New England Research, Inc.
331 Olcott Drive, Suite L1
White River Junction, VT 05001 USA
+1 802.296.2401
www.ner.com

Fabryka-Martin, J., Flint, A., Meijer A., and G. Bussod (2006) “Water and Radionuclide Transport in the Unsaturated Zone” In: A. MacFarlane and R. Ewing (eds.), Uncertainty Underground: Yucca Mountain and the Nation’s Hugh-Level Nuclear Waste, The MIT Press, Cambridge, Ma., 179-197

Abstract

From a human perspective, the desert environmental around Yucca Mountain seems harsh and uninviting. Summer temperatures often exceed 100°F (38°C). The total annual rainfall averages only nineteen centimeters, and the amount of water than manages to escape the thirsty desert vegetation and soil and to infiltrate into the underlying bedrock is typically only a few millimeters—about the thickness of a cracker. Indeed, the original appeal of placing a geologic repository above the water table as proposed over thirty years ago was based largely on the perceptions that subsurface water in such a dry environment moves at rates too slow to measure and is completely buffered from the vagaries of the capricious desert weather at the surface.

The study of unsaturated-zone flow and transport in a desert environment is a young science because hydrologists have traditionally focused on finding usable sources of water. The current interest in quantifying vanishingly small flow and transport rates is a relatively new direction, limited mostly to evaluating the water-quality impacts of past, present and future waste disposal practices. Nevertheless, growing field and laboratory evident indicates that it would be a mistake to assume that water and dissolved substances (solutes) are immobile in such an environment. Even though this movement cannot usually be directly seen or measured, we can infer it from clues left behind or picked up by the water along its path.

This chapter reviews some of the dramatic changes that have occurred in our technical understanding of water and solute movement in unsaturated fractured rocks, and how these scientific advances have influenced repository design, primarily in the United States. In addition, we point out some of the remaining uncertainties associated with transport issues, and offer some critical perspectives and possible solutions to these problems.

Contact NER for more information.