CALIBRATION OF AN IN-SITU GAMMA-SPECTROMETER

Bence Tasnádi[1], András Kocsonya[2], Krisztina Kristóf[1], Erik Molnár[1]

[1]Szent Istvan University Isotope Laboratory, Godollo
[2]HAS Centre for Energy Research, Budapest

The determination of the level and composition of the environmental γ-radiation field and the concentration of its sources on the ground surface requires reliable techniques, including model calculations and detector calibration. A suitable technique is the in-situ environmental gamma spectroscopy. According to the usual practice, the detector used is placed downward on a tripod 1 meter above the ground.

In this study, the full energy peak efficiency and angular sensitivity of a semiconductor detector, the Canberra BEGe (Broad Energy Germanium) was examined and measured for specific energies in the range between 39.9 keV and 1408.0 keV using 137Cs and 152Eu standard sources. To determine the absolute efficiency for different energies, the intensity of the sources was measured at the axis of the detector, at 100 cm. To determine the angular sensitivity, the sources were measured from 0° to 165° using 15° increments, at 50 cm (measured from the detector's effective point).

As a result, a wide range of data was collected to calculate the detector's sensitivity (and efficiency) for specific energies at different angles. By measuring these detector-dependent quantities, the sensitivity can be taken into account when calculating a specific radionuclide concentration from the γ-spectra recorded in-situ, resulting a more reliable outcome.

While in the case of in-situ measurements the angular dependence of the detector is only relevant in the range between 0° and 90°, expanding it up to 165° revealed the detector's charasteristics even more. These results can be used not only in the quantitative evaluation of in-situ spectra, but in measurements performed in different geometries as well.