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High-Quality Medium-Resolution Gamma-Ray Spectra from Certified Reference Uranium and Plutonium Materials

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The Institute of Transuranium Elements (ITU) has made an effort to record a collection of medium resolution gamma-ray spectra from well-characterized U and Pu certified reference materials CRM-171 (also known as SRM-969), CBNM-271, and Harwell PIDIE standards. The goal of this exercise was twofold: (i) to complement the international database of reference gamma-ray spectra with high-quality data for medium resolution spectrometers, and (ii) to feed Phase I of the U/Pu isotopic inter-comparison exercise that is being jointly organized by the ESARDA NDA Working Group and IAEA. Phase II of the exercise will be fed by similar spectra recorded by Institute for Radiological Protection and Nuclear Safety (IRSN).

These activities are supported through a joint Member State Support Programmes (MSSP) task and aimed at delivering reliable methodologies for the determination of U/Pu isotopic composition using medium resolution gamma-spectrometers. The latter have obvious benefits for in-field applications, amongst which are better usability, portability and maintainability. As the spectra will be made available online for software developers and end users, ultimately this will also contribute to sustainability as well as the improved and validated performance of existing U/Pu isotopic codes.

The spectra were recorded using the IAEA's standard Lanthanum Bromide ($\text{LaBr}_3(\text{Ce})$) (2.0" x 0.5") and Cadmium Zinc Telluride (CdZnTe) (500 mm³) detectors and acquisition electronics. Aiming to acquire the highest quality reference data, the spectra were measured for long acquisition times, ensuring very good counting statistics across potentially useful spectral intervals - up to 1 MeV for the CdZnTe and up to 2.6 MeV for the $\text{LaBr}_3(\text{Ce})$ detectors. Great attention was also paid to ensure that the measurement geometry was stable and reproducible, and the spectra had minimum influence from background radiation and pile-up effects.

The paper will briefly discuss challenges of U/Pu isotopic analysis using medium resolution gamma-spectrometers and provide complete information about the sample properties and conditions of measurements, as will be needed for future use of the collected reference spectra.

Country or International Organization

European Commission, Joint Research Centre, Institute for Transuranium Elements

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