NUMERICAL VISUALIZATION OF GAMMA RADIATION DISTRIBUTION IN NUCLEAR DECOMMISSIONING PROCESSES

EWA ŁASZYŃSKA[1,*], MIKOŁAJ OETTINGEN[1]

[1]AGH University of Krakow, Faculty of Energy and Fuels, Department of Nuclear Energy and Radiochemistry, al. Mickiewicza 30, 30-059 Krakow, Poland

** Corresponding author email: elaszynska@agh.edu.pl*

The radiological characterization of decommissioned nuclear power plant components is crucial for planning dismantling operations and ensuring radiation safety. One of the most significant challenges in nuclear decommissioning is the accurate assessment of residual radiation levels, particularly in large, highly activated components such as the Reactor Pressure Vessel (RPV). This study presents a numerical approach to visualize the gamma radiation distribution from the RPV of Trino Nuclear Power Plant (NPP) using the Monte Carlo-based RayXpert software [1,2]. The analysis focuses on the spatial distribution of radiation in both horizontal and vertical cross-sections of the RPV, considering residual activation and surface contamination as primary sources of radiation.

The Trino NPP, a 280 MWe Pressurized Water Reactor (PWR), was operational from 1965 to 1987. Over three decades after shutdown, its structural components, particularly the RPV, remain radioactive due to neutron activation and surface contamination [2]. Using computational modeling, the radiation dose distribution around the vessel was simulated, providing essential insights for optimizing decommissioning strategies in compliance with the ALARA principle [3]. The obtained results offer a comprehensive spatial representation of dose rates, identifying high-exposure zones and facilitating the selection of appropriate shielding and dismantling techniques.

The study demonstrates the effectiveness of advanced numerical modeling in assessing radiation hazards associated with nuclear facility decommissioning. The presented visualization approach enhances radiological safety planning and contributes to optimizing waste classification and disposal strategies.

References:

[1] Rossini S. et al., Radiological characterization of the reactor pressure vessel of Trino NPP for dismantling purposes, “Progress in Nuclear Energy”, Volume 107, August 2018, Pages 17-30, https://doi.org/10.1016/j.pnucene.2018.04.001

[2] TRAD tests and radiation, 907 l’Occitane, 31670 Labège cedex, France, https://www.rayxpert.com/, (access: 10.09.2024)

[3] U.S. Department of Energy, Radiation Protection of the Public and the Environment, Washington, DC, 2011, https://www.directives.doe.gov/directives-documents/400-series/0458.1-BOrder-chg4-ltdchg/@@images/file, (access: 10.09.2024)

112_abstract_final