

PRELIMINARY COMMENTS ON THE 73rd ACNW MEETING  
ON THE DOE APPROACH TO ASSESSING GWTT

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DOE NRC Interaction

The DOE and the NRC staff deserve high praise for the increased frequency and quality of interaction on the issue of Ground-Water Travel Time (GWTT). It is very refreshing to hear that they are listening to one another and even more refreshing to find out that their positions on GWTT are actually changing as a result of their interaction. Hopefully, this interaction and this demonstrated flexibility is a sign that trust and mutual respect is building between the two agencies. I sincerely hope that the State of Nevada and the general public are included in this developing open interaction and that the technical and programmatic concerns and views of the State and the public are considered for the same level of debate and discussion.

DOE's Approach to Assessing GWTT

*Assessment of the Effects of the Disturbed Rock Zone (DRZ)*

The DOE's approach to addressing the DRZ in GWTT calculations appears to be converging with the approach laid out by Jeff Pohle (NRC) at the Denver Technical Exchange. As I understand it, Mr. Pohle's approach is based on a simple comparison of the pre- and post- waste emplacement GWTT with a corresponding recommendation that the post-waste emplacement GWTT be used if it is shorter than the pre-waste GWTT and that the pre-waste emplacement GWTT be used otherwise. In other words, the NRC is concerned that the repository effects may adversely effect the ability of the geologic barrier to contain waste but does not allow credit to be taken if the effect of the repository is to lengthen GWTTs. The DOE's has altered their approach to realign it more toward the NRC approach in terms of looking at pre- and post-waste emplacement GWTT. However, it appears that the DOE may have misunderstood part of the NRC intent. Specifically, the DOE is proposing to release particles at locations that are beyond the limit of the effects of the repository. Then, in the event that the effects of the repository reach the accessible environment, the conclusion would be that the site violates the GWTT. As I understand NRC's guidance, the post-waste emplacement analysis would have particles released at the edge of the repository. Then in the case of extensive repository effects (large

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thermal loading), the calculated travel times would be much longer than the pre-emplacement times or, in the extreme, they would be infinite because the repository is dry. Furthermore, since the NRC would not allow credit for this favorable condition, the analysis would revert back to the use of the pre-waste emplacement GWTT as the sole indicator of compliance with 10CFR60.113a. In other words, the large thermal effects would not adversely affect the GWTT analysis as they would based on the DOE approach.

As I have stated in a previous letter, I believe the DOE would be wise to simply accept the current NRC guidance with respect the assessment of the DRZ.

*DOE and NRC Interpretation of the Terms - Likely and Fastest Path*  
DOE's calculational approach as proposed today goes a long way toward meeting at least the intent of the existing NRC guidance on GWTT. In fact, the new DOE approach is very similar to an earlier version of the NRC GWTT guidance. That approach was based, in a sense, on the deterministic definition of the fastest path (for example, along fractures or along a fault) followed by a stochastic analysis of the variability of the GWTT along that path. Please note two points about the new DOE approach. First, the new approach is consistent with older NRC guidance but may not be consistent with the new NRC GWTT guidance depending on the level of confidence that is found to be acceptable. That is, if the mean of the DOE GWTT distribution is used, then the new DOE approach is inconsistent with the current NRC guidance. On the other hand one could envision a level of confidence (say the 95th percentile) that would essentially lead to consistency between the NRC guidance and the DOE approach. However, I believe that either NRC or DOE should perform a hypothetical analysis to determine at what level of confidence the two approaches become indistinguishable. Note that at extreme levels of confidence, the DOE approach will become more conservative than the NRC guidance would indicate a need for. Second, I would point out that, as I understand it, the reason that the NRC abandoned it's earlier guidance was based in part on criticism from the DOE.

*DOE and NRC Interpretation and use of the Term - Significant*

This issue represents perhaps the main remaining difference between the DOE and NRC positions. As I understand it, the DOE's belief is simply that if a pathway with an associated GWTT less than 1,000 years is not expected to carry many or any radionuclides then it should be deemed insignificant and not considered in an assessment of compliance with either the DOE or

the NRC GWTT regulation. On the other hand, I understand the NRC position to derive from the concept of independent multiple barriers or defense in depth. Therefore, according to this position, the use of a total system analysis (which would yield the amount of radionuclides a pathway would carry) in weighting or eliminating a GWTT is inconsistent with the very intent of requiring multiple barriers.

My personal opinion is that if the concept of defense in depth is to be retained then the NRC position is much closer to meeting that intent. Furthermore, I would agree with the NRC that the DOE's approach is a clear violation of the multi-barrier concept and defense in depth.

#### *Need for Additional Guidance from the NRC on GWTT*

I believe that NRC should provide further guidance on GWTT to DOE on the following topics:

- 1) Acceptable level of confidence -- Either the NRC should define what measure of confidence is acceptable for their current approach or the NRC should define an acceptable level of confidence for the DOE's approach.
- 2) Definition of Pre-Waste Conditions -- Pre-waste emplacement as term describing a point in time requires some quantitative or qualitative guidance. For example, infiltration studies at Yucca Mountain have been ongoing for a number of years therefore at a minimum one would expect that pre-waste conditions imply an integrated time from the start of characterization until compliance demonstration. That's the simple aspect. A more complicated concern arises from the data used to condition the GWTT model output or used to assess the belief in a given conceptual model. These data ( including the current moisture content of the geologic layers and the ground-water isotopic data) are not a result of "current" conditions. Quite the contrary, they may be the result of ground-water movement over the last several thousand years. Conceptual models built and conditioned on these data would inherently define pre-waste conditions as a very large window of time. One potentially positive aspect of the use of this data could be that future effects such as climate change have, to some extent, already been addressed in the GWTT analysis. In any event, I do believe that NRC should provide guidance with respect to the meaning of "pre-waste emplacement conditions".
- 3) Use of transport processes (i.e., diffusion) in analyzing GWTT -- The DOE has proposed the inclusion of some transport processes in the analysis of GWTT. While to me this seems like a clear violation of the GWTT

requirement, some of the NRC staff appear to be encouraging the DOE to include these effects. Therefore, I believe that the NRC should provide clear guidance to DOE on this topic. In addition, I believe that if the NRC is to allow the inclusion of transport phenomena in a GWTT analysis, they should begin to consider which alternative travel time is appropriate. That is the a correlation was demonstrated between a 1,000 year GWTT and meeting the EPA standard and that correlation would not exist for a calculation that included transport effects.

4) Treatment Weighting of Alternative Conceptual Models -- The existence of viable alternative conceptual models through the time of licensing is, in my opinion, a fact that the NRC and DOE must begin to come to grips with. I believe that NRC should provide guidance on the weighing of alternative conceptual models, the collection of data in support of these models, and the use of expert opinion in the definition and weighing the results of multiple models.

5) Treatment of Bias resulting from the conversion of Conceptual to Numerical Models -- The DOE has stated that due to computational limitations, their numerical models are simplifications of their conceptual models. Therefore, I believe the NRC should provide guidance on the need to document and treat any biases that arise from this simplification. The NRC also needs to account for this bias in determining acceptable levels of confidence. For example, if, as I pointed out, the 2-D model results always overestimate GWTT, then the NRC may have to consider the need for a higher level of confidence.

#### *Site Characterization, GWTT Modeling, and the DOE Schedule*

The relation between the DOE site characterization efforts, the GWTT modeling, and the DOE schedule appears to be as follows. The DOE has arbitrarily set a date for determining the suitability of the site, 1998. Next to meet this date, the modeling results must be finalized by February of 1997. And finally, the modeling results will be based on data collected some time prior to February 1997, a time dependent on the time to develop conceptual models from the data, define parameter distributions, and perform the calculations.

In my mind, the success of this schedule depends in a large part how successful DOE will be in developing and defending conservative models for GWTT that indicate compliance with the GWTT requirements. That is, no one, even the DOE, believes that by 1998 defensible "realistic" models for GWTT will exist. Therefore, in the absence of data, the DOE has stated

they will rely on conservative assumptions. This raises two questions. First, if the DOE is able to demonstrate compliance, then why continue to collect GWTT data and continue to perform GWTT analyses after 1998 (as stated by the DOE today). Second, if their conservative 1998 GWTT analysis indicates non-compliance, does this mean that the site is unsuitable or does it mean that the site could be proven to be suitable if more time were available to collect data and defend a less conservative model?