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Steady-State Thermal-Hydraulics Analyses for the Conversion of BR2 to Low Enriched Uranium Fuel

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ABSTRACT

The code PLTEMP/ANL version 4.2 was used to perform the steady-state thermal-hydraulic analyses of the BR2 research reactor for conversion from Highly-Enriched to Low Enriched Uranium fuel (HEU and LEU, respectively). Calculations were performed to evaluate different fuel assemblies with respect to the onset of nucleate boiling (ONB), flow instability (FI), critical heat flux (CHF) and fuel temperature at beginning of cycle conditions. The fuel assemblies were characteristic of fresh fuel (0% burnup), highest heat flux (16% burnup), highest power (32% burnup) and highest burnup (46% burnup). Results show that the high heat flux fuel assembly is limiting for ONB, FI, and CHF, for both HEU and LEU fuel, but that the high power fuel assembly produces similar margin in a few cases. The maximum fuel temperature similarly occurs in both the high heat flux and high power fuel assemblies for both HEU and LEU fuel. A sensitivity study was also performed to evaluate the variation in fuel temperature due to uncertainties in the thermal conductivity degradation associated with burnup.