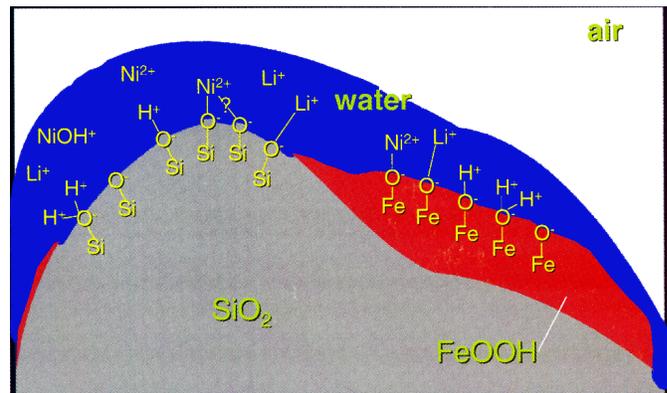




# Soil-Actinide-Metal Interactions Analysis and Modeling Laboratory

## Need

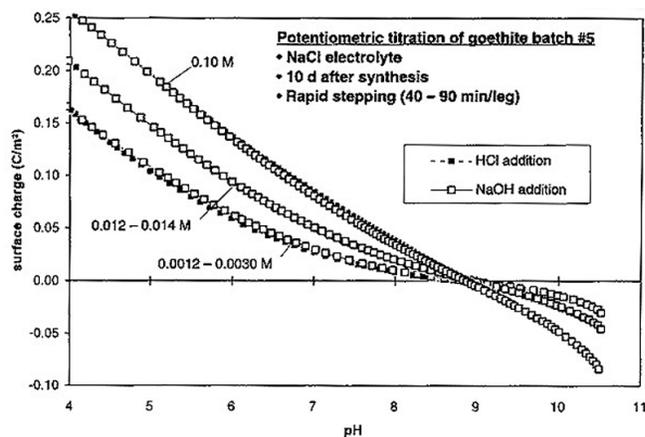
Precipitation and adsorption of radionuclides and toxic metals onto mineral surfaces constitute barriers to pollutant migration and may reduce contaminant releases to levels below regulatory limits. The Soil-Actinide-Metal Interactions Analysis and Modeling Laboratory has been established to investigate processes important to the release and transport of radioactive and hazardous materials through the geosphere and engineered barriers. Detailed analytical studies of the chemistry of mineral surfaces, bench-scale transport experiments and process-level computer simulation of radionuclide and toxic metal transport can be carried out in support of risk assessment and environmental remediation.



Conceptual model for adsorption of Ni and Li by sand.

## Experimental and Analytical Facilities

- DOE-Approved Radioactive Materials Management Area
- Radiochemical analysis by gamma spectrometry and liquid scintillation counting
- Atomic absorption (flame and graphite furnace)
- Polarography/electrochemistry
- Surface analysis by BET
- UV/Vis spectrophotometry
- Luminescence spectrometry
- Gas chromatography
- Ion chromatography
- CO<sub>2</sub> coulometry
- Computer-aided surface titrimetry
- Facilities for mineral synthesis, soils characterization and solute transport studies including controlled-temperature baths, controlled-atmosphere glove boxes, macrophotography equipment, bench-scale columns



## Geochemical Modeling Capabilities

Laboratory staff have expertise in the use of computer models for calculations of trace metal and radionuclide speciation/solubility in fresh water and brines, reaction-path simulations, and reactive chemical transport modeling. These include:

- *HYDRAQL* - computation of aqueous and surface complexation of inorganic and organic solutes (developed by Stanford University).
- *PHREEQE and PHRQPITZ* - speciation and reaction path calculations for fresh waters and brines (developed by U.S. Geological Survey).
- *NETPATH* - calculations of mass balance reactions along hydrologic flow paths (developed by U.S. Geological Survey).
- *LEHGC* - a coupled reaction/transport simulator which uses the sequential iteration approach to solve systems of equations for advective-diffusive transport and chemical equilibria for aqueous and surface complexation and ion exchange (developed by Penn State and Sandia).

## Selected Current and Completed Projects

*Uranium Adsorption by Clay Minerals in Brines:* Formulation of surface-complexation model for chemical retardation of actinides in NaCl brines flowing through clay-bearing dolomite overlying the WIPP repository (sponsor: Waste Isolation Pilot Plant).

*Coupled Reaction/Transport Code:* Development and implementation of a mixed kinetic/equilibrium coupled reaction/flow/transport computer code for calculations of contaminant transport and engineered barrier design in saturated and unsaturated media. (sponsors: Yucca Mountain Project and Waste Isolation Pilot Plant).

*Integrated Reactive Transport Experiments:* Measurement and prediction of the migration of fluid and tracers through a 6-m high x 3-m diameter caisson filled with an unsaturated porous medium to validate key geochemical and hydrological assumptions in performance assessment models for high-level waste disposal (sponsor: Yucca Mountain Project).

*Development of Models of Contaminant Sorption for Natural Attenuation:* Characterization of the surface chemistry of natural and analog materials for laboratory and field tracer studies to establish potential extent of natural attenuation of uranium and other metals (sponsors: Yucca Mountain Project, Uranium Mill Tailings Remedial Action Program, and internal Sandia research funds).

## Contacts

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