NUMERICAL ANALYSIS OF NEUTRON ACTIVATION PROCESSES IN CLADDING MATERIAL OF SPENT FUEL ROD

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European Joint Programme on Radioactive Waste Management (EURAD), 2019-2024 is established to support the participating countries in implementing EU Directive 2011/70/Euratom that defines a Community framework for the responsible and safe management of spent nuclear fuel and radioactive waste in their national Research, Development & Demonstration (RD&D) programmes. Within the EURAD one of the RD&D work packages is focussing on spent nuclear fuel characterisation and evolution until disposal. The main objective of this work package is to perform experimental and numerical studies to determine reliable source terms for spent nuclear fuel and associated uncertainties from the irradiation of the fuel assembly in the reactor core to the time of its disposal into a deep geological repository (DGR). The studies also include the determination of neutron activation and fission products in the cladding material of the irradiated fuel rod. In radiological impact assessments of the DGR, the analysis is performed per released radionuclides rather than as a bulk of released elements. Fuel rod cladding material contains impurities that produce safety relevant long-lived radionuclides such as C-14, Cl-36 during irradiation and neutron activation. It also produces fission products since the cladding material contains uranium impurities. This poster presents the work of the researchers of the Lithuanian Energy Institute who performed a numerical analysis of radionuclide inventories in the Zircaloy cladding of the PWR spent fuel assembly 15x15 irradiated in the Gösgen Nuclear Power Plant (Switzerland). The modelling is performed using a SCALE 6.1 control module TRITON that is used for transport, depletion, sensitivity and uncertainty analysis for reactor physics applications. Analysis of the impacts of accepted modelling assumptions is performed including variations of initial impurities concentrations in Zircaloy, fuel assembly irradiation history and user-defined or default code parameters on the calculation results. The performed modelling has revealed that the activated impurities in the fuel rod cladding are important for long-term impact assessments. The obtained modelling results have also been used in the RD&D work package to perform the code-to-code comparison and compare them with experimental investigations of fuel rod cladding.

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