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M E M O R A N D U M

DATE: December 22, 2000
TO: Mal Murphy [malmurphy@home.com]
CC: Danielle Fife **[**dfife@nrff.com]
RE: **UNSATURATED ZONE TESTING AMR Reviews**
Natural Analogs for the Unsaturated Zone
ANL-NBS-HS-000007

Key Items are:

1. p. 13, Section 1. The stated objectives of this AMR are "to test and build confidence in the representation of UZ processes in numerical models utilized in the UZ Flow and Transport Model." In other words, if they can model somewhere else, the model should work here. This is not true. He two analogs cited are Box Canyon, Idaho basalt and Peña Blanca, Mexico uranium deposits.

2. p. 21, Section 5, Assumption 1. Notes that the "dual-permeability" [sic] representation for flow through fracture and matrix continua is assumed. This assumption may be erroneous especially for the fractures, which may or may not constitute a continuum, but also may have scale effects – *i.e.*, the fracture permeability may be larger or smaller depending on the scale of the region tested. This is difficult to model with a continuum approach. The scale effect is also potentially a problem in p. 22, Assumption 5, where pneumatic tests are stated to be the basis for the fracture permeabilities.

3. p. 22, Section 5, Assumption 5. States that because the simulated pressure response was the same whether computed with injected gas moved only in the fractures or in both the

fractures and matrix using the Box Canyon data, no further confirmation is needed. This is not correct. A pressure match alone in one test case comparing two different model runs is not sufficient evidence for a model conclusion to be reached.

4. The validity of the analysis of the Peña Blanca, Mexico uranium deposits (Section 6.5.2.1, p. 69-94) and the Nevada analogues (Section 6.5.2.2, p. 94-97) are interesting, but beyond my areas of expertise, and should be reviewed by Don Shettel.

5. p. 109, Section 7, Paragraph 2. **"Using numerical simulation of the extensive data set from tracer infiltration tests, the Box Canyon study demonstrated that conceptual models and large-scale, volume-averaged numerical modeling approaches used for the UZ flow and transport at Yucca Mountain can be applied with confidence." That statement is flat wrong. Their "success" in modeling an infiltration test with the Box Canyon model (Section 6.5.1.1, pp. 29-66) simply says they could model an infiltration test *there*.** It does not and cannot be used to imply that the model for Yucca Mountain is good, bad or indifferent.

   It is important to distinguish between the model, which is the underlying program, and its datasets that are used to run the model with certain applied conditions. The Box Canyon results could have been "matched" with any number of other models, so just because pressure profiles, etc. in an infiltration test were matched does not imply the model or the data set are true, actual or correct representations of the system. This is seen clearly in p. 66, Section 6.5.1.1.6, which notes that **input data were changed *substantially* to achieve matches – fracture porosity in some instances by 50 times, matrix permeability by 4.5 times, and fracture-matrix interface areas by a factor of 0.01! Have similar parameter changes been made or tested for the Yucca Mountain modeling?**

   The last full paragraph on this page states, "The scaling factors employed during calibration imply a bias indicating inaccuracies in applying the conceptual model as

discretized to represent flow processes controlling water infiltration in variably saturated fractures." I think it is important to challenge the DOE to clarify what this means. What have they done to remove the "bias" and "inaccuracies" in the Yucca Mountain runs?

The success of the model with one data set does not preclude success of alternative models with alternative data sets. Nor do the Box Canyon datasets have any relevance to Yucca Mountain.
