Department of Energy
Washington, DC 20585

MAY 03 1991

Mr. John Linehan, Director
Repository Licensing & Quality
Assurance Project Directorate
Division of High-Level
Waste Management
Office of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Linehan:

Enclosed are the U.S. Department of Energy's (DOE) comments on the U.S. Nuclear Regulatory Commission's (NRC) report entitled "Phase 1 Demonstration of the U.S. Nuclear Regulatory Commission's Capability to Conduct a Performance Assessment for a High-Level Waste Repository". These comments were discussed at the Performance Assessment Technical Exchange held in Washington D.C. on July 27, 1990. In general, the reviewers found the paper a valuable demonstration of the NRC's capabilities, and a useful frame for planning future interactions between NRC and DOE staff on the subject of performance assessment.

If you have any questions about this review, please contact Cori Macaluso of my staff at 586-2837.

Sincerely,

Linda J. Desell
Acting Chief, Licensing Branch
Office of Systems Integration and
Regulations
Office of Civilian Radioactive
Waste Management

Enclosure: U.S. Department of Energy Comments on Phase 1 Demonstration of the U.S. Nuclear Regulatory Commission's Capability to Conduct a Performance Assessment for a High-Level Waste Repository, Final Draft; April 20, 1990



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cc:
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U.S. DEPARTMENT OF ENERGY COMMENTS ON
PHASE 1 DEMONSTRATION OF THE
U.S. NUCLEAR REGULATORY COMMISSION
CAPABILITY TO CONDUCT A PERFORMANCE ASSESSMENT
FOR A HIGH-LEVEL WASTE REPOSITORY,
FINAL DRAFT, APRIL 20, 1990

GENERAL COMMENTS

The Department of Energy (DOE) welcomes the opportunity to comment on the draft Phase 1 Performance Assessment demonstration. The effort involved in the Phase I Performance Assessment demonstration was apparent and the report provides additional insight into the difficulties that both the Nuclear Regulatory Commission (NRC) and the DOE may encounter in future performance assessment efforts. In particular, the report makes it clear that the current lack of mature site models and availability of site-specific data constrain performance assessment at least as much as the availability of the computational models themselves. Even taking the above limitation into account, the NRC demonstration identifies points that should be considered in the future as the performance assessment programs mature. In this review, the DOE has recognized the NRC's objective in undertaking the performance assessment demonstration, and the limitations under which the demonstration was performed. The DOE does, however, have some concerns that are discussed in the more detailed comments that follow.

The NRC staff's approach to integrating selected submodels into a total system model-while necessarily limited by constraints that are appropriate at this time for the individual components of the overall model-appears to be a note-worthy contribution. In addition, we note that many of the auxiliary analyses are quite sophisticated, and that the integrated total system model appears to be particularly amenable to sensitivity analyses. Similarly the use of a source term model that is not arbitrarily based on an assumed release rate of one part in $10^5$/year appears to be a reasonable approach.

We would like to emphasize that we fully agree with the NRC staff's position that the assessment is not to be construed as representative of the suitability of the Yucca Mountain site, and does not reflect regulatory guidance. With respect to the latter point, however, we are somewhat concerned that certain aspects of the report could be construed as regulatory guidance relative to the implementation of the U.S. Environmental Protection Agency (EPA) standard. The statement in question is that "the authors did not encounter any problems which indicated the EPA standard could not be implemented." The staff properly qualifies this observation by stating that "not all aspects of the standard were tested (e.g., the difficulties in estimating scenario probabilities)." In spite of the qualifying statement contained in the document the DOE is concerned that the above statement may be interpreted as indicating that a single complimentary cumulative distribution function (CCDF), as shown in the report, is appropriate for the

integration of all the scenarios and alternative conceptual models. The DOE feels that judgments relative to the ability to implement the EPA standard should be based on experience gained, consideration of a more complete range of scenarios, and a more thorough treatment of the several different types of conceptual model uncertainties with which we will be faced.

SPECIFIC COMMENTS

Page 0-3, Paragraph 5, and Page 2-3, Paragraph 2: The descriptions of the CDF and CCDF are incorrect. The CDF is the probability that the value of a random variable is less than or equal to some real number. The CCDF is the probability that the value of the variable is more than the number.

Pages 0-6 and 0-7, "Tentative Conclusions": Although the DOE recognizes the need to draw tentative conclusions in order to proceed with the demonstration, the DOE is concerned with the appropriateness of developing guidance for an important program such as site characterization from studies using simplified models. Of particular concern to the DOE are conclusions 4 and 5 (concerning the importance of plutonium and selecting important hydrological parameters), which may be overly biased by the simplified conceptual models of ground water flow and waste/rock geochemical interactions used in the study.

Page 5-3, paragraph 2: The term "resaturate" is inappropriate because it implies that the rock is currently saturated, and that it is necessary for the rock to become saturated for liquid water to be able to contact waste package containers. The phase "infiltrate again" would be more accurate in the sentence.

Page 5-4, Paragraph 2: Given the assumed values of 18,000 packages, 0.66 meters in diameter, and a repository area of 5.6 square kilometers, the fraction of water contacting the vertically emplaced packages should be 0.0011 rather than 0.00078.

Page 6-7, Paragraph 2: The regulatory period of performance for the repository is 0 to 10,000 years for the major total system performance measures, not 10 to 100,000 years. Clarification of the rationale for selection of the 100,000-year period would be useful and could mitigate misunderstanding relative to the current provisions of 40 CFR Part 191 and 10 CFR Part 60. (See related statement on Page 2-1.)

Page 7-11: We believe scenario 18 is irrelevant to the EPA containment standard because the water that would be withdrawn from the well would already be in the accessible environment. Likewise, the difference between scenarios 19 and 20 is irrelevant, because the use of the water after it enters the accessible environment is immaterial to the containment standard.

Page 9.1-2, Paragraph 1: The projected waste emplacement area of the repository is 1380 acres (SCP Overview, page 41). This equals approximately 5.6 square kilometers rather than 5.1.

Page 9.3, Section 9.3-general comment: It appears that no disturbed zone was considered when the liquid pathway legs were defined for the NEFTRAN simulations that were used for comparison with related NRC criteria for the natural barrier system. The basis for not including the disturbed zone could benefit from clarification.

Page 9.3-3: the term "q": in Equation 9.3.6 should be the infiltration rate "I".

Page 9.3-8: The expression in parentheses in Equation 9.6.3 should be $I-k_s$. If flow is assumed to be solely in the fractures, $k_s = 0$.

Page 9.4-8, last paragraph: The lower limit of the range for the water contact fraction does not agree with the value given in Table 9.4.2. The value in the table appears more reasonable, given the geometry of the emplacement.

Page 9.4-11, Paragraph 9.4.2.10: The DOE does not understand the rationale for the value selected for the plutonium retardation coefficient. Apparently, the rationale used was to represent the retardation coefficient for plutonium as an average for dissolved and colloidal species. If so, this could be interpreted as an approach for combining two alternative conceptual models for plutonium transport. This representation of the plutonium case emphasizes the importance of determining appropriate ways of representing alternative conceptual models in a CCDF. Such an approach is confusing to the DOE since, as discussed in the meeting of July 27, 1990, there appears to be a general consensus that this may not be an appropriate integration of these two conceptual models. The DOE has, and continues to, recommend this as a topic for a future NRC/DOE technical exchange.

Page 9.4-11, middle paragraph: Thompson (1989) is not in the list of references at the end of the section.

Page 9.5-3, Paragraph 3: Figures 9.4.3 and 9.4.4 should be changed to Figures 9.5.3. and 9.5.4.

Page 9.5.7: Placement of tables should be consistent throughout the report, either within the text or at the end of each section.

Page C-7: Robinson, Hodgkinson, et al. are not in the list of references at the end of the appendix.

Page D-1, Paragraph 2: Till (and Myer) (1983) indicates (Page 9-17) that terrestrial biota can be represented by a low- and a rapid-turnover compartment with mean resistance times of 41 and 2.2 years, respectively. These residence times correspond to half lives of 28 and 1.5 years, rather than the cited values of 9 to 15 years.

Page D-11, Table D-2: It is unclear how the release fractions for the various times of release were calculated from the travel times for only the four release times considered by Amter (1988). It is also unclear why the earliest release time doesn't have the largest release fraction. Is it because of heat up time?

Pages H-4 and H-5: Figures 1a and 2, referred to on these pages, are not in the appendix.

Page H-7, Paragraph 1, and Page H-13, Paragraph 1: It appears to be assumed that all of the vadose water below the repository horizon is saturated with $UO_2$. Such an assumption would be inappropriate for the total population of boreholes, because the mass of $UO_2$ in solution would exceed the original inventory of the repository. for example, given the other assumptions made by the NRC staff, the mass of $UO_2$ dissolved in 100 meters of water below the repository, would be approximately 180,000 metric tons, whereas the expected inventory of $UO_2$ in a 63,000 MTU spent fuel repository would be about 71,000 metric tons (which also assumes contribution by naturally occurring U).

Page H-11, middle paragraph: Given the definitions of $T_d$ and $T_p$ on Page H-2, there is no drilling during the period of interest if $T_d$ is equal to or greater than $T_p$, as stated correctly on Page H-14.