WG6 IPNDV Experimental Technology Data Sheet

Hungary

Name of Experimental Campaign: Belgium exercise to investigate performance of measurement methods

Technology Name: Gamma Spectrometry

Physical Principle/Methodology of Technology: Gamma photon detection by HPGe Detector

What Does the Method Determine/Measure (e.g., presence of nuclear material, isotopics, mass): presence, mass and isotopic composition of U and Pu

What is the Applicability to IPNDV: The presence of WG Plutonium in the scrapped HE or other components' container after the disassembly (step9) means the breach of the protocol.

Type of Data Collected by the Technology: Gamma spectras

Constraints (e.g., time to install the equipment, measurement times including distance from object, dose rate required, required Cd shielding to limit the count rate): time to install: 30 min, measurement time: 30 min. Lead collimator was required to distinguish the isotopic ratio distribution in the pin. The liquid nitrogen supply.

Physical Description/Diagram/Photos of the Experimental Setup/Layout:
The measuring campaign of the IPNDV found its place at the SCK●CEN campus in Mol, Belgium. The scene was in the vicinity of a large shielded RaBe source. The aim of the campaign was to demonstrate the presence of fissile material being shielded or unshielded in a nonzero background environment.

The measurements were carried out with a Canberra GL 2020 planar HPGe detector with an ORTEC DigiDart portable MCA. A collimator with 2 diameter configurations was used to collect data from different parts of the pin. The distance was changed in accordance to the input count rate.

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Narrow collimator aperture and close geometry for measuring isotopic ratio distribution

Wide collimator aperture for general measurements

We could detect the presence of the fissile material even in the case of the weakest source (fuel assembly) with the strongest shielding, although the lead attenuated the important low energy range and only the higher energy peaks could be detected.

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Conclusions

The presence of the fissile material could be detected in any case even if it was small and behind the provided shielding. In this sense the test was successful.

In the presence of shielding materials the MGA++ code used for determining isotopic composition couldn't calculate properly.

Specific Objects Measured (which of the experimental objects were measured; if not described elsewhere, describe experimental objects here): MOX fuel assemblies were measured

Process Required to Analyze the Data (include any software used): GammaVision (for measuring), MGA++, MGAU (for analyzing the spectra)

Preliminary Results (qualitative, not quantitative; e.g., did the method perform as expected, if not how was it different): Presence of nuclear material was detected in every experimental setup with and without any available shielding.

Final Results (if available; if not, estimate of when final results will be available):

Lesson Learned (e.g., what went well what went wrong or not as expected, do the results confirm what we said in the technology tables): The gamma spectroscopy is sensitive to the shielding materials, especially to the lead, this can cause difficulties in the calculations using the low energy range. In presence of plutonium, the MGAU couldn't evaluate the U content properly.

Simulations (if the participant envisages to carry out simulations, which ones; indicate willingness to share the simulations results with IPNDV): Simulations has not been carried out until now.

Willingness to Share the Experimental Data within IPNDV:

☒ Yes ☐ Yes, anonymously ☐ No