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Development of Evaluation Method of Uncertainty of Radioactivity by Propagating Nuclear Data Covariance for Clearance Verification in Decommissioning of Nuclear Power Plants

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To optimize disposal of low-level radioactive waste originating from decommissioning of nuclear facilities, required are 1) reliable assessment of radioactivity level by calculation and measurement and 2) a good estimate of the uncertainty of those results for the classification of radioactive waste. In order to improve the reliability of the calculations in clearance verification, we established a procedure of estimating the uncertainty of radioactivity concentration due to that of nuclear data. For that, we estimated covariance of neutron cross sections of important nuclides that account for over 90 % in ΣD/C of concrete material and carbon steel by employing a propagation of uncertainties in the resonance parameters and statistical model parameters with nuclear data code group T6. Here, D stands for radioactivity concentration, and C stands for clearance level. Then, we developed a new method to calculate uncertainty of radioactivity with Total Monte Carlo method by connecting randomly perturbed endf-format files generated by the T6 calculation to a cross section processing code NJOY and an activation calculation code ORIGEN2 using ORLIBJ40, a set of cross section library based on JENDL-4.0. It was concluded that the uncertainty of the radioactivity due to that of nuclear data for nuclides which dominate the ΣD/C is sufficiently small, and the main factor of uncertainty of radioactivity comes from that of the neutron flux.

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