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- 1 -

MEMORANDUM FOR: Myron Fliegel, Section Leader
Hydrology Section
Geotechnical Branch
Division of Waste Management

FROM: Matthew Gordon and Neil Coleman
Hydrology Section
Geotechnical Branch
Division of Waste Management

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SUBJECT: DECEMBER 11, 1984 MEETING WITH BWIP HYDROLOGY CONTRACTORS

The subject meeting with Roy Williams and Gerry Winter (Williams and Associates) and Paul Davis (Sandia National Laboratories) attracted the attendees listed on Attachment I. The purpose of the half-day meeting was three-fold:

1) To prepare for the next day's meeting with BWIP to discuss stage 2 hydrologic testing of the BWIP site

2) To discuss the characteristics of fractured media hydraulics and its impact on characterization of the BWIP site hydrology

3) To discuss Sandia's efforts in regional modeling studies of BWIP site hydrology.

Item I was dispensed with quickly through a brief explanation by Wright, Fliegel, Gordon and Coleman of the objectives and purpose of the next day's meeting.

Discussion of Item 2 began with an introductory description of the impact of fractures on groundwater flow and tracer advection/dispersion by Gordon. Current analytical methods (equivalent porous medium, discrete fracture, and dual-porosity approaches) and test methods (laboratory studies, field fracture observations and in-situ tests [as performed at Chalk River, Oracle, and Stripa]) were described.

Williams suggested that NRC consider a policy decision regarding our guidance to DOE with respect to fracture flow and transport characterization. He noted that BWIP STP 1.1 and current DOE efforts have been based on the assumption that the medium can be described hydrologically as an equivalent porous medium for performance assessment. He also noted that the validity of this hypothesis

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DATE	:84/12/17	:84/12/	:	:	:	:	:

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would not necessarily be tested by the current BWIP testing strategy. He considered this to be evident from the Moench et. al. analysis, as described later.

Gerry Winter presented a series of slides from surface and underground mining in basaltic rock which graphically illustrated the impact of structural and tectonic features as well as joints, fissures and fractures. One slide of a surface mine face showed the impact of a fault on groundwater movement. On one side of the fault the mine wall was saturated, with the water table near the top surface of the wall. On the other side of the fault the wall was dry. Apparently the depicted fault restricts horizontal groundwater flow, acting either as a groundwater barrier or a vertical drain. In other slides taken in an underground mine it was shown that the occurrence of water in the mine was closely tied to the interception of fractures by mine openings or boreholes. In some cases the mine wall was dry, whereas a borehole drilled laterally a few hundred feet into the wall yielded confined groundwater at high head, apparently due to the interception of a fracture network or fault. These slides illustrated the significant effects of heterogeneities on groundwater flow in fractured basalt. These features may have an impact on the representativeness of test results at the BWIP site.

Mr. Winter went on to discuss the Moench et. al. article, in which Moench et. al. demonstrated the similarity between leaky aquifer type curves and type curves derived using a dual-porosity treatment. It is clear that the standard test methods yield non-unique responses which can be interpreted in a variety of ways. The inherent non-uniqueness of aquifer test interpretation is a recognized limitation of aquifer testing (Freeze and Cherry, 1979).

A discussion ensued regarding what could be suggested or expected from the BWIP program in terms of resolving questions regarding fracture flow and transport. The following approaches that BWIP could take were mentioned:

1) Collect more data about individual fractures and features. A complete or comprehensive set of data on spatial and probabilistic distributions of fracture location, frequency, aperture, roughness, interconnection, etc. would be difficult or impossible to obtain. Some data, however, is needed. It has not been determined what data is needed, where it should be collected, or how much data is required regarding fracture properties.

2) Implement special tests designed to analyze hydraulic properties of fractures. There are few tests that have been designed for this purpose, and they are limited in applicability. Some tests of this

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sort should be attempted, but further exploration into the feasibility and value of these tests is needed.

3) Utilize existing field testing methods, and analyze with a broad set of approaches including equivalent porous medium, discrete fracture, and dual-porosity approaches. This is a feasible approach, but may not provide a complete picture of the true physics or may provide an unrealistically conservative envelope of bounding parameter values.

Some combination of the three approaches was preliminarily suggested within the NRC hydrology review team for BWIP at this time.

The final topic of discussion for the afternoon meeting was the status of NRC's regional modeling of BWIP hydrology. Paul Davis of SANDIA presented an overview of the current status of FIN A1757, "TA in Numerical Modeling Assessment of High-Level Waste Repositories". This project will directly apply in TA fashion those methodologies developed under the Research contract FIN A1266.

For NRC's regional model of BWIP, SANDIA is currently using the Posson et. al. version of the USGS 3-D code. This version of the USGS code was designed to facilitate rapid input of grid data. Under the research contract A1266 a model was gridded using this code which defined a hypothetical repository site in basalt. Specific site data for the Pasco Basin are currently being incorporated to produce a site-specific regional model of BWIP.

At this early stage in A1757 it is important that the NRC technical staff and contractors reach agreement on the approach and data needs for BWIP hydrologic modeling. Important points to be resolved include but are not limited to the following:

1. scale of model
2. proper use and interpretation of data supplied by BWIP and USGS
3. acceptable "envelope" of conceptual models
4. choice of code (transient vs. steady-state and finite difference vs. finite element)
5. acceptable node spacing and layering
6. definition of boundary conditions (including free surface and basal)
7. relationship to near-field modeling

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8. application of NRC's code QA
9. role of hydrochemistry in regional modeling
10. definition of internal boundaries based on geologic structure
11. recognition and treatment of areal head boundaries
12. significance of fluid density contrasts on a regional scale.

Original Signed By

Matthew Gordon
Hydrology Section
Geotechnical Branch
Division of Waste Management

Original Signed By

Neil Coleman
Hydrology Section
Geotechnical Branch
Division of Waste Management

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