ASSESSMENTS OF HYDROGEOLOGIC FEATURES WITHIN THE UNSATURATED ZONE, YUCCA MOUNTAIN, NEVADA

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ABSTRACT

The unsaturated zone at Yucca Mountain, Nevada, ranges from 500 to 750 meters thick and consists of a sequence of welded ash-flow tuffs and nonwelded, bedded tuffs of Miocene age. The welded tuffs tend to be considerably more fractured than the nonwelded tuffs, and both tuffs have undergone varying degrees of chemical alteration. The hydrologic state and dynamics of the unsaturated-zone hydrogeologic system at Yucca Mountain are incompletely known and quantified. Several features of the hydrogeologic system that may be important to the design and performance of a mined, geologic repository for the disposal of high-level radioactive waste within the unsaturated zone have been identified during the development of a provisional conceptual model for the hydrogeologic system. These features include:

1.The conditions that must prevail within the unsaturated zone in order to produce significant, longitudinal flow of liquid water in open fractures and fracture networks.

2.The hydrologic properties of fault and fault zones and the extent to which faults and fault zones act as barriers to or conduits for liquid-water flow.

3.The possible occurrence of convective, geothermally or baro-metrically driven airflow within open, interconnected fracture networks. Appreciable air movement within the system is expected to affect the local moisture balance as a result of the advective transport of water vapor and to be a possible mechanism for gas-phase radionuclide transport.

4.The processes and their distribution over the surface of Yucca Mountain by which (a) liquid water could infiltrate into the deep unsaturated zone and (b) airflow could either enter or discharge from the unsaturated zone.

5.The necessary conditions and likelihood for the formation of perched-water bodies within the unsaturated zone.

6.The degree to which fluid movement within the unsaturated zone approximates a steady-state flow system.

7.The validity of the Darcian, continuum-flow hypothesis for describing fluid flow in the densely welded tuffs, which are characterized by low rock-matrix porosity and low saturated hydraulic conductivity.

8.The effectiveness with which the chemically altered tuffs can be expected to retard the migration of water-borne radionuclides.

A FULL PAPER IS NOT AVAILABLE.