Heterogeneous seepage at the Nopal I Uranium Mine, Chihuahua, Mexico

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Abstract

An integrated field, laboratory, and modeling study of the Peña Blanca natural analogue is being conducted to evaluate flow and transport processes of relevance to the proposed Yucca Mountain repository. One component of this study is an evaluation of fluid flow and associated radionuclide transport through the unsaturated zone via a seepage study at the Nopal I uranium mine. Seasonal rainfall on exposed bedrock along the +10 m surface infiltrates into fractured rhyolitic ash-flow tuff and seeps into the +00 m adit located 8 m below. An instrumented seepage collection system and automated weather station permit correlation between local precipitation events and seepage. Monitoring of seepage within the adit between April 2005 and December 2006 indicates that seepage is highly heterogeneous in both time and space. Within the back adit area, there are a few zones where large volumes of water have been collected. These large volume seepage events are linked to fast flow path fractures (<4 h transit times) and are associated with heavy rainfall (>25 mm). In most locations, however, there is a significant (1-6 month) time lag between major precipitation events and seepage within the adit, with longer water residence times observed for the front adit area.

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