



## SPECIFICATION

### Gamma – Beta – Alpha Spectrometer-Radiometer

#### 1. Scope

- 1.1. This Specification describes the requirements for a gamma, beta and alpha spectrometer-radiometer (hereinafter referred to as the “System”).
- 1.2. The System shall be used to measure the specific activity of natural ( $^{226}\text{Ra}$ ,  $^{232}\text{Th}$ ,  $^{40}\text{K}$ ,  $^{222}\text{Rn}$ ) and artificial radionuclides ( $^{137}\text{Cs}$ ,  $^{90}\text{Sr}$ - $^{90}\text{Y}$ ) in soil, rocks, vegetation, water, food, building materials and other environmental samples.
- 1.3. The System shall also be used to measure gross alpha and gross beta activity in water samples.

#### 2. Requirements

##### 2.1. Technical Requirements – System Components

The System shall have at least the following components:

- (i) One NaI(Tl) crystal (gamma detector) for the measurement of gamma spectra. The crystal shall be cylindrically shaped with size of at least 76 mm in height and 76 mm in diameter (3 inches X 3 inches). The gamma detector shall have a proper lead shielding;
- (ii) One plastic scintillator (beta detector) for the measurement of beta spectra. The scintillator shall be cylindrically shaped with at least 10 mm in height and 70 mm in diameter and shall have a proper lead shielding;
- (iii) One ZnS(Ag) scintillation detector (alpha detector) for counting alpha particles, with at least 70 mm diameter (flat round-shape) and shall have a proper lead shielding; and
- (iv) Containers to hold samples for the gamma, beta and alpha detectors in proper geometries; and
- (v) Windows-based software for full spectrometric analysis.

##### 2.2. Functional and Performance Requirements

The System shall meet the following functional and performance requirements:

- (i) The gamma detector shall operate in the energy range 40-3000 keV;
- (ii) The gamma detector shall have a relative energy resolution not more than 9% for a gamma-ray of energy 661,7 keV emitted by a  $^{137}\text{Cs}$  point source;
- (iii) The gamma detector shall have a relative full peak efficiency not less than 2% for a gamma-ray with energy 661,7 keV emitted by a  $^{137}\text{Cs}$  point source located at a distance of 50mm from the upper surface of the detector;
- (iv) The beta detector shall operate in the energy range 60-4000 keV;

- (v) The beta detector shall have a relative energy resolution not more than 15% for energy 624 keV (conversion electron energy from  $^{137}\text{Cs}$ );
- (vi) The beta detector shall have a detection sensitivity not less than 1.5 counts per Becquerel a  $^{90}\text{Sr}$ - $^{90}\text{Y}$  source;
- (vii) The alpha detector shall operate in the energy range 2000-10000 keV; and
- (viii) The alpha detector shall have a minimal detectable activity not more than 0,01 Becquerel for a  $^{239}\text{Pu}$  source measured not more than 3 hours.

### 3. Marking

The System shall have all safety markings in the English language.

### 4. Packing

The System, for the shipment by air to the End-User, shall be packed in accordance with international standards that are applicable for the shipment by air of this kind of equipment.

### 5. Quality Requirements

- 5.1. The System shall be manufactured, shipped and installed in accordance with the Supplier's ISO quality assurance system or an equivalent quality assurance system.
- 5.2. The Supplier shall document the compliance with this quality assurance system.

### 6. Testing and Acceptance

- 6.1 The System, prior to shipment, shall be tested for conformance of the System with manufacturer's performance specifications and the minimum requirements specified herein.
- 6.3 The results of the testing of the System shall be documented by the Supplier and submitted to the End-User.

### 7. Deliverable Data Items

The Supplier shall provide two (2) complete sets of operation and servicing manuals and technical drawings in the English language.