

## E1-51: Calibration of an *in situ* gamma ray spectrometer with point sources

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Rapid methods to determine radioactivity in tile environment are needed especially following accidental releases of radionuclides or when surveys over large areas are required. The term *in situ* gamma ray spectrometry has been adopted for measurements performed close to the source. The difficulties associated with *in situ* gamma spectrometry are the calibration procedures and the unavailability of standard area sources which are used for calibration. The present study discusses the calibration of a gamma spectrometer using point sources and corrections made to enable the use of the spectrometer in field measurements. The *in situ* measurements were compared with spectrometric analysis in the laboratory.

A Hyperpure Germanium detector with Inspector system was used for field calibration.  $^{241}\text{Am}$ ,  $^{133}\text{Ba}$ ,  $^{137}\text{Cs}$ ,  $^{152}\text{Eu}$  and  $^{60}\text{Co}$  point sources were placed 1m from the detector to determine parallel beam detector efficiency factors for the energy range 0.3 - 3.0 MeV. Source distribution parameter  $\alpha$  of the field area was determined by measuring depth profiles in the laboratory. Angular correction factors of 0.900- 0.948 for energies ranging from 0.3-2.5 MeV were selected on the basis of length to diameter ratio 0.88 of the detector crystal.  $\alpha$  was determined as  $0.0198 \text{ cm}^{-1}$ . The fluence rates per unit activity at 1m above ground were selected for natural radionuclides based on the calculated value  $\alpha$ . The activity concentration of  $^{238}\text{U}$  and  $^{232}\text{Th}$  at the maximum and minimum dose rate sites measured by a potable survey meter, using *in situ* measurements

were  $827 \pm 11$ ,  $4652 \pm 76$  and  $611 \pm 8$ ,  $2826 \pm 59$  Bq kg<sup>-1</sup> respectively. The corresponding laboratory analytical values were  $861 \pm 2$ ,  $5004 \pm 4$  and  $619 \pm 2$ ,  $3178 \pm 4$  Bq kg<sup>-1</sup> respectively.

*In situ* gamma ray spectrometry is useful in emergency response situations when a rapid assessment of deposited activity and exposure rates from specific radionuclides are desired.

Technical assistance from the International Atomic Energy Agency (Grant SRL/009/008) is acknowledged.