

MAY 25 1988

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MEMORANDUM FOR: Ronald L. Ballard, Chief, HLTR

FROM: B.J. Youngblood, Chief, HLOB

SUBJECT: COMMENTS ON DRAFT TECHNICAL POSITION ON GROUNDWATER TRAVEL TIME

In response to your memorandum dated April 25, 1988, the Operations Branch (HLOB) has prepared comments on the draft Technical Position (TP) on Groundwater Travel Time (GWTT). The main HLOB concern with the TP is the definitions of the fastest path and GWTT. In the opinion of HLOB, the definitions are ambiguous. The TP does not develop a definition of GWTT in terms that have meaning with respect to the acceptability of the site. It leaves the definition of GWTT and the determination of how to demonstrate compliance almost entirely up to the Department of Energy (DOE). Without a better set of criteria, DOE cannot possibly know whether the staff is satisfied with the DOE appraisal.

As an example of the kinds of problems that could develop, consider that there are at least three perfectly logical definitions of GWTT:

- (1) the time for flow passing through the disturbed zone of the repository to reach the accessible environment;
- (2) the time for a small fraction of the total flow passing through the repository to reach the accessible environment; or
- (3) the time for the fastest molecule of water leaving the disturbed zone to arrive at the accessible environment.

The travel time under assumption 3 would be a single value, but for assumptions 1 or 2, the travel time would be a distribution. The travel time is distributed for assumptions 1 and 2 because the velocity and length of the streamlines are different for each point of release. Furthermore, the travel of water released at the disturbed zone could be construed to take into account the exchange by means of molecular diffusion or mixing of water originally released at the disturbed zone with immobile water along the path. It should be noted that in the present flow-field example, the GWTT distribution just expresses the variability of the GWTT rather than the uncertainty. The distribution also could include the uncertainty of the parameters for the model which was used to determine GWTT.

The question is "what is the fastest groundwater travel time, given that the travel time of individual water molecules is a distribution rather than a single-valued quantity?" Should the mean, median or some other norm of this distribution be used? The conservative answer is to take the fastest particle, which reduces to assumption 3. However, this would not be a fair appraisal of

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the site. Under some modeling assumptions it might be impossible to prove that the fastest time was anything greater than zero.

In a related issues, HLOB is concerned with the definition of seepage velocity on page 6 of the TP. The flux of water in a continuous, porous medium is usually developed in terms of a macroscopic average of the velocities of the water molecules in the paths around individual grains and through fractures in the medium. The volume over which the velocities are averaged is known as the "representative elementary volume" (REV). In discontinuous media such as rocks with large, extensive fractures, one may not be able to define a REV, or the REV may be bigger than the domain of interest. This leaves open the possibility that the seepage velocity cannot be defined for a given medium, which leads us back to an ambiguous statement of GWTT.

Another concern HLOB has with the TP is that it fails to address transient flow explicitly. This could result in conditions of short duration that lead to small travel times. These small travel times might be insignificant in terms of the site performance but could violate the GWTT requirement. This is an especially important point with regard to the Yucca Mountain repository location where there is a potential for rapid downward flow during periods of high recharge.

Finally, it is not clear to HLOB how compliance with 10 CFR 60.113(a)(2) can be demonstrated by considering the steps proposed in Section 4.0, "Statement of Regulatory Positions." For example, how does the adoption of the technical considerations and definitions demonstrate compliance? The same is true for providing the details of the information collected. At best, the TP is very general in the guidance it provides and the steps described in Section 4.0 offer no additional detail. Rather, these steps still leave most of the burden of elaborating the regulations to DOE. This can be seen in item (d), "Calculate and discuss an estimate of GWTT." That is suppose to be the whole purpose of the TP, to provide guidance on how to calculate and estimate GWTT.

Overall, HLOB believes that the TP needs to clarify the regulations as to what is needed to meet the GWTT requirement. This can be done by adopting the simplest approach that meets the overall intent of the regulations. In its present form, the TP accomplishes very little.

In addition to the above overall issues, HLOB also has some concerns with the TP as it is written. The specific comments are contained in the enclosure to

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this memorandum. Mr. Joe Holonich was the HLOB member responsible for preparing and coordinating these comments. If you require any additional assistance, please contact him at X23403.

B.J. Youngblood, Chief, HLOB

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ENCLOSURE

1. Page 1, Section 1.0, "Introduction"

The entire introduction should be changed. In its present form it does not seem to be appropriate. A more appropriate introduction would be what is contained in Footnote 1.

2. Page 2, Section 1.1, "Background"

(a) In the first line, define what is meant by "approach." The term that the staff routinely uses is "methodology." If approach is used, explain the difference.

(b) In the first sentence of the first paragraph of this section, the TP states that it describes a general approach for analyzing GWTT that "meets the needs of the NRC staff." These words should be changed to "is one acceptable method for demonstrating compliance with the NRC requirements (or regulations) contained in 10 CFR 60.113(a)(2)."

3. Page 2, Section 1.2, "Purpose and Scope"

The second sentence of the first paragraph states that the TP "also provides criteria by which the NRC staff will review the GWTT analyses." The next sentence discusses the fact that the TP does not establish procedures for implementing the approach since the acceptability of methods and procedures has yet to be developed. How can the TP establish acceptance criteria if an acceptable methodology has not been developed.

4. Page 3, Section 1.3, "Regulatory Consideration"

The EPA standard has been vacated. Therefore, the paragraph containing a reference to 40 CFR 191 needs to be revised.

5. Page 4, Section 2.1, "Pre-Waste Emplacement"

In the second paragraph, sixth line, the TP states that irrigation practices or any other hydrological factors may need to be considered in calculating GWTT. The word "may" is too soft. A more appropriate verb would be "should." Irrigation practices and other hydrological factors should be considered. Once considered, it may be determined that they are irrelevant in calculating GWTT but at least they were considered.

6. Page 5, Section 2.2 "Pathway Selection and Travel Time Calculation to Determine Fastest Path"

The TP needs to define what a path is. Without defining what a path is, how can the TP provide adequate guidance on how to calculate the fastest path?

7. Page 6, First paragraph, last two sentences.

It is not clear what is meant here.

8. Page 7, First line

"What is the difference between "minimize" and "reduced?" Since the definitions are nearly the same, the TP should use one or the other.

9. Page 7, Section 3.2, "Treating Uncertainty"
Page 8, Section 3.3, "Expressing Uncertainty"

In both of these sections the TP states that "expert and professional" judgements may be used. It has been the staff policy to rely on professional judgement only in those instances where no other means can be used. The reason for this is that expert and professional judgements are subjective and are based on individual opinion. Experts can and do have different conclusions. If the treatment and expressions of uncertainties are such that in some cases the staff must rely on judgements, the TP should have a caveat that the use of judgements be minimized and used only when no other options are available.