Field Investigation of the Drift Shadow

Grace W. Su, Timothy J. Kneafsey, Teamrat Ghezzehei, Brian Marshall, and Paul Cook

A drift shadow is an area immediately beneath an underground void that, in theory, will be relatively drier than the surrounding rock mass. Numerical and analytical models of water flow through unsaturated rock predict the existence of a drift shadow, but field tests confirming the existence of the drift shadow have yet to be performed. Proving the existence of drift shadows and understanding their hydrologic and transport characteristics could provide a better understanding of how contaminants move in the subsurface if released from waste emplacement drifts such as the proposed nuclear waste repository at Yucca Mountain, Nevada.

We describe the field program that will be used to investigate the existence of a drift shadow – and the corresponding hydrological process at the Hazel-Atlas silica-sand mine located at the Black Diamond Mines Regional Preserve in Antioch, California. The location and configuration of this mine makes it an excellent site to observe and measure drift shadow characteristics. The mine is located in a porous sandstone unit of the Domengine formation, an approximately 230 meter thick series of interbedded Eocene-age shales, coals, and massive-bedded sandstones. The mining method used at the mine required the development of two parallel drifts, one above the other, driven along the strike of the mined sandstone stratum. This configuration provides the opportunity to introduce water into the rock mass in the upper drift and to observe and measure its flow around the underlying drift.

The passive and active hydrologic tests to be performed are described. In the passive method, cores will be obtained in a radial pattern around a drift and will be sectioned and analyzed for *in-situ* water content using a gravimetric technique, as well as analyzed for chemistry. With the active hydrologic test, water will be introduced into the upper drift of the two parallel drifts and the flow of the water will be tracked as it passes near the bottom drift. Tensiometers, electrical resistance probes, neutron probes, and ground penetrating radar may be used to monitor the change in moisture content/potential over time as water is released.