

U XAFS Measurements to Determine the Chemical Speciation of Uranium in FRC Sediments

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X-ray Absorption Spectroscopy (XAS) is ideally suited to determine the major chemical species of uranium (U) within sediment and groundwater at the ERSP ORNL FRC. This speciation information is needed to elucidate the biogeochemical processes controlling the fate and transport of U within the subsurface both before and after biostimulation. Information concerning the initial chemical speciation of U within the subsurface can be used to develop details of biostimulation experiments and predict the effect of biostimulation. Information concerning the U speciation after abiotic and biotic treatments can provide insight in the effects of the treatments. Similarly, this type of information can also provide insight into future needs for additional remediation processes; something very valuable to those concerned with long term monitoring requirements of contaminated sites. Hence, XAS can be a powerful tool in the iterative design of successful remediation strategies and long term monitoring strategies. We have used U LIII-edge XAS spectroscopy to determine the average valence state and chemical speciation of U at a variety of depths throughout the contaminated plume at site 3. Further, in concert with other projects at area 3 at the FRC, we have repeated these XAS measurements on particulate sediment surged from biostimulated wells at the same depth after biostimulation. The results provide unique depth-dependent information on the chemical speciation of U at area 3, both before and after biostimulation. Results indicate some reduction of U and chemical interactions between the reduced ion and transition metal oxides. A more detailed presentation of these results will be provided.

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