

Gamma-Spectrometer with X-ray Channel IAEA TC Project UKR9042	 <b>IAEA</b> International Atomic Energy Agency	IAEA Specification Date: 13 June 2024
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## SPECIFICATION

### Gamma-Spectrometer with X-ray Channel

#### 1. Scope

This specification describes the requirements for a multichannel gamma-spectrometer to measure X-rays and gamma-rays, hereinafter referred to as “the Equipment”.

The scope includes the supply of the Equipment, its installation, start-up and adjustment, training for the SSE Chornobyl Nuclear Power Plant laboratory personnel (hereinafter refers to as “End User”) to operate the equipment, testing by using the SSE ChNPP process media, and warranty service.

The Equipment will assist the End User in performing characterization activities related to radioactively contaminated water and radioactive waste management. Specifically, it will be utilized for measuring the specific and volumetric activity of gamma-emitting radionuclides.

#### 2. Applicable Documents

The following documents shall be applicable for this Specification to the extent specified hereinafter:

- ISO 18589-3:2007 Measurement of radioactivity in the environment - Soil - Part 3: Measurement of gamma-emitting radionuclides.

In the event of any discrepancies between the documents mentioned above and the content of this specification, this specification shall take precedence to resolve the conflict.

#### 3. Requirements

##### 3.1. Functional and Performance Requirements

The Equipment shall meet the following functional and performance requirements:

- 3.1.1. shall measure the quantum energy of X-ray or gamma-rays emitted by the radionuclides;
- 3.1.2. shall be a stationary equipment to be used in the laboratory;
- 3.1.3. the set of spectra, their visualization and analysis, calibration and other necessary operations with the equipment shall be controlled by software installed on a personal computer;
- 3.1.4. shall have the possibility to send the measurement results to the printer; and
- 3.1.5. the detector shall be equipped with appropriate shielding for ultra-low background measurements, considering the X-ray range.

##### 3.2. Technical Requirements

The Equipment shall meet the following technical requirements:



- 3.2.1. The range of X-ray and gamma-ray energy shall be within the following range: from 3.0 to 3,000 keV;
- 3.2.2. Shall be capable to determine simultaneously the specific activity of <sup>55</sup>Fe, <sup>241</sup>Am, <sup>56</sup>Co, <sup>137</sup>Cs radionuclides;
- 3.2.3. Power supply shall be provided from alternating current network of 220 V, frequency of 60 Hz;
- 3.2.4. The High Purity Germanium semiconductor detector shall be Broad Energy Germanium Detectors (BEGe);
- 3.2.5. Hybrid cryostat to cool detector (liquid nitrogen and electrical and mechanical freezing);
- 3.2.6. Ultra Low Background (ULB) Lead Shield min 6" wall with copper cover inside;
- 3.2.7. Spectroscopy software (for multiple peak searches and calibration, Peak Area Background Subtract, Efficiency Correction, Nuclide Identification, Automatic Interference Correction, Cascade Summing Correction, Weighted Mean Activity Calculation, and Minimum Detectable Activity) shall be provided to control the equipment with licensed installation package;
- 3.2.8. To carry out analysis and to process the data with displaying on the screen or providing the hard copy paper, the equipment shall include:
  - i. personnel computer, Windows 10 (or newer), 24" Monitor; and
  - ii. multifunctional laser printing.

#### **4. Marking**

- 4.1. The Equipment shall have the appropriate marking/labelling with identification of equipment model, manufacturer, serial number, and bar-code.
- 4.2. The Equipment shall have all safety markings in the English language.

#### **5. Packaging**

- 5.1. The Equipment delivered to the End User shall be packed in accordance with international standards applied for land and air shipping.
- 5.2. All labelling signs on the components and packaging shall be in the English language with clear designation of address and contact person of End User.

#### **6. Safety requirements**

- 6.1. The Equipment shall be manufactured and installed in line with the requirements of the Contractor's ISO quality system or equivalent quality assurance system.
- 6.2. The Contractor shall document the compliance with the quality assurance system requirements (international calibration certificate of CIPM MRA, or verification/calibration certificate issued by a metrological centre of Ukraine).

#### **7. Testing and acceptance**

- 7.1. The Equipment, prior to shipment, shall be tested for compliance with manufacturer's technical parameters and minimum requirements specified herein.

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- 7.2. The Equipment, after installation at the End-User site, shall be tested by the Contractor in the presence of the End-User to demonstrate that the performance meets the manufacturer's performance specification and the minimum requirements specified in Section 3 above.
- 7.3. The results of the testing of the Equipment shall be documented by the Contractor in an acceptance protocol that shall be signed by the End-User.

## 8. Installation and training

- 8.1. The Contractor shall install the Equipment at the End-User facility. Within one (1) month after receipt of the Purchase Order, the Contractor shall notify the End-User of the requirements for installation and site preparation (if any).
- 8.2. The Contractor shall provide a two (2) day training for up to three (3) staff of the End-User in the operation and maintenance of the Equipment at the End-User's location, immediately after installation.

## 9. Deliverable Data Items

- 9.1. The Contractor shall provide, in both hard copy and electronic format, two (2) complete sets of operation and servicing manuals both in the English language.
- 9.2. The Contractor shall provide a CIPM MRA international calibration certificate, or a verification/calibration certificate issued by a metrological centre of Ukraine.