

SECTOR STUDY

INTERNATIONAL OPEN TENDER
MONÓMEROS 003-2024

OBJECT OF THE SELECTION PROCESS:

To contract the "Supply of a Secondary Nitrous Oxide (N₂O) Abatement System, for the Nitric Acid Plant of Monómeros, located in the Special, Industrial and Port District of Barranquilla, Department of Atlántico - Colombia, in the context of the Nitric Acid Climate Action Group (NACAG) initiative."

Barranquilla - Atlántico, Colombia.
2024 August

1. INTRODUCTION.

The purpose of this document is to analyze the sector related to the object of the contracting process for the "Supply of a Secondary Nitrous Oxide (N₂O) Abatement System for the Nitric Acid Plant of Monómeros, located in the Special, Industrial and Port District of Barranquilla, Department of Atlántico - Colombia, in the context of the Nitric Acid Climate Action Group (NACAG) initiative, which will be carried out through an International Open Tender.

Monómeros Colombo Venezolanos S.A. is a commercial company with 56 years in the petrochemical industry, a subsidiary of the Venezuelan state-owned company, Petroquímica de Venezuela S.A. (Pequiven), located near the mouth of the Magdalena River in the city of Barranquilla, Colombia, being a producer of various products such as simple and complex fertilizers, tricalcium phosphate for cattle feed and other industrial products, such as nitric acid. In 2018 it received the "Best Company in Social Responsibility Simón Bolívar" award. Monómeros is the second largest agro industrial company in Colombia producing fertilizers covering 40% of the national market.

Monómeros has a nitric acid plant with a production capacity of 280 MTPD, which is an important product for the agrochemical industry, as it is used for the production of nitrogen-based inorganic fertilizers. However, the nitric acid manufacturing process emits N₂O, which is a greenhouse gas with a global warming potential 273 times greater than that of carbon dioxide (CO₂).

Monómeros has a budget authorized by the *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)*, which it will use to finance the eventual Contract for which this tender is issued. This grant is part of the [NACAG](#) (Nitric Acid Climate Action Group) initiative, which is a project funded by the *German Federal Ministry for Economic Affairs and Climate Action (BMWK)* and for whose global implementation the GIZ has been appointed.

The NACAG initiative aims to phase out global N₂O emissions from nitric acid production and provides all governments and plant operators with assistance on technological and regulatory issues related to the mitigation of N₂O emissions produced in this industry. NACAG also offers financial support for the purchase and installation of emission reduction technology and monitoring equipment in those plants that are eligible under certain criteria defined by the initiative. Thus, within the framework of the NACAG initiative, GIZ is providing financial support to the company Monómeros for the acquisition of N₂O abatement technology.

In accordance with the above, the company Monómeros is interested in contracting the supply of a secondary nitrous oxide (N₂O) abatement system for its nitric acid production plant located in the city of Barranquilla - Colombia, according to the details and technical specifications listed in Annex 1A, which is an integral part of this Draft Tender Document and the future contract.

2. GENERAL ASPECTS OF THE MARKET.

On an international scale, nitric acid production represents a considerable source of greenhouse gas (GHG) emissions, especially a source of nitrous oxide (N₂O) emissions, which is the third most significant greenhouse gas released into the atmosphere and highly destructive of the ozone¹ layer. The global warming potential (GWP) of N₂O is 273² times that of CO₂³.

N₂O is formed in the production of nitric acid during the ammonia combustion stage as an unwanted by-product. Once formed, this gas passes unreacted through the plant and is not affected by operating conditions in the absorption stage or any other equipment⁴.

Global emissions from nitric acid production are estimated at 350,000 tons of N₂O per year, corresponding to about 100 million tons of carbon dioxide (CO₂-eq), accounting for about 24% of non-CO₂ greenhouse gas emissions from key industrial processes⁵.

For nitric acid production plants, there are three main technologies at the forefront of N₂O emission reduction, which are feasible to install in a wide range of plants. We have experience from numerous successful cases of implementation of these technologies in the context of CDM and JI⁶ projects, emissions trading schemes and other emissions regulations around the world.

After an evaluation of which system is more convenient to install in its nitric acid plant located in Barranquilla, Monómeros selected the secondary abatement technology. Secondary abatement consists of mitigating N₂O emissions directly after their formation in the ammonia oxidation reactor through a catalytic decomposition reaction that takes place in a catalyst bed (also called secondary catalyst) installed below the primary gauzes inside the oxidation reactor.

In this way, secondary abatement systems do not require an additional reactor to house the N₂O abatement catalyst, as it is installed in the ammonia reactor. Therefore, this technology only needs a catalyst containment system, in the form of a basket, installed directly in the oxidation reactor. The state of the art of secondary abatement technologies has improved significantly in recent years, thanks to the increasing number of plants equipped with N₂O mitigation systems.

¹ IPCC, «Assessment Report Climate Change 2013: The Physical Science Basis,,» 2013.

² <https://www.nitricacidaction.org/>

³ G. G. Protocol, «Global Warming Potential Values. <https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming->

⁴ J. Pérez-Ramírez, F. Kapteijn, K. Schöffel y J. Moulijn, «Formation and control of N₂O in nitric acid production. Where do we stand today?,» Applied Catalysis B: Environmental, vol. 44, p. 117–151, 2003.

⁵ IPCC, «5th Assessment Report, "Climate Change 2014",» 2014

⁶ CDM means Clean Development Mechanism and JI means Joint Implementation. Both are part of the so-called flexible mechanisms of the Kyoto Protocol.

i. TECHNICAL ASPECTS.

The goods and services to be contracted will have the following scope (for more information see Annex 1A - Technical Specifications):

The scope of these specifications, and therefore of the budget quotation to be submitted by interested suppliers, must include the unit cost of the all activities described in this document. It should be clarified that the **supplier that is awarded the contract** will only be obliged to carry them out once the respective contract for the supply of the secondary abatement technology has been signed. The activities to be developed by the awarded Supplier will be those described below:

- 1.1.1.** To carry out the engineering study, design and manufacture of a new basket associated with a secondary nitrous oxide (N₂O) abatement system. It should be noted that the basket must be designed to support the primary gauzes and the new secondary abatement catalyst, which will be selected and supplied by the **successful supplier**.

For the fabrication of the new basket, the **successful Supplier** shall supply the labor, materials, tools and consumables required for this purpose. It should be noted that the labor used for the fabrication of the support basket shall include **welders qualified** under the ASME Section IX code, certified welding inspectors -AWS or equivalent- with knowledge of ASME Codes and certified non-destructive testing technicians in accordance with the SNT-TC-1A code or equivalent.

Likewise, the **successful supplier** shall supply the components and accessories required for the initial installation of the new basket, which will be in charge of Monómeros.

- 1.1.2.** Select, supply and deliver the secondary catalyst, according to the technical specifications of the nitric acid production plant.
- 1.1.3.** To carry out the transportation and effective delivery of the goods described in this annex, at the facilities of Monómeros, located in the Special, Industrial and Port District of Barranquilla, Department of Atlántico - Colombia.
- 1.1.4.** Provide *on-site* technical assistance required for supervision during the assembly, installation and commissioning process of the components associated with the secondary abatement system.
- 1.1.5.** Train personnel designated by Monómeros in the process of installation and maintenance of the abatement system, in order to provide knowledge on common problems and how to solve them, which may arise during the operation of the nitric acid plant with the proposed secondary technology.

- 1.1.6.** Provide remote after-sales technical support to ensure optimum performance of the abatement system for a minimum of 5 years after successful commissioning of the technology.
- 1.1.7.** Perform a **field inspection** of the abatement system at the end of the first campaign of the primary catalyst in order to evaluate its mechanical and operational performance. This activity is expected to be carried out after 10 months of operation.
- 1.2. General Description of the Scope.**
- 1.2.1.** Regarding item 1.1.1: The engineering study performed by the **successful bidder** shall include an analysis of the plant and equipment operation requirements to ensure the correct installation and operation of the proposed abatement system. In this order of ideas, the study shall report all the modifications required by the **awarded Supplier** for the commissioning of the proposed system.
- 1.2.2.** Regarding item 1.1.1: The engineering and design studies of the basket include the review of the mechanical design of the current reactor, in particular the points where the new basket will be supported. The purpose of this activity is that the **awarded supplier** guarantees the operation and reliability of these points to support the additional load that the new basket will exert which will support the primary catalyst (gauzes) and contain the secondary one.
- 1.2.3.** Regarding item 1.1.1: During the design of the support basket, the **successful supplier** shall consider that the method of fastening the screens or primary catalyst to the basket shall be the "Weighted ring" type or an equivalent design that avoids ammonia by-pass.
- 1.2.4.** Regarding item 1.1.1: During the manufacturing process of the support basket, the **awarded Supplier** shall deliver to Monómeros for approval of activities, the Inspection Test Plan, which shall include and not be limited to the following activities: preparation of fabrication drawings, PMI -positive material identification- application record, weld inspection record, application of non-destructive tests such as penetrant dyes, radiography, application of heat treatment, dimensional control record, on-site inspection by Monómeros and submission of fabrication dossier.
- 1.2.5.** Regarding item 1.1.3: The place of performance of the contract for the acquisition of the secondary abatement system shall be in the city of Barranquilla, Atlántico - Colombia. Likewise, the goods to be supplied shall be delivered at the facilities of Monómeros at the address: Via 40 Las Flores, Barranquilla, Atlántico - Colombia.

1.2.6. Regarding item 1.1.4: The **successful supplier** shall provide the personnel required at its discretion for the **supervision activities of the technical personnel provided by Monómeros** during the assembly, installation and commissioning of the components that make up the secondary abatement system. The estimated duration of these activities is ten (10) days.

1.2.7. Regarding item 1.1.5: The requested training shall be provided during the initial installation and commissioning of the secondary system. It is the responsibility of the **successful Supplier** to ensure adequate training of Monómeros designated personnel.

1.3. Kick Off Meeting (KOM).

Before starting the execution of the respective contract, Monómeros will summon the **Supplier to a "KOM"** meeting with the purpose of coordinating the development of the activities to be carried out and the conditions and requirements defined in the International Public Bidding. It should be noted that this meeting may be in person or virtual, according to the agreement between the parties.

In the event that the parties agree on the need to hold the kick-off meeting in person, the costs and expenses associated therewith shall be borne exclusively by the awarded Supplier.

ii. REGULATORY ASPECT.

The current contractual process is adjusted within the legal framework applicable in Colombia and the Subsidy Contract signed between Monómeros and GIZ. In this sense, it is foreseen that the legal framework contains the minimum requirements that potential bidders must comply with to be part of the selection of the successful bidder and future contractor, which must be objective and in general in compliance with the principles of contracting.

The rules included in the contracting process are defined in the previous studies, the procedure to be followed will be governed under the principles of the Public Contracting Regime in Colombia, in Law 80 of 1993 *"By which the General Statute of Contracting of the Public Administration is issued; Regulated Decree 1082 of 2015 and other rules on the subject; the process and the proposals submitted in the development of the same, are subject to the rules of public procurement. Article 2 of Law 1150 of 2007, Law 1474 of 2011, Article 94 of Law 1474 of 2011, Decree Law 019 of 2012, in accordance with Decree Law 1082 of 2015, the commercial and civil regulations insofar as these are applicable and other relevant regulations and other regulations in force that are presumed to be known by all the bidders participating in the present selection process..."*.

iii. HISTORICAL SPENDING BEHAVIOR.

There is no public information available regarding costs/expenditures in similar contracting processes (through open international tenders) carried out by other national or international entities.

iv. STUDY OF THE OFFER.

The present process will be carried out with the Legal Entity, Temporary Union or Consortium that accredits what is established in the bidding documents, as well as the experience and suitability, in order to carry out the analysis that supports the estimated value of the contracting to be carried out.

The economic conditions were established based on market quotations. According to the answers obtained in the market analysis, there are possible bidders in the local and/or national market and in the international field, which state that they can fully comply with all the goods and services according to Monómeros' requirements.

However, it is clarified that any supplier that complies with the conditions established in the tender documents may submit an offer to participate in the open international tender, regardless of whether or not the supplier participated in the market research conducted in 2023.

v. STUDY OF THE DEMAND.

The need is to supply SECONDARY Nitrous Oxide (N₂O) abatement technology for the nitric acid production plant of Monómeros Colombo Venezolanos S.A., located in the Special, Industrial and Port District of Barranquilla, Department of Atlántico - Colombia. Following is a general description of the scope of the activities that will be covered by the contract in question (see item i. Technical aspect):

The required technical information associated with the nitric acid plant for which the abatement system will be acquired is provided below. Also, Annex 1B contains the drawings associated with the ammonia oxidation reactor.

SECTOR REVIEW INTERNATIONAL OPEN TENDER
SUPPLY OF A SYSTEM FOR SECONDARY ABATEMENT OF NITROUS OXIDE
(N₂O)"

GENERAL PLANT SPECIFICATIONS		
<i>Company name</i>	Monómeros S.A.	
<i>Plant location</i>	25QH+55 Barranquilla, Atlántico - Colombia	
<i>Type of plant (medium or high pressure)</i>	Mono-medium pressure	
<i>Design (Chemico, Weatherly, GP, Uhde, etc.)</i>	Stamicarbon	
<i>Reactor Supplier</i>	Breda/Borsig (Revamping 2006)	
<i>Year of commissioning</i>	1972	
<i>Reactor pressure (bar, absolute)</i>	4.5	
<i>Number of plants</i>	1	
<i>Number of reactors per plant</i>	1	
<i>Reactor Inside Diameter</i>	3090	mm
<i>Reactor operating pressure</i>	3.5	kg /cm ² (gauge)
<i>Mixing gas temperature</i>	150 - 160	°C
<i>Gauze temperature</i>	850 - 870	°C
<i>NH content₃</i>	10.0	%
<i>Gauze campaign duration (Min)</i>	365	days
<i>Actual plant production (max.)</i>	280	MTPD HNO ₃ (100%)
<i>Campaign production rate</i>	100'000	MTPY HNO ₃ (100%)
<i>HNO aqueous solution₃ (%)</i>	50	
<i>Actual average conversion efficiency</i>	96	%
<i>Average emissions of N O₂</i>	1200	ppmv
<i>Frequency of plant cleaning</i>	5 years	
<i>Type of support system (basket, secondary catalyst, other Raschig rings, yes/no)</i>	Hexagonal basket grid - Basket is not designed to support the secondary catalyst	
<i>Overall composition of the losses of precious metals</i>	Pt : 16.00 Pd : 36.00 Rh : 4.00	
<i>Average number of stops per year</i>	8	
<i>Operating time (days per year)</i>	360	

Table 1A.1 General information on the Monómeros nitric acid plant.



SPECIFIC INFORMATION		
<i>Oxidation efficiency at the beginning of the campaign</i>	96%	
<i>Oxidation efficiency at the end of the campaign</i>	92%	
<i>Air flow, primary to reactor</i>	41'567 Nm ³ /h	
<i>Ammonia gas flow rate</i>	3491 kg/h	
<i>Air flow rate, secondary to bleaching</i>	7'318 Nm ³ /h	
<i>Platinum alloy catalytic gauze system</i>	Number of gauzes	4
	Diameter of gauze	3076 mm
	Composition	97% Pt, 3% Rh
	Thread diameter	0.076 mm
<i>Palladium alloy woven pickup gauze system</i>	Number of gauzes	3
	Diameter of gauze	3076 mm
	Composition	95% Pd, 5% Ni
	Thread diameter	0.076 mm
<i>Available depth for De-N₂ O in bed (mm)</i>	650 mm	Dear
<i>Loss of load</i>	10 mbar	Dear

Table 1A.2 Technical information specific to the Monómeros nitric acid plant.

2. SECONDARY N₂O ABATEMENT TECHNOLOGY SPECIFICATIONS.

SPECIFICATION - SECONDARY CATALYST.	
<i>Description</i>	Catalyst for N ₂ O reduction selected by the proponent based on the best available technological proposal.
<i>Form</i>	According to the proponent.
<i>Layer thickness</i>	According to the proponent.
<i>Allowable pressure drop</i>	80 mbar or less.
<i>Expected useful life</i>	A minimum of 5 production campaigns of 300 days each.
<i>N reduction efficiency O₂</i>	85% minimum, monthly average.
<i>Impact on NO</i>	None

Table 1A.3 Technical specifications of the secondary catalyst.

 <small>Filial de</small>  <small>Petroquímica de Venezuela, S.A.</small>	SECTOR REVIEW INTERNATIONAL OPEN TENDER SUPPLY OF A SYSTEM FOR SECONDARY ABATEMENT OF NITROUS OXIDE (N₂O)"
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EQUIPMENT SPECIFICATION - CONVERTER BASKET.		
<i>Function</i>	Support primary gauzes together with new N ₂ O reduction catalyst.	
<i>Capacity</i>	Ammonia gas flow rate	3491 kg/h Ammonia (3775 kg/h max);
	Mixing gas flow to the reactor (Ammonia + Air)	45,334 kg/h (46,158 kg/h max) 55,125 kg/h (56,127 kg/h max)
<i>Design criteria</i>	Shelf life	The service life should be 50,000 operating hours or greater.
	Design style	The design style should be "Weighted ring" or similar.
	Pressure drop	According to the selected N ₂ O reduction system.
	Temperature	850 °C - 870 °C
	Reactor dimensions	See plan EO-11-0005 (Annex 1B).
<i>Construction materials</i>	Mounting flange; housing and heat shield:	According to the proponent.
	Gauze support flange:	According to the proponent.
	Weighted ring:	According to the proponent.
	Gauze support grid:	According to the proponent.
	Support screen:	According to the proponent.
	Hexagonal grid:	According to the proponent.

Table 1A.4 Technical specifications of the basket.

vi. RISK ANALYSIS.

In the development of the contract, unforeseen events and other aspects related to the previous studies of the present contractual process must be considered as potential risks. For further details see the Risk Matrix Annex.