CONTAMINANT LEACHING FROM REDUCING CEMENTITIOUS MATERIALS

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At the Savannah River Site (SRS), low-level saltwaste solutions from nuclear material production are sent to the Saltstone Disposal Facility (SDF) as a final destination for safe disposal. Saltwaste is combined with dry feed components – blast furnace slag (BFS), fly ash (FA), and portland cement (PC) – to form a cementitious grout material known as Saltstone. Radioactive contaminants (e.g., ^{137}Cs, ^{129}I, ^{99}Tc, U, and ^{3}H) are immobilized in the cementitious material. Redox sensitive elements (^{99}Tc and U) are retained in the Saltstone due to chemical reduction associated with BFS. Technetium-99 (^{99}Tc; $T_{1/2} = 2.13x10^5$ years), a common fission product, is readily mobile in the environment in its oxidized form, Tc(VII). Instead of ^{99}Tc, rhenium (Re) was used as a nonradioactive analog to evaluate the reductive capacity of Saltstone. A dynamic leaching experiment was conducted to study the mechanisms controlling the release of Re and other major saltwaste components, with critical leachate parameters monitored using a series of flow-through electrodes, e.g. pH, ORP, and EC. The data shows two different phases: an initial phase (0-10 pore volume) demonstrating high concentrations, followed by a second phase (10-40 pore volume) composed of low and constant concentrations (Si, Re, As, Ca, Na). The trend indicates an initial flush of highly soluble molecules, followed by slow dissolution. Further, data indicates that Re leaching from the column occurred at a faster rate than expected for ^{99}Tc as almost 80% Re was recovered in the effluent solution. Overall, a greater understanding of the complexity of the saltstone system will allow us to use modeling to predict long term performance of Saltstone.

Jill in the lab.