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CALCULATION OF CHARACTERSTIC LIMITS FOR GAMMA SPECTROMETRY WITH INFLUENCE OF INTERFERING NUCLIDES

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ABSTRACT

Gamma spectrometry is a widely used technique for the measurement of gamma-emitting nuclides and is used in a wide range of applications in radiation protection, nuclear security and environmental sciences. One of the critical steps in analysing the spectrum includes the decision on which nuclides are present in the sample. Many laboratories report the Minimum Detectable Activity (MDA) as an upper limit for any activity present if a nuclide is determined to be not detectable. Statistical methods for evaluating whether the measurement signal is consistent with background noise or contains a signal were established a long time ago (Currie, 1968). Ignoring complications that may arise from more complicated regions of the spectrum, dedicated commercial gamma-spectrometry software can routinely calculate characteristic limits based on Currie or ISO11929 for the case that the region of interest does not contain a peak. If, however, an interfering peak is present the standard calculations will give incorrect results.
We present results of applying a modified method for determining characteristic limits based on ISO11929:3 (2019) to experimental spectra. The formalism was applied to 13 similar spectra measured on 13 different detectors. The spectra are reasonably complex and contain Eu-155 whose two major lines are heavily affected by interfering nuclides. Standard calculations without interference correction give MDA 10 x lower than the certified activity of Eu-155. ISO11929 formalism gives MDA at the same level as the certified activity. The number of non-detections (2 out of 13) and agreement of calculated activities with reference value support the validity of the approach.

Primary author: HERMANSPAHN, Nikolaus (CTBTO)

Presenter: HERMANSPAHN, Nikolaus (CTBTO)

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