FEB 06 1994

Dr. Daniel A. Dreyfus, Director
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Dr. Dreyfus:

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION STAFF COMMENTS ON SITE CHARACTERIZATION PROGRESS REPORT NUMBER 8

On September 22, 1993, the U.S. Department of Energy (DOE) transmitted the "Progress Report on Site Characterization: Yucca Mountain, Nevada, Number 8" (PR) to the U.S. Nuclear Regulatory Commission (NRC). The staff's review was conducted in accordance with the guidance delineated in the "Review Plan for NRC Staff Review of DOE Site Characterization Progress Reports," issued August 10, 1990. As a result of the review, the NRC staff has identified no objections, as defined in the PR Review Plan. However, the staff has identified several concerns that are discussed later in this letter and in Enclosure 1.

In previous letters transmitting the NRC staff's reviews on PRs (letters from R. Bernero to J. Bartlett, June 25, 1990, and October 27, 1992, and to L. Barrett, May 5, 1993) it was requested that DOE address progress on Site Characterization Analysis (SCA) concerns in PRs. Therefore, an important component of the staff's review has been to evaluate DOE's progress on SCA concerns, in addition to evaluating whether or not the PR was responsive to the staff's concerns on previous PRs. The staff believes that DOE is continuing to make progress in its efforts to respond to many of the SCA and PR concerns. The revision of Table 2-1, page 2-19, in PR 8, that presents information on those actions that DOE is taking to resolve the remaining SCA open items represents an improvement over previous PRs.

The staff's review of PR 8 has resulted in one comment and four questions (Enclosure 1). The enclosed comment and questions will be tracked as open items similar to SCA and study plan comments and questions. The DOE did not propose to close any SCA open items based on information provided in PR 8, but provided information in response to the staff's review of PRs 6 and 7 (letter from D. Shelor to J. Holonich, September 17, 1993). Enclosure 2 contains the staff's evaluation of DOE's responses, with the exception of PRs 6 and 7 Comment 3 and Question 1. Comment 3 noted the absence of an updated Q-List of those items and activities covered by the 10 CFR Part 60, Subpart G (which references 10 CFR Part 50 Appendix B). On December 23, 1993, DOE transmitted a revised copy of the Yucca Mountain Project Q-list, Revision 2 of YMP/90-55, to NRC (letter from D. Shelor to C. W. Reamer). The staff is reviewing the revised Q-list and will advise DOE of the status of Comment 3 following the conclusion of that review. DOE's response to Question 1 related to the

102.8
WM-11
NH16

potential for air movement from the exploratory studies facility to adversely impact the collection of geochemical data necessary for site characterization, is under continued review by the staff. The staff intends to complete its review of this concern in early 1994.

This letter is intended to transmit information for DOE's use in the preparation of future PRs. If you have any concerns with these observations or information contained in the Enclosures, we are available to meet with you and your staff as needed. Please contact me or Ms. Charlotte Abrams of my staff if there are any questions regarding this letter. I can be reached at (301) 504-3352; Ms. Abrams can be reached at (301) 504-3403.

Sincerely,

Original signed by
Robert M. Bernero
Robert M. Bernero, Director
Office of Nuclear Material
Safety and Safeguards

Enclosures: As stated

cc: R. Loux, State of Nevada
T. J. Hickey, Nevada Legislative Committee
J. Meder, Nevada Legislative Counsel Bureau
R. Nelson, YMPO
M. Murphy, 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. Mariani, White Pine County, NV
R. Williams, Lander County, NV
L. Fiorenzi, Eureka County, NV
J. Hoffman, Esmeralda County, NV
C. Schank, Churchill County, NV
L. Bradshaw, Nye County, NV

C 2/1/94

* See previous concurrence

OFC	HLPD* E	HLPD*	HLGE*	HLHP*	HLPD*
NAME	CAbrams/dh	PPrestholt	RBallard	MFederline	CWReamer
DATE	01/19/94	01/19/94	01/19/94	01/19/94	01/19/94

OFC	HLWM	HLWM	NMSS	NMSS	
NAME	JLinehan	JYoungblood	GArlotto	RBernero	
DATE	01/31/94	02/1/94	01/ /94	02/6/94	

C = COVER E = COVER & ENCLOSURE N = NO COPY

g:\PR8FIN OFFICIAL RECORD COPY

2/2/94

propose to close any SCA open items based on information provided in PR 8, but provided information in response to the staff's review of PRs 6 and 7 (letter from D. Shelor to J. Holonich, September 17, 1993). Enclosure 2 contains the staff's evaluation of DOE's responses, with the exception of PRs 6 and 7 Comment 3 and Question 1. Comment 3 noted the absence of an updated Q-List of those items and activities covered by the 10 CFR Part 60, Subpart G (which references 10 CFR Part 50 Appendix B). On December 23, 1993, DOE transmitted a revised copy of the Yucca Mountain Project Q-list, Revision 2 of YMP/90-55, to NRC (letter from D. Shelor to C. W. Reamer). The staff is reviewing the revised Q-list and will advise DOE of the status of Comment 3 following the conclusion of that review. DOE's response to Question 1 related to the potential for air movement from the exploratory studies facility to adversely impact the collection of geochemical data necessary for site characterization, is under continued review by the staff. The staff intends to complete it's review of this concern in early 1994.

This letter is intended to transmit information for DOE's use in the preparation of future PR's. If you have any concerns with these observations or information contained in the Enclosures, we are available to meet with you and your staff as needed. Please contact me or Mr. C. William Reamer of my staff if there are any questions regarding this letter. I can be reached at (301) 504-3352, Mr. Reamer can be reached at (301) 504-3387.

Sincerely,

Robert M. Bernero, Director
Office of Nuclear Material
Safety and Safeguards

Enclosures: As stated

cc: R. Loux, State of Nevada
T. J. Hickey, Nevada Legislative Committee
J. Meder, Nevada Legislative Counsel Bureau
R. Nelson, YMPO
M. Murphy, 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. Mariani, White Pine County, NV
R. Williams, Lander County, NV
L. Fiorenzi, Eureka County, NV
J. Hoffman, Esmeralda County, NV
C. Schank, Churchill County, NV
L. Bradshaw, Nye County, NV

OFC	HLPD	E	HLPD	C	HLGE	E	HLHP		HLPD	C
NAME	CAbrams/dh		PPresthost		RBallard		MFederline		CWReamer	
DATE	01/14/94		01/14/94		01/14/94		01/14/94		01/19/94	

OFC	HLWM		HLWM		NMSS		NMSS			
NAME	JLinehan		JYoungblood		GArlotto		RBernero			
DATE	01/ /94		01/ /94		01/ /94		01/ /94			

C = COVER E = COVER & ENCLOSURE N = NO COPY
g:\PR8FIN OFFICIAL RECORD COPY

DISTRIBUTION FOR LETTER TO DR. DANIEL A. DREYFUS, DATED FEB 06 1994
SUBJECT; U.S. NRC STAFF COMMENTS ON SITE CHARACTERIZATION PROGRESS REPORT NUMBER 8

DISTRIBUTION

CNWRA	NMSS R/F	HLPD R/F	LSS
LPDR	ACNW	PDR	CENTRAL FILE
BJYoungblood, HLWM	JLinehan, HLWM	RBallard, HLGE	MFederline, HLHP
On-Site Reps	Dir Off r/f		

ENCLOSURE 1

SubSection 1.3.5 International Program

COMMENT 1

The definition and use of natural analogs as given in this subsection are not consistent with the staff's position on the meaning of the term as used in 10 CFR Part 60 and the range of topics to which natural analog studies can apply appears to be too restrictive.

BASIS

On page 1-18 DOE outlines the results of the Natural Analogue Review Group (NARG) noting that the NARG report states, "natural analogue studies should be process-oriented and should basically address the issues resulting from the perturbation of a natural system (the geologic site) by the introduction of a technological system (the repository)." Furthermore, the NARG report states that, "...all investigations normally part of site characterization, even when considering comparisons with similar remote sites, such as (paleo)hydrology, etc., should not be considered as natural analogue studies."

In a letter from Holonich to Roberts (September 28, 1992) the staff indicated to DOE that "These recommendations are inconsistent with 10 CFR Part 60 which recognizes use of natural analog studies in support of a broad range of both performance assessment and site characterization activities." The letter continued that if the NARG report was used to develop a strategy and program of study for natural analogs, "...your scope of 'natural analog studies' may be defined too narrowly."

In Question 12 of the Site Characterization Analysis (NRC, 1989), the staff noted that natural analogs may be necessary in the study of processes related to basaltic volcanism.

The term "natural analog studies" as used in 10 CFR Part 60 broadly includes topics related to both performance assessment and site characterization (Bradbury, 1993).

In the staff technical position, "Investigations to Identify Fault Displacement Hazards and Seismic Hazards at a Geologic Repository" (NRC, 1992), the staff noted that requirements of 60.21(c)(1)(ii) including citations related to natural analog studies were applicable to the identification of fault displacement hazards and seismic hazards.

In the Draft Regulatory Guide, DG-3003 ("Format and Content for the License Application for the High-Level Waste Repository"), the staff notes that natural analogs are applicable to a broad range of geological factors, including faulting, seismicity, and volcanism (NRC, 1990, p. 3-1).

RECOMMENDATION

Adopt a broader definition of natural analog studies to ensure the full benefit of this information in guiding site characterization, validating conceptual models, and estimating repository performance.

REFERENCES

Bradbury, J.W., 1993, Natural Analog Studies: Licensing Perspective, in Murphy, W.M. and Kovach, L.A., eds., The Role of Natural Analogs in Geologic Disposal of high-Level Nuclear Waste Regulatory Analyses: Center for Nuclear Waste Regulatory Analyses, San Antonio, CNWRA 93-020, p. 15-20.

U.S. Nuclear Regulatory Commission, "NRC Staff Site Characterization Analysis of the Department of Energy's Site Characterization Plan, Yucca Mountain Site, Nevada," NUREG-1347, August 1989.

U.S. Nuclear Regulatory Commission, "Format and Content for the License Application for the High-Level Waste Repository," Office of Nuclear Regulatory Research, Draft regulatory Guide DG-3003, November 1990.

U.S. Nuclear Regulatory Commission, "Staff Technical Position on Investigations to Identify Fault Displacement Hazards and Seismic Hazards at a Geologic Repository," NUREG-1451, July 1992.

U.S. Nuclear Regulatory Commission, Letter from J. Holonich (NRC) to J.Roberts (DOE); Subject: Department of Energy Development of Natural Analog Studies, September 28, 1992, 2 pp. plus 1 enclosure.

Section 2.1.8 Site Characterization Program Baseline

QUESTION 1

How will DOE ensure that a comprehensive set of alternative conceptual models will be considered during site characterization?

BASIS

- On page 2-42, it is stated that in Revision 9 to the Site Characterization Program Baseline (SCPB), the hypothesis testing tables were removed from the SCPB. Although the reasons for their removal are not explicitly stated, it is implied in the discussion that DOE considers their presence unnecessary as the alternative conceptual models contained in the tables in the SCP are currently under active consideration by DOE.

- In the Site Characterization Plan (SCP, DOE, 1988), it is stated that "[s]ystematic hypothesis testing is being employed to discriminate between alternative conceptual models by eliminating untenable or nonviable hypotheses and to evaluate the likelihoods that alternative, admissible conceptual models are applicable" (p. 8.3.1.1-6). Hypothesis testing tables were developed for the SCP "to ensure comprehensive consideration of potentially viable alternative conceptual models and to document this consideration" (p. 8.3.1.1-6).

- In Comment 6 of its Site Characterization Analysis (SCA) of the SCP (NRC, 1989), the staff expressed its concern that the hypothesis testing tables in the SCP were not integrated across technical disciplines, and did not in all cases, cite studies that would distinguish between the alternative conceptual models identified in the tables.

RECOMMENDATION

A description of the systematic method through which a comprehensive set of alternative conceptual models will be considered in site characterization and their consideration documented should be included in the text, or by reference, in future Progress Reports.

REFERENCES

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

U.S. Nuclear Regulatory Commission, 1989, "NRC Staff Site Characterization Analysis of the Department of Energy's Site Characterization Plan, Yucca Mountain Site, Nevada," Office of Nuclear Material Safety and Safeguards, NUREG-1347.

Section 2.1.8 Site Characterization Program Baseline

QUESTION 2

How was the replacement of the Expected Partial Performance Measure (EPPM) with the Complementary Cumulative Distribution Function (CCDF) in the Site Characterization Program Baseline (SCPB) accomplished?

BASIS

- On page 2-44, it is stated that in Revision 10 of the SCPB, "[t]he performance measure, Expected Partial Performance Measure, was replaced with CCDF throughout [Section 8.3.5.13 of the SCPB] for consistency with current planning in the PA program."

- In the SCP (DOE, 1988), the EPPM was used to screen scenarios and to establish goals for the performance allocation used to guide site characterization. The staff considers that the CCDF cannot be used for similar purposes, and if a straight exchange of "CCDF" for "EPPM" was made in the SCPB, then goals established for performance allocation will be in question.

RECOMMENDATION

The revisions made to the SCPB concerning the replacement of EPPM with CCDF should be discussed in future 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 2.6.1 Postemplacement Near-Field Environment (SCP 8.3.4.2)
Section 2.6.1.3 Study 1.10.4.2 Hydrologic Properties of Waste Package Environment

QUESTION 3

What is DOE's overall approach to validation and verification of models?

BASIS

- On page 2-173, it is stated that DOE/Lawrence Livermore National Laboratory proposes to replace "model validation" and "verification" of hydrologic models with the following process:

  > "(1) using models to obtain a better fundamental understanding of the system, (2) asking what it is about the system that needs to be predicted, (3) utilizing this understanding to formulate fundamental hypotheses that are the basis of the conceptual models and performance attributes of the system, and (4) performing analyses and experiments in an attempt to test or invalidate the conceptual models (or hypotheses)."

- It is not clear (1) how this proposed approach improves upon the concepts and approach outlined in Section 8.3.5.20 of the SCP (DOE, 1988), (2) whether this process will be applied to models developed for other disciplines beyond that of hydrology, and (3) whether this process is consistent with the approach taken for validation of the hydrologic models being developed for predicting ground-water travel time (discussed in Section 2.7.5 of Progress Report 8).

- It also is not clear whether or how, this proposed process will address the concerns in Site Characterization Analysis Comment 56 (NRC, 1989).

RECOMMENDATION

The use of models will be an important aspect of licensing. It is important that DOE develop strategies for the verification and validation of the models at an early time so scientific investigations necessary for validation can be formulated and performed.

REFERENCES

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

U.S. Nuclear Regulatory Commission, 1989, "NRC Staff Site Characterization Analysis of the Department of Energy's Site Characterization Plan, Yucca Mountain Site, Nevada," Office of Nuclear Material Safety and Safeguards, NUREG-1347.

Activity 8.3.1.3.2.2.1 - History of mineralogical and geochemical alteration of Yucca Mountain

QUESTION 4

How effective will the zeolites be in retarding radionuclides if they are 2 to 10 million years old and have not experienced significant ion exchange for that period of time? Also, if the zeolites were sampled from the rock matrix, how effectively can matrix diffusion retard radionuclides, given the apparent closed system behavior of the zeolites?

BASIS

Progress Report 8 states that a study evaluating the use of K/Ar geochronology in determining the alteration history of the zeolitized portions of Miocene tuffs at Yucca Mountain was completed.

Using potassium/argon (K/Ar) dating techniques, WoldeGabriel and others, 1992, determined that zeolites from drillholes in the Yucca Mountain vicinity range in age from 2 million years to 10 million years old, with older zeolites generally occurring in the saturated zone.

The potassium/argon dating technique assumes that the system dated be closed with respect to potassium and argon.

However, ion exchange involving potassium and sodium on zeolites has been shown to reach equilibrium in about two days (Pabalan, 1991).

Study Plan 8.3.1.3.2.2 states that "possible postcrystallization K exchange in zeolites will be investigated by examining dating results for inconsistencies."

WoldeGabriel and others, 1992, state that "the precision of preliminary clinoptilolite K/Ar dates are acceptable and similar results suggest some sensible meaning to the dates obtained."

RECOMMENDATION

Explain the implications of the results of K-Ar dating of zeolites, which appear to exhibit closed system behavior with respect to ion exchange for the last 2 to 10 million years, on flow and radionuclide transport at Yucca Mountain.

REFERENCES

Pabalan, R. T., 1991, Nonideality effects on the ion exchange behavior of the zeolite mineral clinoptilolite, Mat. Res. Soc. Symp. Proc., vol. 212, p. 559-567.

WoldeGabriel, G., Broxton, D. E., Bish, D. L., and Chipera, S. J., 1992, Preliminary assessment of clinoptilolite K/Ar results from Yucca Mountain, Nevada, USA: A potential high-level radioactive waste repository site, Water-Rock Interaction, Kharaka & Maest (eds.), Balkema, Rotterdam.

ENCLOSURE 2

Section 2.6.5.3 Activity 1.4.2.1 - Selection of the container materials for the license application design

PROGRESS REPORTS 6 AND 7 COMMENT 1

Since the issuance of the Site Characterization Plan there has been no updated information provided on the Yucca Mountain Project's official reference advanced conceptual waste package design.

EVALUATION OF DOE RESPONSE

PR 8 presents current information concerning the waste package (WP) program.

The response states that the reference design of the waste package/engineered barrier system in accordance with the SCP has not been changed.

Useful information on advanced conceptual design (ACD) WP concepts was discussed at the (DOE/NRC) Technical Exchange on Substantially Complete Containment on August 24, 1993.

PR 8 (Section 2.6, p. 2-162) contains a list of ACD WP concepts. However, references documenting these concepts have not been provided in the PR.

The staff believes that future PR updates should provide reference documents of ACD WP concepts.

The staff considers this comment resolved.

Section 2.1.2 Exploratory Studies Facility (ESF) Design and Construction
Section 2.4 Repository Design

PROGRESS REPORTS 6 AND 7 COMMENT 2

Although the ESF design has undergone major changes since the issuance of the Site Characterization Plan (SCP), those changes and how they affect the potential repository have not been reflected in Progress Reports.

EVALUATION OF DOE RESPONSE

The topic of this comment about receiving timely information related to the ESF was one of the topics of a DOE/NRC management meeting on September 17, 1993, and a Technical Exchange on October 4-5, 1993. At both meetings, in the Progress Report 8, and in the response to this comment, the DOE presented material to bring the NRC staff up-to-date on ESF activities.

The NRC staff considers this comment resolved.

Section 2.2.6 Postclosure Tectonics (SCP Section 8.3.1.8)
Section 2.6.1 Post Emplacement Near-Field Environment (SCP Section 8.3.4.2)

PROGRESS REPORTS 6 AND 7 QUESTION 2

How and to what extent is DOE factoring site characterization analyses into its Total System Performance Assessment (TSPA) calculations and how are the results and preliminary conclusions of performance assessment activities being considered in on-going and future site characterization activities?

EVALUATION OF DOE RESPONSE

In the DOE's response to NRC staff comments, questions, and observations on Site Characterization Progress Reports 6 and 7 (Shelor to Holonich, September 17, 1993), DOE addressed the specific examples (i.e., near-field environmental thermal studies and basaltic volcanism scenarios) provided in the bases for the NRC staff's question. DOE provided some discussion of the linkages between site characterization and laboratory studies in these areas with its TSPA efforts.

DOE also stated that the NRC staff's recommendation to include information documenting the linkage between site characterization and performance assessment will be acted upon in future progress reports.

The NRC staff considers this question resolved.

Section 2.4.3.1 Design Activity 8.3.1.4.1.1 - Design activity to verify access and drift usability.

PROGRESS REPORTS 6 AND 7 QUESTION 3

How does DOE plan to demonstrate confidence in the drift design methodology?

EVALUATION OF DOE RESPONSE

The recommendation of the question was that DOE "Demonstrate that the design methodology will result in a successful design or modify the design methodology to produce a support system in which the allowable stresses are not exceeded ...." The response of the DOE is that it "... plans to demonstrate confidence ...." Although DOE has not yet made the demonstration, the plan that DOE presents could lead to an effective demonstration.

The staff considers this question resolved.

Table 2.1 Status of SCA Open Items

PROGRESS REPORTS 6 AND 7 QUESTION 4

What specific plans and studies are proposed to address NRC's Site Characterization Analysis open items?

EVALUATION OF DOE RESPONSE

The DOE responded as follows: "DOE has revised Table 2-1 (Status of Site Characterization Open Items) of Progress Report 8 to more specifically identify the actions currently planned to address each SCA open item. The actions identified include specific steps that need to be performed to resolve the concern, and/or what specific study plans, studies, reports, etc., that need to be prepared. However, the discussions of all studies and activities reported in PR 8 do not reference each open item to which that particular study or activity may provide input."

This open item has been addressed by revising Table 2-1 to specify the further actions required to address each SCA open item.

The NRC staff considers this question resolved.