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**Notice:** This document is only a courtesy translation into English of the document written in Spanish with Reference "Anexo 1A Especificaciones técnicas". Therefore, in the event of any difference between the two versions, the Spanish version shall prevail.

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**ANNEX 1A.  
TECHNICAL SPECIFICATIONS - REQUIREMENTS FOR GOODS AND SERVICES**

**I. INTRODUCTION AND DESCRIPTION OF THE NEED.**

**Monómeros Colombo Venezolanos S.A.**, hereinafter "**Monómeros**", wishes to acquire a Nitrous Oxide (N<sub>2</sub>O) secondary abatement system, which will be installed in the ammonia burner reactor (R-1101), belonging to the nitric acid production plant of Monómeros, located in the Special, Industrial and Port District of Barranquilla, Department of Atlántico - Colombia.

The technical specifications described in this document are part of the **tender documents** in which suppliers of this type of systems, hereinafter "Suppliers", will be invited in order to validate if the requested equipment and services are available in the market and to establish an estimated cost for them.

This document contains technical information on the nitric acid plant - See *Table 1A.1* - and the technical specifications required at the discretion of Monómeros, for the contracting of a secondary abatement system. It should be noted that this annex does not intend to specify all the technical requirements, nor to specify the requirements already covered by the applicable codes and standards, since it is expected that the suppliers interested in these specifications have the experience and knowledge required to apply robust engineering practices in the supply of the components that make up this type of system.

In any case, it should be noted that, for the purposes of this phase called Tender specifications, it will be allowed to suggest within the budget quotation, all the equipment and services not mentioned in this document and which, at its discretion, are required to guarantee the total execution of the scope requested by Monómeros.

In this order of ideas, the present tender documents will be prepared in accordance with the following specifications:

1. Conditions of the goods and services to be quoted in the budget - Scope of supply of the secondary N<sub>2</sub>O abatement system.
2. Guarantee conditions to be required by Monómeros to the supplier that is awarded the contract.
3. Nitric acid production plant overview.
4. N<sub>2</sub>O secondary abatement system specifications.

**1. CONDITIONS OF THE GOODS AND SERVICES TO BE QUOTED IN THE BUDGET - SCOPE OF SUPPLY OF A SECONDARY NITROUS OXIDE ABATEMENT SYSTEM (N<sub>2</sub>O).**

**1.1. Scope.**

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 (N<sub>2</sub>O) 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.

#### **1.4. Obligations of Monómeros.**

Once the respective supply contract is signed, Monómeros will be responsible for:

- Provide all technical information on equipment and reference drawings required for the execution of the contract.
- Unloading and storage of the abatement system components at the Monómeros facilities.
- To supply **technical personnel** for the assembly and start-up of the abatement system at the Monómeros facilities.

#### **1.5. Waiting points during the execution of the supply contract to be entered into.**

The following shall be standby items for the **Supplier** during the performance of the contract, which shall include and not be limited to the following activities:

- Monómeros will give final endorsement to the engineering study and design submitted by the **successful Supplier** before proceeding with the manufacture of the basket.
- Monómeros will give final endorsement to the manufacturing drawings submitted by the **successful Supplier** prior to proceeding with the manufacture of the basket.
- Monómeros will give final endorsement to the Inspection test plan submitted by the **successful Supplier** before proceeding with the manufacture of the basket.
- Monómeros will give final endorsement to the manufactured components described in the scope of this contract before the **successful Supplier** proceeds with the shipment of these to the Nitric Acid Plant facilities.

#### **1.6. Deliverables:**

The **successful Supplier** shall deliver the following documentation to Monómeros:

- The engineering study associated with the installed abatement system. The delivery must include all engineering designs, risk evaluations, resistance analysis and sizing of equipment, if applicable. This documentation must be submitted in digital format type ".PDF".
- The "as built" fabrication drawings associated with the installed folding system. This documentation must be submitted in the following digital formats: ".PDF"; ".DWG".

- A manufacturing "dossier" - "Quality Assurance Document Package"- which shall contain at least the following documentation: List of components, quality inspection and dimensional control report, manufacturing drawings, inspection test plan, non-destructive testing reports -END- such as: liquid penetrant test report, positive material identification test report -PMI-, radiographic test report, WPS, PQR, WPQR, applied heat treatment reports, material test reports-, spare parts list, consumables list, special tools list (if required).
- Training documentation, such as guidelines, manuals and/or guides associated with the abatement system. This documentation must be delivered in digital format ".PDF".
- All project documentation, including codes, system licenses, etc.

**2. GUARANTEE CONDITIONS TO BE REQUIRED BY MONÓMEROS FROM THE SUCCESSFUL SUPPLIER.**

**a. Performance Guarantee:**

Monómeros expects an N<sub>2</sub>O reduction of at least 85% compared to the N<sub>2</sub>O concentration estimated prior to the installation of the secondary technology. The **Supplier** shall select the secondary abatement catalyst accordingly, and shall take the necessary precautions to ensure the expected performance for at least five (5) production campaigns of 360 days each one.

Likewise, the **Supplier** shall ensure that its design causes the minimum pressure drop, in order to avoid limitations in the system hydraulics that affect the operation of the plant.

**b. Mechanical Warranties:**

The Supplier shall provide a minimum 2-year operating warranty for the structure of the abatement system. The support basket shall be covered against any design, material, welding or other failures for all equipment components under normal operating conditions. A basket life of at least 50,000 hours is expected.

The Supplier selected in the International Competitive Bidding process shall guarantee the correct acquisition, machining, heat treatment, welding, thermal stability and water tightness.

**c. Bank Guarantees:**

See "*Table 2. Bank guarantees to be required from the supplier that is awarded the contract, after the signing of the contract*" included in the document Request for Information to Suppliers - SIP, Monómeros - 003 of 2023.

### 3. GENERAL INFORMATION ABOUT THE NITRIC ACID PRODUCTION PLANT.

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

<b>GENERAL PLANT SPECIFICATIONS</b>		
<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 <sup>2</sup> (gauge)
<i>Mixing gas temperature</i>	150 - 160	°C
<i>Gauze temperature</i>	850 - 870	°C
<i>NH content<sub>3</sub></i>	10.0	%
<i>Gauze campaign duration (Min)</i>	365	days
<i>Actual plant production (max.)</i>	280	MTPD HNO <sub>3</sub> (100%)
<i>Campaign production rate</i>	100'000	MTPY HNO <sub>3</sub> (100%)
<i>HNO aqueous solution<sub>3</sub> (%)</i>	50	
<i>Actual average conversion efficiency</i>	96	%
<i>Average emissions of N O<sub>2</sub></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.

<b>SPECIFIC INFORMATION</b>		
<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 <sup>3</sup> /h	
<i>Ammonia gas flow rate</i>	3491 kg/h	
<i>Air flow rate, secondary to bleaching</i>	7'318 Nm <sup>3</sup> /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-N<sub>2</sub> 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.

**4. SECONDARY N<sub>2</sub>O ABATEMENT TECHNOLOGY SPECIFICATIONS.**

<b>SPECIFICATION - SECONDARY CATALYST.</b>	
<i>Description</i>	Catalyst for N <sub>2</sub> 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 O<sub>2</sub></i>	85% minimum, monthly average.
<i>Impact on NO</i>	None

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

<b>EQUIPMENT SPECIFICATION - CONVERTER BASKET.</b>		
<i>Function</i>	Support primary gauzes together with new N <sub>2</sub> 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 <sub>2</sub> 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.