

SORPTION PROPERTIES OF RADIONUCLIDES IN SALINE SOLUTIONS

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Sedimentary rocks in Canada, including shales and limestone, are being considered as potential host rocks for a deep geological repository (DGR) for radioactive waste. Within deep-seated groundwater systems these sediments have been observed to contain Na-Ca-Cl brine solutions with total dissolved solids (TDS) of up to 350 g/L (e.g. groundwaters in Southern Ontario [1]). Sorption is a potential mechanism for retarding sub-surface radionuclide migration from a DGR to the environment. The Nuclear Waste Management Organization (NWMO) has supported a long-term comprehensive program for development of sorption distribution coefficient (K_d) data.

Detailed sorption measurements were conducted for Ni, Cu, Eu, Pb, As, Se, Zr, Cs, Tc, Pd, Sn, U, Th, Np and Pu to determine the K_d values for Canadian sedimentary rocks and bentonite under saline conditions. Sorption measurements considered a reference synthetic porewater brine (Na-Ca-Cl type) with an ionic strength (I) of 6.0 m (mol/kgw). Sorption measurements were also conducted in dilute solutions (Na-Ca-Cl type) with an ionic strength of 0.01 m to investigate the effect of ionic strength on sorption. Batch sorption measurements for redox-sensitive elements (U, Se, As, Tc, Np and Pu) were conducted under controlled reducing conditions, as expected within a DGR (-150 ~ -200 mV). The effects of pH and ionic strength on sorption were investigated. The measured sorption K_d values are used to update the NWMO's database of sorption values for Canadian sedimentary rocks and bentonite for use in the evaluation of potential DGR sites.

References:

[1] Hobbs, M.Y. et al. NWMO technical report NWMO
DGR-TR-2011-12, Toronto, Canada (2011).