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STUDY OF U SORPTION ONTO GRANITE AND BENTONITE

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While nuclear power offers a low carbon emission and reliable source of energy, the long-term management of used fuel waste remains a challenge. Deep geological repositories (DGRs) are the preferred solution for the long-term management of used nuclear fuel worldwide. In Canada's site selection process, there are currently two potential siting areas for hosting the DGR, located within crystalline rock and sedimentary rock, respectively (1). MX-80 bentonite will be used as the engineered barrier and backfill material in the DGR. The study of sorption of radionuclides onto crystalline rocks and MX-80 will provide useful information for safety assessment calculations.

While reducing conditions are expected to prevail within the DGR, it is important to explore the sorption behavior of radionuclides under a range of different groundwater geochemical conditions. This work focuses on the sorption of U(VI) onto MX-80 bentonite and Canadian crystalline rocks (granite) collected from Manitoba, where groundwaters have been characterized as Ca-Na-Cl type brackish to saline solutions at the repository depth. To investigate the impact of pH and ionic strength of groundwater on the sorption behavior of uranium, sorption of U(VI) onto granite and MX-80 bentonite was investigated in Ca-Na-Cl solutions at a range of pH between 4 and 10, and ionic strength between 0.05 and 1 molal. The extent of sorption is expressed by sorption distribution coefficient (K_d), which was calculated using equation 1. Geochemical models were applied to determine the sorption sites and compare with the experimental data.

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Equation 1 Sorption distribution coefficient (Kd)

$$K_d = \frac{C_i - C_{eq}}{C_{eq}} \times \frac{L}{S}$$