UNIVERSITY GRADUATE SCHOOL BULLETIN ANNOUNCEMENT

Florida International University
University Graduate School

Master's Thesis Defense

Abstract

The Effect of Microbial Growth on the Spectral Induced Polarization Response in Hanford Vadose Zone Sediment in the presence of Autunite Mineral

by

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Uranium contamination of the subsurface remains a significant problem at the Department of Energy Hanford site. A series of column experiments were conducted on Hanford sediment saturated with simulated groundwater to study the effects of aqueous bicarbonate and microbial growth on the mobility of Uranium. Spectral induced polarization (SIP) measurements in the columns were conducted concurrently with pore water sampling in order to monitor changes occurring inside the sediment after the initiation of microbial growth induced by glucose injection. The microbial growth caused significant increases in the real component of the conductivity is the result of ion release into the pore fluid. In addition, an increase in the imaginary conductivity was observed at low frequencies (<10 Hz) which may be due to biotic processes. Due to the use of natural sediment, the SIP response is complex and difficult to understand. However, results across all columns with microbial growth are consistent. Pore water testing showed that microbial growth leads to sudden increases in uranium concentrations; however, microbes also eventually create reducing conditions in the sediment which transforms soluble U^{6+} to insoluble U^{4+}. Bicarbonate leads to significant increases in uranium concentrations likely due to the formation of mobile uranyl carbonate complexes. For the purposes of field scale remediation, microbial growth in an oxic environment should be avoided. However, within reducing conditions in the deep vadose zone and phreatic zone microbial growth seems unlikely to significantly increase uranium mobility.

Date: June 22, 2018
Time: 2.00 PM
Place: University Park, AHC5-300

Department: Earth and Environement
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