Environmental Restoration at Hanford Waste-Storage Facility

Studying Mineralogical Reactions and Retardation in Sediments Adjacent to the Hanford 200 Area Tank Farm

D. Bish (bish@lanl.gov), S. Chipera, and P. Snow (EES-6)

Radionuclide contamination of surrounding groundwater and soil is an ongoing problem at nuclear-waste storage sites. To help establish long-term mineralogical controls on aqueous radionuclide concentrations at one of these sites, the Hanford 200 Area tank farm in Hanford, Washington, we are collecting data to generate a mineralogical model of the site. We plan to analyze minerals from both pristine and contaminated sediments and compare their characteristics. At present, we are analyzing uncontaminated samples containing mica, altered biotite, vermiculites, smectites, Mn or Fe oxide/hydroxide minerals, including mixed-valence oxides (*e.g.*, magnetite and ilmenite). We will perform similar mineralogical and chemical analyses with contaminated samples (containing ^{137}Cs) to provide information on how the mineralogy may have changed as a result of high-level waste interaction and whether new mineral constituents have precipitated (Al oxides, Fe oxides, aluminosilicates, zeolites). The latter will be particularly important in understanding the manner in which contaminants are held and in predicting future contaminant migration. Our mineralogical model will contribute to understanding the role of reactive minerals in possible future reactions (e.g., recarbonization), which may be significant to long-term contaminant behavior.

Hanford Modeling Initiative

P. C. Lichtner (EES-6, lichtner@lanl.gov)

The Hanford tank farms, in which radioactive waste from nuclear weapon reprocessing plants is being stored, present new challenges in modeling contaminant fate and transport. To evaluate potential hazards of the waste to the surrounding environment and to decide on the most appropriate remediation procedures, the ability to forecast the behavior of contaminants leaked to the vadose zone under different cleanup scenarios is essential.

To this end, we are conducting modeling studies in a joint project with Pacific Northwest National Laboratory (PNNL), Lawrence Berkeley National Laboratory (LBNL) and Lawrence Livermore National Laboratory (LLNL). Some of the tanks are at elevated temperatures and contain extremely caustic fluids with pH values as high as 14 in a 10 molar or higher sodium-nitrate solution. The Hanford sediments in which the waste has leaked are highly heterogeneous, consisting of fine sand with sand lenses, and coarser sand with cobblestones. The heterogeneous soil properties, combined with the caustic chemistry, is certain to provide researchers with plenty of opportunities to try out the latest advances in modeling techniques.

Vadose Zone Transport Field Project

E. Springer (EES-10, everetts@lanl.gov)

At the Hanford waste-storage facility near Richland, Washington, elevated concentrations of chromate, technetium, tritium, and nitrate have recently been found in the groundwater beneath the site. In collaboration with PNNL, Idaho National Engineering Laboratory, and LBNL; several universities; and private industry, we are working to mitigate the risk from accelerated transport of contaminants through the vadose, or unsaturated, zone. This large consortium has been asked to address this problem because recent characterization efforts, coupled with simplified transport modeling, have not been able to predict these observed contaminant plumes. (Problems with earlier research on this subject may be the failure to account for the heterogeneous nature of the unsaturated zone sediments.) We are obtaining data from uncontaminated sites around Hanford to support development and refinement of conceptual models and to facilitate calibration of numerical models of water flow and contaminant transport through Hanford's heterogeneous unsaturated zone. Los Alamos is the lead for analyzing test results from the tracer field experiments. We also will evaluate new ways to characterize changing conditions in the unsaturated zone, particularly in relation to currently undetectable high-risk contaminants.

Environmental Restoration at the Nevada Test Site (NTS)

Performance Assessment for the Great Confinement Disposal Boreholes at Area 5

B. Crowe (EES-9, bmc@lanl.gov)

Disposing of classified transuranic (TRU) waste poses a challenge because it must be buried in a limited-access classified area and is not currently accepted at the recently opened Waste Isolation Pilot Plant in Carlsbad, New Mexico. Classified TRU waste was buried in large-diameter boreholes at a classified area withn the Area 5 radioactive waste management facility from 1984 to 1988. In collaboration with SNL, the lead DOE contractor, we have assisted with completing the final version of a DOE-mandated performance assessment of four boreholes containing classified TRU waste at Area 5. We investigated several significant technical issues: subsidence/flooding models for the 10,000-year compliance interval; moisture movement and radionuclide transport in unsaturated alluvium; and the impact of coupled flow and biointrusion processes with respect to upward radionuclide releases, from the buried waste inventory to the surface. DOE Headquarters developed review criteria for assessing the performance assessment and assembled a team to evaluate our results. The review is scheduled for January 2001.