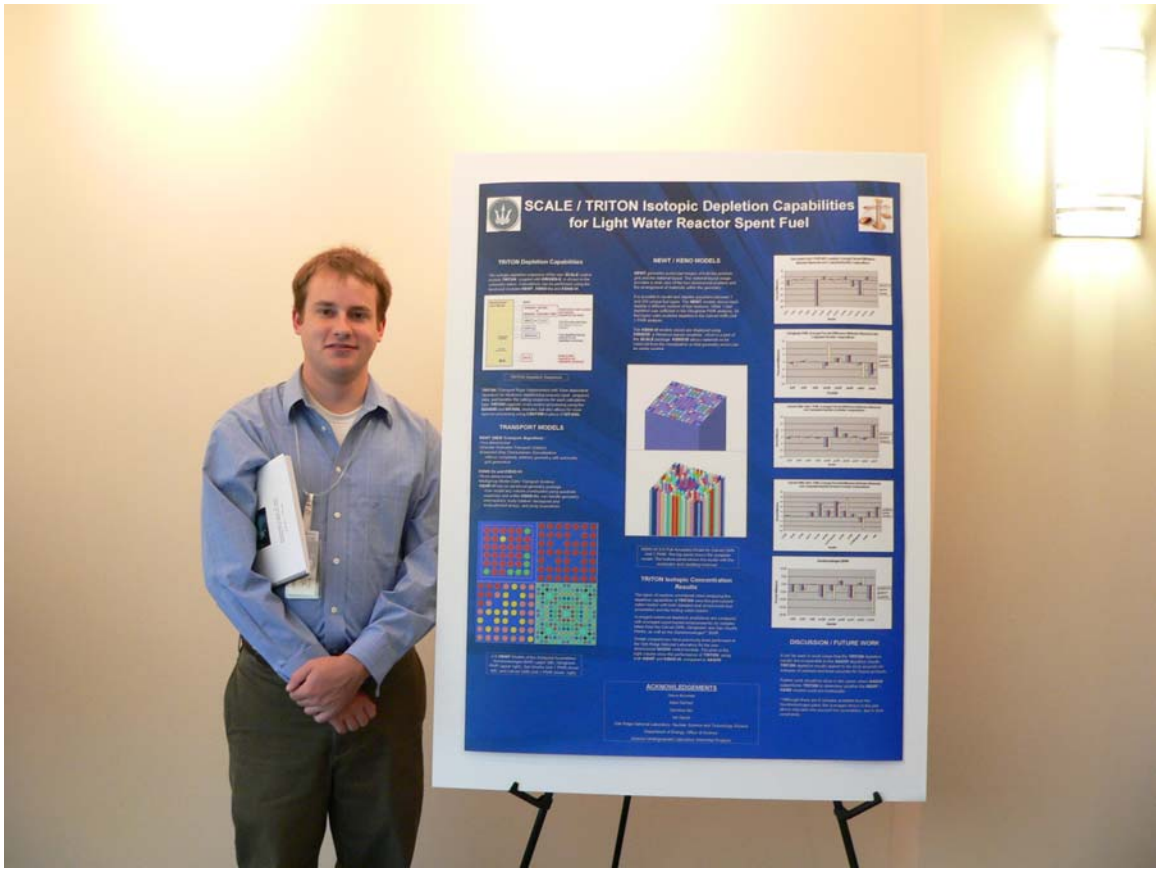
Validation of SCALE (TRITON) Isotopic Predictions for Light Water Reactor Spent Fuel



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The ability to accurately predict the nuclide composition of spent fuel samples over the course of time is important in a wide variety of applications. These applications include, but are not limited to, the design, licensing and operation of radioactive waste transport systems, interim waste storage, and a permanent waste repository. The isotopic depletion capabilities of the new SCALE (Standardized Computer Analyses for Licensing Evaluation) control module TRITON, coupled with ORIGEN-S, were evaluated using spent fuel assays from several commercial light water reactors. The type of reactor analyzed was the pressurized-water-reactor (PWR) with both standard and mixed-oxide fuel (MOX) assemblies. Calculations were performed using the functional modules NEWT and KENO-VI. NEWT is a two-dimensional, arbitrary geometry, discrete ordinates transport code and KENO-VI is a multigroup, Monte Carlo transport code capable of handling complex three-dimensional geometries. To validate the codes and

data used in depletion calculations, numerical predictions were compared with experimental measurements for a total of 29 samples taken from the Calvert Cliffs, Obrigheim, and San Onofre PWRs and the Gundremmingen BWR. Similar comparisons have previously been performed at the Oak Ridge National Laboratory (ORNL) for the one-dimensional SAS2H control module. The SAS2H, TRITON/KENO-VI, and TRITON/NEWT results were compared for corresponding samples. All analyses showed that TRITON/KENO-VI and TRITON/NEWT produced typically similar results, leading to the conclusion that the transport/depletion models are performing correctly. Overall the TRITON results for the reactors analyzed were comparable to previous SAS2H results. In many cases TRITON showed more accurate depletion results, however, there were also some instances where SAS2H proved superior. The calculations performed in this validation study largely demonstrate that the depletion capabilities of TRITON accurately model spent fuel depletion and decay and are similar to those of SAS2H, which previous ORNL studies have concluded qualifies as a basic tool for predicting isotopic compositions of spent fuel.

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