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Hydrogeology • **WM DOCKET CONTROL CENTER** • Mineral Resources Waste Management • Geological Engineering • Mine Hydrology

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

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Distribution:

J. Pohle

(Return to WM, 623-SS)

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RE: NTS Trip Report

Dear Jeff:

Please change the communication number of our December monthly report from No. 18 to No. 19. We have used number 18 twice.

This letter constitutes our trip report to Tucson, Arizona, to participate in the Unsaturated Rock/Contaminated Transport Workshop #3, sponsored by the University of Arizona, Nuclear Regulatory Commission and Sandia National Laboratory on January 6-9, 1986. Williams and Associates, Inc. was represented by George Bloomsburg at the Workshop. This meeting was attended by approximately 70 invited experts in various aspects of unsaturated flow and contaminant transport. In addition approximately 14 graduate students from the University of Arizona participated. They are involved in the research project conducted by Dan Evans. The entire meeting consisted of a field trip on Monday and presentations of papers on Tuesday, Wednesday and Thursday. Six different sessions were presented with four or five papers in each session. A great deal of time was available for discussion and the audience was quite vocal.

The field trip consisted of a tour through the laboratories in which Dan Evans' project is being conducted and a brief review of each project by graduate students. A visit to the field site near Superior, Arizona, approximately 100 miles from the campus followed. At this field site, three boreholes have been installed in such a way that it will be possible to inject fluid (either air or water) into one borehole and monitor it in another one. It also will be possible to apply water to the ground surface and monitor its movement downward. We also were shown a location in an abandoned highway tunnel where heat flow

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experiments had been conducted between two boreholes. The field trip was very informative.

The Tuesday, Wednesday and Thursday meetings were held in an excellent theater type facility at the Hotel Park Tucson.

The six sessions were: 1) physical and chemical properties of unsaturated fractured rock with emphasis on tuff, 2) matrix versus fracture flow, 3) natural analogs, 4) coupled processes, 5) model approaches and calibration, and 6) effects of vapor phase. The strategy for each of these topics was to keep the discussion as generic as possible and not emphasize Yucca Mountain exclusively. In many cases, however, some discussion on Yucca Mountain came up. The first paper was by Dr. James Davis from the University of Washington on the role of pore surface properties on contaminant transport through unsaturated rock. Dr. Davis is a Chemical Engineer and an expert in surface phenomena. This phenomenon appears to be very significant in Yucca Mountain from the standpoint of fracture flow. Flow in the fractures would be absorbed into the matrix if the surface characteristics of tuff are such that the water wets the surface. However, if the fracture is coated with material that is not easily wet by water, flow may occur for considerable distances in fractures. Dr. Davis soon will be starting a project funded by Sandia to investigate this characteristic of tuff.

The session on natural analogs was interesting from the standpoint of the possibility of finding instances in which flow has occurred through long geological time periods which may be similar to that in Yucca Mountain. Presently no direct analogs have been found.

The session on model approaches and calibration was interesting from the direct standpoint of Yucca Mountain. A paper was presented by Ralph Peters of Sandia Lab concerning a one dimensional model which suggests that significant matrix flow through Yucca Mountain is relatively rare. The natural profile and the best known hydraulic properties of these materials were used in the simulation. The model showed that in order for the insitu saturation values to occur, the downward rate of flux must be relatively small. Some discussion was directed at more general models that are being developed presently and the difficulty of obtaining sufficient data to operate these models.

The last session on effects of vapor flow sparked interest in the possibility of air flow through the fractures in the entire mountain. A paper was presented by Doral Kemper of the Snake River Conservation Research Station concerning air flow through the basalt of the Snake Plain. Although it is recognized that the fractures in most basalt formations are much larger than in

volcanic tuff the quantities of air flow that can occur due to convective movement is significant. A great deal of interest was expressed in this paper because of the possibility of air movement through Yucca Mountain.

Two factors concerning flow into the porous matrix that should be investigated are: 1) the wetting characteristics of the tuff along the fractures; and 2) the possibility of air being confined in the matrix which would prevent water from moving into the matrix during an infiltration event.

Several comments made in the discussion at the end of the Workshop centered around the need for researchers to understand the NRC regulations and the actual criteria that must be satisfied. There is considerable indication that some researchers are investigating things that may easily be shown to be insignificant.

The Workshop was excellent from the standpoint that many of the most well-known people in the country in various areas of fluid flow in porous media were there; consequently the discussion was very informative.

Sincerely,

*George Bloomsburg*  
George Bloomsburg

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