

PROJECT FACT SHEET

Rapid Deployment of Engineered Solutions for Environmental Problems at Hanford - FIU's Support for Uranium Remediation at the Hanford Site

FIU's Applied Research Center (ARC) is supporting the U.S. Department of Energy's Hanford Site in developing a strategy to improve the efficiency of uranium stabilization process through polyphosphate injection technology. This task focused on laboratory tests to examine discrete effect of the carbonate complexation on the dissolution of autunite mineral created as a result of the uranium stabilization through polyphosphate injection.

Uranium has been recognized as one of the most widespread groundwater contaminants at the U.S. Department of Energy's (DOE) Hanford site, Washington State. In oxidized groundwater conditions that are typically present at the Hanford site, soluble uranyl ion (UO_2^{2+}) creates strong complexes with carbonate and $Ca_2UO_2(CO_3)_3$ and $UO_2(CO_3)_2^{2-}$ are the predominant U(VI) aqueous species. The concentration of uranium exceeds the maximum contaminant level for drinking water of 30 $\mu\text{g/L}$ required by EPA. Injections of a soluble sodium tripolyphosphate amendment into the uranium contaminated groundwater and soil have been shown to effectively sequester uranium through the formation of insoluble uranyl phosphate minerals. However, the effect of carbonate complexation on uranyl phosphate dissolution is needed to be evaluated.

Task Objectives

- Quantify the effect of carbonate complexation with autunite minerals and investigate factors such as temperature and pH on the dissolution kinetics.
- Characterize synthetic autunite mineral created by the direct precipitation method by using scanning electron microscopy (SEM), X-ray diffraction (XRD) analyses, and N_2 -adsorption BET method to determine the surface area of autunite solids.
- Conduct dissolution experiments in a single-pass flow-through (SPFT) apparatus using carbonate as a buffer solution.
- Analyze the effects of temperature and pH in the ranges of 5-70°C and 6-11, respectively on the dissolution kinetic of autunite



Figure 2. Preparation and testing of carbonate buffers

Task Benefits

- Quantify kinetic rate law of autunite dissolution in the presence of carbonate ligand under strictly controlled dilute solution conditions.
- Develop an effective solution for immobilization of uranium and predicting its fate and transport in subsurface

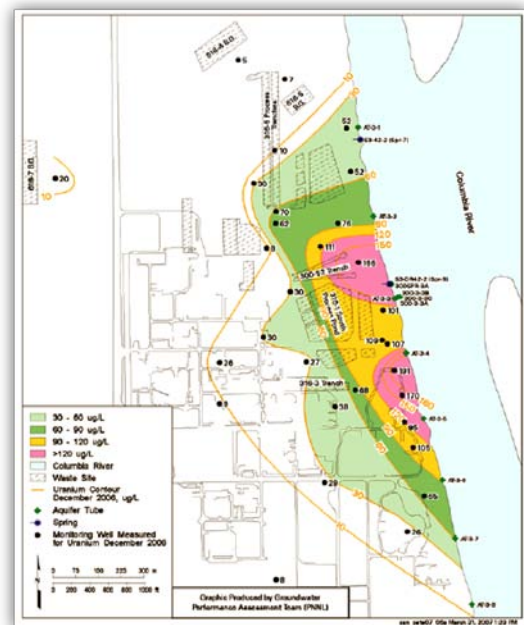


Figure 1. Current uranium concentrations at Hanford site