

APPLICATION OF MONTE CARLO MODELING AND COMPTON-TO PEAK RATIO ANALYSIS OF GAMMA SPECTRA FOR THE EVALUATION OF ACTIVITY BEFORE AND AFTER METALLIC RADIOACTIVE WASTE DECONTAMINATION PROCEDURE

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One of the important tasks for successful nuclear power plant (NPP) decommissioning process is optimization of management of nuclear facility low-level metallic radioactive waste (MRW) by grouping and decontamination of MRW. Approximately 1000 m³ of contaminated metal waste is generated for every 1 GW decommissioned (13% by volume) [1] during decommissioning of a nuclear facility. For efficient characterization of very low-level metallic waste, the determination of surface contamination is done by γ -spectrometry measurement combined with Monte Carlo simulation of applied measurement geometry [2]. The aim of this work was to identify the main parameters of analysis of gamma spectra of metallic radioactive waste before and after decontamination procedure, when only part or total surface contaminants (¹³⁷Cs) are removed from MRW with presence of volume activation of other γ -emitters (i.e., ⁶⁰Co) sources.

The experiments with the laboratory-made metallic waste samples of volume activity of ⁶⁰Co and removable different activity ¹³⁷Cs (surface contaminants) sources have been performed using stationary HPGe semiconductor and portable CeBr₃ scintillation detectors with and without collimators. MCNP6 modelling of both detectors and different sample geometries of the experiments has been carried out for comparison and method development purposes. Modelling, inter-comparison of γ -spectra, and analysis of the nuclide peaks and Compton backscattering for samples with different activity ¹³⁷Cs and ⁶⁰Co sources in established iron shielding conditions are presented to mimic the decontamination procedure of the metallic radioactive waste.

1. R. Traboulsi et al., Metallic Low-Level Waste (LLW) Handling Options: An Optimal Lifecycle-Based Approach for North American Operations, Proc. of Int. Conf. WM2019, March 3 – 7, 2019, Phoenix, Arizona, USA.
2. K. Mikalauskiene et al., Assessment of Compton/photoppeak ratio for various thickness metal shielding, Proc. of Int. Conf. “Medical Physics in the Baltic States 2023”, 09-11 November 2023, Kaunas, Lithuania.

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