ANEXO 005: TECHNICAL SPECIFICATIONS FOR CONTINUOUS N20 EMISSIONS MONITORING SYSTEM

1. GENERAL SCOPE

This document presents complete technical information on the nitric acid production installation to provide suppliers with a sufficient database to answer specific questions about estimated costs and the possibility of offering a turnkey solution, among others.

However, this document does not intend to specify all technical requirements, nor does it specify requirements already covered by applicable codes and standards. The supplier/OEM (original equipment manufacturer) awarded in the subsequent tender must apply sound engineering and manufacturing practices and include all equipment and services not mentioned to deliver a unit suitable for the required functionality, complying with current industry standards.

2. Technical Information

This annex provides relevant technical information to define the monitoring system to be installed.

3. Scope Details (Minimum Requirements)

APASA will install an N2O monitoring technology (which will be covered by a different tender and is outside the scope of this tender) and requires the installation of a CEMS (Continuous Emission Monitoring System). The supply of the monitoring system must be carried out on a turnkey basis.

The required CEMS will consist of two sets of gas analyzers (the first directly upstream of the abatement unit and the second downstream of this unit), both capable of measuring N2O concentration, a tail gas flow meter located in the stack, sample conditioning system (one per set), sample lines, valves, pipe fittings, data acquisition and handling system (SCADA/DAHS), among other necessary elements, to monitor, store, analyze, and trend the plant's emissions.

The CEMS must have QAL1, only for measurement at the outlet of the new gas scrubber reactor, certification for the plant's typical operating conditions.

The supplier must consider the "General Specifications and Design Principles of the Monitoring System" for the supply of the CEMS.

The monitoring equipment will be installed and operated according to the requirements of EN14181 (latest version), including regular maintenance and calibration.

3.1 ENGINEERING

The supplier will execute all engineering work, prepare all engineering documents, including drawings and interface documents, and prepare all associated documentation, such as operation and maintenance manuals and as-built documentation.

The supplier must prepare a master document list including all documents and drawings necessary for the execution of the work.

APASA will review the general arrangement drawings and design drawings for acceptance before manufacturing.

Delivery will include all necessary engineering designs, risk assessments, strength analysis, and equipment sizing. The supplier must provide design documents in an electronic and editable format.

Engineering, production and/or procurement, factory acceptance test, site delivery, installation, commissioning, start-up, on-site support, on-site testing to ensure the warranty proposed by the bidder, training of plant personnel, and supply of all required documentation for the tail gas flow meter and the two copies of the Continuous N2O Emission System (one upstream and the other downstream of the new abatement unit):

1. Sampling System

The sampling system will be hot extractive (wet basis analysis - hot wet-). Gas sampling probe, heated sample line, gas sample treatment.

- Sampling probe and installation flange.
- Heated sample line suitable for aggressive environmental conditions, high temperatures, and UV radiation.
- Gas sample treatment unit with sample filtration pump.
- Sample flow regulator.

Note: *Recirculation of the sample gas to the stack is not necessary, but it must not be emitted or vented to the environment.*

2. Gas Analyzers

Gas analyzers for N2O measurement (certified under EN 14181 QAL1, only for measurement at the outlet of the new gas scrubber reactor).

- N2O (upstream of the reactor) Range 1: See Annex-001-Plant Information.REV.2 (*)
- N2O (downstream of the reactor) Range 2: See Annex-001-Plant Information.REV.2 (*)
- Calculated value: N2O emissions (kg N2O/h)
- Calculated value: N2O emission factor (kg N2O/ Ton HNO3)
- Must comply with EN 14181 - QAL1 (only for measurement at the outlet of the new gas scrubber reactor) - Data capture and evaluation.

Note: *It must include the necessary hardware and configurations for remote maintenance and/or diagnostics, compatible with the x800A system.*

(*): Consider a higher ppm percentage to avoid equipment saturation.

3. Data Collection and Storage

Data logger with on-site display, automatic on-site backup: all raw data and all average values (log configuration to be defined) must be permanently stored without data compression, including the hardware or configuration necessary for remote maintenance and/or diagnostics.

The monitoring system will provide separate hourly average values for the N2O concentration in the tail gas before (upstream) and after (downstream) the N2O reactor, based on continuous measurements that are electronically recorded and stored. These datasets are identified by a unique date and time key indicating exactly when the values were observed. The overall reduction efficiency and emission reductions are calculated from the monitored values.

The following data are currently measured at the APASA nitric acid plant:

- Concentration before the NOx (NO y NO2) reactor, [ppm]
- Concentration downstream of the NOx (NO y NO2) reactor, [ppm]
- Gas analyzer status (Operating, Under Maintenance, Failure)
- Stack gas velocity, [m/s]
- Stack gas velocity analyzer status (operating, under maintenance, faulty)
- Stack gas temperature, [°C]
- Stack gas pressure, [bar]
- Volumetric or mass flow measurement of stack gases, [Nm3/h or kg/h]
- Ammonia oxidation reactor temperature (signal provided by APASA), [°C]
- Ammonia oxidation reactor pressure (signal provided by APASA plant), [bara]
- Ammonia flow to the ammonia oxidation reactor (signal provided by APASA), Nm3/h
- Ammonia-to-air ratio to the ammonia oxidation reactor (signal provided by APASA)
- HNO3 production (signal provided by the plant operator), [kg/h]
- HNO3 concentration (Determined by laboratory test)
- Plant operational status (signal provided by the plant operator)
- Temperature in the analyzer cabinet, [°C]
- 3x Status reserve
- 3x Analog reserve
- Calculated value: NOx (NO y NO2) emissions (kg NOx /h)
- Calculated value: NOx (NO y NO2) emission factor (kg NOx / Ton HNO3)
- Sampling frequency: 150 milliseconds
- Data acquisition time: 1 second
- Calculation of hourly average values (for analog and status signals)

Note: The data acquisition and handling system (DAHS) must comply with EN14181 standards on how to calculate, record, and store emissions and installation data in accordance with EN 15259.

3.2 INSTALLATION AND ASSEMBLY.

All construction and assembly work will be executed by the bidder according to the norms and design specifications of Section 3: REFERENCES REFERENCE and the safety requirements applicable at APASA. It will be the responsibility of the bidder:

1. To install the monitoring system and be responsible for the commissioning of the equipment in the plant with the support of local personnel.
2. Installation and Commissioning: The supplier must provide final verification of mechanical completion, commissioning, and performance tests. If applicable, the supplier must provide the special tools necessary for installation.
3. Training of local plant employees to operate and maintain the monitoring system (including training certificate). A trainer from the supplier must be present for a sufficient time to ensure proper training of APASA personnel. A training schedule will be agreed upon. (It will be evaluated in the matrix)
4. Regarding documentation, all documents submitted for engineering review must be in Spanish. All final documents to be used by operational personnel, documents and certificates, and legends on panels and instrumentation will be in Spanish.
5. Annual maintenance of the complete analyzer system and data logging system for 3 years (remotely).
6. Engineering and design of the necessary construction works and plant modifications in coordination with the APASA responsible person.
7. Civil works necessary for the execution of the project.
8. The Analyzer Cabinet must be installed in an air-conditioned room or in a separate container.
9. Valves, pressure reducers, pipes, fittings, etc. for automatic calibration gas application.
10. Zero gas and span calibration gas for N2 and N2O with a certificate of analysis from an ISO IEC 17025 accredited laboratory for both N2O measurement ranges.
11. Rack for calibration gas cylinders
12. A spare parts stock for 3 years of regular maintenance, a list of standard spare parts specifications, and a list of critical spare parts for its correct operation will also be provided.

3.3 VERIFICATIONS

Tests shall be conducted in accordance with the procedures indicated in the applicable standards.

3.3.1 Factory Acceptance Test (FAT)

Technicians from the Vendor or the OEM shall test the entire system, including sample conditioning, at the Vendor's or OEM's workshop. The Vendor/OEM shall prepare the procedure and provide all necessary test equipment to conduct the Factory Acceptance Test (FAT).

The FAT shall include, among others:

Simulation of all inputs and outputs, showing all associated initiators, alarms, and trip action outputs. All simulated inputs and outputs shall be organized and labeled for easy identification during FAT.

1. Complete functional tests of the analyzer's power, ventilation, and air conditioning system.
2. Alignment and cleaning.
3. Visual inspection of the sampling system.
4. An audit of the provisions for effective CEMS management and maintenance.
5. Leak checks.
6. Bias checks (system integrity).
7. Zero and span calibration checks.
8. Linearity check.
9. Linearity check for N2O with 5 points for each range (20, 40, 60, 80, and 100% of full-scale deflection). In the case of a non-linear calibration curve, a minimum of 10 concentrations is required.
10. Response time.
11. Documentation supplied.
12. Test gases used shall be traceable according to ISO 17025.
13. For calibration gas, accredited suppliers shall be used. The uncertainty of the gas mixture used shall be better than ± 2% with 95% confidence for all gases according to ISO 17025 gas accreditation standards

3.3.2 Test Report Electrical Installation

The test report shall include, among other elements, the following:

1. References to applicable international standards.
2. Complete identification of sample and calibration gases: quality, concentration, uncertainties.
3. Circumstances under which the tests were performed: locations, conditions, etc.
4. Sample scheduling: date and time.
5. Test results: calibration, lower detection limit, precision, zero and span drift (including temperature effect), linearity, effect of interferences on the determinant, response time, standard deviations and systematic errors, and a statement of compliance with this specification.

3.3.3 Site Acceptance Test (SAT)

The bidder shall install the monitoring equipment and perform the commissioning and start-up of the monitoring system.

At the APASA plant, the supplier's representative shall perform the installation of the monitoring equipment and test the system installation prior to start-up. The representative shall also perform the required OEM standard tests to verify the correct operation of the system after start-up. The supplier's representative shall prepare relevant documentation to report on the site commissioning activities.

Acceptance tests shall be performed under actual operating conditions on a sample.

The stack gas flow meter and gas analyzers shall undergo a QAL2 test shortly after installation. The OEM shall assist the independent and authorized body in the first certification of the test system according to QAL2.

The CEMS shall have facilities allowing plant testing and QAL2 after installation, as well as facilities allowing for periodic maintenance and calibration.

3.3.4 Electrical Installation Electrical Installation

The bidder shall provide the engineering, materials, and labor necessary for the construction and commissioning of all electrical installations required for the perfect operation of the Continuous Emission Monitoring System (CEMS) subject of this Terms. This includes the assembly works for motor power and lighting circuits, controls, conductor laying, grounding, etc.

- Note: Consider APASA plant data: 480V, 60Hz.

3.3.5 Instrumentation and Control

The bidder shall be responsible for performing all tasks listed below, plus those necessary for the perfect operation of the facility's installations, it being understood that the list is not limiting:

1. Installation, assembly, and connection of instruments.
2. Laying of conduits, power and signal cabling between instrumentation and the control room.

3.4 Project Deliverables

A minimum list of engineering document deliverables for the project is provided below. This list does not exclude or limit the delivery of any other documentation the bidder deems necessary. All documentation shall be delivered in digital format (editable PDF, DOC, XLS, and DWG) except for the equipment operation and maintenance manuals, which, in addition to their digital copy, must be delivered in two printed copies.

General:

- Design Bases
- Project Execution Plan
- Process Descriptive Report
- Process Flow Diagrams
- Equipment List

- P&IDs
- Line List
- Operations Guide
- Operation, Control, and Safety Philosophy

Piping:

- Equipment Layout (Lay Out of Equipment)
- Piping Material Classes (Piping Class)
- Design Specifications and Typical Designs
- Piping Descriptive Report

Electricity:

- Detailed Electrical Installation Descriptive Report
- Single-Line Diagrams
- Technical Specification for Electrical Equipment
- Load List and Balance
- Electrical Materials List
- Electrical Connection Plans
- Wiring Diagrams
- Electrical Routs

Instruments and Control System:

- Descriptive Report of Instrumentation and Control Installation
- Typical Electrical and Mechanical Mounting for Instruments.
- Communications Systems Specification
- Cable and Installation Material Computation
- Instrument Cable Conduit Plans
- Instrument/Field Panel Layout
- Datasheet for analyzer, accessories, calibration gases, etc.
- Equipment configuration backup

4. REFERENCE

The following codes, national and international standards, specifications, and recommendations are listed, applicable only to the set of structures and equipment to be designed, modified, or constructed.

This list does not exclude the norms, good practices, and specific construction standards that apply to the technology to be supplied. The bidder must consider them for their responses to the SIP.

Construction:

- ANSI/CEMA 550 (Conveyor Equipment Manufacturers Association): Classification and Definitions of Bulk Materials
- ASTM (American Society for Testing and Materials): Materials must comply with ASTM standards.
- CIRSOC Std. 103 (mandatory): INPRES-CIRSOC 103 Regulation “Argentine Standards for Seismic-Resistant Constructions”.
- ASCE Std. 7 (reference): American Society of Civil Engineers Std. 7.
- AISC: American Institute of Steel Construction.
- D-1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort. (ASMT).
- D-1883: Standard Test Methods for CBR (California Bearing Ratio) of Laboratory Compacted Soils. (ASMT)

Manufacturing:

- ASME B 31.3: “Process Piping”
- ASME B 16.25: “Butt welding Ends”.
- ASME B 16.5: “Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard”.
- ASME SEC I: “Rules for Construction of Power Boilers”.
- ASME SEC II: “Material Specification Part A – Ferrous”.
- ASME SEC V: “Nondestructive examination”.
- ASME SEC VIII: “Division 1 Pressure Vessels”.
- IEC-60529 Standard (Mandatory)

American Institute of Steel Construction (AISC):

- AISC/ANSI 327-05 “Seismic Design Manual”
- AISC/ANSI 360-05 “Manual of Steel Construction”
- AISC 303-05 “Code of Standard Practice for Steel Buildings and Bridges”.
- RCSC “Specification for Structural Joints Using ASTM A325 or A490 Bolts”.

American Welding Society (AWS):

- AWS D1.1/D1.1M:2006 “Structural Welding Code – Steel”

- ANSI/AWS D2.4-98 “Standard Symbol for Welding, Brazing, and Nondestructive Examination”

APASA Design Specifications:

- DOCUMENTATION CONTROL FOR DRAWINGS AP-ES-09
- Subject to ATEX standards - Explosive atmosphere (mandatory)
- Subject to IEC-61511 standards (mandatory)
- PIPE-STRUCTURE PAINTING AP-ES-28
- PRESSURERIZED SYSTEMS AP-ES-31
- A1290-01-50-C01-ESP-201-0
- A1290-01-90-C01-ESP-001-4
- A1290-01-90-C01-ESP-004-3
- A1290-01-90-C01-ESP-005_2
- A1290-01-90-C01-ESP-006-0
- A1290-01-90-C01-TEC-001-0
- A1290-01-90-C01-TEC-421_0
- A1290-01-90-T09-ESP-202_4
- A1290-01-90-T09-ESP-201-1
- A1290-01-90-T09-ESP-203-2
- A1290-01-90-T09-ESP-204-0
- A1290-01-90-T39-TEC-201_C
- A1290-01-90-T11-ESP-201-3
- A1290-01-90-T11-ESP-201-4
- A1290-01-90-I03-003-1
- A1290-01-90-I03-004-1
- A1290-01-90-I03-006-1

5. RESPONSIBILITIES

5.1 SUBMISSION OF RESPONSES TO THE SIP

The bidder must analyze all documentation that forms part of the tender. In case of discrepancies, inconsistencies, or lack of definition, the bidder may inform APASA according to the schedule defined in the tender documents.

6. WARRANTY

6.1 PERFORMANCE WARRANTY

Parameters and specifications provided by the supplier will be guaranteed. Limits and tolerance ranges shall be declared and established.

The performance test shall be conducted after installation; the system must pass the performance test during 60 hours of continuous operation. Once the performance test is

completed, commissioning will be finalized and the system will be officially declared operational.

If the supplier is unsuccessful due to failures or deficiencies revealed during the test, it must correct everything as soon as possible at no cost to APASA and then conduct a new warranty test.

6.2 MECHANICAL/ELECTRICAL/ELECTRONIC WARRANTY

The equipment shall be guaranteed against defects in design, material, welding, workmanship, or other defects for all components of the equipment under operating conditions.

The bidder must guarantee the correct supply, machining, heat treatment, welding, corrosion protection, and accessories as a mechanical/electrical warranty.

Any defect described herein that occurs during the warranty period will result in the application of the requirements set forth in the specific and general commercial conditions.

The bidder must include a minimum warranty of one (1) year for the equipment. During this period, the bidder must provide specialized technical support to diagnose and correct any errors that may arise in the system.

6.3 GUARANTEE OF INTEGRATION OF MONITORING TECHNOLOGY WITH SAMPLE CONDITIONING SYSTEM

A sample conditioning system is required to be included in the monitoring system equipment in order to ensure the reliability and representativeness of the measurements. This sample conditioning system may be presented as a single, comprehensive solution and must be detailed in the technical proposal.

6.4 SOFTWARE WARRANTY WITH TRAINING

The bid must include the operating, diagnostic, and data analysis software, accompanied by formal training programs for plant personnel.

The bidder must attach a signed training plan certifying its commitment to the execution of the additional service offered.

Likewise, the system's ability to anticipate possible failures or deviations through predictive diagnostics will be evaluated, favoring risk reduction and optimizing equipment availability.

6.5 CEMDA/DAHS ON-SITE TECHNICAL ASSISTANCE GUARANTEE

The bidder must include in the bid, for the commissioning (PEM) of the emissions monitoring system, a technical assistance guarantee, which must be duly signed.