Public Abstract

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Title:THE DISSOLUTION RATE OF UNIRRATIATED UO2 UNDER REPOSITORY CONDITIONS: THE INFLUENCE OF FUEL AND WATER CHEMISTRY, DISSOLVED OXYGEN, AND TEMPERATURE

As part of the performance assessments of proposed geologic repositories the effects of temperature, dissolved O2, and water and fuel chemistry on the dissolution rates of spent fuel are necessary to provide a quantitative estimate of the potential dose over geologic time frames. In this research, fuels containing Gd2O3-doped UO2 were tested in a single-pass flow-through setup. These tests have verified that in bicarbonate solutions as temperature increased the dissolution rate increased. However, the presence of silicate in the feedwater altered the system and lowered the dissolution rate at higher temperatures. Only the pure UO2 samples exhibited a dependence on the dissolved O2 concentration, which increased with rising temperature. The Gd2O3-dopant stabilized the fuel matrix and lowered the dissolution rate increasingly up to 4 wt%.

The dissolution rates for pure UO2 compared reasonably well with the Yucca Mountain Model for tests performed at 50 C and 75 C, but were found to be approximately half the values predicted by the model at 25 C. After long time periods when the radiolytic field has diminished, additional benefits in dissolution reduction should exist due to constituents such as Gd2O3 in the fuel matrix and silicate in the groundwater. Thus, the durability of spent fuel in Yucca Mountain may be greater than previously modeled.