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Communication No. 76

Mr. Jeff Pohle  
Division of Waste Management  
Mail Stop 623-SS  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

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PDR ✓  
LPDR B.N.S

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Pohle

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RE: NTS

Dear Jeff:

This letter constitutes a semi-annual update of conceptual models for NNWSI by Williams and Associates, Inc. as required by the SOW for Contract No. NRC-02-85-008. No modifications have been made to the USGS conceptual model for groundwater flow in the saturated zone. However, we believe the data base supports an additional conceptual model for flow in the unsaturated zone that is more defensible (doesn't require capillary barriers, fracture flow or flow through faults) than the conceptual model being proposed by the USGS (Montazer and Wilson, 1984) currently. We believe that the USGS should be made aware of this additional conceptual model so that the appropriate data will be collected during site characterization to verify the conceptual model(s).

As we indicated in our letter of July 14, 1986 (Communication No. 68) calculations performed by Williams and Associates, Inc. on the flux through Yucca Mountain suggest that heterogeneity of matrix hydrogeologic properties may control the apparent flux, and the distribution of moisture content measured in the field. We believe that a conceptual model that incorporates heterogeneity of the matrix properties to explain variable saturation levels in the Topopah Spring Member is more defensible than one that incorporates capillary barriers.

We do not believe that the current data base supports the concept of capillary barriers and the diversion of flow. The DOE agrees that the existence of capillary barriers is questionable. The FEA (Volume III, p. C.5-14) states:

...It should be noted that full or near saturation is not required for lateral flow, particularly when the flow is driven by gravitational forces. There is no

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direct evidence yet for permeability and capillary barriers. However, the estimates of average recharge are much greater than can be accounted for by the matric potential in the Topopah Spring welded unit, suggesting that lateral flow has diverted some flux so that it does not reach the Topopah Spring welded unit...

Our calculations (presented in the July 14, 1986 letter) indicate that tensions in the Topopah Spring Member would vary from about zero to 3,000 meters with a uniform flux of 0.5 mm/yr and the range of hydraulic conductivity values reported by Peters and others (1984). This range is not realistic because water would flow from areas of low tension to areas of high tension under capillary pressure gradients.

Available data suggest that flux is not uniform and that downward flow occurs through preferential flow paths of higher matrix hydraulic conductivity. Nonuniform flux in excess of 0.7 mm/yr (average saturated matrix hydraulic conductivity of the Topopah Spring Member) would not necessarily cause fracture flow because greater fluxes (nonuniform) could move through regions with greater than average hydraulic conductivity values. Additional data are needed to describe the three-dimensional distribution of hydraulic properties and to evaluate whether flux is uniform or nonuniform throughout the Yucca Mountain area. Additional data also are needed to evaluate the significance of fracture flow under the conditions of nonuniform flux and heterogeneous, matrix hydraulic properties.

Sincerely,

*Roy Williams/pl*

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