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Safeguarding Advanced Generation IV Reprocessing Facilities: Challenges, R&D Needs, and Development of Measurements

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Recycling of nuclear fuel will be an essential component of Generation IV (Gen IV) systems. Both the aqueous and electrochemical reprocessing techniques, which comprise the main recycling routes considered for future closed fuel cycles, face challenges related to safeguards implementation. Thus, advancements in the research related to Gen IV cycles call for simultaneous development of safeguards approaches for new types of nuclear facilities.

The feasibility to perform spent fuel measurements in aqueous and electrochemical facilities, respectively, depends heavily on the fuel composition, the chemical processes in operation, and the environments in which they take place. Regardless of reprocessing technique, efficient measures are required in order to conform to the limited resources allocated by the IAEA for safeguards implementation. Remote and online monitoring capabilities at a facility are therefore crucial. At the same time, for establishing and maintaining knowledge of the fuel even in complex bulk handling facilities with high material throughputs, improved accuracy in measurements is desirable.

As part of Sweden's Gen IV research program, financed by the Swedish Research Council, and as one of the safeguards research projects carried out at Uppsala University, a series of physical measurements of solutions containing used nuclear fuel is planned. X-ray and gamma photons emitted from the fuel will be measured at different stages of a laboratory scale GANEX (Group ActiNide EXtraction) aqueous recycling process. Radiation measurements hold a potential for quick, online measurements as a complement to DA (Destructive Assay) sampling. In this paper, results of MCNP simulations performed in preparation of the measurements will be discussed.

Country or International Organization

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