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Publication Date
2002-07-17

Inverse Modeling of Seepage into Underground Openings

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Abstract

We discuss the development and calibration of a model for predicting seepage into underground openings. Seepage is a key factor affecting the performance of the potential nuclear waste repository at Yucca Mountain, Nevada. Three-dimensional numerical models were developed to simulate field tests in which water was released from boreholes above excavated niches. Data from air-injection tests were geostatistically analyzed to infer the heterogeneous structure of the fracture permeability field. The heterogeneous continuum model was then calibrated against the measured amount of water that seeped into the opening. This approach resulted in the estimation of model-related, seepage-specific parameters on the scale of interest. The ability of the calibrated model to predict seepage was examined by comparing calculated with measured seepage rates from additional experiments conducted in different portions of the fracture network. We conclude that an effective capillary-strength parameter is suitable to characterize seepage-related features and processes for use in a prediction model of average seepage into potential waste emplacement drifts.

Keywords: capillary barrier, unsaturated zone, parameter estimation