

DC#34071
QA:NA
10/7/02

BUSTED BUTTE PHASE 2: ANALYSIS OF POST-TEST MINEBACK AND OVERCORE ROCK SAMPLES

GROFFMAN, A.R., TURIN, H.J., MCGRAW, M.A., JONES, C.L., SCISM, C.D., and SOLL, W.E., Los Alamos National Laboratory, Los Alamos, NM 87544, groffman@lanl.gov

A complex tracer mixture was injected continuously for over two years into a 10 x 10 x 7 m block of tuff as part of the unsaturated-zone (UZ) tracer test at Busted Butte. The test was designed to address uncertainties associated with flow and transport models within the Topopah Springs and Calico Hills tuffs. The tracer mixture included nonreactive (Br, I, and FBAs) and reactive tracers (Li, Ce, Sm, Ni, Co, and Mn) and synthetic colloids. Once injection was completed, samples from the block were collected in two ways. Overcores were taken from around and below injection holes. Then, the entire block was excavated via mineback – during which progressive vertical planes of the block were exposed. Samples from the overcores and mineback were analyzed to determine the distribution of tracers on different spatial scales than available from collection borehole data.

Rock analyses confirmed collection pad results that the nonreactive tracers, Br and FBAs, moved several meters. Furthermore, Br and FBAs are observed above and lateral to the injector planes suggesting that capillarity was an important process for tracer movement. Lithium, the most mobile of the metals, was transported on a scale of meters. This is consistent with laboratory sorption measurements and observed breakthrough on the collection pads. Co and Ni show transport distances of tens of cm, while Sm and Ce moved far less, possibly due to precipitation and sorption effects.

Colloid transport was assessed using 1 ft³ blocks extracted from the BB Phase 2 block. In the Calico Hills material, after 15 L of water was injected over 3.5 months, less than 1% of the colloids injected were recovered. Flow patterns in the block indicate that water injected at the center imbibed outward from the injection point. In a block taken from a boundary of the Calico Hills ashfall layer, breakthrough was observed only due to fractures formed during drying of the block. The colloid transport module for FEHM was tested against colloid data from the 1 ft³ block scale laboratory experiments with excellent agreement.