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Hydrogeology • Mineral Resources Waste Management • Geological Engineering • Mine Hydrology

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Fin No. D-1020

Communication No. 173

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

RE: NTS

Dear Jeff:

This letter constitutes the semiannual update of our conceptual models for NNWSI by Williams and Associates as required by the SOW, Subtask 1.3 for Contract No. NRC-02-85-008.

In our update of one year ago we discussed our conceptual model for the unsaturated zone which suggested that heterogeneity of the matrix hydrogeologic properties may control the apparent flux and the distribution of moisture content measured in the field. Further evaluation of this conceptual model suggested that such heterogeneity could also influence the horizontal distribution of vertical flux. This concept has been investigated under the Topics of Investigation by Williams and Associates, Inc. (Communication No. 126, 1/19/87). During the past six months we have completed a two-dimensional modeling study of the distribution of downward flux through the unsaturated heterogeneous Topopah Spring Member of the Paint Brush Tuff Formation to determine whether such heterogeneity actually does affect the horizontal distribution of downward flux. A draft of the results of this study were transmitted to you as Communication No. 168.

In general the study showed that heterogeneity will cause the downward flux to be nonuniformly distributed in a horizontal plane. Thus, even if the flux at the upper surface of a unit is uniformly distributed when it enters the unit it will be nonuniform at the lower edge of the unit. Even more important is the fact that portions of the rock with unsaturated hydraulic conductivity less than the flux will develop positive pressures; fracture flow may result. Portions of the member with hydraulic conductivity greater than the downward flux often will have positive pressures immediately below those regions; again the possibility of fracture flow exists. One way of investigating this phenomenon is by two-dimensional modeling with a realistic distribution of hydrogeologic properties for the rock in each unit. Such a model should consider unsaturated flow in the fractures as well as in the matrix. This nonuniformity of flux also could accommodate the variations of moisture content and matric potential which have been measured in the field.

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The Consultation Draft SCP presents one conceptual model for groundwater flow in the saturated zone. This model assumes that "In general, groundwater flow beneath Yucca Mountain probably is southward through the site, southeastward away from the site into the Fortymile Wash area" (p. 3-198). This conceptual model ignores other valid conceptual models that recognize the potential influence of the Ghost Dance Fault and adjacent subparallel normal faults (p. 3-215) that lie across this predicted flow path.

These normal faults could behave as barriers to flow or as preferential pathways for flow. The faults will act as barriers to flow if the faults are characterized by a lower hydraulic conductivity than the surrounding undisturbed tuffs. Steep hydraulic gradients may exist in the vicinity of this type of fault. As a result, groundwater flow would be directed southward beneath Yucca Mountain; the flow paths would be parallel to these faults.

Conversely, the faults may behave as preferential groundwater flow paths. Such faults are characterized by hydraulic conductivities that are higher than the surrounding undisturbed tuffs. Groundwater flow paths could converge in these faults. The resulting flow direction would be toward the south along the eastern flank of Yucca Mountain.

Both of these alternative conceptual models assume that in general groundwater flows southward toward Death Valley. These alternative conceptual models preclude a probable groundwater flow direction to the southeast from the site. Other conceptual models may exist that are valid based on the current data base. The two conceptual models discussed above were presented in the review comments (Communication Nos. 169 and 170) we prepared for the Consultation Draft SCP.

Please call if you have any questions regarding this discussion.

Sincerely,

George Bloomsburg
George Bloomsburg

GB:s1

cc: D.L. Chery, Jr.

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