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## A New Approach for the Application of the Self-Interrogation Neutron Resonance Densitometry (SINRD) to Spent Fuel Verifications

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The verification of spent nuclear fuel is one of the activities performed by the International Atomic Energy Agency (IAEA), and the development of innovative non-destructive assays (NDA) is one of the fields of research in the safeguards community.

In this framework the Belgian nuclear research center SCK-CEN started the investigation of the Self-Interrogation Neutron Resonance Densitometry (SINRD). SINRD is a NDA technique that aims at the direct quantification of the residual  $^{239}\text{Pu}$  content in a spent fuel assembly. The technique is proposed in the framework of the Next Generation Safeguards Initiative (NGSI) and is also being studied by Los Alamos National Laboratory (LANL). SINRD relies on detecting the neutron flux attenuation by  $^{239}\text{Pu}$  around the 0.3 eV neutron resonance by measuring the neutron flux with detectors covered with Gd and Cd filters. Since it was found that this signature is significantly affected by the presence of water around the fuel elements, a new approach has been proposed within our work.

This contribution starts from the results of a previous feasibility study aimed at a better understanding of the technique. We first compare the performance of different detector types that can be used for the SINRD measurements and from these considerations an optimal range for the thickness of the Gd and Cd filters is identified. The results obtained with these simulations will be used for the assessment of the neutron count rate that can be obtained with realistic measurement conditions, and they will guide the planning of the future benchmark experiments.

### Country or International Organization

Belgium

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