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Title	**Technical Specifications: Alpha Spectrometer**
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APPROVAL & DISTRIBUTION

	NAME	SIGNATURE & DATE
PREPARED	I LOUW Senior Scientist: RC	Signed by Immanda Louw, immanda.louw@necsa.co.za 03/10/2025 13:43:12(UTC+02:00) SIGNIFLOW
Checked	AM RASUTHA Section Head: RC	Signed by Ann Rasutha, ann.rasutha@necsa.co.za 03/10/2025 13:44:49(UTC+02:00) SIGNIFLOW
Checked	EN MOALOSI Manager: RAC	Signed by Eleanor Moalosi, Eleanor.Moalosi@necsa.co.za 03/10/2025 14:17:16(UTC+02:00) SIGNIFLOW
Approved	Z ZITUTA Senior Manager: NLS	Signed by Zamokwakhe Zituta, zama.zituta@necsa.co.za 03/10/2025 15:30:49(UTC+02:00) SIGNIFLOW
Distribution	Department and SharePoint Records	

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1 EXECUTIVE SUMMARY

This specification describes the technical requirements for an **alpha-spectrometry system** for the determination of alpha-emitting radionuclides (hereinafter referred to as "the system").

The main objectives of this BID are to solicit quotations and proposals for:

- Supply of a fully functional alpha spectrometry system.
- Supply of all relevant instrumentation, software, and accessories.
- Installation and testing of the complete system.
- Training and after-sales support.

These technical specifications are prescriptive. However, interested service providers may propose alternatives that differ from these specifications, provided such alternatives are aligned with the intended purpose of the system or are demonstrated to produce superior results. In such cases, the respondent must clearly state the deviation and provide appropriate justification in the proposal.

2 SCOPE CLARIFICATION

2.1 Testing and acceptance of a fully functional system

This task involves the following actions:

(a) Supply and installation of the system in compliance with the requirements specified in this document.
(b) Factory Acceptance Test (FAT): Prior to shipment, the system shall undergo testing to verify conformance with the manufacturer's performance specifications as well as the minimum requirements outlined herein

2.2 Supply of all relevant information and accessories

This task involves the following actions:

(a) Acquisition and supply of all necessary equipment, instrumentation, and accessories required to ensure full functionality of the system, from the manufacturer's site to the Necsa site.
(b) Securing all documentation required for the transportation and delivery of the equipment from the manufacturer's site to the Necsa site.
(c) Provision of documentation and certification, including but not limited to:
    - Technical and user manuals
    - Software licenses and installation media
    - Certificates of conformity and calibration
    - Maintenance and service documentation.

2.3 Installation, testing and verification

This task involves the following actions:

(a) System installation in a functioning condition, ready for commissioning.
(b) Testing and verification of the system, including execution and/or provision of all necessary tests in accordance with applicable accreditation requirements, such as ISO/IEC 17025.
(c) Skills transfer through the active participation of Necsa technicians and scientists during installation, testing, and verification.
(d) Infrastructure readiness, including any required on-site modifications (e.g., electrical, plumbing, or air conditioning).

(e) Material availability assurance, ensuring that all required materials and components are available before installation begins.
(f) On-site installation of the system at Necsa by the Service Provider.
(g) On-site Acceptance Test (SAT): Following installation, the system shall be tested jointly by the Service Provider and Necsa personnel to verify that performance meets both the manufacturer's specifications and the minimum requirements defined by the End-user.
(h) Acceptance protocol: The Service Provider shall document the test results in an acceptance protocol, which must be formally reviewed and signed by the End-user.

2.4 Training and after-sales support

This task involves the following actions:

(a) Operational training: The Service Provider shall provide training to Necsa personnel on the daily operation of the system immediately after installation.
(b) On-site technical training: Onsite training at the Necsa facility shall cover troubleshooting procedures and preventative maintenance required for routine operation.
(c) Documentation: The Service Provider shall provide a complete set of operation and service manuals, as well as technical drawings, in the English language.
(d) Support contacts: The Service Provider shall identify designated support contacts for technical assistance and after-sales support.
(e) Service and maintenance requests: Should Necsa require service and maintenance beyond the scope of this contract, a Supply Chain Management (SCM) process shall be followed to request quotations under a separate agreement.

3 SYSTEM REQUIREMENTS

3.1 Instrument system components

Necsa seeks to procure an integrated desktop Alpha Spectrometer. Specifications of the required system are detailed below:

(a) Performance specifications: The system shall achieve the minimum performance requirements as indicated in Table 1. Compliance shall be confirmed through QC tests before shipment and again upon installation.
(b) Number of Chambers: Twelve (12) to sixteen (16) alpha chambers, with modular construction to allow future expansion.
(c) Detectors: Twelve (12) to sixteen (16) ion-implanted silicon detectors, each with a nominal active area of 450 mm² and a cleanable surface.
(d) Recoil suppression: The system must incorporate recoil suppression functionality.
(e) System control: Computer-controlled electronics and vacuum system. Independent control of each detector must be possible.
(f) Computer and software: As specified in Section 3.3.
(g) Uninterruptable power supply (UPS): Sufficient to maintain full operation of the system for at least 5–10 minutes in the event of a power failure.
(h) Vacuum pump: The system shall include a vacuum manifold and a vacuum pump suitable for the proper operation of the instrument. The pump must provide sufficient vacuum capacity and stability to achieve the specified performance parameters (Table 1) and be compatible with the detector chambers. The pump should be a two-stage rotatory vane vacuum pump, with a speed of at least twelve cubic meters per hour with an inlet and outlet connection; hose barb adaptor for vacuum fitting and exhaust oil mist filter connector flange size of KF25 or equivalent.

(i) Printer: Black and white Laser printer, to handle high volumes.

(j) Technical requirements: The system shall be supplied with the following integrated components:

- Voltage unit,
- Amplifier,
- Multichannel analyser, and
- Installation kit, including the necessary lines, clamps and fittings for the functional setup of the system. Installation kit, including all necessary lines, clamps, and fittings required for functional setup of the system.

3.2 Technical requirements

The minimum performance specifications required for the Alpha Spectrometer are presented in Table 1. For verification purposes, refer to Appendix 1 for completion of the compliance checklist.

Table 1: Performance Specifications and requirements

	Parameter	Expected Performance
1	Energy range	0 – 10 MeV
2	Energy resolution	≤ 20 keV FWHM at 5.846 MeV with Am-241
3	Efficiency	≥25% for detector source spacing of > 5mm for Am-241
4	Background	≤ 1 count/hour (in the range between 3 – 8 MeV
5	Electrical voltage and frequency	220V, 50Hz
6	Results output/units	Bq/L (conversion from cps to be done via a built-in equation into the system

3.3 System Management Software

System management software shall be supplied along with the instrument and shall include the following features:

(a) A fully functional desktop computer equipped with software for data acquisition and analysis, provided under a perpetual license.

(b) Operating system: Compatible with Windows 11 or latest, with provisions to accommodate future updates.

(c) Internet connectivity: The system must allow secure data transfer and support export of information to common Microsoft applications such as Excel and Word.

(d) Full control of all electronics and hardware components, including vacuum systems, bias supply, and related subsystems.

(e) Quality Assurance: Preferably, the software should include built-in Quality Control functions and the ability to calculate Minimum Detectable Activity (MDA) using the Currie formula or ISO-11929 methodology.

(f) Security features to prevent unauthorized access, including user authentication and role-based access control

(g) Software capabilities shall include:

- Acquisition of spectra
- MCA control
- Spectrum display
- Calibration and analysis
- Nuclide-specific activity calculations

- Interactive peak fitting
- Procedures for routine assays
- A flexible reporting system with customization options.

3.4 Warranty and Support Requirements

The Service Provider shall provide full details regarding the warranty, support, and previous experience with similar installations. This shall include:

(a) A description of the nature and scope of the standard warranty provided with the system.
(b) The Service Provider shall clearly specify the manufacturer's guarantee conditions, as well as provide details of preventive and corrective maintenance contracts to ensure uninterrupted operation of the system.
(c) The Service Provider shall provide at least two (2) years of post-installation technical support.

3.5 Quality and compliance requirements

(a) The system shall be packaged for shipment to Necsa in full compliance with applicable international standards for the transportation of this type of equipment.
(b) The system shall be manufactured, shipped, and installed in accordance with the manufacturer's certified quality assurance system, or an equivalent recognized quality system. The Service Provider shall provide documentation confirming compliance with this quality system.
(c) All equipment shall carry the required safety markings and shall be supplied with operating instructions in the English language.

4 TERMS AND CONDITIONS

(a) The Service Provider shall install the equipment at the End-user site, Building P1600 at Necsa, and hand over a fully functional system.
(b) A pre-site inspection assessment shall be mandatory for prospective Service Providers to enable accurate costing of any potential infrastructure modifications.
(c) Both a hard copy and a soft copy of detailed instructions, operation, and maintenance manuals shall be supplied with the system. All documentation must be provided in English.
(d) Any deviation from the specified technical requirements in the quotation must be clearly indicated by the Service Provider.
(e) System management software shall be supplied on CD/DVD, or alternatively, access shall be provided for download from the Service Provider's website at no additional cost to Necsa.
(f) The Service Provider shall provide on-site training to Necsa personnel covering operation, routine maintenance, and troubleshooting of the system.

5 ACCEPTANCE CRITERIA

The system shall be formally accepted upon:

(a) The annual costs associated with extended warranty coverage, beyond the standard warranty period. Successful demonstration that all intended functions of the system operate in accordance with the manufacturer's performance specifications and the technical requirements outlined in this document.
(b) Satisfactory performance of the system for a continuous period of one (1) month from the date of installation and commissioning, without critical failure or significant deviation from expected results

(c) Completion and signing of an acceptance protocol by both the Service Provider and the End-user, confirming compliance with the requirements.

6 COMPLIANCE CHECKLIST

The Service Provider is required to confirm the specifications of the quoted system by completing the checklist in Appendix A.

Compliance with each requirement must be indicated in the Compliance column by responding YES or NO.

Where the response is “NO”, the Service Provider must provide details of the deviation together with a clear justification in the Remarks column.

Documented evidence shall be included as proof of specifications affirmed as “YES”. Such evidence may be supplied within the quotation itself or as supporting datasheets attached to the quotation.

APPENDIX 1: CHECKLIST PERFORMANCE SPECIFICATIONS

Company			
Instrument Model			
Requirement no	**Requirement Description**	**Comply (YES/NO)**	**Remarks**
3.1 System Requirements			
3.1(b)	Twelve (12) to sixteen (16) alpha chambers, modular construction for future expansion		
3.1(c)	Twelve (12) to sixteen (16) ion-implanted silicon detectors, nominal active area 450 mm², cleanable surface		
3.1(d)	Recoil suppression functionality incorporated		
3.1(e)	Computer-controlled electronics and vacuum system; independent control of each detector		
3.1(f)	Computer and software as specified in Section 3.3		
3.1(g)	UPS sufficient to operate system for at least 5–10 minutes during power failure		
3.1(h)	Vacuum manifold and a vacuum pump suitable for the proper operation of the instrument. The pump should be a two-stage rotatory vane vacuum pump, with a speed of at least twelve cubic meters per hour with an inlet and outlet connection; hose barb adaptor for vacuum fitting and exhaust oil mist filter connector flange size of KF25 or equivalent.		
3.1(i)	Printer: Black and white Laser printer, to handle high volumes.		
3.1(j)	Integrated components supplied: voltage unit, amplifier, multichannel analyser, and installation kit with lines, clamps, and fittings		
3.2 Technical requirements			
1. Energy Range	0-10 MeV		
2. Energy Resolution	≤ 20 keV FWHM at 5.846 MeV with Am-241		
3. Efficiency	≥25% for detector source spacing of > 5mm for Am-241		
4. Background	≤ 1 count/hour (in the range between 3 – 8 MeV		
5. Electrical voltage	220v, 50Hz		

and frequency			
6. Results output/units	Bq/L (conversion from cps done via a built-in equation		
3.3. Software requirements			
3.3(a)	Fully functional desktop computer with software for data acquisition and analysis under a perpetual license.		
3.3(b)	Operating system compatible with Windows 11 or latest, with provision for future updates		
3.3(c)	Internet connectivity provided, with ability to export data to Microsoft Excel, Word, etc.		
3.3(d)	Full control of electronics and hardware (vacuum, bias supply, etc.) via the software		
3.3e(i)	Acquisition of spectra.		
3.3e(ii)	MCA control.		
3.3e(iii)	Spectrum display.		
3.3e(iv)	Calibration and analysis.		
3.3e(v)	Nuclide-specific activity calculations.		
3.3e(vi)	Interactive peak fitting.		
3.3e(vii)	Procedures for routine assays		
3.3e(viii)	Flexible reporting system with customization options.		
3.3e(ix)	Built-in Quality Control functions and MDA calculation		
3.3e(x)	Security features to manage unauthorized access		