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Experimental activation determination in and on components of nuclear power plants and comparison with activity calculations

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Due to the “German Energiewende”, all nuclear power plants (NPPs) in Germany will have been shut down by the end of 2022. Consequently, a safe, economical, and efficient dismantling of the NPPs will be an important challenge for the next decades. This includes to progress with methods for optimal planning and implementation of decommissioning.

Several studies have been conducted to develop a standardized method for evaluating the specific and temporal progression of the activation in the reactor components, near-reactor concrete, and construction elements based on the reactor’s power history. This will serve as an early non-destructive tool for the radiological characterization of the NPP’s components. Such essential knowledge can significantly minimize the radioactive waste and the radiation exposure of the operating personnel during the NPP’s decommissioning.

The studies considered two strategies. In the first one, the radionuclide inventory in the material of an NPP already under dismantling was investigated. Among others, Co-60 and C-14 in steel samples from the reactor pressure vessel and Eu-152 and Ba-133 in concrete drill cores from biological shielding were determined. In the second strategy, the neutron flux in NPPs still under operation was determined with activation monitors (small metal foils, e.g., In, Sn, Zn). The experimental data from both strategies were compared with results from Monte-Carlo simulations.

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