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Effect of oxidation state and ionic strength on sorption of actinides (Th, U, Np, Am) to geologic media

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The Waste Isolation Pilot Plant (WIPP) near Carlsbad, NM has been accepting transuranic (TRU) waste since 1999 and is the only operating nuclear waste repository in the US. The WIPP is located in a salt deposit approximately 650 m below the surface overlain by multiple layers of dolomite and other geologic material. Performance assessment (PA) modeling for a 10,000 year period is required to recertify the operating license with the US EPA every five years. Human intrusion caused by drilling operations is the main pathway of concern for environmental release of radioactive material. We are evaluating the degree of conservatism in the estimated sorption partition coefficients (K_d s) used in the PA model based on a complementary batch and column method (Dittrich and Reimus, 2016, 2015, 2014, 2013; Dittrich et al., 2015). The main focus of this work is to investigate the role of ionic strength, solution chemistry, and oxidation state (III-VI) in actinide sorption to dolomite rock. Based on redox conditions and solution chemistry expected at the WIPP, possible actinide species include Pu(III), Pu(IV), U(IV), U(VI), Np(IV), Np(V), Am(III), and Th(IV). We will present (1) a conceptual overview of K_d use in the PA model, (2) background and evolution of the K_d ranges used, and (3) results from batch and column experiments and model predictions for K_d s with WIPP geologic media. We will also briefly discuss the challenges of upscaling from lab experiments to field scale predictions, the presence of ligands (e.g., acetate, citrate, EDTA), the role of colloids and microbes, and the effect of engineered barrier materials (e.g., MgO) on sorption and transport conditions.

References:

- Dittrich, T.M., Reimus, P.W. 2016. Reactive transport of uranium in fractured crystalline rock: Upscaling in time and distance. *J Environ Manage* **165**, 124-132
- Dittrich, T.M., Reimus, P.W. 2015. Uranium transport in a crushed granodiorite: experiments and reactive transport modeling. *J Contam Hydrol* **175-176**: 44-59.
- Dittrich, T.M., Boukhalfa, H., Ware, S.D., Reimus, P.W. 2015. Laboratory investigation of the role of desorption kinetics on americium transport associated with bentonite colloids. *J Environ Radioactiv* **148**: 170-182.
- Dittrich, T.M. and P.W. Reimus. 2014. Potential for colloid-facilitated transport of americium in a bentonite/granodiorite system. *Abstracts of Papers of the American Chemical Society* **247**, Presented at the 247th American Chemical Society National Meeting, Dallas, TX, March 16-20. American Chemical Society: Washington, D.C, 2015; 113-GEOC.
- Dittrich, T.M. and P.W. Reimus. 2013. Experimental evaluation of actinide transport in a fractured granodiorite. *Proceedings of the 14th International High-Level Radioactive Waste Management Conference*, American Nuclear Society, LaGrange Park, IL. pp. 473-480.