

## SORPTION/DESORPTION EXPERIMENTS ON CHALK RIVER SAND AND POTENTIAL BUFFER MATERIALS

by

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### ABSTRACT

Sorption data are required by predictive models to estimate the retardation of a contaminant due to sorption relative to the movement of groundwater through natural and engineered barriers. Sorption is known to be a function of many variables, including but not limited to, the sorbing substrate, the contaminant concentration, the ionic strength of the background electrolyte, competing ions, pH and complex formation. In this work, sorption and desorption of a number of potential contaminants by mixtures of sand, sand/clinoptilolite and sand/clinoptilolite/apatite was determined as a function of some of these factors. Sorption and desorption of Pu was examined as a function of ionic strength of the synthetic groundwater and the presence of acetate, both as a complex-forming ligand and as a nutrient for microbial growth. Sorption and desorption of U was studied as a function of ionic strength and pH. Sorption and desorption of Co, Sr, Nb, Cs and Ra was measured as a function of ionic strength. Sorption of Am was determined as a function of the sorbing substrate.

The results of the sorption experiments with Pu indicated generally higher sorption of this element from solutions containing acetate. The interpretation of these experimental results was complicated by biological activity in the test solutions. In organic-free solutions, the addition of clinoptilolite and apatite increased the amount of sorption observed. In the systems containing acetate, little effect on sorption was observed due to the addition of either of these two materials to the solid mix.

Where a range of pH could be established and maintained, sorption of U appeared to maximize near pH 6.5 and decreased as pH increased or decreased. For a given pH, sorption appeared to increase with decreased ionic strength. The addition of clinoptilolite appeared to enhance U sorption from some of the solutions, but data interpretation was complicated by pH effects. The addition of apatite to the solid mix increased U sorption in the pH range 7.8 to 8.3.

The sorption characteristics of Co, Sr, Nb, Cs and Ra varied with solution ionic strength and sorbing substrate. In general, increased ionic strength resulted in decreased sorption of Sr, Cs and Ra. Clinoptilolite enhanced the sorption of Sr, Ra and Am. Apatite enhanced the sorption of Nb.

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