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JUL 2 1984

MEMORANDUM TO: Hubert J. Miller, Chief
Repository Projects Branch
Division of Waste Management

FROM: Malcolm R. Knapp, Chief
Geotechnical Branch
Division of Waste Management

SUBJECT: REVIEW OF MODELING STRATEGY DOCUMENT

WM Record File

109.7

WM Project

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As requested in your memo dated May 9, 1984, the subject document has been reviewed, and comments are compiled below.

Comments

- (1) The document presents, in very general terms, the NRC staff's strategy, overall logic and approach for using numerical models and computer codes for evaluating the performances of High-Level Waste (HLW) repositories. Consideration should be given to changing the title of the document to more clearly reflect its intent (i.e., "Modeling Strategy Document for High Level Waste Performance Assessment").
- (2) P-1, paragraph 2: paragraph 2 suggests that details not included in this document are contained in "technical positions related to specific technical disciplines." However, no references were provided. These references are needed since they will support the "general" nature of the discussions contained in this document.
- (3) P-4, Heading: For clarity, consideration should be given to changing the heading "Through Permanent Closure" to "Prior to Permanent Closure."
- (4) Pages 6-9, "Nature of Proposed EPA Standard": As you state, the EPA standard is a probability-based standard. This ties in with the idea of having a probabilistic risk assessment as the basis for the overall assessment of the repository. If so, the uncertainties in the definition of the source term, transport data, and mathematical models could all conceivably be taken into account in the performance assessment. For example, an uncertainty in the values of hydraulic conductivity used in the transport model would affect the CCDF in much the same way an uncertainty in the release rate from the repository.

The last sentence of Page 8 discusses factoring uncertainty into the CCDF's, but this subject deserves greater attention.

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We should try to tie the probabilistic angles of "Nature of Proposed EPA Standard", pages 6-9, and "IV Uncertainties", starting on Page 12, together in the framework of PRA. Other mentions of uncertainty are also scattered through the text. I'm not sure how to do it simply.

The second paragraph on Page 20 dealing with simple models and codes, also ties in with the PRA concept, since complex models are not well suited to the monte carlo techniques often employed in PRA.

- (5) P-7, lines 8-21; p. 8; and p. 9, lines 1-14: Inclusion of this material under "Nature of proposed EPA Standard" is not parallel to the development of "Nature of the NRC Regulation." Consideration should be given to either referencing this material or including it in Section V (Key Assumptions).
- (6) P.7: Mention should also be made of the proposed EPA water concentration limits in the Standard.
- (7) P-15, lines 9-18: This statement is technically incorrect and thus leads to the incorrect conclusion that a simple Kd approach to modeling radionuclide transport is conservative. Two problems associated with this statement are:

- (a) The use of the concept of "steady state Kd" is more accurate than equilibrium Kd",
- (b) the example described applies only to modeling single species. The simple Kd approach, when dealing with multiple speciation, provides a "weighted", average sorption value, that in the absence of detailed experiments, cannot be shown to be either an over estimation or under estimation of the concentration of a radionuclide in solution (i.e., conservative or non-conservative).

Thus, this example should either be deleted or rewritten so that it is clear that in the absence of detailed geochemical characterization the example applies only to very simple systems (which, in general, do not apply to HLW isolation).

- (8) P. 16, paragraph 2, calculational uncertainties: The statement of uncertainty needs to be stated more clearly and include the interaction between individual uncertainties and total uncertainty.

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- (9) P. 17, lines 5/6: Considerations should be given to deleting or clarifying the statement, "although the NRC staff may choose to do so." In it's present form it looks like we are doing unnecessary work.
- (10) P. 17, lines 13-18: This sentence should be revised to reflect the fact that "groundwater travel time" is highly dependent on empirical values (i.e. hydraulic conductivity, hydraulic gradient, head, effective porosity, geometry).
- (11) P. 19, lines 4, 5 and 6: This sentence needs to be clarified. A suggested rewrite is as follows--" ...those barriers to which demonstrations of compliance with the regulations and standards are least certain."
- (12) P. 22, It is not clear if the performance of sensitivity analyses is included. Consideration should be given to adding another bullet to cover sensitivity studies or otherwise clarifying the strategy. Sensitivity analysis could be tied to quantifying the consequences of uncertainties in the models and data.
- (13) P. 23, paragraph 1: Figure C-1 from the DSCA, which lists the major performance issues, should be referred to and included in this document.
- (14) P. 24, lines 1 and 2: The use of such a code as ORIGIN is mischaracterized. This should be rewritten to reflect that such a code would be used to estimate the inventory of radionuclides present in any waste available for release.
- (15) P. 24 - 25, "Releases in Water": The impacts of construction and normal operation of the HLW facility during its active lifetime, about 100 years, would be similar in many ways to those of nuclear power plants. These inputs are covered by various NRC criteria and guidance in the form of Standard Formats, Regulatory Guides, Environmental Standard Review Plans and Safety Standard Review Plans. In some cases, back of the envelope approaches would do, but I think that a fairly detailed analyses of impacts might also be required by an Environmental Impact Statement.
- (16) P. 26, paragraph 1, sentence 2: This sentence should reference available codes.
- (17) P. 31, last paragraph: This paragraph should provide references pertaining to the use of the TOUGH code, and the ability of this code to simulate a resaturation-of-backfill problem. I don't think we have made a determination of the applicability of TOUGH to this problem.

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- (18) P. 33, line 11: In addition to issue P. 8, issues P. 3 and 4 will be relevant.
- (19) P. 34, lines 1-5: The staff will probably need to use a code such as WAPPA. Therefore, we should be intimately familiar with it, and take an active role in reviewing DOE's development of the code. In this way, we can help to assure that the proper phenomena are correctly modeled.
- (20) P. 35, line 1: This sentence does not make it clear whether it's NRC's or DOE's (or both) analysis that "will consist principally of extrapolations of empirical data ..."
- (21) P. 35, item 6.1: We do not agree that DOE will rely on the waste form to achieve a release rate of less than 10^{-5} /yr. Please give a suitable reference for your statement.
- (22) P. 36, paragraph 2: See comment 19 above.
- (23) P. 37, paragraph 1; This paragraph needs to address the effects that the "Technical uncertainties ..." will have on our modeling strategy. We don't necessarily agree that NRC's strategy will be unaffected.
- (24) P. 23,27,30,32,35,37,38,41,43,46, and 48; "Anticipated DOE Technical Analyses": This section is obviously key to the "NRC Review" section and needs to be referenced or reviewed by DOE in order to establish the viability of our assumptions.
- (25) P. 37, item 7.1; We question whether DOE will in fact assert that the release rate criteria will be met as simply as this section suggests.
- (26) P. 39, ° Simplified models such as a CSTR (Continuous Stirred Tank Reactor) and Plug Flow model will be used to define the conservative limits of the effect of the backfill for isolation of the waste."
- (27) P. 40, paragraph 1: It is doubtful that SWIFT will provide close support in the very near field. TOUGH has not yet been demonstrated to be acceptable for the stated purposes. (See comment 16).
- (28) P. 40, paragraph 2, lines 9, 10, 11: Assumptions concerning DOE activities need to be supported by references.
- (29) P. 43, end of first paragraph: Be sure to mention that NRC (WMGT) is working on a staff position on the disturbed zone.

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(30) P. 45, paragraph 2: This paragraph needs clarification concerning:

- 1) definition of "far-field",
- 2) the status of the modifications to SWIFT and NWFT/DVM, and
- 3) the application to unsaturated transport.

(31) P. 46, paragraph 1: This paragraph needs clarification concerning:

- 1) Documentation that "the current level of understanding of relevant phenomena (e.g., groundwater flow and contaminant transport) in the farfield is substantially better than ..." in the near field and,
- 2) Uncertainties associated with unsaturated and fracture flow.

(32) P. 47, paragraph 3: In addition to SWIFT, consideration should be given to PORFLO and TOUGH.

I hope that these comments prove useful to you in proceeding with the development of this Strategy document. I will be happy to discuss these comments with you at any time.

Malcolm R. Knapp, Chief
Geotechnical Branch
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cc: R. Codell
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WM Section Leaders
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