Nuclear Science and Technology Division

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Sara A. Pozzi, Lucia Cartegni, and John T. Mihalczo
Oak Ridge National Laboratory

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This paper describes the Monte Carlo simulations that were performed for planning the passive measurements on plutonium oxide samples stored at the Joint Research Center in Ispra, Italy. The simulations were performed with the MCNP-PoliMi code which correctly simulates the higher order statistics of the neutron and photon field in a multiplying medium. The samples analyzed have mass in the 200-to 2500-g range, with three compositions corresponding to three different burnups. The measurements will be performed with eight large (25 × 25 × 8 cm) liquid scintillators, arranged in two 2 × 2 arrays. The measurements rely on the Pu-240 spontaneous fission which emits multiple neutrons and gamma rays. These are detected with the scintillators which are sensitive to fast neutrons and gamma rays. Correlations between detectors are studied on the time scale of a few hundreds of ns. The correlations include gamma-gamma, gamma-neutron, and neutron-neutron coincidences.

The paper presents the Monte Carlo simulations and analysis. Contamination of the signature by (alpha, n) reactions and detector cross-talk are analyzed and discussed. Finally, a method to determine Pu-240 mass is described.

Paper justification:
The paper presents the results of simulations performed on plutonium oxide samples with the MCNP-PoliMi code.

Paper significance:
The ability to simulate correlation measurements performed with Monte Carlo methods is of interest in the nuclear safeguards community and elsewhere.