

Sensitivity/uncertainty Analysis Applied to the Phase VII Benchmark.

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In November 2008, a Phase VII Benchmark entitled “*UO₂ Fuel: Study of spent fuel compositions for long-term disposal*” was proposed by the Expert Group on Burnup Credit of the NEA-OECD. The main objective of this benchmark is to *study the ability of relevant computer codes and associated nuclear data to predict spent fuel isotopic compositions and corresponding keff values in a cask configuration over the time duration relevant to spent nuclear fuel disposal, out to 1,000,000 years*. The results of this exercise are expected to show differences in international nuclear data sets (decay/branching data to predict the isotopic inventory along decay time and cross sections to predict keff) and computing tools (inventory and transport codes).

For decay calculations, and in order to accomplish this objective at the same time increasing the understanding and confidence in our ability to predict keff for timeframes relevant to long-term disposal, we have performed a decay sensitivity analysis assessing: i) impact of different nuclear decay libraries, ii) importance of numerical solvers to predict the inventory, iii) study of the main pathways for the formation of relevant nuclides, iv) sensitivity to decay data for the formation of relevant nuclides, v) overall uncertainty analysis by a general Monte Carlo procedure.

For criticality (keff) calculations, a representative PWR cask model is selected. MCNP and KENO, with different nuclear data libraries, were used to compare the predicted keff. To take advantage of the previous decay sensitivity analysis, the sensitivity profiles to the isotopic composition have also been calculated. This permits the identification of the most contributing cross sections and the most relevant uncertainties in this problem.