Uranium association and interaction with redox boundary in Rifle surface seep sediments

BRANDY D. STEWART [1*], PETER S. NICO[2], AND BRENT M. PEYTON[1]

[1]Montana State Universiy, Bozeman, MT, USA
(* presenting author)
[2]Lawrence Berkeley National Laboratory, Berkeley, CA, USA
Brandy.stewart@erc.montana.edu
psnico@lbl..gov
bpeyton@coe.montana.edu

Owing to ecosystem and human health consequences, understanding uranium's potential for mobility in environmental settings is important. In anaerobic soils and sediments, oxidized U(VI) may be reduced through biological or chemical pathways to U(IV), forming sparingly soluble solids. However, formation of uranyl-calcium-carbonato complexes may limit reduction and authogenic UO_2 is susceptible to reoxidation. Determining reaction pathways of uranium that promote solids stable under aerobic and anaerobic conditions is critical for limiting dissolved concentrations and migration of uranium. This is of particular concern in settings near or at redox boundaries where surface and subsurface environments may be subjected to fluctuating redox conditions. We examined the nature and association of solid-phase uranium in both oxidized and reduced sediments from a hillside surface seep in Rifle, Colorado where uranium appears to be naturally attenuated in the solid phase. Visibly reduced sediments occur at the surface of the seep adjacent to (< 100cm from) pockets of freshly precipitated iron (III) phases, indicative of a redox boundary. Uranium release and solid-phase association were measured in systems containing sediment and 3 mM Fe(II) that were maintained under reducing conditions for 15 d followed by 5d of oxidation to simulate a redox cycle. Aqueous and solid-phase results show that >75% of uranium present in the sediments remains associated with the solid phase throughout the oxidation portion of the experiments.

Predicting the speciation and transport behaviour of contaminants in a wet discard dam

GIDEON STEYL[1]*, IZAK L. MARAIS[2], LORE-MARI CRUYWAGEN[2]

[1]University of the Free State, Chemistry Department, Bloemfontein, South Africa, steylg@ufs.ac.za (* presenting author)
[2]University of the Free State, Institute for Groundwater Studies, Bloemfontein, South Africa, CruywagenLM@ufs.ac.za

The burning of pulverised coal in coal-fired boilers to generate heat causes the production of fly ash. In addition water used in the process of cooling and turbine propulsion results in the production of high saline effluents. The high saline streams (ca. 20% ash) are used for the hydraulic transport of ash to the dumping sites, which results in ash dams that can act as salt sinks. The slurry that is pumped onto the wet dump area is allowed to settle. The water that has separated from the ash is skimmed off and re-circulated to transport more fly ash to the site. However a certain fraction of the water infiltrates the dam resulting in geochemical transformations.

Due to the presence of high saline water during the operational phase an extensive salt loading is observed onto the ash particles. During the decommisioning phase of the ash dam certain physical and chemical processes need to be considered to manage the produced water from the system. In particular the mechanism of leachate production needs to be considered in conjunction with the temporal and spatial extent.

The results presented will focus on the effect that disposal methods of the fly ash has on the transport of chemical species within the ash dam (Figure 1). In addition the rate of release of chemical species will also be presented as this influences the measures required to manage these facilities over an extended time period.

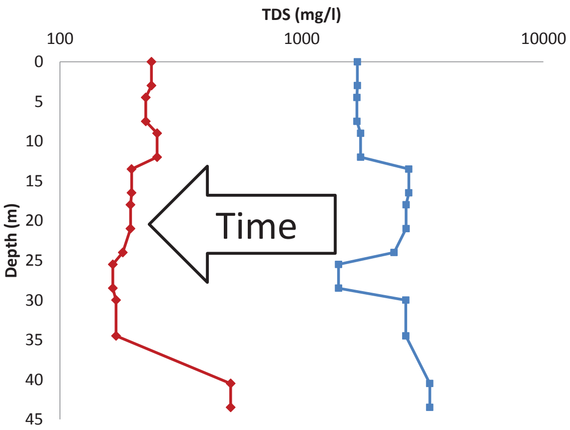

Figure 1: Diagram depicting the change in TDS values over time from a leachate analysis. The build-up of initially higher TDS values can be observed in two distinct areas (15 – 24 and 30 – 45 m).