

PAPER

Measurement of uranium enrichment by gamma spectroscopy: result of an experimental design

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Abstract

Gamma spectroscopy is commonly used in nuclear safeguards to measure uranium enrichment. An experimental design has been carried out for the measurement of uranium enrichment using this technique with different software used in safeguards application: MGA, MGA++, PCFRAM and IGA. The main goal is to estimate correctly the uncertainties of the measurement taking into account realistic in situ acquisition condition.

To set up the experiment, uranium sources have been achieved. It is U_3O_8 reference material in powder form, with a wide enrichment range in sealed container. Enrichment as well as mass of uranium are certified. The paper will first report on the characteristics of these reference materials.

This paper will then focus on the result of the experimental design. Regarding the acquisition systems, several gamma spectroscopic germanium detector (planar, coaxial) and multichannel analysers have been used. Five entry parameters have been considered: ^{235}U enrichment, adjustment of the acquisition gain, the source-detector distance, shielding, and matrix effect. With all this spectra, there is a direct comparison between the uncertainty announced by the different software and the error made by the code compared with the value of reference material. The paper will present statistical analysis of these results, with the objective to confirm or to improve our current knowledge of uncertainties for these uranium enrichment measurements.

Keywords: NDA, Gamma Spectrometry, uranium enrichment