

REVIEW OF RESULTS FOR THE OECD/NEA PHASE VII BENCHMARK: STUDY OF SPENT FUEL COMPOSITIONS FOR LONG-TERM DISPOSAL

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Abstract – This paper summarizes the problem specification and compares participant’s results for the OECD/NEA/WPNCS Expert Group on Burn-up Credit Criticality Safety Phase VII benchmark – Study of Spent Fuel Compositions for Long-Term Disposal.

After spent nuclear fuel (SNF) is discharged from a reactor, the reactivity continues to vary as a function of time due to the decay of unstable isotopes. Burnup credit analyses for storage and transport consider timeframes that are extremely short (typically less than 100 years), as compared to the timeframe of interest to long-term disposal (e.g., 10,000 years after closure in the US). The Phase VII benchmark was developed to study the ability of relevant computer codes and associated nuclear data to predict spent fuel isotopic compositions and corresponding k_{eff} values in a cask configuration over the time duration relevant to SNF disposal. Expected outcomes of the benchmark exercise include improved understanding relative to potential differences in international nuclear data sets and improved understanding and/or confidence in our ability to predict k_{eff} and source terms for timeframes relevant to long-term disposal of SNF. The benchmark is divided into two sets of calculations: (1) decay calculations out to 1,000,000 years for provided PWR UO_2 discharged fuel compositions and (2) criticality (k_{eff}) calculations for a representative cask model at selected time steps. This paper will provide detailed comparisons of the numerous (>10) participant’s isotopic compositions and k_{eff} values that were calculated with a diversity of computer codes and nuclear data sets.

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