

MEMORANDUM FOR: The Chairman
 Commissioner Rogers
 Commissioner Curtiss
 Commissioner Remick
 Commissioner de Planque

SEP 01 1992

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FROM: James M. Taylor
 Executive Director
 for Operations

SUBJECT: TRANSMITTAL OF STAFF COMMENTS ON THE "REPORT OF EARLY SITE
 SUITABILITY EVALUATION OF THE POTENTIAL REPOSITORY SITE AT
 YUCCA MOUNTAIN, NEVADA"

For your information, I am providing you with comments prepared by staff in the Office of Nuclear Material Safety and Safeguards on the U.S. Department of Energy (DOE) contractor baseline site evaluation, "Report of Early Site Suitability Evaluation of the Potential Repository Site at Yucca Mountain, Nevada" (ESSE). These comments are based on the staff review described in the enclosed letter and reflect Advisory Committee on Nuclear Waste comments from a briefing to the Committee on the staff's review. The staff centered its review on DOE's implementation and application of siting guidelines which was the guidance from the Commission during the development of 10 CFR Part 960, "General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories."

Overall, the staff found that the discussions in the ESSE imply that the engineered barrier system has been used to compensate for deficiencies in the site. This application is inconsistent with the original intent of the guidelines. In addition, the staff believes that the bases to support high-level suitability findings are insufficient. Also, the staff does not believe that the ESSE is sufficiently conservative in its application of 10 CFR Part 960. The staff concerns are detailed in the enclosed letter and its attachments.

Original signed by
 James M. Taylor
 James M. Taylor
 Executive Director
 for Operations

Enclosure: As stated
 cc: SECY
 OGC

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*See previous concurrence

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 22 1992

Mr. John P. Roberts, Acting Associate Director
for Systems and Compliance
Office of Civilian Radioactive Waste Management
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

Dear Mr. Roberts:

**SUBJECT: REVIEW OF REPORT OF EARLY SITE SUITABILITY EVALUATION OF
THE POTENTIAL REPOSITORY SITE AT YUCCA MOUNTAIN, NEVADA**

On March 3, 1992, the U.S. Department of Energy (DOE) transmitted the contractor baseline site evaluation, "Report of Early Site Suitability Evaluation of the Potential Repository Site at Yucca Mountain, Nevada" (ESSE) to the U.S. Nuclear Regulatory Commission and other interested parties for a 90-day public comment period. In a letter of April 29, 1992 (Holonich to Roberts), the NRC transmitted the staff's review plan for the subject report to DOE and, at that time, provided the schedule for the completion of the staff's review. This letter transmits the NRC staff's comments on the ESSE based on that review plan.

As laid out in the review plan, the NRC staff conducted a limited review of the ESSE to determine if: 1) the application and interpretations of DOE's siting guidelines are consistent with those concurred in by the Commission; 2) technical evaluations are free of major concerns related to the use of data or interpretations; and 3) the peer review process for the ESSE is consistent with NRC's guidance on peer review as laid out in NUREG-1297, "Peer Review for High-Level Nuclear Waste Repositories." In general, the NRC staff comments only serve as examples of concerns, although the staff has cited the more important questions and inadequacies in its review. Due to the limited review, the lack of comment in a specific area does not necessarily mean that the staff agrees with the DOE's conclusion. The staff's examination of the peer review process was limited to the information presented in the accompanying report to the ESSE entitled, "Report of the Peer Review Panel on the Early Site Suitability Evaluation of the Potential Repository Site at Yucca Mountain, Nevada." Based on that limited review, the staff has no comments on that aspect of the ESSE at this time.

The staff's review was focused on whether or not all available data had been considered in the ESSE analyses, interpretations were reasonable, and appropriate alternative conceptual models had been considered. The review, as stated in the staff's review plan, was not conducted to determine the adequacy of the site with respect to the guidelines and did not include a detailed review of the ESSE analyses. Because the review was of limited scope and did not have the rigor and depth given to reviews of other program documents, should DOE plan to use conclusions based on the ESSE to make changes to its site characterization program, the rationale for those changes should be laid out in DOE's semi-annual Site Characterization Progress Reports.

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Based on the criteria defined in the review plan, the staff has identified five specific concerns. These concerns are organized into two categories which include three comments and two questions. The definitions of comments and questions are the same as those applied in the "NRC Staff Site Characterization Analysis of the Department of Energy's Site Characterization Plan, Yucca Mountain, Nevada" (NUREG-1347) and in reviews of study plans. Specifically, a comment is a concern with a particular area of the report or the DOE program that may result in a significant adverse effect on licensing if not resolved, and a question is a concern with the presentation of information. The detailed comments and questions are contained in the enclosure.

The NRC staff has particular interest in DOE's application of the siting guidelines (10CFR Part 960). The Commission expressly conditioned its concurrence on the siting guidelines on DOE's satisfying seven specific conditions, one of which was that the guidelines would make it clear that "engineered barriers cannot constitute a compensating measure for deficiencies in the geologic media..." (49 FR 9650). In response to the Commission's comments, Part 960.3-1-5, "Basis for site evaluation," discusses the evaluations of individual sites and comparisons between sites, and states that "... engineered barriers shall not be used to compensate for an inadequate site...." However, the staff believes that discussions in the ESSE imply that the engineered barrier system has been used to compensate for deficiencies in the site. This application of the guidelines is inconsistent with their original intent.

In addition, the staff believes that the bases to support high-level suitability findings (with the exception of the findings for dissolution) presented in the ESSE are insufficient and this level of findings may be premature and inconsistent with the intent of Part 960. Based on information contained in Part 960, Appendix III, it is anticipated that only lower level findings will be made prior to the start of significant site characterization activities, although it is recognized that "a higher level finding shall be made if there is sufficient evidence to support such a finding." Part 960, Appendix IV provides the types of information necessary to make findings at the nomination stage. On the basis of information collected thus far, the NRC staff does not believe high-level findings are warranted since DOE has just begun many site characterization activities and much of the data collected prior to the issuance of the Site Characterization Plan (SCP) still remains to be qualified. Based on the higher-level findings, the ESSE appears to paint a picture that implies that the basic characteristics of the site are well understood and that there is little need to gather additional data. The NRC staff believes that there is a significant difference in the information needed to support lower- (the disqualifying condition is not present or the site is likely to meet the qualifying condition, but additional data could change those conclusions) versus higher- (the disqualifying condition is not present or the site meets the qualifying condition and it is unlikely that additional information will change that conclusion) level findings. The NRC staff is concerned that the discussions and data are not sufficient to support the higher-level findings presented in the ESSE with a high degree of confidence. By projecting an image that no additional data need to be collected, DOE may be unnecessarily limiting its data collection activities. Because DOE plans to use the ESSE to focus and prioritize future data acquisition

activities, it is important that the document portray an accurate picture of the amount of data and data collection activities needed to support the findings with a high degree of confidence. The staff believes that the ESSE is only one of several inputs to the prioritization of studies and the evaluations in the ESSE should not be used as a basis to terminate any proposed studies laid out in the SCP.

Expert judgment is frequently used to estimate site characteristics for which experimental or test data are not available. At this stage of site development, such use is entirely appropriate. Nevertheless, the NRC staff wishes to reemphasize its earlier cautions that expert judgment should not generally be viewed as a substitute for analyses, field or experimental data, or other more technically rigorous information that is reasonably available or obtainable. As site characterization proceeds, DOE should make every reasonable effort to develop "hard" data rather than relying on expert judgment for estimates of site characteristics.

The NRC staff notes that use of expert judgment in the ESSE does not generally conform to the "good practices" discussed in references such as NUREG/CR-5411, "Elicitation and Use of Expert Judgment in Performance Assessment of High-Level Radioactive Waste Repositories," by E.J. Bonano and others. For purposes of the ESSE, it may not be necessary to follow such "good practices" for all elicitations of expert judgment. The ESSE is not a licensing document, but it is proposed as a management tool by DOE to focus and prioritize characterization activities at Yucca Mountain. If the information contained in the ESSE is used to prioritize future data collection activities, or as a justification for not collecting certain types of data, the NRC staff strongly recommends that such decisions by expert judgments be obtained by following the "good practices" recommended in NUREG/CR-5411.

The staff believes that DOE should assure that those judgments expressed in the ESSE that will be used to prioritize future data collection activities are supported by appropriate data, analyses, information, and consideration of alternative models. Based on the staff's review of the ESSE and as elaborated on in the attached comments, it is not clear that judgments presented in that report, which may be used as a basis to preclude the collection of information to ultimately demonstrate compliance with the requirements in 10 CFR Part 60, are based on appropriate and necessary data and analyses.

The March 3, 1992, letter (Roberts to Holonich) transmitting the ESSE indicated that the ESSE would be used "to focus and prioritize future data acquisition activities and to provide a foundation for resolution of technical issues concerned with site evaluation." The ESSE is a DOE contractor report that clearly states that "judgments presented in this report [ESSE]... are not findings or conclusions made or endorsed by the U.S. Department of Energy." For these reasons, it is unclear to the NRC staff how the DOE proposes to use the results of the ESSE. In addition, it is unclear how the ESSE relates to the performance allocation and issue resolution processes described in the SCP by which information needed to resolve issues for site characterization is identified, and how the judgments made in the ESSE, if adopted by DOE, will be integrated into various documents such as the semi-annual Progress Reports and the Mined Geologic Disposal System Annotated Outline.

Mr. John P. Roberts

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Finally, one of the things to be considered with respect to the siting guidelines is the potential need to modify those guidelines in the future in response to possible changes in 10 CFR Part 60 and 40 CFR Part 191. For example, the higher-level suitability findings in the ESSE for the Individual Protection and Ground Water Protection Requirements of the U.S. Environmental Protection Agency (EPA) standard, 40 CFR 191, may not be supported given the possible changes to the standard. Publically available working drafts of the revised EPA standard indicate that the time period of consideration for 40 CFR 191.15 and 191.16 may be changed to 10,000 years, thus making the criteria more restrictive. Future iterations of the ESSE should reflect the considerations that will be necessary if the performance period for the Individual Protection and Ground Water Protection Requirements of 40 CFR 191 are changed to 10,000 years.

If you have any questions related to the staff's comments or the review plan for the ESSE, please contact Charlotte Abrams, of my staff, at (301) 504-3403.

Sincerely,



Joseph J. Holonich, Director
Repository Licensing and Quality
Assurance Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosures: As stated

cc: R. Loux, State of Nevada
T. J. Hickey, Nevada Legislative Committee
C. Gertz, DOE/NV
S. Bradhurst, Nye County, NV
M. Baughman, Lincoln County, NV
D. Bechtel, Clark County, NV
D. Weigel, GAO
P. Niedzielski-Eichner, Nye County, NV
B. Mettam, Inyo County, CA
V. Poe, Mineral County, NV
F. Sperry, White Pine County, NV
R. Williams, Lander County, NV
P. Goicoechea, Eureka County, NV
L. Vaughan II, Esmeralda County, NV
C. Shank, Churchill County, NV
B. Barnard, NWTRB

Section 2.3.7.3.3 Conclusions and Recommendations for Future Postclosure Tectonics Activities

ESSE COMMENT 1

The treatment of engineered barriers for Postclosure Tectonics appears to be inconsistent with the intended application of the 10 CFR Part 960 Siting Guidelines.

BASIS

In 1984, NRC agreed to concur in the DOE siting guidelines provided seven conditions were met. These conditions were stated in 49 FR 9650. NRC Condition 4 stated that the Commission would concur provided DOE "modifies the siting guidelines to make clear that engineered barriers cannot constitute a compensating measure for deficiencies in the geologic media during site screening."

In response to the NRC concerns, as well as the concerns raised by the U.S. Environmental Protection Agency, the States of Texas and Nevada, and some citizens groups, the DOE provided a section 960.3-1-5, "Basis for Site Evaluation." Section 960.3-1-5 states "... engineered barriers shall not be used to compensate for an inadequate site; mask the innate deficiencies of a site; disguise the strengths and weaknesses of a site and the overall system; and mask differences between sites when they are compared."

In the discussion of Qualifying conditions on page 2-116 of the ESSE, it is apparent that DOE places importance on the design of the engineered barrier system (EBS) in making an evaluation against the siting guidelines. The ESSE states: "Ground motion is highly unlikely to cause damage to the waste canisters, assuming reasonable conservatism in the design of canister emplacement."

The findings in the ESSE for postclosure tectonics appear to be based on considerations of an EBS design that could disguise or compensate for weaknesses of a site.

RECOMMENDATION

Although the EBS design may provide for additional margins of safety in a licensed repository, DOE should evaluate the site against the siting guidelines without implying that the EBS is being used to compensate for a weakness of the site with respect to postclosure tectonics. The staff believes this is critical during the evaluation of the site's suitability so that the collection of data to identify site deficiencies is not precluded.

U. S. Nuclear Regulatory Commission, "Preliminary Decision Related to U. S. Department of Energy's General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories," Federal Register, Vol. 49, No. 51, March 14, 1984, pp. 9650-9661.

U. S. Department of Energy, "10 CFR Part 960, Nuclear Waste Policy Act of 1982; General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories," Federal Register, Vol. 49, No. 236, December 6, 1984, pp. 47714-47770.

Section 2.3.4.3.2.1 Tectonic Models**Section 2.3.7.3.2.6 Probabilistic Volcanic-release Models****ESSE COMMENT 2**

The analyses and conclusions provided within the referenced sections do not appear to reflect the conservatism required by 10 CFR Part 960.

BASIS

In developing bases for evaluating the ability of a site to meet the qualifying conditions of the guidelines, "...assumptions that approximate the characteristics or conditions considered to exist at a site, or expected to exist or occur in the future, may be used. These assumptions will be realistic but conservative enough to estimate the potential for a site to meet the qualifying condition of a guideline...." (Part 960.3-1-4-2)

On page 2-102 of the ESSE, although the theories of Smith and others (1990) are discussed, they are generally dismissed with the statement "The Crowe and Perry (1989) analysis is considered to be more rigorous...."

In the discussion of probabilistic volcanic-release models on page 2-114 and 2-115 the DOE only presents numbers generated in various publications by Crowe with the general statement that "Numerous assumptions that are believed to be conservative underlie the probability estimates...."

One of the most obvious differences between the models of Smith and his coworkers and Crowe and his coworkers is the orientation assumed for the controlling features. As has been shown in such places as Sheridan (1992), if the other factors are held constant the change in orientation can cause about an order of magnitude difference in the results with the northwest orientation theorized by Crowe providing the least conservative results.

RECOMMENDATION

DOE should consider alternative conceptual models and, based on presently available data, reevaluate the assumptions used in arriving at findings related to tectonics and volcanism to assure that they are conservative in accordance with the requirements of 10 CFR 960.

REFERENCES

B. M. Crowe and F. V. Perry, "Volcanic Probability Calculations for the Yucca Mountain Site: Estimation of Volcanic Rates," in FOCUS '89, Proceedings of the Topical Meeting on Nuclear Waste Isolation in the Unsaturated Zone, American Nuclear Society, Las Vegas Nevada (1989)

M. F. Sheridan, "A Monte Carlo Technique to Estimate the Probability of Volcanic Dikes," in Proceedings of the Third International Conference, High Level Radioactive Waste Management, Las Vegas, Nevada, April 12-16 (1992)

E. I. Smith, D. L. Feuerbach, T. R. Naumann, and J. E. Faulda "The Area of Most Recent Volcanism Near Yucca Mountain, Nevada: Implications For Volcanic Risk Assessment," in Proceedings of the International Topical Meeting on High Level Radioactive Waste Management, Las Vegas, Nevada (1990)

U. S. Department of Energy, "10 CFR Part 960, Nuclear Waste Policy Act of 1982; General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories: Final Siting Guidelines," Federal Register, Vol. 49, No. 236, pp 47714-47770 (1984)

Section 2.3.7 Postclosure Tectonics Technical Guideline

ESSE COMMENT 3

The higher-level suitability findings for the qualifying and disqualifying conditions appear to be inconsistent with the intent of 10 CFR Part 960.

BASIS

Part 960, Appendix III anticipates that only lower-level findings will be made prior to the start of significant site characterization activities. However, Appendix III states, "For both the disqualifying and qualifying conditions of any guideline, a higher finding shall be made if there is sufficient evidence to support such a finding." As site characterization continues and more data is gathered, it may be appropriate to make higher-level findings.

Part 960, Appendix IV specifies the types of information "...that the DOE expects will be included in the evidence used for evaluations and applications of the guidelines..." at the nomination stage. For example, for tectonics, Section 960.4.2.7 of Appendix IV states the types of information needed to make findings, such as "Quaternary faults in the geologic setting, including their length, displacement, and any information regarding the age of latest movement."

The ESSE (Page 2-117) states that "Yucca Mountain and the surrounding vicinity have been intensely studied by means of geologic mapping, geophysical surveys, remote sensing, and geomorphic analysis." However, the Site Characterization Plan outlines data needs in a series of investigations to gather information such as the age, length, and displacement of faults at the proposed site and in the geologic repository operations area.

The NRC staff considers that data collected to this point and available for review is not sufficient to define the characteristics of Quaternary faulting at Yucca Mountain to the extent required to support a high-level finding. Significant uncertainties about the nature and rates of faulting and applicable tectonic models exist at the Yucca Mountain site, such that higher level findings are not warranted at this time. This condition also appears to be true in the case of the high-level findings for natural resources and erosion expressed in the ESSE.

RECOMMENDATION

Higher-level findings appear not to be supported by the existing data and are not consistent with the intent of Part 960. Those findings should be re-evaluated based on the information provided in Part 960, Appendices III and IV.

Section 2.4.4 Steps Needed to Support Higher-level Suitability Findings for the Postclosure System Guideline

ESSE QUESTION 1

What is the relationship between the judgments regarding data needs expressed in the ESSE and the information needs identified through the performance allocation and issue resolution process, as documented in DOE's Site Characterization Plan (SCP)?

BASIS

The March 3, 1992, letter (Roberts to Holonich) transmitting the ESSE states that judgments made and expressed in the ESSE will be used to focus and prioritize future data acquisition activities and to aid in the resolution of the site technical issues.

Performance allocation is a formal process that provides the rationale for establishing particular site characterization activities to obtain the information DOE considers necessary to resolve the issues related to 10 CFR Part 60. This process was applied by DOE in the generation of its plans for the characterization of the Yucca Mountain site (DOE, 1988).

It is not clear to the staff how the judgments expressed in the ESSE are related to the identified information needs generated by the performance allocation process.

RECOMMENDATION

DOE should assure that the prioritization of future data collection activities based on judgments documented in the ESSE is consistent with the acquisition of that information considered necessary to resolve site issues, as generated by the performance allocation and issue resolution process described in the SCP, applied to site suitability and licensing, and implemented through the semi-annual Progress Reports.

REFERENCE

U.S. Department of Energy, 1988, "Site Characterization Plan: Yucca Mountain site, Nevada Research and Development Area, Nevada," DOE/RW-0199.

Section 2.0 Evaluation of the Postclosure Guidelines

ESSE QUESTION 2

How were 10 CFR Part 960 "Favorable Conditions," and "Potentially Adverse Conditions" used to determine site suitability findings for either the qualifying or disqualifying conditions?

BASIS

An important requirement of 10 CFR Part 960 for each technical guideline is an evaluation of both favorable conditions and potentially adverse conditions. The ESSE does not appear to directly consider individual favorable and potentially adverse conditions in the evaluation of either the qualifying or disqualifying conditions.

The supplementary information section of Part 960 (Recommendation of sites for characterization, 960.3-2-2) states that "... standards of site suitability to be used by the licensing authority (NRC) are to be reflected in the guidelines so that siting and other program decisions will be consistent with these requirements."

The supplementary information section of Part 960 (IV.A. Structure of the Guidelines) states that "The inclusion of the favorable and adverse conditions is based on 10 CFR Part 60. These conditions can be used to predict the suitability of a site before detailed studies of the site have been performed. They provide preliminary indications of systems performance."

The supplementary information section of 10 CFR 960 (IV.A. Structure of the Guidelines) states that "Although favorable conditions need not exist at a given site for that site to meet the qualifying conditions, the existence of such conditions leads to an expectation that subsequent evaluations will yield enhanced confidence in a site's suitability. Similarly, the purpose of determining whether any potentially adverse conditions exist at a site is to provide an early indication of conditions that must be examined carefully before judging the acceptability of that site. Such examinations must evaluate the effects of the other, possibly compensatory conditions of the site. Thus a site that has most of the favorable conditions may be presumed likely to meet the system guidelines, while a site with many potential adverse conditions may not meet them."

Part 960.3-1-5 states that "... for each technical guideline, an evaluation of compliance with the qualifying condition shall be made in the context of the collection of system elements and the evidence related to that guideline, considering on balance the favorable conditions and the potentially adverse conditions identified at the site."

RECOMMENDATION

Explain how favorable conditions and potentially adverse conditions were integrated into the ESSE evaluation of qualifying and disqualifying guidelines.

REFERENCE

U.S. Department of Energy, "10 CFR Part 960, Nuclear Waste Policy Act of 1982; General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories; Final Siting Guidelines," Federal Register, Vol. 49, No. 236, December 6, 1984.