*Pakistan Journal of Science (Vol. 73 No. 1 March, 2021)*

# MONITORING & ASSESSMENT OF N2O, NOX EMISSIONS FROM FERTILIZER PLANT (NITRIC ACID) FOR THE ENVIRONMENTAL SUSTAINABILTY

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**ABSTRACT:** Nitrous oxide (N2O) is an invisible product of nitric acid by Ostwald process. Formed during oxidation of ammonia over platinum / Rhodium gauzes; there is a need for technology to reduce the release of nitrous oxide from nitric acid plants.N2O technology can play a major role in reducing greenhouse gas emissions. The major impact of N2O on the environment such as greenhouse gas and stratospheric ozone depletory, primary options environmentally uncontroversial materials with a long operating lifetime.Secondary controls EnviNO$_x$ does not interact in any way with the plant product or its precursors.The higher Applications in other kinds of industrial waste gas streams are also being developed. Selected catalytic Regeneration (SCR) is a well-known technology for controlling the release of nitrogen oxide (NOx) emitted by fire from various energy / chemical plants. This strategy requires a reducing agent such as ammonia to reduce NOx.This research is based directly on Practical/technical control and aims to obtain, update researchers' information on the various aspects of the Clean Development Mechanism to gain $N_2O$ emissions are reduced by ~98–99% and higher, while $NO_X$ emission levels of 1 to ~40 ppm are achieved. The results of ongoing investigations are promising.

**Key words:** Exhaust Fume Cleaning, Selective CDM,Catalytic filter medium, NO/N2O Conversion, ENViNOx/N2O.

*(Received 05.12.2020 Accepted 15.02.2021)*

## INTRODUCTION

Our bio-network is under constant threat due to human instability. The advent of technology and Science not only poses a high risk but also provides high-quality and understandable information so that the balance of the environment is not compromised. Of all the things that people are most at risk, it is the spirit. So our goal is to build a plant to fix air pollution .Before we do that, we have to understand the philosophy of air pollutants, Polluter's and pollution.The nitrogen oxides NO and $NO_2$ which make up $NO_X$ have long been known as precursors of acid rain and smog,Nitrous oxide ($N_2O$) is a powerful greenhouse gas, being about 300 times more potent than carbon dioxide [1].Emissions of greenhouse gas (GHG) into the atmosphere and their impact on global climate are one of the major environmental concerns in modern times.

The research described in this thesis focuses on the release of N2O, NOx.N2O is located in one of the most important ozone Depleting Substances (ODS) and Greenhouse Gases (GHG) emissions. GlobalN2O emissions are increasing and research indicates that their total exposure to space will increase 100% by 2050 (United Nations Environment Program, 2013). It is estimated that the 2020 N2O global emissions potential is around 200 million CO2e and is expected to reach 500 million CO2e by 2030, which is about 1% of the emissions gap degree C (BMUB, 2015). Approximately 3.78% of the total N2O emissions are due to nitric acid production areas (United Nations Environment Program, 2013). The Clean Development Mechanism (CDM) and Joint Implementation (JI) under the patronages of the United Nations Framework Convention on Climate Change (UNFCCC) have given motivation to increased N2O technology in reducing nitric acid plants in both developed countries and and developing. As of April 2016, 97 nitric acid N2O and UNFCCC projects have been registered.Nitrogen oxides belong to the family of toxic gases, the most active. These gases form when fuel is burned at high temperatures. NOx pollution is emitted by various non-road vehicles, trucks and non-road vehicles (e.g., construction machinery, boats, etc.) as well as industrial sources such as power stations, industrial boilers, cement stoves, and turbines. NOx often appears as brown gas. A powerful chemical agent and plays a major role in the natural response to organic chemicals (VOC) producing ozone (smog) on hot summer days. CDM allows pollution reduction projects in developing countries to obtain reduced emissions reduction (CER) credits, each equivalent to one ton of CO2. These CERs can be sold and sold, and used by developed countries to meet part of their pollution reduction targets under Kyoto Protocol, Certified Release Reduction (CERs) is a type of emission unit (or carbon credits) issued by the Clean Development Mechanism (CDM) Executive Board to reduce pollution detected by CDM projects and certified by DOE (Select Business Operations) under the terms of the Kyoto Protocol. Joint implementation (JI) is one of three flexible approaches set out in the Kyoto Protocol to help countries with responsible targets for greenhouse gas emissions.

The Kyoto Protocol is an agreement reached by the United Nations Framework Convention on Climate Change (UNFCCC) 1992 which commits the United Nations to reduce greenhouse gas emissions, based on (a) global warming and (b) man-made CO2 environmental emissions caused that.

## METHODOLGY

The subject of $N_2O$ destruction at the low concentrations of typically 800–1900 ppm 5–12 kg $N_2O$ / tonne $HNO_3$ product, [4] encountered in nitric acid plant tail gases has attracted a great amount of scientific interest in recent years. Among the most intensively investigated catalytic substances are the iron zeolites.

NO, even at low concentrations, has been found to play an important, positive role in the decomposition of $N_2O$ on iron zeolites as reported by [9] and [14] Since nitric acid plant tail gases invariably contain NO this co-catalytic effect [9] can be usefully exploited. The co-catalytic effect was found to depend upon the method of preparation of the iron zeolite [15].

Studies on the reduction of $N_2O$ with hydrocarbons on iron zeolites have shown that high rates of $N_2O$ destruction are possible. [14] Established that methane is a more effective reluctant either ethane or ethene. These results were obtained in the absence of NO or $NO_2$. In investigations on various iron zeolites, [12] found that NO had a strongly inhibiting effect on the SCR of $N_2O$ with propane, and concluded that “the simultaneous removal of NO and $N_2O$ with hydrocarbons (is) unfeasible over Fe-zeolites”.

This potentially fatal drawback for the application of the SCR of $N_2O$ with hydrocarbons over iron zeolites in nitric acid plant tail gases, in which NO is always present can be overcome if the NO and $NO_2$ are removed with a nitrogen-containing reducing agent as described by [16]

SCR of $NO_X$ with ammonia over iron zeolites has been investigated for several decades by many authors, for example, [2],[4, 5] and [14]. Iron zeolites are in general characterized by high $NO_X$ SCR activity with ammonia and a wide operating temperature range [2], 300°C–600°C).

**Destruction of $N_2O$ in Nitric Acid plants:** While the current article discusses the use of a particular method and technology in reducing nitrogen oxides and in particular N2O emissions from nitric acid plants, it should be noted that other possibilities for reducing N2O emissions from nitric acid plants exist. [13] Distinguish between:

(a) Initial measures are intended to prevent the formation of the N2O from the outset”. Either platinum based ammonia oxidation catalyst should be developed, or alternative catalyst systems that produce less N2O are needed.

(b) The second steps ‘‘removing N2O from the critical central stream ’’ between the ammonia burner and the absorber. By doing this, this means placing the catalyst directly under the platinum-based ammonia oxidation catalyst, where the temperature is therefore very catalytic activity.

(c) Higher education measures where ‘‘the stream of waste gas from the nitric acid plant, the tail gas leaving the suction tower, is treated to destroy the N2O ’’. The highest temperature in the tail gases usually rises rapidly at the top of the propeller (see Figure 1). This is therefore the preferred location for the maximum reduction system.Recently [13] reviewed other alternative N2O reduction technologies

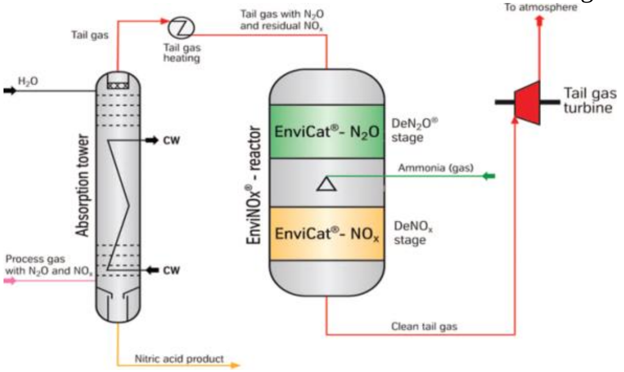

**Figure 1. Secondary $N_2O$ abatement and SCR of NOx over Zeolites [12].**

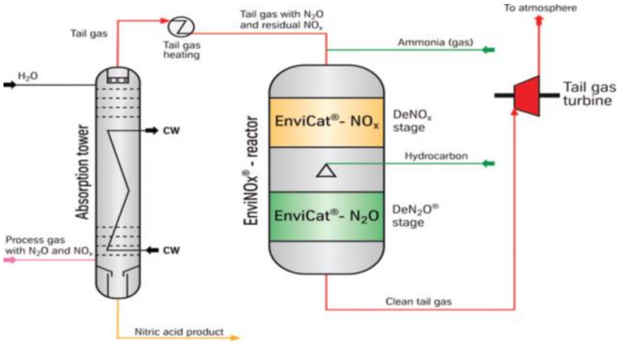

**Figure 2. Tertiary $N_2O$ abatement and SCR of NOx over Zeolites [12].**

The topic of N2O destruction at low concentrations of 800-1900 ppm (5-12 kg N2O / ton HNO3 product, [7] encountered in the tail gases of nitric acid plants has attracted great scientific interest in recent years. Among the most intimate investigations into fossils are metal ions.

NO, even with low concentrations, it has been found to play a significant role in the depletion of N2O in iron zeolites as reported by [14] and [13] since the nitric acid tail gases always contain NO this cooperative effect [7] can be used appropriately. The resulting effect was obtained depending on the method of preparation of iron zeolite [1]. Studies of N2O depletion of hydrocarbons on iron zeolites have shown that high levels of N2O destruction are possible.[2]have established that methane impairs the most effective efficacy either ethane or ethane. These results were obtained in the absence of NO or NO2. In a study of various iron ore metals, [6] found that NO had a strong inhibition of N2O SCR with propane, and concluded that " simultaneous removal of NO and N2O by hydrocarbons (impossible) over Fe-zeolites ".This potential reversal of the N2O SCR utilization by hydrocarbons over iron zeolites in nitric acid plant tail gases, where there is no regular NO, can be overcome if NO and NO2 are removed with a reducing agent containing nitrogen as defined by [9] NOX SCR containing ammonia over iron zeolites has been investigated for several decades by several authors, for example, [6], [10], & [7]. Iron zeolites are commonly characterized by high NOX SCR performance in ammonia and a wide range of active temperatures ([4], 300C-600C).

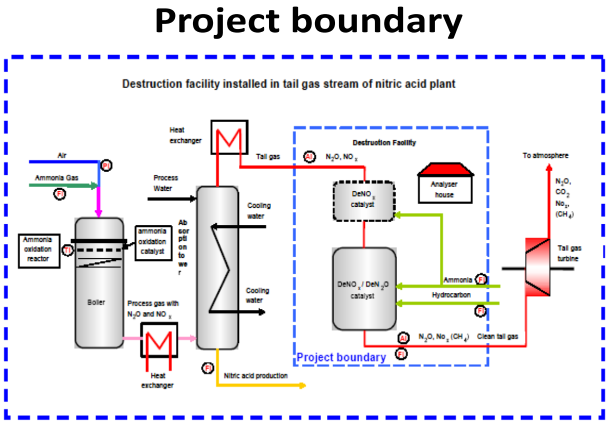

**Figure 3. Overall plant layout [12].**

There are a few technologies that control the release of N2O and NOX. These technologies include extended absorption, and reduction of simplification. Extended absorption reduces NOX emissions by increasing the efficiency of the suction tower or installing an additional absorption tower.

In a strenuous reduction, the tail gases from the suction tower are mixed with petrol, heated by the hot heat and passed through the suction bed. Nonselective catalytic depletion (NSCR) converts NOX and N2O emission into water, carbon dioxide and nitrogen in a low oxygen environment. Selected Catalytic Reduction (SCR) uses ammonia to reduce NOX emissions from nitrogen and water, but it is not known to reduce N2O emissions. 17 (17%) of SCR applications and Five (5%) procedures use NSCR as Abetment Technologies. Fifty-eight (58%) of these processes use a continuous pollution monitoring system (CEMS) to measure NOX emissions. the use of CEMS to monitor NOX emissions is required by the performance standards of the new source (NSPS) nitric acid.The main reason for the differences in estimates is that the greenhouse gas production method assumes that 20% of nitric acid resources using a non-selective reduction factor (NSCR) as N2O removal technology. Institutional-level analysis showed that only 5% of nitric acid sites use NSCR.

**MONITORING METHODS Simplified Emissions Calculation:** The automatic emission rates for nitric acid production are definite. First, N2O can be produced in the reaction gauze phase of nitric acid production as an unintended product reaction. Second the exhaust gas can reduce or decrease the N2O concentration of the treated air. A well-maintained and balanced monitoring system can detect up to 5% pollution at 95% confidence level (IPCC-2006).

**Hybrid (Facility Specific Emission Factor Using Stack Test):** Directly monitor N2O emissions and determine the relationship between nitric acid production and the amount of N2O emissions e.g., improve a specific site emissions factor. A special factor of output rate and production level (performance level) is used to calculate output. Annual N2O release tests will also be required to confirm the release feature over time. The test should be performed without the use of any NOX or N2O technologies. Testing will also be required whenever a major process change is made. The amount of N2O emitted varies depending on the production rate, equipment state, and technology used. The release feature is not expected to be very different on a daily basis. Annual testing should be sufficient to respond to changes in equipment over time and re-testing should be sufficient to respond to any reduction in output due to equipment installation or closure.

**Direct Measurement:** The process and release of fire from the production of nitric acid can also be determined by the directing rate. The two methods can be used for compliance under the CEMS method or stack test method, the output rate data will be reported annually.

**Stack Test Data:** The difference between stack testing and continuous monitoring is that CEMS data provides a continuous release rate, while stack testing provides a specific release rate. With a hybrid approach, the facility can report its production data and a specific site release feature. They may also be asked to report N2O release tests performed to confirm the release feature over time. Details on the type and use of weight loss technology may be required. If a major policy change is made, and further testing is done, this information may also be reported. The institution may also report the operational process (e.g., raw materials, supply prices) at the time of the inspection.

**NEW SOURCE PERFORMANCE STANDARD APPROACH:** Accurate measurement is required by Nitric Acid New Source Performance Standards (NSPS) (40 CFR Part 60, subpart G). Under the NSPS method, however, owners or operators must use CEMS to directly measure NOX and use a specific site release rate to convert NOX rating into N2O emissions per ton of nitric acid produced. This option will require continuous monitoring of NOX emissions and measuring N2O emissions to establish a discharge rate and periodic monitoring (using stack tests) to ensure the rate of discharge rate over time. The test should be performed without the use of any NOX or N2O technologies. Testing will also be required whenever a major process change is made.

**CONTINUOUS EMISSIONS MONITORING SYSTEMS:** CEMS continues to withdraw and analyze the bulk gas sample and continuously measure the concentration and flow rate of the GHG gas tank. Because CEMS would continue to measure N2O emissions from a nitric acid production facility in operation, this method is the most accurate precautionary measure for determining GHG emissions from a specific source.

**Prevention:** Arrangement of the system may be prevention while sub system is relief valve and its component is safety relief valve, description system limits i.e. relief safety valve role is to provide facilities that permit rapid depressurization of blocked inventory in process sections and isolated sections to safe disposal system. Function is to provide facilities that permit rapid depressurization of blocked inventory in process sections to safe disposal system while availability pressure and temperature relief shall be provided in accordance with API RP 521 & 14C, so if we discussed its survivability the relief system shall maintain integrity & remain operational under extreme Environmental conditions. The relief systems shall be routed to safe location.

**Control:** Arrangement of the system is control while sub system is emergency shutdown and its component is emergency shutdown valve, description system limits i.e. ESD logic, Valve, Actuator, Solenoid, Relay & Electrical input signal. **Role** To provide facilities initiate appropriate shutdown & isolation actions to limit the inventory, escalation of fire into a major hazardous event & to minimize the duration of any such event. **Function** is to The ESD system shall be designed to initiate appropriate action in accordance with ESD logic while **availability** The arrangement of the specific equipment shall have a probability of failure on demand of not more than 1 time out of 10 when a hazard is present. so if we discussed its **survivability** The arrangement of the specific equipment are protected by location from the specific hazards which the system is designed to mitigate. Various process upsets & shutdown.

**Detection:** Arrangement of the system is detection while sub system is gas detection system and its component is $NO_X/N_2O$, $CH_4$, $NH_3$, $H_2S$, description system limits i.e. $NO_X/N_2O$, $CH_4$, $NH_3$, $H_2S$ Gas Detection System. **Role** To provide continuous automatic monitoring to alert personnel of the presence & location of a toxic gas release & to enable manual initiations of remedial actions to avoid/minimize escalation of events. **Function** is to provide continuous monitoring in areas where there is a risk of toxic gas accumulation. While **availability** Toxic gas detectors shall be constructed & installed in accordance with recognized codes & standards, equipment shall be certified for zone. so if we discussed its **survivability** The Safety Integrity Level (SIL) requirement of the toxic detection system shall be in accordance with the finding of SIL classification study. Detect the presence of a gas release with the type of detector being appropriate to the nature of the fire hazard in the area.

**Mitigation:** Arrangement of the system is mitigation while sub system is Effluent treatment system and its component is $NO_X/N_2O$, $CH_4$, $NH_3$, $H_2S$, and description system limits i.e. primary, secondary and tertiary effluent treatment. **Role** The Effluent Treatment Systems are provided to support the process units by treating the waste stream for safe disposal. The treatment of facility is designed for. Oily waste water & sanitary sewer system, Acid neutralization facility, spent caustic waste water treatment. **Function** The Corrugated plate interceptor (CPI) Separator shall be capable of treating effluent. Oil 5mg/L, TSS 20, Sulphide0.1, BOD100-300, PH 7 to 9. While **availability** CPI Separator shall be capable of treating Discharge effluent. Oil 2000-10000mg/L, TSS 250-500, Sulphide1-2, BOD25, PH 6.6 to 8.5.so if we discussed its **survivability**All catch basin shall be hydraulically designed with maximum liquid levels to meet storm condition & fire fighting condition of all areas. Detect the presence of a gas release with the type of detector being appropriate to the nature of the fire hazard in the area.

**Escape, Evacuation, Rescue:** Arrangement of the system is escape, evacuation and rescue while sub system is escape, evacuation routes and its component is means of evacuation. Description system limits i.e. Escape Routes, Means of Evacuation, Rescue & escape equipment & facility. **Role** to provide routes & facility which personnel can use to move away safely from the effects of a hazardous event in their vicinity and escape safely? **Function** Exit doors from the control building shall not face process areas. While **availability** Escape, Evacuation & Rescue system shall be in accordance with the equipment, specification in the safety studies. So if we discussed its **survivability** Escape routes from processing area should not be impaired in case of a credible event. Emergency & escape system shall maintain its integrity & remain operational under extreme environment condition. Safety& warning signs shall be provided in native language.

**Fire and Gas System:** Arrangement for Assurance and verification purpose **Functionality** of fire and gas IF $N_2O$ detectors positioned so that line of sight to identified hazards are not obstructed, By design, layout review and offshore survey, MAXIMO PMR Ref. Doc # F&G Philosophy Ref.Doc # , it will done by Independent verification body. **Availability** System intake gas detection loop fire & gas logic solver. System to achieve SIL 2 i.e. minimum availability of 99%, Determine test interval by reliability analysis.

Cary out maintenance on loop components in line with testing intervals required for loop to meet the required SIL target. Cary out PM on regular base, Ensure safe reliability should be checked on regular interval. These devices are required to survive for a sufficient period of time to ensure event can be controlled/monitored from control room and orderly muster/evacuation can be coordinated in HOLD minutes. Survivability ensured through location i.e. The F&G Panel & console is located in the control room.

**Vent and Flare System:** Arrangement for Assurance and verification purpose **Functionality** The flare system shall collect and dispose of flammable and toxic in a safe manner, the flare system shall be designed to the requirements of API 521 HOLD, Blow down valves shall open in accordance with the ESD cause and effect charts on receipt of signals from the ESD system. This includes manual initiation and initiation associated with a level 1 depressurized shutdown. it will done by Independent verification body. **Availability** Confirm design meets criteria Integrity of flare piping will be covered under hydrocarbon containment. Confirm system meets the requirement of API 521 Function test and record actual blow down times, Function test to confirm valves open on receipt of signal from ESD system. Survivability ensured through location i.e. The F&G Panel & console is located in the control room, Blow down valve data sheet Ref Doc#.....Blow down valve data sheet Ref Doc#.....Process Automation System (PAS) records Ref Doc#....Confirm by review of records that blow down segments meet the performance standard criteria. Witness testing, with executive actions inhibited, to confirm that localized blow down is initiated by process/utility shutdowns.

Source: Conoco Phillips U.K. Limited (CPUKL) Southern North Sea (SNS) Saturn installation. ADNOC COP V1-02 01st OCT 2005. ADNOC COP V5-01 9th May 2004. ADNOC COP V6-01 2nd Oct 2004. TAKREER HSE-CP20. RUWAIS REFINERY RRD-COM-REP-003 SEPTEMPER 2006.

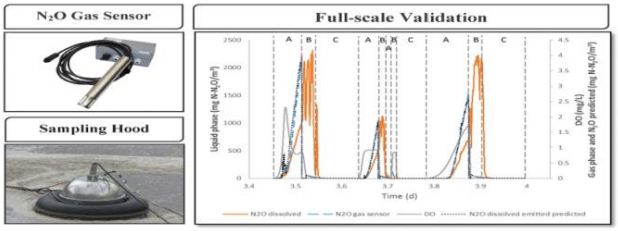

**Figure-4: $N_2O$ GAS SENSOR TEST KIT [13].**

**CDM Abatement Technology:** Client: Pak Arab Fertilizer Multan

Main Contractor: Sumiko Eco-Engineering Co. Ltd Mitsubishi Tokyo Japan Sub-Contractor: KS Engineering Co. Ltd.

The abatement system is modern, efficient and reliable abatement system to be installed at the existing nitric acid plant to abate $N_2O$ and $NO_x$ (NO, $NO_2$) from the tail gas generated in the process of the production of $HNO_3$plant. The said tail gas is induced to SCR (Selective Catalyst Reduction) from the boiler (Mixer, reactor) of Nitric Acid Plant where $NO_X$ is eliminated through the chemical process on the catalyst surface by the reaction with ammonia. Ammonia is fed in to SCR.

De ____ NOx IN SCR

$4NO+4NH_3+O_2$ __________ $4N_2 + 6H_2O$

$NO+NO_2+2NH_3$________ $4N_2 + 6H_2O$

The SCR catalysts are based on a titanium dioxide ($TiO_2$) carrier in a monolithic structure impregnated with active Vanadium pent oxide ($V_2O_5$) and tungsten trioxide ($WO_3$) species. The SCR catalysts are used for removal of nitrogen oxide NOx (NO, $NO_2$) from off-gases. NOx (NO, $NO_2$) are reacted with $NH_3$ and converted into $N_2$ and $H_2O$.

De _____$N_2O$ IN RCS

The treated tail gas is compressed into the combustion chamber of RCS (Regenerative Catalyst System) through the inlet manifold where N2O is decomposed through the reaction of catalyst under certain temperature.

$N_2O$ ___________ $N_2$+1/2$O_2$ 19.6 Kcal

In order to maintain the specified efficiency of catalyst reaction, the temperature within the chamber is to be raised and kept at suitable temperature by the burner, and also temperature of tail gas introduced in to the chamber of RCS is to be raised up $H_2O$ treatment temperature by passing through ceramic bed with the catalyst. This RCS is an energy saving system where around 95% of heat energy is recycled and used to raise the temperature of induced tail gas from the next cycle of $H_2O$ reduced. The air after $N_2O$ has been decomposed from the tail gas is purged into the atmosphere through the stack. This abatement system is designed to eliminate such safety hazards as much as possible as may cause adverse effects again the steady operation of the existing $HNO_3$plant. However, in order to achieve the above-mentioned purpose. The great and special emphasis is to be placed on the daily management of the operation and maintenance activities made by the operational and maintenance staff.

## RESULT AND DISCUSSIONS

**BASIC:** It contained in the Glossary of CDM methodology. The following process descriptions apply:

**Secondary $N_2O$ Abatement:** Means the incorporation of catalyst into an ammonia heating unit for the sole purpose of removing N2O emissions from the river;

**Tertiary $N_2O$ Abatement:** It refers to the installation of a tail-gas reduction system that leaves the plant to absorb the nitric acid plant to destroy the N2O produced in the ammonia heating unit.
<http://cdm.unfccc.int/goto/MPappmeth"NM0339:
$N_2O$ abatement in New Capacity nitric acid plants" prepared by N.serve Environmental Services GmbH; 31 May 2013

**Project Boundary:** The scope of the project's boundary space includes the location and equipment of the nitric acid production process from the insertion of the ammonia cortex to the outlet of the tail gas component.

- If the project work only introduces a second N2O reduction and does not have a high altitude, then the only gas to be installed as a project discharge is N2O which can be destroyed and still in the plant's tail. The scenario using demolition second technology is shown below in Figure below.

Figure 5 Project boundaries when project work involves the introduction of a second N2O reduction rate (simplified nitric structure showing the location of the N2O catalyst cathedral, N2O process resources and the sample location of the Automated Monitoring System (AMS).

If the project work introduces a high N2O reduction, then any remaining N2O emissions from the project center and CO2 emissions from the implementation of the high N2O reduction program are included as project outsourcing to the project boundary. The scenario using the advanced N2O reduction technology is shown below in Figure 4.

Project boundary when project work involves the introduction of a N2O higher education standard (simplified nitric structure indicating the location of the N2O catalyst catalyst, N2O process resources and the sample location of the Automated MonitoringSystem (AMS)

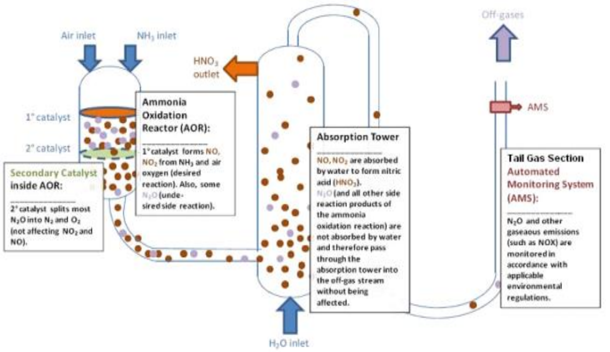

Figure 5. Automated Monitoring System [14].

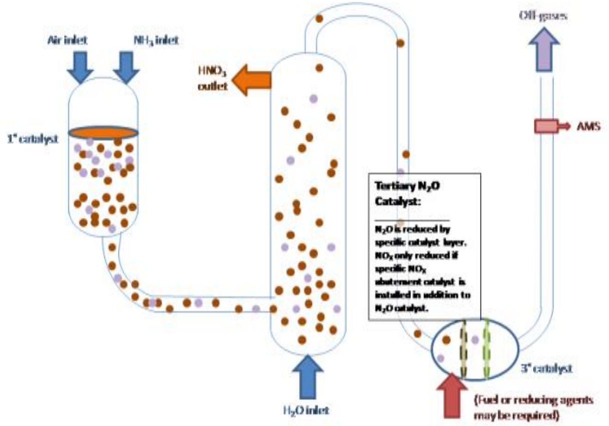

Figure 6. Automated Monitoring System [14]

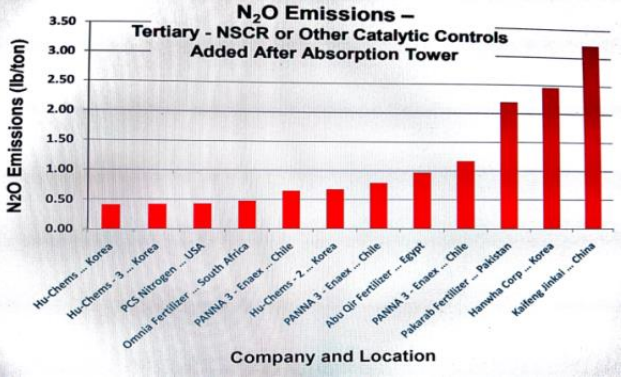

Figure 7. N2O Emissions from Tertiary Control [13].

Three types of controls are present in N2O in nitric acid plants depending on the regulatory environment within the nitric acid production process.

**1-**Essential - reduces the amount of N2O produced in the step of ammonia oxidation. This can be done by modifying the catalyst used in the oxidation process and / or changing the operating conditions of the process.**2-** Reduces N2O immediately after it is formed in the step of ammonia oxidation.**3-**Higher education institution - reduces N2O by inserting a catalytic reactor either up or down the tail gas booster unit following ammonia oxidation.

**Table 1. Summary of $N_2O$ Control Measures in the Nitric Acid Production (EPA 2006; European Commission August 2007)**

| Pollutants | Control Technology | Emission reduction % | Energy savings | Capital Cost($/ton CO2e | Operating cost ($/ton CO2e | Demonstrated in practice |
|---|---|---|---|---|---|---|
| $N_2O$ | Primary | 30-85 | None | Unknown | Unknown | Yes |
| $N_2O$ | Secondary | 70-80 | None | Unknown | 0.12-0.97 | Yes |
| $N_2O$ | NSCR | >80 | None | 6.27 | 0.14-0.22 | Yes |
| $N_2O$ | Other Tertiary Control | >80 | None | 2.18-3.55 | 0.14-1.91 | Yes |

**Non Catalytic Selective Reduction (NCSR).**

In non-catalytic reduction (NSCR) chemicals such as ammonia, urea or cyanuric acid are injected into the flue gas to reduce NO. This leads to some emissions of N2O, which are higher in the case of urea or cyanuric acid than in the case of ammonia. A more expensive, but more effective techniques for reducing NO emissions in flue gases is selective catalytic reduction (SCR), where ammonia is injected into the flue gases in the presence of a catalyst, commonly titanium oxide based to reduce NO and NO2 to nitrogen and water. But SCR appears to have little effect on N2O emissions.

**Table 2. Comparison of Secondary Catalyst Based Technologies and Tertiary Abatement Technologies.**

| Parameters | Secondary catalyst based technology | Tertiary abatement technology |
|---|---|---|
| N2O Abatement Efficiency | Typically 50-80%, although some projects have also reported over 90% abatement efficiency (CDM Monitoring Report-Ref 2550, 2012), | High (more than 90%, reaching 100% in some cases 22) in most cases (Schmidt, Groves 2009) |
| Capital Investment | Lower | High |
| Catalyst Life | 2-4 years | 10 years |
| On-line Monitoring of Real-time N2O Abatement | Not possible | Possible |
| Impact on Production | At times pressure drops observed inside AOR leading to loss of production | Being an end-of-pipe solution, does not interfere with the production process. |
| Interactions with NOX Reduction | | Where EnviNOX systems are used, N2O and NOX reduction can be combined in a single reactor vessel |
| Cost of Abatement | High | Low |

**Selective Catalyst Regeneration (IN-SITU)**

- HIGH DUST concentrations
- High temperature
- High gas velocity

By the Research study at CDM Plant, I may able to know and give suggestion that SCR Bypass solution to achieve a typical concentration in a mixture a representative sample is taken through even distributed boards under optimum condition a sensor/analyzer takes measurement using a special development bypass cell without storing the results, **GM32 UV** analyzer measurement not contents directly with the bypass cell while optics of the analyzer colds and maintained free of dust using per gel. the measurement result obtain and able inject of ammonia to precisely regulated in addition volumetric flow measurement provides information to calculate mass flow, the volume **FIC 100** is continuing to detect across the complete duct by means of ultra-sonic meter, the gas mixture after the SCR is also measure the effectiveness of catalyst and provide feedback control, if any $NO_X$ is present Ammonia injection is increased, if Ammonia level is high Ammonia injection is reduced. **GM 700** is additionally step at outlet of the system preciously measure the Ammonia slip and moisture contents. The continuing monitoring of the volume flow with **FIC 100 M–AC** is the SCR by pass system ensure smooth operation and detect any possible malfunction at an early stage. Addition measurement such as pressure, temperature, humidity and oxygen can be included to report the value under low level NO condition. This ensured the value from both measuring point (up/down stream) of SCR are capable and guaranteed optimum system control. The bottom line, this is money and quickly makes the investment worldwide.

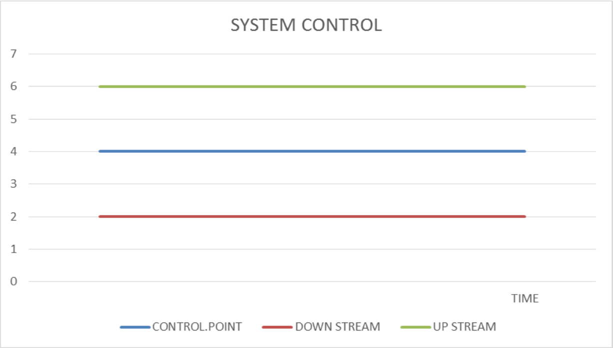

**Figure: 8 System behaviors at Control Point [13]**

- Maximizing the run time of catalyst.
- Minimizing the Ammonia consumption
- Producing fly ash with a minimal Ammonia content for further utilization
- Lower emission limit values are already observed during the process.

The SCR Bypass system provides ecological and economical flue gas measurement for large and small process.

**Improving Catalyst Performance:** The three current modification methods are designed to reduce NOX emissions, CO and VOCs, all of which are precursors of ozone. N2O is produced due to incomplete catalytic degradation of NO and NO2 to N2. It is possible that in the long run it was possible to develop a new converter that prevented the formation of N2O. It is likely that this will require a significant R&D effort.

**Table-3. Cost-effectiveness of Measures Designed to Reduce Emissions of $N_2O$ from the Chemical Industry (best estimate) Reimer (1996)**

| Mitigation measures | ECU per tonne of $N_2O$ Abated |
|---|---|
| End of pipe technology | 37 |
| NSCR | 42 |
| Catalytic Destruction | 43 |

**Table 4. The Greenhouse Gases Included in or Excluded from the Project Boundary are Shown in.**

| **Data / Parameter:** | **$EF_{new,y}$** |
|---|---|
| **Data unit:** | kg $N_2O$/t $HNO_3$ |
| **Description:** | Baseline $N_2O$ emission factor for nitric acid production in year *y* (related to 100 per cent pure acid) |
| **Source of data:** | The baseline $N_2O$ emission factor for nitric acid production will vary every year. In year 2005 the emission factor will be 5.1 and then it will decrease every year until it reaches a final value of 2.5 in the year 2020. The value of 2.5 will remain constant after 2020, as provided in the following table: |

| Year | Emission factor (kg$N_2O$/t $HNO_3$) |
|---|---|
| **2005** | 5.10 |
| **2006** | 4.90 |
| **2007** | 4.70 |
| **2008** | 4.60 |
| **2009** | 4.40 |
| **2010** | 4.20 |
| **2011** | 4.10 |
| **2012** | 3.90 |
| **2013** | 3.70 |
| **2014** | 3.50 |
| **2015** | 3.40 |
| **2016** | 3.20 |
| **2017** | 3.00 |
| **2018** | 2.80 |
| **2019** | 2.70 |
| **2020** | 2.50 |
| **2021** | 2.50 |
| **2022** | 2.50 |
| **Year n** | 2.50 |

| | |
|---|---|
| **Measurement procedures (if any):** | **2023** |
| **Any comment:** | The decrease in the value for the baseline emission factor over time is to reflect the technological development |

**Conclusion:** This research gives an overview of possible, Extended Absorption NSCR/SCR system configurations that are required for different stages of future emission legislation.In this study the projection has been made achievable $NO_X$ reduction percentages with open loop and closed loop control strategies for SCR systems with and without an NO, $NO_2$ Catalyst. Primary advantages of closed loop control strategy with a $NO_X$ sensor is that dosage can be adapted to Engine-out $NO_X$ Variations due to variation in ambient condition and fuel quality.EnviNOx's process of combined reduction of NOX and N2O emissions from nitric acid plants has been demonstrated in global applications now operating at temperatures between 330C and 510C. Typically, N2O emissions are reduced by 98-99% and above, while NOX emissions of 1 to 40 ppm are reached, depending on process variability. Independent confirmation of the high performance N2O reduction of EnviNOx programs can be found on the United Nations Framework Convention on Climate Change website (www.unfccc.org/cdm) where monitoring reports of N2O mitigation projects under the CDM Mechanism of Kyoto Protocol can be read.

EnviNOx is a " friendly operator 'technology because EnviNOx catalysts are easy to handle, environmentally durable and long-lasting. In addition as a pipeline termination process, EnviNOx does not interact in any way with a plant or predecessor product.EnviNOx technology can be used in nitric acid plants at tail temperatures between 330C and 600C comprising approximately 70-80% of the total nitric acid production worldwide. In many nitric acid plants with tail gas temperatures outside this range, very simple plant modification is likely to allow for the incorporation of the N2O reduction system. EnviNOx technology can make a significant contribution to reducing greenhouse gas emissions.

I have suggested by the help of this research for about Catalyst life which normally replaced after 3years can be increased up to 8years by applying urea dosage before going to Selective Catalytic Reduction. Using this method the Concentration of tail gases minimized up to 30% out of 100%. At SCR the efficiency of Catalyst improved and life of Catalyst increased near about 6-8years at same capacity.The Management of PAFL are conscious of the benefits of GHG emission reduction and the abatement potential of their nitric acid production facilities. However, technical support as well as financial commitment to mainstream their mitigation efforts would be required.

**Recommendations:** Scientific analysis of the research results shows that the decomposition of N2O is proven as a pollution control technology as its implementation is an action taken to reduce greenhouse gas emissions. The results of the project are expected to make a significant contribution to the establishment of new world standards that reduce N2O emissions from nitric acid production. The project is open to further scientific research to find the most technologically and constructive ways to reduce N2O emissions.

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