project proponents used the statistical tests that are already being used in AM0034 to ensure a consistent approach.

If the mean values for OTh, OPh, AFR and AIFR obtained during the baseline campaign fall within the 95% confidence interval (1.96 times the standard deviation) of the normal operating conditions, then the baseline campaign is considered to be representative of a normal campaign.

The result of these tests was that the baseline campaign is representative of a normal campaign because all four mean values obtained during the baseline campaign fall within the 95% confidence interval of the normal operating conditions.

Leakage

As per methodology AM0034, no leakage emission calculation is required since no leakage emissions are expected to occur as a result of the project activity.

Project Emissions

Over the duration of the project activity, N_2O concentration and gas volume flow in the stack of the nitric acid plant as well as the temperature and pressure of ammonia gas flow and ammonia-to-air ratio will be measured continuously.

The same statistical evaluation that was applied to the baseline data series is applied to the project data series of NCSG and VSG:

a) Calculate the sample mean (x)

b) Calculate the sample standard deviation (s)
c) Calculate the 95% confidence interval (equal to 1.96 times the standard deviation)
d) Eliminate all data that lie outside the 95% confidence interval
e) Calculate the new sample mean from the remaining values

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

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

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

$$EF_n = PE_n / NAP_n$$

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

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

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

To calculate the total emission reductions achieved in a campaign according to the formula below, the higher of the two values $EF_{ma,n}$ and EF_n shall be applied as the emission factor relevant for the particular campaign to be used to calculate emissions reduction s (EF_p). Thus:

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

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

Minimum Project Emissions Factor

N_2O emissions that may result from a potential built up of platinum deposits. After the first ten campaigns of the crediting period of the project, the lowest EF_n observed during those campaigns will be adopted as a minimum (EF_{min}). EF_{min} Is equal to the lowest EF_n observed during the first 10 campaigns of the project crediting period ($N_2O/tHNO_3$). If any of the later project campaigns results in a EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall used EF_{min} and not EF_n.

Project Campaign Length

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

Emission Reductions

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

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

According to AM0034, the value for Nitric acid production (NAP) during the project campaign shall not exceed the design capacity of the nitric acid plant.

The existing production capacity is 64,605 metric tonnes of 100% concentrated nitric acid per year (based on 365[6] operating days per year and a daily nameplate capacity of 177 tonnes per day of nitric acid). Therefore, the F&C's nitric acid plant shall not be eligible to earn CERs for any tonnes of nitric acid produced exceeding 64,605 in any one year.

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

All of the monitoring equipment used to derive the data for this PDD has been made part of the ISO 9001/14001 procedures.

All of the data obtained and used as part of the baseline and during the crediting period of the project will be archived electronically for at least 2 years in at least 2 different locations.

Data reporting and storage: Analogue input in Siemens PLC type S7 300 operating with HMI, type WIZCON data registration once a minute. Data file stored in HD, backed-up on tape, available from 2003 onwards.

Data / Parameter:	**B.1 NCSG$_{BC}$**
Data unit:	mg N_2O / m³ (converted from ppmv, if necessary)
Description:	N_2O concentration in the stack gas during the baseline campaign.
Source of data used:	Servomex Xentra 4900 Continuous Emissions Analyser
Value applied:	2,207
Justification of the choice of data or description of measurement methods and procedures actually applied :	AM0034 requires the determination of the concentration of N_2O in the stack gas. NCSG is continuously monitored with the gas analyser[7]. Monitoring results are recorded for every second of plant operation. Hourly means for NCSG are derived from the collected data. NCSG data taken during times when the respective plant was operating outside the permitted operating range were eliminated. The remaining NCSG values where subjected to the following adjustment. The analyser reads ppmv (parts per million in volume); in order to obtain mg/Nm³ is necessary use the next equation: $$NCSG = ppmv * \frac{RMM}{v}$$ Where: *NCSG* is N_2O concentration in the stack gas (mg/N m³) *ppmv* means parts per million in volume *RMM* means relative molecular mass of N_2O (44.013 mg) *v* means standard volume of an ideal gas (22.4 Nm³)

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[6] As per AM0034 page 11.

[7] The Servomex Xentra 4900 gas analyser has been designed according to ISO 14956 specifications. Formal QAL1 procedures as suitable for stack gas concentration monitoring have not been conducted. At the time of installation of the AMS at F&C, no analyser was available on the market that had already passed the QAL1 suitability certification for N_2O.

The resulting hourly average NCSG values are now expressed in mg/Nm^3 as required by AM0034 and where subsequently subjected to the following statistical analysis:

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 NCSG values

Any comment:	none

Data / Parameter:	**B.2 VSG$_{BC}$**
Data unit:	Nm^3/h
Description:	Normal gas volume flow rate of the stack gas during the baseline campaign.
Source of data used:	Gas Volume Flow meter DFL 100 (multiple point pitot tube) from Durag
Value applied:	22,011
Justification of the choice of data or description of measurement methods and procedures actually applied :	AM0034 requires the determination of the gas volume flow (VSG) in the stack. VSG is continuously monitored with a flow meter (operational since May 7, 2006) and monitoring results are recorded for every second of plant operation. The DFL 100 was tested by TÜV Nord and found suitable under 17. BImSchV and QAL1. Hourly means for VSG are derived from the collected data. VSG data taken during times when the respective plant was operating outside the permitted operating range were eliminated. The remaining VSG data series has been subjected to the following adjustment. The flow meter was installed with an operational range of 0 – 10 mbar of differential pressure. To obtain the flow (Nm3/h) at normal conditions (101.325 kPa and 0°C) from measured differential pressure the instrument equation – taken from the AMS manual – is used which includes pressure and temperature correction factors. Calculation formula (standard volume flow): $$V_n = K_x * \frac{\sqrt{P}}{\sqrt{(273,15+T)}} * \sqrt{dP} \qquad \text{whereby:} \qquad K_x = \frac{0,020763 * D^2 * k}{\sqrt{\rho_N}}$$ calculated: Kx = 7774 Where: *VSG* means standard volume flow (Nm^3/h) *D* means stack inner diameter (mm) *ρN* means standard density (kg/Nm^3) *k* means instrument correction factor (specific for each individual instrument) *P* means pressure working conditions (mbar) *T* means temperature working conditions (°C)

	ΔP means differential pressure (mbar) *0.020763* is the unit conversion factor The resulting hourly average VSG values are now expressed in Nm^3/h as required by AM0034 and where subsequently subjected to the following statistical analysis: 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 VSG values
Any comment:	none

Data / Parameter:	**B.3 BE$_{BC}$**
Data unit:	tN_2O
Description:	Total N_2O gas flow for baseline campaign
Source of data used:	Calculation from measured data (B.1 and B.2)
Value applied:	Exact calculation result
Justification of the choice of data or description of measurement methods and procedures actually applied :	The total mass N_2O emissions during the baseline campaign are determined as a product of NSCG, VSG and the total hours of operation during that baseline campaign: $BE_{BC} = VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC}$
Any comment:	none

Data / Parameter:	**B.4 OH$_{BC}$**
Data unit:	h
Description:	Operating hours
Source of data used:	Production log
Value applied:	1,870
Justification of the choice of data or description of measurement methods and procedures actually applied :	During the baseline campaign, the plant was operational for a total of 2,062 hours. However, due to an adjustment of the NAP value to be in line with CL_{normal}, the OH value had to be adjusted accordingly. All NAP and OH values from including 21. December 2006 to the end of the baseline campaign (morning of 30 December 2006) have been excluded.
Any comment:	none

Data / Parameter:	**B.5 NAP$_{BC}$**
Data unit:	$tHNO_3$
Description:	Nitric acid (100% conc.) over baseline campaign

Source of data used:	Production Log.
Value applied:	13,338
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement by Magnetic Flow Meter, PT100 for temperature and aerometric densimeter for concentration evaluation. Point of measurement is the product line, close to the exit from the absorption column leading to the storage tank.
	Specially elaborated Access routine calculates concentration of the product and its total output by flow (on-line), density (last measured in sample), product line temperature (on-line) using regression (R^2>0.8).
	The total amount of nitric acid produced during the baseline campaign was 14,551 tonnes (100% concentrated). However, according to AM0034, NAP had to be adjusted in line with CL_{normal}. Hence, the final hours of production of NAP after 21 December 2006 at 13:00 hours were excluded from the derivation of NAP_{BC}, BE_{BC} and EF_{BL}.
Any comment:	None

Data / Parameter:	B.6 TSG
Data unit:	Degrees Centigrade (°C)
Description:	Temperature of the stack gas
Source of data used:	Probe (part of gas volume flow meter)
Value applied:	n/a
Justification of the choice of data or description of measurement methods and procedures actually applied :	Not reported.
Any comment:	The temperature measurements of the stack gas are required to calculate the Normal Volume Flow (Nm^3/h) in the stack and is not required to be reported as a separate parameter in accordance with AM0034.

Data / Parameter:	B.7 PSG
Data unit:	bar
Description:	Pressure of stack gas
Source of data used:	Probe (part of the gas volume flow meter)
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	As prescribed by AM0034
Any comment:	None

Data / Parameter:	B.8 EF_{BL}
Data unit:	$tN_2O / tHNO_3$
Description:	Emissions factor for baseline period
Source of data used:	Calculated from measured data (tons of nitric acid produced / tons of N_2O emitted)
Value applied:	6.66
Justification of the choice of data or description of measurement methods and procedures actually applied :	As required by AM0034 the plant specific baseline emissions factor representing the average N_2O emissions per tonne of nitric acid during the baseline campaign is derived by dividing the total mass of N_2O emissions by the total output of 100% concentrated nitric acid during the baseline campaign. The overall uncertainty of the monitoring system shall also be determined and the measurement error will be expressed as a percentage (UNC).
	The product of the NCSG, VSG and OH is the total N_2O mass emissions during the baseline campaign.
	However, during reference measurements carried out by an accredited testing house under the guidance of EN14181 QAL2 it was determined that the measurements of N_2O concentration taken by F&C were on average 1.997% lower than the reference measurements. In accordance with prevailing practice under emission regulations in Europe, this factor will be used to correct the NCSG measurements in the calculation of BE prior to applying the total calculated uncertainty UNC of the AMS to the calculated EF_{BL}. Therefore, the formula for the calculation of BE is as follows: $BE_{BC} = VSG * NCSG * 1.1997 * 10^{-9} * OH$
	The N_2O emission factor per tonne of nitric acid produced in the baseline period (EF_{BL}) shall then be reduced by the percentage uncertainty as follows:
	$EF_{BL} = (BE_{BC} / NAP_{BC}) (1 - UNC/100) (tN_2O/tHNO_3$
Any comment:	none

Data / Parameter:	B.9 UNC
Data unit:	%
Description:	Overall measurement uncertainty of the monitoring system
Source of data used:	Calculation of combined uncertainty of the applied monitoring equipment
Value applied:	4.87
Justification of the choice of data or description of measurement methods and procedures actually applied :	In November 2006 the overall AMS uncertainty was determined and a series of reference measurements under the guidance of QAL2 of EN14181 was carried out by an accredited testing house.
	During these reference measurements it was determined that the measurements of N_2O concentration taken by F&C were on average 1.997% lower than the reference measurements. In accordance with prevailing practice under emission regulations in Europe, this factor will be used to correct the NCSG measurements in the calculation of BE prior to applying the total calculated uncertainty UNC of the AMS to the calculated EF_{BL}.

Any comment:	none

Data / Parameter:	**B.10 AFR**
Data unit:	$kgNH_3/h$
Description:	Mean Ammonia gas flow rate to the Ammonia Oxidation Reactor (AOR)
Source of data used:	Monitored by Orifice plate (without temperature and pressure compensation)
Value applied:	Not applicable, monitored data of AFR will be used to determine if plant was operating outside of AFR_{max}.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The monitoring of AFR is required by AM0034 in order to determine when the plant was operating outside of AFR_{max} and to eliminate those NCSG and VSG data.
Any comment:	none

Data / Parameter:	**B.11 AFR$_{max}$**
Data unit:	$kgNH_3/h$
Description:	Maximum Ammonia flow rate
Source of data used:	Plant records
Value applied:	4,276
Justification of the choice of data or description of measurement methods and procedures actually applied :	AFR_{max} is used to determine those periods where the plant may be operating outside of the permitted operating conditions. The AFR data from the previous 5 campaigns was used to determine AFR_{max} during these campaigns after the exclusion of the upper and lower 2.5% percentiles.
Any comment:	None

Data / Parameter:	**B.12 AIFR**
Data unit:	% v/v of NH_3 in air
Description:	Mean Ammonia to air ratio into the ammonia oxidation reactor
Source of data used:	Calculated from measured data of AFR and primary air flow rate.
Value applied:	Not applicable, monitored data of AIFR will be used to determine if plant was operating outside of $AIFR_{max}$.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The monitoring of AIFR is required by AM0034 in order to determine $AIFR_{max}$. The permitted range for the NH_3 to Air ratio is taken from the data of the historic campaigns. Primary Air flow is measured with a Venturi dP flow meter.
Any comment:	AM0034 (Version 02) states that the units for AIFR should be m^3/h, this is a mistake. AIFR should be expressed as a ratio or percentage volume by volume of Ammonia in Air.

Data / Parameter:	B.13 CL_{BL}
Data unit:	$tHNO_3$
Description:	Length of the baseline campaign measured in metric tonnes of 100% concentrated nitric acid produced during that baseline campaign.
Source of data used:	NAP_{BC}
Value applied:	14,551
Justification of the choice of data or description of measurement methods and procedures actually applied :	CL_{BL} is comprised of each and every tonne of nitric acid produced during the baseline campaign, regardless of whether the measured NCSG and VSG data were excluded from the relevant period. In accordance with AM0034 the respective baseline campaign length for each plant (CL_{BL}) has to be compared to the established average historic campaign length (CL_{normal}); and If $CL_{BL} \leq CL_{normal}$, then all N_2O values measured during the baseline campaign can be used for the calculation of EF_{BL} (subject to the elimination of data that was monitored during times where the plant was operating outside of the "permitted range"). If $CL_{BL} > CL_{normal}$, then N_2O values that were measured beyond the length of CL_{normal} during the production of the quantity of nitric acid (i.e. the final tonnes produced) are to be eliminated from the calculation of EF_{BL}. CL_{BL} exceeds CL_{normal} by 1,211 tonnes of nitric acid. Therefore, the time data series of CL_{BL} was cut by the last few hours of measurements until the NAP value for CL_{BL} was just below CL_{normal} at 13,338.
Any comment:	None

Data / Parameter:	B.14 CL_{normal}
Data unit:	$tHNO_3$
Description:	Average length of the five historic campaigns measured in metric tonnes of 100% concentrated nitric acid.
Source of data used:	Production Log
Value applied:	14,340
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement by Magnetic Flow Meter, PT100 for temperature and aerometric densimeter for concentration evaluation. Point of measurement is the product line, close to the exit from the absorption column leading to the storage tank. Specially elaborated Access routine calculates concentration of the product and its total output by flow (on-line), density (last measured in sample), product line temperature (on-line) using regression ($R^2 > 0.8$). CL_{normal} is used to adjust CL_{BL} and NAPBC in accordance with AM0034.
Any comment:	None.

Data / Parameter:	**B.15 $AIFR_{max}$**
Data unit:	% v/v of NH_3 in air
Description:	Maximum Ammonia to air ratio into the ammonia oxidation reactor
Source of data used:	Calculated from measured data of AFR and primary air flow rate.
Value applied:	13.59
Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance with AM0034 $AIFR_{max}$ is used to determine those periods where the plant may be operating outside of the permitted operating conditions.
	The AIFR data from the previous 5 campaigns was used to determine $AIFR_{max}$ during these campaigns after the exclusion of the upper 2.5% percentile.
	In practice, AIFR is a critical parameter for controlling the plant's operation. The critical threshold for F&C's high pressure nitric acid plant is an AIFR of 7.77%, if the ammonia ratio is any higher, the plant will "trip", i.e. shut down automatically. Because the measurement of AIFR continues during periods of start up and shut down, some extreme AIFR values are recorded and even after the percentile analysis of AIFR data, a fairly high value of 13.59 remains as the valid $AIFR_{max}$ in accordance with the methodology. However, when the OTh, OPh, AFR_{max} and $AIFR_{max}$ limits are applied to the baseline campaign, the remaining AIFR values range from 6.60 to 7.02 which is well below the "trip" threshold of 7.77 – therefore it is unnecessary to use 7.77 as a fixed $AIFR_{max}$ value during the baseline campaign.
Any comment:	AM0034 (Version 02) states that the unit for AIFR is m^3/h, this is a mistake: AIFR should be expressed as a ratio or percentage volume by volume of Ammonia in Air.

Data / Parameter:	**B.16 OT_h**
Data unit:	°C
Description:	Oxidation temperature for each hour during the baseline campaign
Source of data used:	Thermocouples inside Ammonia Oxidation Reactor (AOR)
Value applied:	Not applicable, used to determine if OTh during baseline campaign falls outside OT_{normal}.
Justification of the choice of data or description of measurement methods and procedures actually applied :	OTh is measured by two Type-K thermocouples (TT1203 and TT1208) at two different locations inside the Ammonia Oxidation Reactor.
	In accordance with AM0034 the oxidation temperature in the ammonia oxidation reactor (OT_h) has to be monitored and compared to the normal range for oxidation temperature (OT_{normal}).
	VSG and NCSG data obtained during times when OT_h was above or below OT_{normal} has to be eliminated from the calculation of EF_{BL}.
Any comment:	None.

Data / Parameter:	**B.17 OT_{normal}**
Data unit:	°C (min and max)

Description:	Normal range of operating temperatures during the 5 historic campaigns.
Source of data used:	Thermocouples inside Ammonia Oxidation Reactor (AOR) during historical campaigns.
Value applied:	915.0°C (min.) and 926.05°C (max.)
Justification of the choice of data or description of measurement methods and procedures actually applied :	OTh is measured by tow Type-K thermocouples at two different locations inside the Ammonia Oxidation Reactor. Measurements are taken continuously by a thermocouple inside the AOR, all data taken during the 5 historic campaigns have been interpreted as a sample of a stochastic variable. All data falling within the upper and lower 2.5% percentile have been eliminated, the range of the remaining values represents the maximum and minimum normal operating temperatures in the AOR.
Any comment:	None

Data / Parameter:	**B.18 OP_h**
Data unit:	Bar (gauge)
Description:	Oxidation Pressure for each hour during the baseline campaign
Source of data used:	Monitored by pressure transmitter.
Value applied:	Not applicable, used to determine if OP_h during baseline campaign falls outside OP_{normal}.
Justification of the choice of data or description of measurement methods and procedures actually applied :	AM0034 requires the monitoring of the oxidation pressure in the ammonia oxidation reactor. In F&C's nitric acid plant, the pressure is measured after the compressor and filter for primary air but before the air filter, ammonia and air mixer and the ammonia oxidation reactor. Since the location of this pressure probe remains the same during the historic campaigns, the baseline campaigns and the project campaigns, it is appropriate to use this value for comparison of OP_h between these campaigns. In accordance with AM0034 the oxidation pressure in the ammonia oxidation reactor (OP_h) has to be monitored and compared to the Normal range for oxidation temperature (OP_{normal}). VSG and NCSG data obtained during times when OPh was above or below OP_{normal} has to be eliminated from the calculation of EF_{BL}.
Any comment:	None.

Data / Parameter:	**B.19 OP_{normal}**
Data unit:	Bar (gauge)
Description:	Oxidation Pressure for each hour during the five historic campaigns.
Source of data used:	Monitored by pressure transmitter.
Value applied:	12.00 bar (min.) and 12.34 bar (max.)
Justification of the choice of data or description of measurement methods and procedures actually	AM0034 requires the monitoring of the oxidation pressure in the ammonia oxidation reactor. In F&C's nitric acid plant, the pressure is measured after the compressor and filter for primary air but before the ammonia and air mixer and the ammonia oxidation reactor. Since the location of this pressure probe remains the same during the historic campaigns, the baseline campaigns and the

applied :	project campaigns, it is appropriate to use this value for comparison of OP_h between these campaigns.
	In accordance with AM0034 the oxidation pressure in the ammonia oxidation reactor during the five historic campaigns is used to determine the normal range of operating pressures (OP_{normal}). All data taken during the 5 historic campaigns have been interpreted as a sample of a stochastic variable. All data falling within the upper and lower 2.5% percentile have been eliminated; the range of the remaining values represents the maximum and minimum normal operating temperatures in the AOR.
Any comment:	None.

Data / Parameter:	B.20 GS_{normal}
Data unit:	Name of supplier.
Description:	Gauze supplier for the five historic campaigns
Source of data used:	Monitored / Invoices.
Value applied:	Johnson Matthey plc.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value for GS_{normal} is only a plausibility check; the decisive value in determining if the baseline campaign data is applicable is the comparison of GC_{normal} and GC_{BL}.
	F&C has been using gauzes supplied by Johnson Matthey continuously for the past several years.
Any comment:	None.

Data / Parameter:	B.21 GS_{BL}
Data unit:	Name of supplier.
Description:	Gauze supplier for the baseline campaign
Source of data used:	Monitored / Invoices
Value applied:	Johnson Matthey plc.
Justification of the choice of data or description of measurement methods and procedures actually applied :	See B.20 above.
Any comment:	None.

Data / Parameter:	B.22 GS_{PC}
Data unit:	
Description:	Gauze supplier for the project campaign
Source of data used:	Monitored / Invoices
Value applied:	Not available yet.
Justification of the	See B.20 above.

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	None.

Data / Parameter:	B.23 GC_{normal}
Data unit:	%
Description:	Gauze composition during the five historic operating campaigns expressed as percentage by weight of the precious metals Platinum, Rhodium and, if applicable, Palladium comprising the Ammonia Oxidation Catalyst gauzes.
Source of data used:	Monitored / Invoices
Value applied:	Platinum: 95.0 Rhodium: 5.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance with AM0034, if the composition of the ammonia oxidation catalyst used for the baseline campaign and after the implementation of the project are identical to that used in the campaign for setting the operating conditions (previous five campaigns), then there shall be no limitations on N_2O baseline emissions.
Any comment:	None.

Data / Parameter:	B.24 GC_{BL}
Data unit:	%
Description:	Gauze composition during the baseline campaign expressed as percentage by weight of the precious metals Platinum, Rhodium and, if applicable, Palladium comprising the Ammonia Oxidation Catalyst gauzes.
Source of data used:	Monitored / Invoices
Value applied:	Platinum: 95.0 Rhodium: 5.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance with AM0034, if the composition of the ammonia oxidation catalyst used for the baseline campaign and after the implementation of the project are identical to that used in the campaign for setting the operating conditions (previous five campaigns), then there shall be no limitations on N_2O baseline emissions. Since the values for GC are the same during the baseline campaign as during the historic campaigns, there is no limitation on the N_2O baseline emissions.
Any comment:	None.

Data / Parameter:	B.25 $GC_{project}$
Data unit:	%

Description:	Gauze composition during the baseline campaign expressed as percentage by weight of the precious metals Platinum, Rhodium and, if applicable, Palladium comprising the Ammonia Oxidation Catalyst gauzes.
Source of data used:	Monitored / Invoices
Value applied:	To be obtained during the project campaigns.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The gauze composition during the project needs to be monitored and compared to GC_{BL}. If the operator has changed the gauze composition during a project campaign to a composition not used during the baseline campaign, the baseline campaign may have to be repeated or a conservative IPCC default emissions factor applied.
Any comment:	None.

Data / Parameter:	**B.26 EF_{reg}**
Data unit:	$tN_2O/tHNO_3$
Description:	Emissions cap for N_2O from nitric acid production set by government regulation
Source of data used:	Ministry of Environment
Value applied:	None
Justification of the choice of data or description of measurement methods and procedures actually applied :	There is currently no regulation in Israel that limits the emissions of N_2O from nitric acid production.
Any comment:	None.

B.6.3   Ex-ante calculation of emission reductions:

Description of the N.serve Database Management System (N.DBMS)

All data necessary for the monitoring and verification procedures related to the project activity are transferred from the nitric acid plant's data acquisition system into a dedicated relational database management system ("N.DBMS") based on Microsoft Access 2002. Database management systems are designed for a structured storage of large amounts of data providing for minimum redundancy and maximum flexibility to allow best practice data analysis. Relation DBMS organize all data in tables. N.DBMS mainly consists of three such tables, labelled PROJECTS, CAMPAIGNS, and DATA_CROSS.

The first table, PROJECTS, serves as an anchor for all data stored. Each CDM project must be defined here, before any related data can be stored. Table PROJECTS provides a unique identifier and a short name for each project. In addition, project specific data such as owner and location may be stored.

Structure of table PROJECTS

Field Name	Field Type	*Comment*
ProjId	Integer	*Unique identifier for the project*
ProjName	Text	*Short name of the project*
ProjOwner	Text	*Operator of the installation*

ProjLoc	Text	*Location of the installation (City)*
ProjCountry	Text	*Location of the installation (Country)*

Sample content of table PROJECTS

Projects				
ProjId	**ProjName**	**ProjOwner**	**ProjLoc**	**ProjCountry**
1	F&C	Fertilisers & Chemicals	Haifa	Israel

Table CAMPAIGNS defines the individual production campaigns and contains data which describe the campaign as a whole, such as date and time of start and stop and the physical units in which the data are stored. Each campaign must be defined here, before time series of related data can be stored.

Structure of table CAMPAIGNS

FieldName	FieldType	Comment
ProjId	Integer	Identifier of the project, to which the campaign belongs
CampId	Integer	Identifier of the campaign
CampName	Text	Campaign name defined by owner
CampType	Text	Type of campaign: H (historical), B (baseline), I (Intermediate, between BL and CDM registration), P (Project)
DateStart	Date	Starting day of the campaign
TimeStart	Date	Starting time of the campaign
DateStop	Date	Stopping day of the campaign
TimeStop	Date	Stopping time of the campaign
Period	Text	Length of measurement period: hours, minutes, seconds
CampLength	Number	Length of campaign (measured in tons of nitric acid produced)
AFR_Unit	Text	Physical unit of AFR data
AIFR_Unit	Text	Physical unit of AIFR data
NAP_Unit	Text	Physical unit of NAP data
NCSG_Unit	Text	Physical unit of NCSG data
Oph_Unit	Text	Physical unit of OPh data
OTh_Unit	Text	Physical unit of OTh data
VSG_Unit	Text	Physical unit of VSG data

Finally, the times series of the parameter values listed above are stored in table DATA_CROSS. Each set of values for the different parameters is identified by the ProjId, CampId and a date/time-stamp.

Structure of table DATA_CROSS

FieldName	FieldType	Comment
ProjId	Integer	Identifier of the project, to which the campaign belongs
CampId	Integer	Identifier of the campaign to which the data belong
DateTime	Date	Date and time stamp
AFR	Number	AFR value
AIFR	Number	AIFR value
NAP	Number	NAP value
NCSG	Number	NCSG value
Oph	Number	Oph value
OTh	Number	OTh value
VSG	Number	VSG value

The tables PROJECTS, CAMPAIGNS, and DATA_CROSS are linked by so-called 1:n relationships. That is, for each project, there may be n campaigns and for each campaign, m sets of data may be stored, where n and m indicated the number of campaign and data sets, respectively. Other than in Excel, there is no practical limit (other than disk space and computer performance) for n and m when using a DBMS such as Access.

Data model

PROJECTS		CAMPAIGNS		DATA_CROSS
ProjId *	→	ProjId *	→	ProjId *
ProjName		CampId *		CampId *
...		CampName	→	DateTime *
		...		AFR
				...
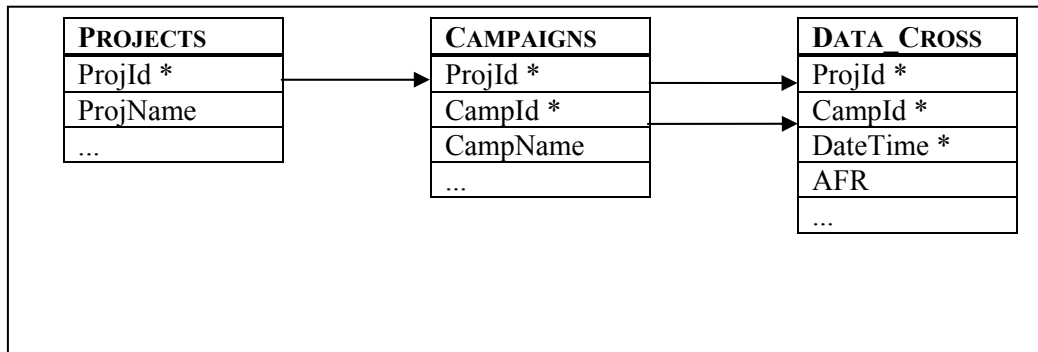
Stars (*) indicate the primary keys of the three tables, which make sure, that data sets are unique.

Using the database structure outlined above, it is now possible to analyse the data stored in many different ways using the database query mechanisms provided by Access. All statistical analyses and exclusions of parameter sets required by AM0034 will be carried out by appropriately designed database queries, which will be described in detail below.

Calibration using historical campaigns and calculation of the baseline emissions factor with N.DBMS

Historical Query 1: Analysis of the raw historical campaign data

In a first step, a number of statistical calculations are carried out for the historical and baseline data using Query 1[8]:

- Number of data sets
- Minimum value
- Maximum value
- Mean value and/or sum (depending on the character of the parameter)
- Standard deviation
- 95% confidence interval

The resulting Access table is shown in part below:

Query 1: Without parameter limits

ProjId	CampType	Count(DT)	Count(AFR)	Min(AFR)	Max(AFR)	Avg(AFR)	StdDev(AFR)	Count(AIFR)	Min(AIFR)	Max(AIFR)	Avg(AIFR)
1	B	2,075.00	2,075.00	0.00	2,236.30	2,131.11	135.04	2,075.00	0.59	46.71	6.86
1	H	9,496.00	7,825.00	0.00	4,276.28	1,983.48	602.62	7,841.00	0.00	206.77	6.82

For convenience of handling, the data from this Access table is exported into Excel for further analysis. The result of this export is shown below:

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[8] All queries are available and can be provided to the DOE upon request.

N.DBMS Baseline Calculation		Fertilizers & Chemicals, Haifa, Israel								
Historical campaigns		Query 1: Without parameter limits								
Parameter	OH	AFR	AIFR	OPh	OTh	NCSG	NCSG	VSG	NAP
Unit	h	t NH3 / h	%	bar	oC	ppm	mg N2O / Nm3	1000 Nm3 / h	t HNO3
Count	9,496	7,825	7,841	8,746	7,945				
Minimum		0	0	0	49				
Maximum		4,276	207	131	1,848				
Mean		1,983	6.8	11.7	922				
Standard deviation		603	2.3	5.7	62				
95% confidence level *(1.96 * Std.dev.)*		1,181	4.5	11.2	122				
Sum									66,700
CL Normal	*(NAP sum of campaigns r57 through r61 divided by 5)*								13,340

This set of data also shows the total tonnes of nitric acid produced during the five historic campaigns. This number is divided by five to derive the average historic nitric acid production during those five campaigns, which represents the value of CL_{normal}.

In the next query, lines of data in which at least one value is missing or obviously wrong (e.g. negative) are completely eliminated. If, for example there is no value for AFR or if there is a negative value for OPh, then the complete data set of that time stamp (i.e. the AFR, AIFR, OPh and OTh) are eliminated from further analysis.

Historical Query 2: Analysis of the raw historical campaign data

N.DBMS Baseline Calculation		Fertilizers & Chemicals, Haifa, Israel								
Historical campaigns		Query 2: Eliminating faulty and blank lines								
Parameter	OH	AFR	AIFR	OPh	OTh	NCSG	NCSG	VSG	NAP
Unit	h	t NH3 / h	%	bar	oC	ppm	mg N2O / Nm3	1000 Nm3 / h	t HNO3
Count	5,944	5,944	5,944	5,944	5,944				
Remaining share of data sets	63%	63%	63%	63%	63%				
Minimum		0	0.00	0.0	512				
Maximum		4,276	13.59	131.1	1,848				
Mean		1,920	6.79	12.4	924				
Standard deviation		677	0.26	6.0	31				
95% confidence level *(1.96 * Std.dev.)*		1,328	1	12	62				
Sum									42,077
Limits acc. to consistency check		not blank	not blank	not blank	not blank				

In a next step, the remaining historical data are analysed in excel to determine and eliminate the upper and lower 2.5% percentiles for OPh and OTh. In the case of F&C, the plant is operating under very stable conditions resulting in fairly narrow "permitted operating ranges" from this analysis of historical data:

OPh range: 12.0 to 12.34 bar

OTh range: 915.0 to 926.5 °C

This permitted range is then applied in Query 5 below.

The analysis of the historical campaigns is now complete. Next, the analysis of the baseline data can be conducted applying the results of the analysis of the historical data.

Baseline Query 1: Analysis of the raw baseline data without any operating limits applied

N.DBMS Baseline Calculation		Fertilizers & Chemicals, Haifa, Israel							
Baseline campaign		Query 1: Without parameter limits							
Parameter	OH	AFR	AIFR	OPh	OTh	NCSG	NCSG	VSG	NAP
Unit	h	t NH3 / h	%	bar	oC	ppm	mg N2O / Nm3	1000 Nm3 / h	t HNO3
Count	2,075	2,075	2,075	2,075	2,075	2,075	2,075	2,075	89
Minimum		0	0.59	1	501	436	863	17	
Maximum		2,236	46.71	13	926	4,741	9,388	655	
Mean		2,131	6.86	12	923	1,120	2,218	25	
Standard deviation		135	1.05	1	24	179	354	43	
Sum	2,062								14,551
Baseline emissions	BE	$= VSG * NCSG * OH$						t N2O	116
Emission factor	EF	$= BE / NAP$						kg N2O / t HNO3	7.99

This table gives the raw results for NAP, OH, NCSG, VSG and EF_{BL}. This data set will now be subjected to the criteria resulting from the historic operating parameters.

Baseline Query 2: Applying the normal operating range from historical data

N.DBMS Baseline Calculation		Fertilizers & Chemicals, Haifa, Israel							
Baseline campaign		Query 5: Permitted Hist. range applied to BL data, invalid data sets excluded, CL cut							
Parameter	OH	AFR	AIFR	OPh	OTh	NCSG	NCSG	VSG	NAP
Unit	h	t NH3 / h	%	bar	oC	ppm	mg N2O / Nm3	1000 Nm3 / h	t HNO3
Count	1,616	1,616	1,616	1,616	1,616	1,616	1,616	1,616	
Remaining share of data sets	78%	78%	78%	78%	78%	78%		78%	
Minimum		2,064	6.60	12.0	923	886	1,755	20.8	
Maximum		2,235	7.02	12.3	926	1,387	2,747	23.6	
Mean		2,146	6.82	12.2	925	1,107	2,192	22.0	
Standard deviation		32	0.10	0.1	1	98	194	0	
95% confidence level *(1.96 * Std.dev.)*		62	0	0	1	192	380	1	
Sum	1883								13,338
Limits acc. to consistency check	<21.Dec 13:00	not blank	not blank	not blank	not blank				
Lower limit					12.0	915			
Upper limit		4,276	13.6	12.3	926				
Baseline emissions	BE	$= VSG * NCSG * OH$						t N2O	91.0
Emission factor	EF	$= BE / NAP$						kg N2O / t HNO3	6.82

This query excludes those NCSG and VSG data from the calculation of BE that were taken during times when the plant was operating outside of the permitted operating range during the baseline campaign. Only those VSG and NCSG values were taken into account for which a matching AFR, AIFR, OPh and OTh value was available.

Also, this query excludes all data that were taken after 13:00 hours on December 21, 2006 in order to adjust for CL_{normal}.

The results of this query are the OH and NAP values used for the calculation of BE and EF_{BL} respectively.

Query 3: Application of 95% confidence interval, AMS UNC and calculation of EF_{BL}

N.DBMS Baseline Calculation		Fertilizers & Chemicals, Haifa, Israel							
Baseline campaign		**Query 6: Q5 + confidence levels applied to baseline data**							
Parameter	**OH**	**AFR**	**AIFR**	**OPh**	**OTh**	**NCSG**	**NCSG**	**VSG**	**NAP**
Unit	h	t NH3 / h	%	bar	oC	ppm	mg N2O / Nm3	1000 Nm3 / h	t HNO3
Count	1,518	1,518	1,518	1,518	1,518	1,518		1,518	
Remaining share of data sets	73%	73%	73%	73%	73%	73%		73%	
Minimum		2,064	6.60	12.0	923	923	1,827	21.1	
Maximum		2,235	7.02	12.3	926	1,288	2,551	23.0	
Mean		2,143	6.82	12.2	925	1,115	2,207	22.011	
Standard deviation		30	0.11	0.1	1	90	178	0	
95% confidence level *(1.96 * Std.dev.)*									
Sum	1883								13,338
Limits acc. to consistency check	<21.Dec 13:00	not blank	not blank	not blank	not blank				
Lower limit				12.0	915	915		21.1	
Upper limit		4,276	13.6	12.3	926	1,299		23.0	
Correction factor NCSG resulting from SGS reference measurements							1.997%		
Baseline emissions	**BE**		*= VSG * NCSG * OH*					t N2O	**93**
Emission factor	**EF**		*= BE / NAP * (1 - UNC/100)*					kg N2O / t HNO3	**6.66**
Uncertainty	UNC								4.87

The 95% confidence level of NCSG and VSG values is derived, thereby excluding outliers and determining the mean values that are to be applied to the calculation of BE.

As a result, the remaining data represent 73% of the raw data and therefore meets the criterion set by AM0034 that the plant must be operating within the permitted range at least 50% of the time during the baseline campaign.

NCSG adjustment factor

A special adjustment factor is applied to the mean NCSG value derived. During the QAL2 reference measurements it was determined that the Servomex analyzer installed at F&C measured lower N_2O concentration than those determined by each of the nine half hour reference measurements conducted in November 2006. On average, the reference measurements were 1.997% higher than the F&C measurements. Therefore, if the calculated UNC value would be applied to the EF_{BL} without any adjustment to NCSG, then EF_{BL} would be double-burdened by two downward corrections. Therefore, the NCSG values, when applied in the BE calculation, are corrected by a factor of 1.01997.

The full UNC value is then applied to the calculated EF_{BL} value, i.e. including the calculated analyzer uncertainty.

Resulting EFBL

The EF_{BL} derived from this analysis of historic and baseline data is 6.66 kgN$_2$O/tHNO$_3$.

Statistical test if the baseline is representative of a normal campaign

The values appearing in green letters in the above Query 3 result table indicate that the values during the BL campaign were within 1.96 times the standard deviation of the mean values from the historic 5 campaigns. Therefore, it can be concluded that the baseline is representative of a normal campaign.

During the EF_P and ER_n calculation, the same procedures will be applied in the N.DBMS as described in this section in accordance with AM0034.

Ex-ante calculation of Emission Reductions

Several of the parameters necessary to calculate the emission reductions expected from the project activity will only be established during the operation of the project.

Therefore, certain assumptions had to be made for the calculations (see section A.4.4 above for details):
- Production output of nitric acid (NAP) per year is expected to be 45,000 tonnes of nitric acid over the next 10 years.
- Emissions Factor during each of the project campaigns (EF_P) which is mainly influenced by the abatement efficiency of the N_2O abatement catalyst, which is assumed to be up to 90% of baseline N_2O emissions. Taking EF_{BL} of 6.66 $kgN_2O/tHNO_3$ and applying 90% abatement efficiency, the annual baseline emissions would be 73,302tCO_2e and the annual emission reductions 65,072tCO_2e.
- Project start in May 2007.

These values are applied in the calculations for table B.6.4 below.

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

Year	Estimation of project activity emissions (tonnes of CO2 e)	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of overall emission reductions (tonnes of CO2 e)
2007	5,416	54,155	0	48,740
2008	9,284	92,838	0	83,554
2009	9,284	92,838	0	83,554
2010	9,284	92,838	0	83,554
2011	9,284	92,838	0	83,554
2012	9,284	92,838	0	83,554
2013	9,284	92,838	0	83,554
2014	9,284	92,838	0	83,554
2015	9,284	92,838	0	83,554
2016	9,284	92,838	0	83,554
2017	3,868	38,682	0	34,814
Total	**92,840**	**928,380**	**0**	**835,540**

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

B.7.1   Data and parameters monitored:

The monitoring procedures as described for each parameter below are an integral part of the company's ISO 9001 QA system, certified to and audited by "The Standards Institution of Israel".

All of the data obtained and used as part of the baseline and during the crediting period of the project will be archived electronically for at least 2 years in at least 2 different locations.

Data / Parameter:	P.1 NCSG

Data unit:	mg N_2O / m³ (converted from ppmv, if necessary)
Description:	N_2O concentration in the stack gas during each project campaign.
Source of data to be used:	Servomex Xentra 4900 Continuous Emissions Analyser
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns.
Description of measurement methods and procedures to be applied:	AM0034 requires the determination of the concentration of N_2O in the stack gas. NCSG is continuously monitored with the gas analyser[9]. Monitoring results are recorded for every second of plant operation. Hourly means for NCSG are derived from the collected data. NCSG data taken during times when the respective plant was operating outside the permitted operating range were eliminated. The remaining NCSG values where subjected to the following adjustment. The analyser reads ppmv (parts per million in volume); in order to obtain mg/Nm³ is necessary use the next equation: $$NCSG = ppmv * \frac{RMM}{v}$$ Where: NCSG is N_2O concentration in the stack gas (mg/N m³) ppmv means parts per million in volume RMM means relative molecular mass of N_2O (44.013 mg) v means standard volume of an ideal gas (22.4 Nm³) The resulting hourly average NCSG values are now expressed in mg/Nm³ as required by AM0034 and where subsequently subjected to the following statistical analysis: 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 NCSG values
QA/QC procedures to be applied:	As per the recommendations of the QAL2 auditor, F&C staff will conduct regular zero and span calibrations of the analyser at least once per week for the forthcoming three months. The procedures will be adjusted to once every two

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[9] The Servomex Xentra 4900 gas analyser has been designed according to ISO 14956 specifications. Formal QAL1 procedures as suitable for stack gas concentration monitoring have not yet been conducted. At the time of installation of the AMS at F&C, no analyser was available on the market that had already passed the QAL1 suitability certification for N_2O.

	weeks or every month when it is found that the drift is minimal or insignificant.
Any comment:	None.

Data / Parameter:	**P.2 VSG**
Data unit:	Nm^3/h
Description:	Normal gas volume flow rate of the stack gas during each project campaign
Source of data to be used:	Gas Volume Flow meter DFL 100 (multiple point pitot tube) from Durag
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns.
Description of measurement methods and procedures to be applied:	AM0034 requires the determination of the gas volume flow (VSG) in the stack. VSG is continuously monitored with a flow meter and monitoring results are recorded for every second of plant operation. Hourly means for VSG are derived from the collected data. VSG data taken during times when the respective plant was operating outside the permitted operating range were eliminated.
	The remaining VSG data series has been subjected to the following adjustment.
	The flow meter was installed with an operational range of 0 – 10 mbar of differential pressure. To obtain the flow (Nm3/h) at normal conditions (101.325 kPa and 0°C) from measured differential pressure the instrument equation – taken from the AMS manual – is used which includes pressure and temperature correction factors.
	$$VSG = \frac{0.020763 * D^2 * k}{\sqrt{\rho_N}} * \frac{\sqrt{P}}{\sqrt{(273.15 + T)}} * \sqrt{dP}$$
	Where:
	VSG means standard volume flow (Nm^3/h)
	D means stack inner diameter (mm)
	ρN means standard density (kg/Nm^3)
	k means instrument correction factor (specific for each individual instrument)
	P means pressure working conditions (mbar)
	T means temperature working conditions (°C)
	ΔP means differential pressure (mbar)
	0.020763 is the unit conversion factor
	The resulting hourly average VSG values are now expressed in Nm^3/h as required by AM0034 and where subsequently subjected to the following statistical analysis:
	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 VSG values
QA/QC procedures to be applied:	The flow meter is taken out of the stack and inspected for physical condition at least once per year. Also, the differential pressure transmitter is disconnected from the Flow Tube and the transmitter is then connected to an absolute pressure simulator and the pressure transmitter is readjusted as appropriate.
	The Flow Tube itself does not need to be calibrated since it is a physical device which will not have drift. Therefore, it is sufficient to regularly inspect the physical condition of the Durag FL-100 at least once per year.
	The results of these calibration procedures are then recorded in the Calibration Procedure log sheet.
Any comment:	None

Data / Parameter:	P.3 PE_n
Data unit:	tN_2O
Description:	Total mass N_2O emissions in each project campaign.
Source of data to be used:	Calculated from the measurements from measured data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns.
Description of measurement methods and procedures to be applied:	Not applicable, calculated value as per the following formula: $PE_n = VSG * NCSG * 10^{-9} * OH$
QA/QC procedures to be applied:	Not applicable. Calculated value.
Any comment:	None.

Data / Parameter:	P.4 OH_n
Data unit:	hours
Description:	Total operating hours during each project campaign
Source of data to be used:	Production log
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns.
Description of measurement methods	Required by AM0034 to determine the total mass emissions of N_2O during each

and procedures to be applied:	project campaign (PE_n).
QA/QC procedures to be applied:	Daily reports are prepared for operation hours and production output by the plant operator for every day on which the plant was operational (i.e. not during shut down). At the end of each campaign a summary report is prepared based on these daily reports.
Any comment:	None.

Data / Parameter:	**P.5 NAP**
Data unit:	$tHNO_3$
Description:	Metric tonnes of 100% concentrated nitric acid produced during each project campaign.
Source of data to be used:	Production log
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns.
Description of measurement methods and procedures to be applied:	Measurement by Magnetic Flow Meter, PT100 for temperature and aerometric densimeter for concentration evaluation. Point of measurement is the product line, close to the exit from the absorption column leading to the storage tank. Specially elaborated Access routine calculates concentration of the product and its total output by flow (on-line), density (last measured in sample), product line temperature (on-line) using regression ($R^2 > 0.8$). The total value of NAP that can be applied for the calculation of CERs in any one calendar year may not exceed the design capacity (daily plant capacity and assuming 365 days of operation per year). For F&C this effective NAP-cap is 177 $tHNO_3$/day * 365 days = 64,605 $tHNO_3$
QA/QC procedures to be applied:	ISO9001/14001 procedures and documented in the applicable ISO handbooks.
Any comment:	A new mass flow meter with density and built-in concentration measurements was recently installed at F&C. This will eliminate the need for 2-hourly sampling of product for density determination and thus will lead to an improvement of both safety and precision of the measurements. Consequently, the procedures described above will have to be changed slightly, this will be described in the first monitoring report.

Data / Parameter:	**P.6 TSG**
Data unit:	°C
Description:	Temperature in the stack gas
Source of data to be used:	Temperature Probe (part of gas volume flow meter)
Value of data applied for the purpose of	Not applicable

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The temperature measurements of the stack gas are required to calculate the Normal Volume Flow (Nm^3/h) in the stack and is not required to be reported as a separate parameter in accordance with AM0034.
QA/QC procedures to be applied:	ISO9001/14001 procedures and documented in the applicable ISO handbooks.
Any comment:	None.

Data / Parameter:	P.7 PSG
Data unit:	bar
Description:	Pressure of stack gas
Source of data to be used:	Pressure Probe (part of gas volume flow meter)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable.
Description of measurement methods and procedures to be applied:	AM0034 requires the determination of gas volume flow at normal conditions in the stack. In order to calculate from the measured VSG values to VSG at normal conditions, the actual pressure in the stack has to be determined and applied to each hourly mean VSG value. The measurements are taken continuously by a pressure probe inside the stack very close to the stack gas volume flow meter.
QA/QC procedures to be applied:	ISO9001/14001 procedures and documented in the applicable ISO handbooks.
Any comment:	None.

Data / Parameter:	P.8 EF_n
Data unit:	$tN_2O/tHNO_3$
Description:	Emissions factor for campaign n.
Source of data to be used:	Calculation from total mass N_2O emissions of campaign n (PE_n) and total nitric acid production (NAP_n).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns.
Description of measurement methods and procedures to be applied:	The campaign specific emissions factor for each campaign during the project's crediting period is calculated 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 campaign n the campaign specific emission factor would be:

	$EF_n = PE_n / NAP_n$
QA/QC procedures to be applied:	Not applicable.
Any comment:	None

Data / Parameter:	**P.9 $EF_{ma,n}$**
Data unit:	$tN_2O/tHNO_3$
Description:	Moving average emissions factor derived over time from campaign specific emissions factors.
Source of data to be used:	Calculation from campaign specific emissions factors EF_n.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns, starting with the second project campaign.
Description of measurement methods and procedures to be applied:	In order to take into account possible long-term emissions trends over the duration of the project activity and to take a conservative approach a moving average emission factor shall be estimated as follows: $EF_{ma,n} = (EF_1 + EF_2 + … + EF_n) / n$ This process is repeated for each campaign such that a moving average, $EF_{ma,n}$ is established over time, becoming more representative and precise with each additional campaign.
QA/QC procedures to be applied:	Not applicable.
Any comment:	None

Data / Parameter:	**P.10 AFR**
Data unit:	$kgNH_3/h$
Description:	Ammonia gas flow rate to the Ammonia Oxidation Reactor (AOR)
Source of data to be used:	Monitored by Orifice plate (without temperature and pressure compensation)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable, monitored data of AFR will be used to determine if plant was operating outside of AFR_{max}.
Description of measurement methods and procedures to be applied:	The ammonia flow is continuously measured by orifice plate.
QA/QC procedures to be applied:	ISO9001/14001 procedures and documented in the applicable ISO handbooks.

Any comment:	A new ammonia gas mass flow meter or dp volume meter will be installed shortly.

Data / Parameter:	**P.11 AIFR**
Data unit:	% v/v
Description:	Ammonia to air ratio into the ammonia oxidation reactor
Source of data to be used:	Calculation for each hour of plant operation based on measurements of AFR and primary air flow rates.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable, monitored data of AIFR will be used to determine if plant was operating outside of $AIFR_{max}$.
Description of measurement methods and procedures to be applied:	The monitoring of AIFR is required by AM0034 in order to determine whether the plant was operating within the permitted operating range. During the analysis of the measured data, any of the NCSG and VSG data obtained from an hour during which the AIFR was above $AIFR_{max}$ will be eliminated from the calculation of EF_P.
QA/QC procedures to be applied:	ISO9001/14001 procedures and documented in the applicable ISO handbooks.
Any comment:	AM0034 (Version 02) states that the units for AIFR should be m^3/h, this is a mistake. AIFR should be expressed as a ratio or percentage volume by volume of Ammonia in Air.

Data / Parameter:	**P.12 CL_p**
Data unit:	$tHNO_3$
Description:	Length of each project campaign measured in metric tonnes of 100% concentrated nitric acid produced during that campaign.
Source of data to be used:	NAP
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns.
Description of measurement methods and procedures to be applied:	In accordance with AM0034 the project length (CL_n) has to be compared to the established average historic campaign length (CL_{normal}); and
	If the length of each individual project campaign CL_n is longer than or equal to the average historic campaign length CL_{normal}, then all N_2O values measured during the baseline campaign can be used for the calculation of EF (subject to the elimination of data from the Ammonia/Air analysis).
	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.
QA/QC procedures to be applied:	See comments for NAP.
Any comment:	None.

Data / Parameter:	P.13 EF_p
Data unit:	$tN_2O/tHNO_3$
Description:	Emissions factor used for the specific campaign n to determine the emission reductions of that campaign
Source of data to be used:	Calculation of EF_n and $EF_{ma,n}$.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined during project campaigns.
Description of measurement methods and procedures to be applied:	To calculate the total emission reductions achieved in a campaign, the higher of the two values $EF_{ma,n}$ and EF_n shall be applied as the emission factor relevant for the particular campaign to be used to calculate emissions reductions (EF_P). Thus: If $EF_{ma,n} > EF_n$ then $EF_P = EF_{ma,n}$ If $EF_{ma,n} < EF_n$ then $EF_P = EF_n$
QA/QC procedures to be applied:	Not applicable.
Any comment:	None

Data / Parameter:	P.14 EF_{min}
Data unit:	$tN_2O/tHNO_3$
Description:	EF_{min} is equal to the lowest EF_n observed during the first 10 campaigns of the project crediting period.
Source of data to be used:	Calculations of $EF_{ma,n}$.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not available yet.
Description of measurement methods and procedures to be applied:	A campaign-specific emissions factor shall be used to cap any potential long-term trend towards decreasing N_2O emissions that may result from a potential built up of platinum deposits. After the first ten campaigns of the crediting period of the project, the lowest EF_n observed during those campaigns will be adopted as a minimum (EF_{min}). If any of the later project campaigns results in a EF_n that is lower than EF_{min}, the calculation of the emission reductions for that particular campaign shall used EF_{min} and not EF_n.
QA/QC procedures to be applied:	Not applicable.

Any comment:	None.

Data / Parameter:	**P.15 OPh**
Data unit:	Bar (gauge)
Description:	Oxidation Pressure for each hour during each project campaign.
Source of data to be used:	Monitored by pressure transmitter.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable. Used to determine when plant is operating outside of permitted range (OP_{normal})
Description of measurement methods and procedures to be applied:	In accordance with AM0034 the oxidation pressure in the ammonia oxidation reactor (OPh) has to be monitored and compared to the Normal range for oxidation temperature (OP_{normal}). VSG and NCSG data obtained during times when OPh was above or below OP_{normal} has to be eliminated from the calculation of EF_{BL}. AM0034 requires the monitoring of the oxidation pressure <u>in</u> the ammonia oxidation reactor. In F&C's nitric acid plant, the pressure is measured after the compressor and filter for primary air but before the ammonia and air mixer and the ammonia oxidation reactor. Since the location of this pressure probe remains the same during the historic campaigns, the baseline campaigns and the project campaigns, it is appropriate to use this value for comparison of OP_h between these campaigns.
QA/QC procedures to be applied:	Subject to ISO 9001/14001 procedures.
Any comment:	None.

Data / Parameter:	**P.16 OTh**
Data unit:	°C
Description:	Oxidation temperature in the ammonia oxidation reactor (AOR).
Source of data to be used:	Monitoring results of thermocouple inside the ammonia oxidation reactor and recorded by the data acquisition system.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable. Used to determine when plant is operating outside of permitted range.
Description of measurement methods and procedures to be applied:	In accordance with AM0034 the oxidation temperature in the ammonia oxidation reactor (OTh) has to be monitored and compared to the Normal range for oxidation temperature (OT_{normal}). VSG and NCSG data obtained during times when OTh was above or below OT_{normal} has to be eliminated from the calculation of EF_n.
QA/QC procedures to	Subject to ISO 9001/14001 procedures.

be applied:	
Any comment:	None.

Data / Parameter:	P.17 GS_{PC}
Data unit:	Name of supplier.
Description:	Gauze supplier for the project campaign
Source of data used:	Monitored / Invoices
Value applied:	Not available yet.
Justification of the choice of data or description of measurement methods and procedures actually applied :	See B.20.
Any comment:	F&C expects to continue to source its gauzes from Johnson Matthey in the foreseeable future.

Data / Parameter:	P.18 $GC_{project}$
Data unit:	%
Description:	Gauze composition during each project campaign expressed as percentage by weight of the precious metals Platinum, Rhodium and, if applicable, Palladium comprising the Ammonia Oxidation Catalyst gauzes.
Source of data used:	Monitored / Invoices
Value applied:	To be obtained during the project campaigns.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The gauze composition during the project needs to be monitored and compared to GC_{BL}. If the operator has changed the gauze composition during a project campaign to a composition not used during the baseline campaign, the baseline campaign may have to be repeated or a conservative IPCC default emissions factor applied.
Any comment:	None.

B.7.2   Description of the monitoring plan:

The emission reductions achieved by the project activity will be monitored using the approved monitoring methodology AM0034 as prepared by N.serve Environmental Services GmbH. It is the appropriate monitoring methodology to be used in conjunction with the baseline methodology AM0034, "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants". Its applicability depends on the same prerequisites as the mentioned baseline methodology.

AM0034 requires the use of the European Norm EN14181 (2004) *"Stationary source emissions - Quality assurance of automated measuring systems"*[10] as a **guidance**[11] for installing and operating the Automated Monitoring System (AMS) in the nitric acid plants for the monitoring of N_2O emissions.

A complete Automated Monitoring System (AMS) to monitor the mass emissions of N_2O at the stack of F&C' nitric acid plant was installed and has been operated since November 2005. As an operator of the nitric acid plants for many years and of dedicated NO_X and other emissions monitoring equipment, F&C staff in general and its Instrument Department in particular is accustomed to operating technical equipment to a high level of quality standards.

The plant manager is responsible for the ongoing operation and maintenance of the N_2O monitoring system. Operation, maintenance, calibration and service intervals are being carried out by staff from the instrumentation department according to the vendor's specifications and under the guidance of internationally relevant environmental standards, in particular EN 14181 (2004) and EN ISO 14956 (2002).

All monitoring procedures at F&C are also conducted and recorded in accordance with the well established procedures under ISO 9001/14001 which is regularly audited by an independent auditing firm accredited for ISO 9001/14001 certification.

Please see Annex 4 for a detailed description of the Automated Monitoring System (AMS) installed at F&C' nitric acid plant and for background information on EN 14181 and the practical implications for using this standard for guidance in the implementation of this CDM project activity.

In the following, it is described how the procedures given in EN14181 for QAL1, 2 and 3 have been practically applied at F&C' plant.

QAL 1

In accordance with EN14181 an AMS shall have been proven suitable for its measuring task (parameter and composition of the flue gas) by use of the QAL1 procedure as specified by EN ISO 14956. 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. Such suitability testing has to be carried out under specific conditions by an independent third party on a specific testing site. A test institute shall perform all relevant tests on two identical AMS. These two AMS have to be tested in the laboratory and field.

At the time of commissioning of the AMS by F&C in late 2005, no AMS was available that had been certified according with EN14181 for N_2O measurements. Even to date, only one type of analyser has been finally certified to comply with the requirements of EN 14181 QAL 1 in accordance with ISO 14956 for N_2O measurements.

However, the Servomex Xentra 4900 was designed and built with a view to comply with the requirements of QAL1 and Servomex is currently considering to have the instrument QAL1 certified.

The Analyser and Flow Meter were calibrated by the vendors (Servomex and Durag) prior to shipment and installation in the nitric acid plant[12].

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

[11] See page 8, last paragraph of AM0034 version 2: "The monitoring system is to be installed using the guidance document EN 14181 …"

Pre-validation of the AMS by a DOE

While this is not explicitly required by either AM0034 or EN14181, a pre-validation of the AMS installation and operation was conducted on site in May 2006 by SGS to inspect whether the AMS is installed and set up in line with the requirements of EN 14181 and to help ensure that the AMS output and the monitoring procedures implemented in the plant are going to be acceptable to the DOE upon validation of the project.

QAL2 and Standard Reference Measurements (SRM)

QAL2 is a procedure for the determination of the calibration function and its variability, and a test of the variability of the measured values of the AMS compared with the uncertainty given by legislation. The QAL2 tests are performed on suitable AMS that have been correctly installed and commissioned on-site (as opposed to QAL 1 which is conducted off-site). QAL 2 tests are to be performed at least every 5 years according to EN 14181 but also after major changes to the plant or changes or repairs to the AMS, which will influence the results obtained significantly.

A calibration function is established from the results of a number of parallel measurements performed with a Standard Reference Method (SRM). The variability of the measured values obtained with the AMS is then evaluated against the required uncertainty. According to EN14181, both the QAL 2 procedures and the SRM need to be conducted by an independent "testing house" or laboratory which has to be accredited to EN ISO/IEC 17025.

The difficulty again with fully complying with EN14181 again is the lack of a regulatory N_2O emissions level and measurement uncertainty limit. Also, Israel currently has no testing house or laboratory that would meet the accreditation requirements of EN14181.

However, a series of QAL2 specific reference measurements using a the SRM method as per EN 14181 for guidance has been carried out at the plant in November 2006 by an accredited testing house (SGS Environmental Services, Netherlands) to ensure the AMS' suitability, establish the calibration curve and test the variability of the measurements. The results of these SRM are available to the DOE as part of the validation process. The AMS calibration function as well as the total uncertainty of the AMS was determined. The results were applied in the calculation of EF_{BL}.

AMS calibration and QA/QC procedures

The calibration procedures for the complete AMS are an integral part of the company's ISO 9001 QA system, certified to and audited by "The Standards Institution of Israel".

Calibration Gasses

Two types of calibration gas are used:

- 100% N_2 for the zero calibrations; and

- 1104ppmv N_2O in N_2 with a precision of ± 1% for the span calibrations.

The span calibration gas is certified by the manufacturer that the analytical examination of the concentration of N_2O in the balloon has been preformed in a laboratory that is designated from the national authority according to standard 17025.

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[12] The calibration report can be reviewed by the DOE during the site visit as part of the validation.

In accordance with the recommendations by the QAL 2 auditor, F&C will now purchase a span calibration gas with an N2O concentration of 1200ppmv being equal to 80% of the analyser range of 1500ppmv.

Analyser Zero and Span Calibrations

Zero and span calibrations will be carried out at least once per week by F&C staff.

In case of a warning of deviation from calibration greater than 1%, it is necessary to calibrate the N_2O analyzer. The calibration results and subsequent actions are all documented with the following information: Name of the person performing the calibration, date, in order/not in order, next date of calibration.

In addition, the analyser room and equipment is visually inspected at least once a week, the results are documented.

The automatic calibration unit for zero and span point must be checked yearly.

Flow meter calibration procedures

The thermostats, pressure gauges and pressure fall meters in the stack flow meter are calibrated in accordance with the manufacturer's instructions. In addition, the flow meter will be physically and visually inspected at regular intervals, at least once per year.

Training

Operations staff at the nitric acid plant who are responsible for the operation of the AMS and regular calibrations, visual and physical checks have been trained appropriately by the AMS vendors and F&C' own instrumentation engineers.

QAL 3

QAL3 is a procedure which is used to check drift and precision in order to demonstrate that the AMS is in control during its operation so that it continues to function within the required specifications for uncertainty.

This is achieved by conducting periodic zero and span checks on the AMS and then evaluating the results obtained using control charts. Zero and span adjustments or maintenance of the AMS, may be necessary depending on the results of this evaluation. In addition, Annual Surveillance Tests (AST) should be conducted in accordance with EN14181, these are a series of measurements that need to be conducted by independent measurement equipment in parallel to the existing AMS.

In essence, F&C staff performs QAL 3 procedures through the established calibration procedures described above. However, similarly to QAL2, there is no independent, qualified and certified entity in Israel that could conduct the QAL 3 procedures and particularly the AST in accordance with EN14181. Therefore, a sufficiently qualified (but not certified in accordance with EN14181) technical surveillance company or laboratory will have to be identified who could perform the independent QAL 3 procedures.

Data acquisition system

The analogue signal (4 to 20 mA) output from the Analyser and Flow meter are converted into a digital signal which is then fed into the data acquisition system. The data acquisition system performs calculations to derive the hourly averages for each of the parameters. These are then extracted and

converted into .csv files which can then be imported into the N.serve Database Management System (N.DBMS) as described in section B.6.3 above.

Monitoring Procedures for parameters other than NCSG and VSG

Throughout the crediting period of the project the following parameters shall be monitored and recorded as described in section B.7.1 above: OTh, OPh, AFR, AIFR, NAP, GS, GC, CL, incoming N_2O regulation and changes in the NO_X regulations.

All of the data obtained and used as part of the baseline and during the crediting period of the project will be archived electronically for at least 2 years in at least 2 different locations.

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

18. January 2007

Fertilisers & Chemicals Ltd (Project Participant)
Mr. Michael Raisky (michaelr@deshanim.co.il) and Mr. George Marmor (georgem@deshanim.co.il)

N.serve Environmental Services GmbH (Project Participant)
Mr. Albrecht von Ruffer (ruffer@nserve.net) (Database management by Dr. Helmuth Groscurth)

SECTION C.   Duration of the project activity / crediting period

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C.1   Duration of the project activity:

C.1.1.   Starting date of the project activity:

April 2007

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

25 years

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

C.2.1.   Renewable crediting period

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

Not selected

C.2.1.2.   Length of the first crediting period:

Not selected

C.2.2.	Fixed crediting period:

	C.2.2.1.	Starting date:

01. April 2007

	C.2.2.2.	Length:

10 years

SECTION D. Environmental impacts

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

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

The project will have no impact on water pollution. No additional water is required for the project activity's implementation or operation. Therefore, there is no impact on the sustainable use of water.

Also, the project does not impact on the community's access to other natural resources as it will not require any additional resources. Also, there is no impact on the efficiency of resource utilization.

The N_2O abatement catalyst will be leased from an overseas supplier. The catalyst will be replaced from time to time and the spent catalyst returned to the supplier for recycling, if possible.

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

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

Confirmation by Ministry of Environment that no Environmental Impact Assessment is required has been obtained.

SECTION E.   Stakeholders' comments

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

The local stakeholder consultation process was carried out in conjunction with Haifa Chemicals Ltd., which owns and operates two nitric acid plants directly adjacent to F&C's site. The stakeholders identified and contacted are therefore virtually identical with those for Haifa Chemicals. The stakeholder consultation procedure was organised and conducted by Netco Ltd., the local partner of N.serve in Israel, with assistance from F&C staff..

Local Stakeholder Consultation process for F&C

Following is a description of the stakeholder consultation process that was conducted for F&C's nitric acid plant located in Haifa, Israel. The list of contact details of all identified and contacted stakeholders is

shown in the tables below. Copies of the letters and email sent as well as a log of the phone calls made are available and can be viewed by the DOE and CDM EB on request.

Phone Conversations

Follow up phone calls were made to selected stakeholders who had received personal invitation. The objective of the phone call was to remind them of the stakeholder consultation process and encourage them to send their comments. The stakeholders were referred to the special webpage for information about the project. However, they were also given the choice to submit their comments by email, fax, phone or regular mail. The Project Idea Note was sent by email to stakeholders who requested further information about the project activity (those are indicated in the list attached). No comments were received to date.

Phone Conversations				
Date	**Organization**	**Stakeholder, Title**	**email/fax**	**Conversation remarks**
01-Nov-06	The Coalition for Public Health	Mr. Shay Cohen, coordinator	shay.ph@gmail.com	The project activity was described briefly. Project Idea Note was sent following request.
19-Oct-06	Ministry for the Protection of the Environment	Mr.Camel Kazamel, air quality coordinator	kamelq@sviva.gov	The project activity was described briefly. A presentation is being scheduled for the beginning of February, 2007.
30-Oct-06	Citizens for the Environment in the Galilee	Ms. Liora Aharon, coordinator		The project activity was described briefly. The stakeholder was referred to special webpage. No comments were received.
16-Oct-06	Life and Environment – The Israeli Union of Environmental NGOs	Mr. Naor Yerushalmi, Vice President	naor@sviva.net	The project activity was described briefly. The stakeholder was referred to special webpage. No comments were received.
09-Nov-06	Haifa District Municipal Association for the Environment	Bella Ben David, Air Quality Coordinator	bellabd@envihaifa.	The project activity was described briefly. Project Idea Note was sent upon request.
09-Nov-06	Sustainable Development for the Negev	Ms. Bilha Givon, Director	bilha@negev.org.il	The project activity was described briefly. Project Idea Note was sent following request.
29-Oct-06	Public Forum Carmel	Ms. Hadara Ben-Yosef, coordinator		The project activity was described briefly. The stakeholder was referred to special webpage. No comments were received.
28-Sep-06	The Society for the Protection of Nature in Israel – Haifa Branch	Ms. Vered Friedman, Director	Fax: 972(0)4 855-3864	The project activity was described briefly. The stakeholder was referred to special webpage. No comments were received.

Personal Letters

Personal letters were sent to environmental and social NGOs in the Haifa region, relevant municipality authorities and governmental offices. The stakeholder's were invited to participate in a stakeholder's meeting and were asked to confirm their attendance. Due to lack of participants (only one person confirmed his attendance) the meeting did not take place.

The letters also described the Clean Development Mechanism in general and the project activity. The letter also referred the stakeholders to a special webpage on the homepage of the local representative of the carbon consultant (http://www.netco.co.il). The webpage included a special form in Hebrew for a fast and simple on-line submission of comments. The webpage has been open since 9 July, 2006 and will remain open for comments until the beginning of the Global Stakeholder Consultation process conducted by the DOE. No comments were received to date.

Personal Letters				
Date	Organization	Stakeholder	Address/Fax number	Response
9.7.2006	The Public Forum Carmel – Residents' forum for Carmel and Haifa	Mr. Yaron Hanan, coordinator	Fax: 972(0)4 810 1548	No response to letter.
09-Jul-06	The Coalition for Public Health, Haifa and North Region	Ms Keren Malchiel Yitzkar, coordinator	Haganim street 10 Haifa 35024	No response to letter. See phone conversation.
09-Jul-06	Ministry of the Environment, South District	Mr. Arik Bar-Sade, Director	P.O.Box 230 Beer Sheva 84102	No response
09-Jul-06	Ministry of the Environment, Haifa District	, Mr. Robert Reuven Director	Pal Yam Ave. 15A Building B Government Campus Haifa 33095	A letter dated 8 August, 2006 was received requesting the project will be presented to the air quality coordinator. Following the letter, the project was described to the coordinator in a phone conversation and a date for a meeting is being arranged.
09-Jul-06	Haifa District Municipal Association for the Environment	Mr. Tzvi Fogel, Director	P.O.Box 25028, Haifa 31250	No response to letter. See phone conversation.
28-Sep-06	The Society for the Protection of Nature in Israel – Haifa Branch	Ms. Vered Friedman Director	Fax:972(0)4 855-3864	No response to letter. See phone conversation.
09-Jul-06	The Association for the Environment – Kriat Tivon	Mr. Yossi Costi, coordinator	P.O.Box 1144 Kiryat Tivon	No response.
09-Jul-06	Life and Environment – The Israeli Union of Environmental NGOs	Ms Alona Sheffer, Director	Nahalat Benyamin street 85 Tel Aviv 66102	No response to letter. See phone conversation.
09-Jul-06	Our Haifa Organization	Mr. Shmuel Gilbhart	Ayalon street 4 Haifa	No response.
09-Jul-06	Sustainable Development for the Negev	Ms Givon Belha	P.O.Box 125 Omer 84965	No response to letter. See phone conversation.
9.7.2006	Blue and Green Association-Association for the preservation of the environment in the Carmel region.	Ms Tali Mersland, coordinator	P.O.Box 1429 Zichron Yaacov 30900	No response.
09-Jul-06	Dimona Municipality		Fax: 972(0)8 655-0105	No response.
09-Jul-06	Arad Municipality	Dr. Motti Brill, Mayor	P.O.Box 100 Arad	No response.
09-Jul-06	Haifa Municipality	Mr. Yona Yahav, Mayor	P.O.Box 4811 Haifa 31047	A letter was received on the 6th of August, 2006 acknowledging the letter was received. No comments were received.
09-Jul-06	Kiryat Ata Municipality	Mr. Yaacov Perez, Mayor	Fax: 972(0)4 844 9383	No response.
09-Jul-06	Local Authority Kyriat Tivon	Mr. Alon Navot, Director	Ben Guryon Sq. 1 Kiryat Tivon	Confirmed his attendance to planned stakeholder's meeting
09-Jul-06	Local Authority Kiryat Biyalik	Dr. Raffi Verthaim,	Jerusalem Ave. 16 Kiryat Bialik	No response.
09-Jul-06	The Planning and Developing Association in Haifa	Prof. Arza Cherchman, coordinator	Center of Urban Planning and Regional Studies Technion Haifa 32000	No response.
15- Ju-06	Adam Teva V'Din- Israeli Union for Environmental Defense	Ms. Tzipi Ease Yitzik, Director	Lilenblum st. 14 Tel Aviv 66102	No Resonse

Newspaper Advertisement and Article

An advertisement was published in a major Haifa Region newspaper "Zman Maariv" on 7th July, 2006. The advertisement informed the public about the CDM activity in F&C and referred to the special webpage for information about Clean Development Mechanism and the project activity. The advertisement invited the public to send their comments or questions regarding the CDM project.

Also, an article about the project was posted in the same newspaper edition. The article described in general the CDM and the project activity in F&C. The article pointed out that a stakeholder's consultation process is currently being carried out.

The article included three comments on the project activity:

Mr. Robert Reuven, Head of the Haifa District of the Ministry of the Environment: "The activity of the production plant is welcomed and will contribute to the environment".

Mr. Jimmy Krikon, a representative of the Coalition for the Public Health: "The polluting plants have no right to operate in Haifa. With all respect to them and to their future plans, they hold very dangerous materials. Because of public pressure they are doing something which is encouraging, but is too late. Thousands of people became ill and died because of these plants. Haifa and the Krayot civilians will be paying the price for many years to come. The Ministry for the Protection of the Environment is supposed to set limit on their activity, but for years the ministry has preformed its duty in a poor way and we no longer have faith in it."

Spokesman of the Ministry for the Protection of the Environment: "The Ministry for the Protection of the Environment views this project as a means for promoting 'clean technologies' and as a first of a kind project that will encourage other plants to join this process".

No comments were received further to the newspaper advertisement or the article.

Environmental Forums

Three major environmental internet forums were identified in Israel (Nana, Ynet and Tapuz) and emails were sent to the forum directors informing them of the project activity and the stakeholder consultation process. Subsequently messages were posted in these environmental forums. The messages informed the forum participants of the stakeholder consultation process, referred them to the special webpage and encouraged them to send comments.

Several comments were received; however none were related specifically to the CDM project in F&C.

Environmental Forums		
Date	Forum Name	address
06-Oct-06	Nana	http://forums.nana.co.il/Forum/?ForumID=2074
02-Oct-06	Ynet	http://www.ynet.co.il/home/0,7340,L-870-7715,00.html
06-Oct-06	Tapuz	http://www.tapuz.co.il/tapuzforum/main/forumpage.asp?id=174

E.2.   Summary of the comments received:

Overall very few comments were received and none of the comments were specific about the project activity. The project proponents interpret this as an indication of the low or non-existent level of impact that the project will have on local environmental or social conditions.

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

As a result, no changes had to be considered in the implementation of the project activity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been or will be received in the development, implementation or operation of this project. The complete financing of the project will be borne by the Project Participants.

Annex 3

BASELINE INFORMATION

Excerpt from the hourly average measurement reports during the baseline campaign[13]:

Date	Time	OTh TT1203_avh	OTh TT1208_avh	OPh RT0201_avh	AFR FT3201A_avh	AIFR RT3201_avh	NCSG GAI1502_avh	VSG FT3401_avh
31/08/2006	12	639.92	441.90	3.87	786.07	3.68	3,573.86	417.89
31/08/2006	13	889.30	885.50	10.68	2,044.98	6.62	1,307.01	18.85
31/08/2006	14	926.04	921.70	12.12	2,218.70	6.81	1,016.39	23.35
31/08/2006	15	926.12	921.50	12.15	2,217.38	6.81	991.14	23.41
31/08/2006	16	926.02	920.93	12.18	2,216.33	6.81	968.78	23.42
31/08/2006	17	925.89	920.97	12.22	2,220.30	6.81	951.97	23.52
31/08/2006	18	926.07	920.80	12.27	2,220.20	6.79	940.19	23.61
31/08/2006	19	925.94	921.23	12.28	2,219.87	6.81	933.67	23.59
31/08/2006	20	925.99	921.00	12.30	2,218.85	6.79	931.66	23.60
31/08/2006	21	926.04	920.97	12.32	2,221.97	6.80	924.19	23.61
31/08/2006	22	926.07	920.98	12.35	2,225.62	6.81	921.90	23.61
31/08/2006	23	925.99	921.03	12.32	2,219.57	6.80	918.09	23.50
01/09/2006	00	925.98	921.00	12.34	2,223.97	6.80	917.32	23.49
01/09/2006	01	926.04	921.27	12.30	2,219.12	6.81	914.44	23.44
01/09/2006	02	925.92	921.25	12.21	2,215.62	6.82	909.05	23.06
01/09/2006	03	925.98	921.63	12.30	2,218.97	6.80	911.76	23.31
01/09/2006	04	926.01	921.37	12.26	2,216.42	6.81	908.13	23.17
01/09/2006	05	926.01	921.63	12.27	2,215.12	6.81	906.47	23.18
01/09/2006	06	926.01	921.90	12.31	2,218.43	6.80	908.42	23.17
01/09/2006	07	925.99	921.03	12.23	2,212.12	6.81	904.91	22.57
01/09/2006	08	926.02	920.47	12.13	2,208.25	6.83	902.21	22.23
01/09/2006	09	925.98	920.98	12.12	2,208.93	6.82	902.60	22.44
01/09/2006	10	925.86	920.87	12.13	2,204.38	6.79	903.08	22.53
01/09/2006	11	925.92	921.08	12.14	2,205.35	6.80	901.97	22.79
01/09/2006	12	926.07	920.88	12.10	2,199.37	6.81	898.35	22.76
01/09/2006	13	925.80	921.00	12.10	2,201.77	6.81	897.92	22.70
01/09/2006	14	925.82	920.82	12.14	2,203.35	6.81	898.55	22.76
01/09/2006	15	926.02	920.77	12.12	2,202.90	6.82	896.71	22.65
01/09/2006	16	925.95	921.00	12.11	2,201.35	6.81	896.70	22.64
01/09/2006	17	925.95	921.00	12.15	2,205.53	6.82	896.15	22.75
01/09/2006	18	926.00	921.00	12.20	2,208.02	6.82	896.33	22.96
01/09/2006	19	926.02	921.00	12.24	2,209.87	6.82	897.88	23.10
01/09/2006	20	926.04	921.03	12.31	2,212.80	6.79	900.22	23.35
01/09/2006	21	925.98	921.00	12.30	2,212.20	6.80	898.15	23.31

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[13] The complete data series is available for review and inspection by the DOE at any time.

Annex 4

MONITORING INFORMATION

A. Background on EN14181

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

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

- Specific procedures for N_2O are not yet defined in EN14181;

- Only very limited experience exists with monitoring systems for N2O emissions;

- No applicable regulatory N_2O levels exist in the EU (or elsewhere) that are required to conduct some of the calculations and tests of EN14181; and

As a result, at the time of ordering and installation of the AMS at Haifa Chemicals' nitric acid plants, no AMS vendors had yet achieved the certification for suitability in accordance with EN14181.

However, N_2O is expected to be regulated in the EU starting in 2008, the Council Directive 96/61/EC on integrated pollution prevention and control is under preparation under the lead of the European IPPC Bureau (http://eippcb.jrc.es/). Only once the regulatory limits and the framework for N_2O measurements have been established can and will AMS vendors finally conduct the suitability testing in accordance with EN14181.

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

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

The monitoring procedures developed for this project under AM0034 aim at providing workable and practice orientated solutions that take into account national environmental standards and regulations, available monitoring and testing expertise in the country as well as the specific situation at each nitric acid plant. Wherever possible, EN14181 is applied as guidance for the development and implementation of the monitoring procedures for this CDM project in order to achieve highest possible measuring accuracy and to implement a quality control system that assures transparency and credibility.

Scope of EN 14181

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

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

EN14181 specifies:

- a procedure (QAL2) to calibrate the AMS and determine the variability of the measured values obtained by it, so as to demonstrate the suitability of the AMS for its application, following its installation;

- a procedure (QAL3) to maintain and demonstrate the required quality of the measurement results during the normal operation of an AMS, by checking that the zero and span characteristics are consistent with those determined during QAL1;

- a procedure for the annual surveillance tests (AST) of the AMS in order to evaluate (i) that it functions correctly and its performance remains valid and (ii) that its calibration function and variability remain as previously determined.

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

B. Description of the AMS installed at F&C nitric acid plant

1. General Description of the AMS

F&C's nitric acid plant is equipped with a state of the art AMS consisting of a Servomex X4900C1® Continuous Emissions Analyser & Sample Conditioning System and a Durag D-FL 100® Velocity Measuring System. The sample points were chosen in accordance with the AMS requirements and the plant design specifications to allow an optimum of data collecting quality.

2. Sample points

The location of the sample point was selected to provide ease of access and a location close to the analyser. The most suitable position is in the vertical section of the exit stack. At this point, the gas is still hot (above dew point) and well mixed.

The sampling points for both the NCSG and VSG are at least 3 times the stack diameter distance after any previous bend in the stack and behind the tail gas expander turbine.

3. Analyser

The X4900C1 is capable of analysing N_2O concentration in gas mixtures. It employs the Sing Beam Dual Wavelength (SBDW) gas filter correlation infrared technology to measure N_2O, which reduces errors caused by cell contamination (dirt on cell optics) and IR source aging, because both the reference and measurement cells are equally affected by both. If the IR signal is reduced at the detector by aging or contamination it will not change the relationship between the 2 signals which in turn is the measurement. Thus, this is one of the most suitable measuring techniques available for the elimination of interferences from any unknown background components in the process.

Some gases – including CO, CO_2, NO, N_2O and SO_2 – have a spectrum with a fine structure. By sending infrared rays through a sample cell and analysing the absorbed spectra of the rays permeating through the sample contained in the cell, on can deduct the content of any of these gasses.

Any of the named gasses has a specific absorption spectrum. When the cell filled with the target gas the infrared beam's energy is absorbed by the target gas in the sample. This gives a gas specific span reading. The difference between the zero and span signals is proportional to the concentration in the sample. This measuring technique is highly accurate – with an intrinsic uncertainty level of less than 1% – and allows a specific and highly selective use on specific gasses.

4. Sample Conditioning System

The sample conditioning system is part of the X4900C1 analyser. The gas samples extracted at the sampling points are delivered to the actual sample conditioning system via heat traced Unitherm 2256/2266® lines that maintain the sample in the gas phase. They are electrically heated and insulated with fibreglass. Before being fed to the analyser, moisture is removed by a Nafion Tube Dryer®. The sample is led through a semi-permeable tube which allows water molecules to pass through its exterior walls. On the outside, the tube's surface is dried with a constant gaseous nitrogen flow. Thus, the system is capable of extracting water vapour from the gas mix without affecting any changes in its other components.
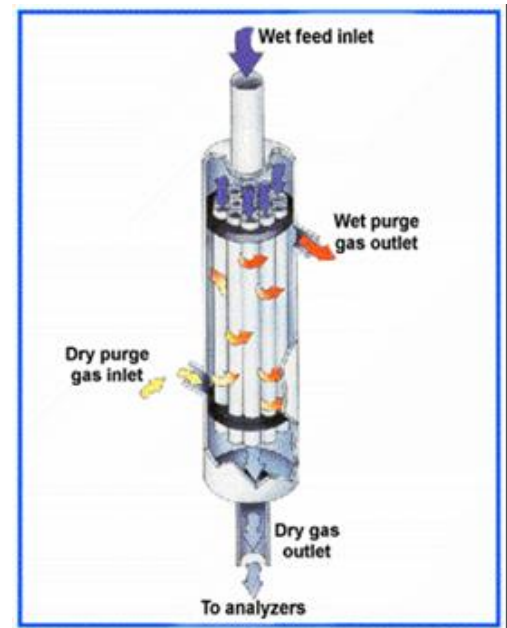
5. Flow Meter

The Durag FL-100 measuring system uses a multiple point pitot tube and therefore allows continuous determination of the flow rate across the diameter of the stack. It is type tested to the guidelines of the German Federal Ministry for the Environment, Nature Conservation and Reactor Safety on suitability testing of measuring equipment for continuous measuring of emissions[14]. Pre-selectable limit value surpassings are indicated inertia-free, so permitting necessary interventions in the plant control system as to comply with prescribed emission limit values.

The D-FL 100 Measuring System works according to the principle of mechanical effect. The probe has two different chambers, between which a pressure difference, caused by the flow in the duct, builds up. The differential pressure resulting at the probe is proportional to the square of the gas speed. Due to the probe's special shape, a highest possible differential pressure is produced, whereby the linearity of the measuring signal is guaranteed.
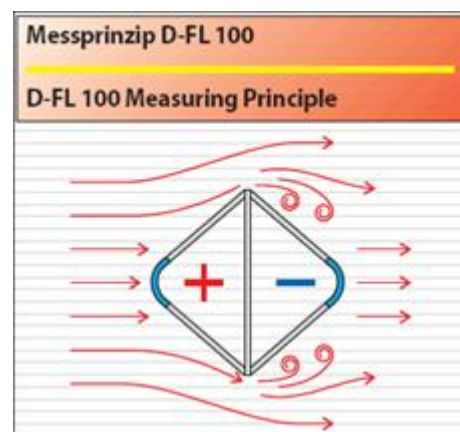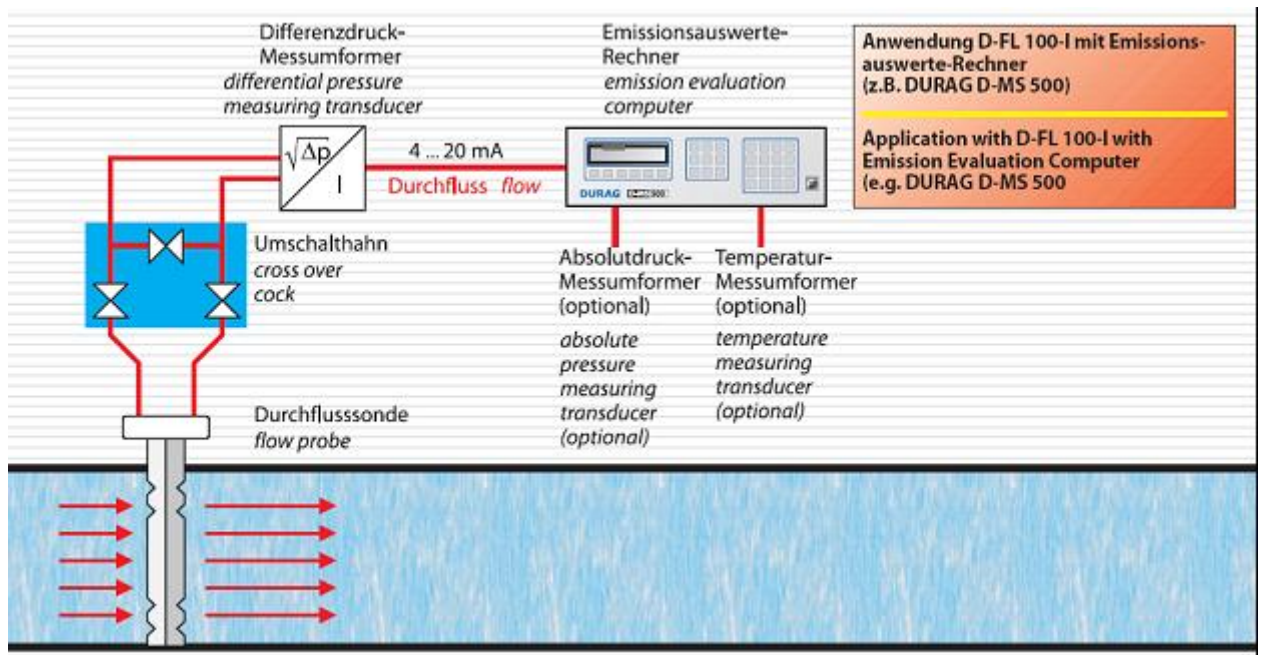
Messprinzip D-FL 100

D-FL 100 Measuring Principle

Diagramme of the Durag FL 100 Measuring System

[14] Test report #128CU11650 by TÜV Nord, Hamburg, Germany, itemized in the list of suitable measuring instruments for continuous registration of emissions GMBl#42 of 1996.

The measurement results are converted from operating to standard conditions by taking temperature and pressure at the sample point into account. The D-FL 100 can be applied to gas flows with a minimum velocity of 3m/sec and a maximum temperature of 400 °C.

The following photographs show the monitoring equipment as it has been installed at the F&C plant for the baseline campaign and will be used for assessing the project emissions.

Air conditioned analyzer house

AMS Equipment inside analyzer house:

Measuring installations at stack:

Analyser sample probe

Flow meter sample probe

Schematic diagrammes of the AMS installation at F&C:

LEGEND

——————— Process Line

— · — Removable Line

- - - - - Electronic Signal