FIU PROJECT 2 - 2012 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 the effect of the bicarbonate ions 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 $Ca_2UO_2(CO_3)_3^0$ 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 µg/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. The study evaluates the effect of bicarbonate concentrations, T, and pH on the dissolution kinetics of synthetic Na meta-autunite. This was accomplished through a series of dissolution experiments conducted in a single-pass flow-through (SPFT) reactor.

Task Objectives

- Quantify the effect of carbonate complexation on autunite minerals and investigate factors such as temperature (5-60°C) and pH (6-11) 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.

Task Benefits

- Evaluates the effect of bicarbonate on the release of uranium from autunite to predict long-term fate and transport of uranium.
- Quantifies the dissolution kinetics of meta-autunite in the presence of carbonate ligand under strictly controlled dilute solution conditions.
- Investigates the formation of secondary uranyl phosphate phases as long-term controls of uranium migration.

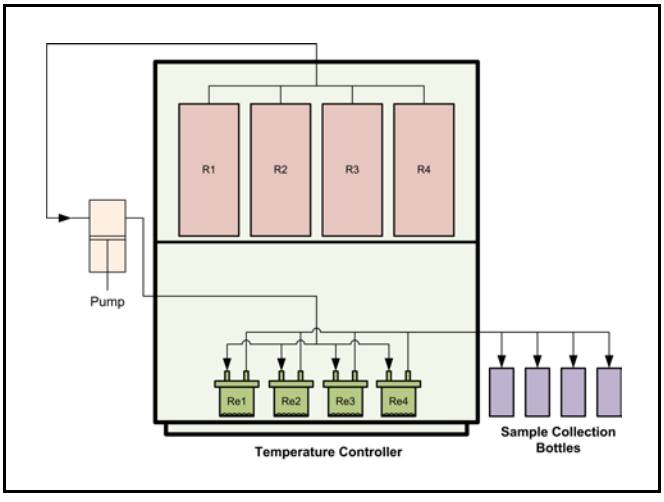

Figure 1 Schematic of single-pass flow-through experiments

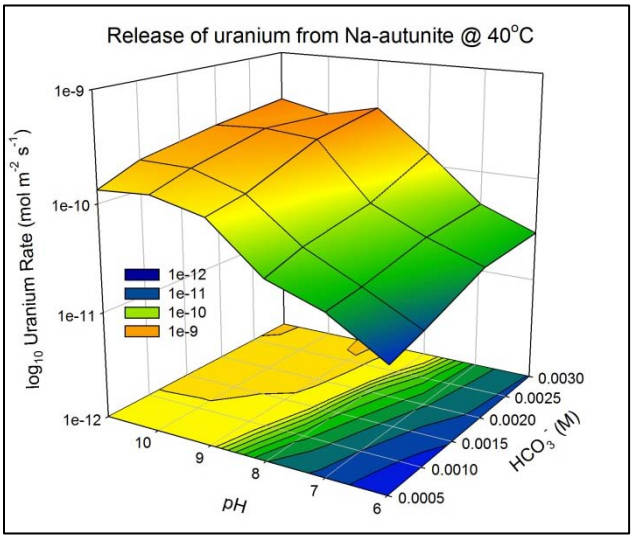

Figure 2 Effect of bicarbonate and pH on the uranium rate of release from meta-autunite.