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U.S. Nuclear Regulatory Commission  
7915 Eastern Avenue  
Silver Spring, MD 20910

Dear Ms. Wastler:

At the request of Atef Elzeftawy, I have reviewed the draft of "Revised Modeling Strategy Document for HLW Performance Assessment" ("the MSD") as a part of A1165 Task 1.

I have no major comments on the content of the MSD, because overall it is excellent; it is well written and sticks to the point. The modeling strategy that is presented is reasonable, and I think that the Licensing Assessment Task of A1165 can be carried out fairly easily in accordance with the MSD.

I have one major comment on the structure of the MSD, one important comment on the relationship between the MSD and the LAM Task, and a number of minor comments, both technical and nontechnical. The minor comments are arranged by page number. The comments are attached.

Please feel free to call me if I can be of further assistance.

Sincerely,

*Regina Hunter*

Regina L. Hunter  
Waste Management Systems  
Division 6431

cc: Dan Fehringer

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## REVIEW COMMENTS

### Revised Modeling Strategy Document for HLW Performance Assessment

#### Major Comments

1. Even though this is a modeling strategy document, the text does not discuss modeling strategy until page 27 of 60, and by that time the reader is bogged down in detail that doesn't have an outline. I suggest the following two changes:

- move Section II (except for Figure 1) into an Appendix, or omit. Move Figure 1 to the beginning of Section VI.
- move Section IV after Section VI.

Now the order of the document is

- Introduction
- Roles of DOE and NRC
- Key Assumptions
- Modeling Strategy
- Uncertainties in Developing the Modeling Strategy
- References
- (Appendix) Regulations
- (Appendix) Definitions

The discussion of modeling strategy should now start around page 16, much closer to the front; the section on uncertainties comes after the major discussion; and the regulations need be read only by those who are unfamiliar with them.

2. Figure 2, p. 15, first bullet, indicates that DOE is responsible for both licensing assessment and performance assessment. The figure caption reinforces this idea by referring to DOE's "Licensing Responsibilities." According to the SOW and 189 for the LAM Task, the published abstract on the LAM by Hunter and others (1985), and Sandia's presentation view graphs on the LAM, which have been seen and discussed by Elzeftawy, Coplan, Miller, Knapp, and Browning, NRC is responsible for licensing assessment. "LICENSING/" should be deleted from the first line. I also suggest changing the caption of Figure 2 to read "DOE's Responsibilities in Preparing a License Application" and the caption of Figure 3 to read "NRC's Responsibilities in Reviewing a License Application."

An additional bullet should be inserted at the top of Figure 3, to read

O PERFORM LICENSING ASSESSMENT EVALUATING COMPLIANCE WITH 10 CFR PART 60

### Reference

Hunter, R. L., M. S. Y. Chu, and L. A. Peeters, "Development of an Integrated Licensing Assessment Methodology," Transactions, Amer. Nuclear Soc. 1985 Annual Meeting, vol. 49, p. 80-82, SAND85-0025A, June 9-13, 1985.

### Minor Comments

p. 2, line 12. Delete "recognized as"--it is redundant.

p. 2, last sentence. I could not find the discussion of an adequate LAM to which this sentence refers. Maybe the discussion needs a heading.

p. 4, Section II, first heading. Delete "Nature of the"--the "nature" is not discussed; only content is discussed.

p. 4, Section II. The arrangement of this section (Nature of the NRC Regulation) is awkward: structurally it is one sentence, three pages long. I suggest replacing "include:" (p. 4, line 7) with "are discussed below." Then, each paragraph should begin with a sentence, for example,

" 60.111, limiting radiation" should be " 60.111 limits radiation"  
" 60.2, defining the term" should be " 60.2 defines the term"

and so on.

p. 5, line 8. "include heat" should be "include models of heat."

p. 5, line 14. Delete "proposed."

p. 5, line 15. "include" should be replaced by "model."

p. 5, last 2 lines. Delete "as illustrated in Figure 1" (recall that I suggest moving Figure 1 to the beginning of Section VI).

p. 8, line 6. This citation should be made consistent with the others in the text.

p. 8, line 7. Delete "Proposed" from heading.

p. 8, line 9. Reword sentence to read "The EPA standard is probability-based and requires a formal probabilistic treatment of . . . and other applications as one of the bases . . ."

p. 8, final 2 sentences, in parentheses. Delete.

p. 9, line 1. Change "the post-closure" to "projected post-closure."

p. 9, final para., p. 10, first para. This paragraph is weak. It identifies three "issues," but it fails to discuss them. The second and third "issues" are tenuously related to the section heading, at best. The second is not an issue in any case; it is a lack of data.

p. 11, line 2. Replace "has the responsibility to" to "must."

p. 12, line 19. There will undoubtedly be significant phenomena that are not understood quantitatively even at the time of licensing; it might be unwise at this time to commit NRC to scientific breakthroughs. I suggest that "quantitatively" be deleted.

p. 14, line 8. Change "1)" to "1."

p. 15, Figure 2, line 3. Delete "AND QUANTITATIVE."

p. 17, first sentence. This sentence is confusing as written. Rearrange to read ". . . uncertainties--programmatic and technical--significantly affect . . . modeling strategy."

p. 18, line 3. "affect" should be "affects."

p. 18, line 15. Change line to read "performance. Where appropriate . . ."

p. 19, line 4. Change line to read "DOE is responsible for identifying sources . . ." in order to make the first and second clauses parallel.

p. 20, line 6, sentence beginning "Uncertainties in the models result . . ." Important uncertainties in models also result from spatial or temporal variability that is either unknown or too complex to model.

p. 24, lines 5 and 6, "uncertainties in projecting the performance of the geologic setting . . ." Waste-package degradation mechanisms seem to be a major source of uncertainty in engineered-barrier performance, possibly as great as any uncertainty in geologic-setting performance.

p. 24, last full sentence, "The degree to which . . ." Delete.

p. 25, line 1. Change "however, the requirement to perform such" to "however, performing such."

p. 25, line 2. Delete "analyses of:"

p. 25, line 3. Change to ". . . and (3) analyses of the . . ."

p. 25, line 9. Change "state-of-the-art" to "state of the art."

p. 26, line 4. Should this read "The DOE codes will be . . ."?

p. 26, line 9. Delete "very."

p. 27, lines 2 and 3. This is confusing as written. Does it mean "The strategy is to do the following" or "This is the way we discuss the strategy"?

p. 27, line 6. Delete comma.

p. 28, P.1. It would be more clear to insert "PRECLOSURE" between "ADDRESS" and "RELEASES."

p. 29, Figure 4. The figure caption should emphasize that each box represents an evaluation of DOE's results on the content of the box, not necessarily a calculation of the results.

p. 33, lines 4 and 5. Reword to read "used in other facilities handling nuclear materials."

p. 33, line 11. Change "strategy since" to "strategy, because."

p. 35, Section 2.2. In other similar sections, a course of NRC research is suggested or described. It may be appropriate here to suggest that NRC begin research on waste-package corrosion mechanisms.

p. 36, line 11, "data limitations represent the largest source of uncertainty." For the waste package, corrosion mechanisms may represent an even larger source of uncertainty than data limitations.

p. 37, line 11, "Measure . . ." and p. 38, lines 10 and 11. Taking measurements is data collection, not analysis, as billed in the heading.

p. 39, lines 6 and 7. Reword to read "NRC staff members are currently using and evaluating . . ."

p. 39, line 13. Delete "under the influence of."

p. 39, line 15 and 16. Delete parentheses.

p. 40, last line. Change "is dependent on" to "depends on."

p. 41, line 6. Delete comma and "will review."

p. 47, line 4. Change "analyses are:" to "analyses model."

p. 48, lines 7, 8, 9. Reword to read "Limited independent NRC staff analyses . . . may be conducted, as a check . . ."

p. 48, lines 10 and 11, and p. 57, line 5. SWIFT is complex and difficult to use and demands a very large computer. It might be wise at this time not to commit NRC to its exclusive use for saturated ground-water flow.

p. 49, line 3. Delete "quite."

p. 52, line 8. Delete comma.

p. 52, line 15. If the suggestion for rearrangement in major comment #1 is followed, "section" should be changed to "Appendix."

p. 53, line 6. Delete colon.

p. 55, line 8. Delete "quite."

p. 55, line 11. Change "require a significant number of data measurements," to "be numerous,".

p. 56, line 4. Should "analytical" be "numerical"?

p. 56, Section 11.1. This section does not suggest what "answer" DOE is expected to submit, as other similar sections do (e.g., Section 2.1, para. 1, p. 34). Isn't DOE "required," not "expected," to submit results of its analyses of flow?

p. 57, last line. Change "analytical treatment," to "analysis,".

p. 57, last line, and p. 58, lines 1 and 2. This suggests to the reader that NRC will concentrate on analyses of geologic barriers simply because that is the easiest thing to do. Please clarify.

p. 58, Summary. This summary is inadequate. Please expand.

p. 59, Figure 5. This figure repeats the bottom of p. 13 and the top of p. 14 almost verbatim. Omit.

p. 61, References. I did not check the citations vs. references in detail, but the correspondence between the two does not seem to be complete.

p. 62 ff., Definitions.

Accessible environment, Disturbed zone, Engineered barrier system, Waste package: "this boundary." These multiple barriers are arranged in shells, and therefore most of them have an inner boundary and an outer boundary. Please specify in each definition which boundary is under discussion.

Controlled Area. Insert a comma after "monuments."

Deterministic code. A deterministic code can indeed consider ranges and distributions with multiple runs. Reword to read ". . . relationships and that does not accept ranges and distributions of input parameters nor produce ranges and distributions of output parameters."

Finding. Shouldn't the list of items to be weighed include the numerical results themselves?

Licensing assessment. Doesn't the licensing assessment include anything other than the sum of the findings? For example, is there a specific requirement (and thus a finding) that the scenario development be reasonably complete, or that probabilities be assigned using the best available techniques?

Performance assessment. Delete "quantitatively." Scenario development, some probability assignment, and the development of conceptual models are all inherently subjective and qualitative.

Risk. The second half of this definition is new to me. Unless it comes from some previous (reactor safety?) NRC publication, I suggest rewording to read "(consequences), i.e., probability times consequence."

Scenario analysis. Reword to read ". . . probability and consequences of their occurrence."

This document repeats three small errors--two grammatical and one idiomatic--several times:

Replace "which" with "that" in the following lines:

p. 1, footnote, line 2	p. 41, line 17
p. 3, lines 3 and 8	p. 46, last line
p. 4, line 6	p. 47, line 3
p. 9, line 16	p. 48, last line
p. 17, line 8	p. 49, line 7
p. 18, lines 11 and 13	p. 54, line 8
p. 20, line 3	p. 55, line 14
p. 22, last line	p. 56, line 10
p. 27, line 10, and line 14 (twice)	p. 57, line 8
p. 28, lines 14 and 16	p. 62, line 9
p. 30, lines 2 and 11	p. 67, line 7
p. 39, line 13	

Insert a comma after the following words:

p. 2, line 2, developed	p. 47, line 6, capability)
p. 3, line 13, documents	p. 47, line 8, flow
p. 13, line 11, NRC	p. 47, line 12, Geochemistry
p. 14, line 9, 3 (i.e., "3, or 4")	p. 47, line 15, transport
p. 18, line 3, programs	p. 49, line 2, phenomena
p. 22, line 14, data	p. 49, line 4, radiation
p. 26, line 1, data	p. 53, line 9, transport
p. 30, line 2, systems	p. 55, last line, regions
p. 39, line 11, materials	

Replace "anticipate(s) (ed)" with "expect(s) (ed)" in the following lines:

p. 1, footnote, line 4	p. 41, line 16
p. 9, line 4	p. 42, line 12
p. 12, line 6, "expects to perform"	p. 44, line 14
p. 32, lines 13 and 15	p. 45, line 6
p. 35, last line	