Rapid movement of an acidic uranium nitrate plume in carbonate-rich weathered shale saprolite. (S02-jardine094414-Poster)

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Abstract:

At the DOE NABIR Field Research Center on the Oak Ridge Reservation in eastern TN, USA, over 300 million liters of acidic uranium-nitrate liquid waste was disposed in unlined seepage ponds during the period of 1951 to 1983. Infiltration and subsequent migration of the U, NO3, and associated co-contaminants (e.g. Al, Ni) into the surrounding carbonate-rich fractured shale saprolite, has resulted in the formation of numerous ill-defined contaminant plumes of varying magnitude and size. The objectives of this research was to quantify the impacts of hydrological and geochemical processes on the effectiveness of indigenous microorganisms to transform and immobilize radionuclides and toxic metals/anions commonly found in the contaminant plumes. A field site was established ~10 m downgradient from the waste disposal ponds. Multilevel hydrologic and geochemical measurements suggested that a 50 ppm U and a 8,000 ppm NO3 plume were preferentially moving strike parallel at a bulk

groundwater flux of ~0.5 m/d. The acidic plume is highly buffered and strongly impacted by multiscale preferential flow coupled with significant matrix storage. In situ metal bioreduction strategies are discussed that consider the effects of complex hydrology and geochemistry.

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