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Vapor-Phase Transport in the Near-Drift Environment at Yucca Mountain

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Yucca Mountain, located 160 km north of Las Vegas, Nevada, is currently being assessed as a potential site for disposal of spent nuclear fuel and high-level radioactive waste. A key issue regarding repository performance is the likelihood of precipitation percolating a vertical distance of ~300 m through unsaturated rock into drifts containing the waste packages. The amount of water that flows into drifts is thought to control the corrosion rates of waste packages, and the mobilization and transport of radionuclides. Subsequently, much effort has been directed towards estimating seepage from the near-drift environment into underground openings.

While no naturally occurring seepage has been observed in the excavated tunnels and cavities at Yucca Mountain, numerical studies show that seepage can occur at steady-state percolation fluxes of tens of millimeters per year. However, under current conditions, the potential for seepage to occur naturally is greatly reduced, because of increased evaporation in the drifts resulting from ventilation.

This presentation includes observations made over a period of four years along the terminal 944 m of a 2.7 km long tunnel within Yucca Mountain, commonly referred to as the Enhanced Characterization of the Repository Block which was initially excavated to study seepage into unventilated drifts. This initial objective was expanded to include an evaluation of the near-drift microclimates after large sections of the nonventilated drift were observed to be damp, or coated with beads of water, or even

occasionally puddled. Observations from this effort indicate that fractures in the unsaturated zone can be primary paths for vapor flow in the immediate vicinity of emplacement drifts which is contrary to conceptual models of liquid traveling through fractures before seeping into the drifts.

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