



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ENCLOSURE 1

DEC 30 1993

Mr. Dwight E. Shelor, Associate Director
for Systems and Compliance
Office of Civilian Radioactive Waste Management
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Mr. Shelor:

SUBJECT: STATUS OF REVIEW OF TOPICAL REPORT ON EXTREME EROSION

On March 9, 1993, the U.S. Department of Energy (DOE) transmitted the topical report, "Evaluation of the Potentially Adverse Condition of Extreme Erosion During the Quaternary Period at Yucca Mountain, Nevada" (hereafter, Topical Report) for review by staff of the U.S. Nuclear Regulatory Commission. The primary purpose of the Topical Report is to provide a means for early resolution of the regulatory issue - "evidence of extreme erosion during the Quaternary Period" [10 CFR Part 60.122(c)(16)]. In the Topical Report DOE presents its technical bases for demonstrating that the potentially adverse condition (PAC) "extreme erosion" is not present at Yucca Mountain, Nevada.

Based upon its preliminary evaluation of the Topical Report the staff has identified, as described below, four concerns, the resolution of which are essential in order for the staff to complete its review of the Topical Report and to prepare a Safety Evaluation on extreme erosion. The concerns are provided for your information and are considered preliminary, subject to change and are not considered by the staff to be "open items." In our opinion, the staff would be unable to reach a conclusion in the draft Safety Evaluation without a resolution of these concerns.

1. Scope of the Topical Report

The stated purpose of the Topical Report is to demonstrate that the PAC "extreme erosion" is not present at Yucca Mountain. The Topical Report however, focuses instead on long term denudation (the wearing down of the earth's surface simultaneously by various natural agencies, one of which is erosion). Although the Topical Report agrees (p. 3) with the staff's definition of "extreme erosion" as the "occurrence of substantial changes in land forms (as a result of erosion) over relatively short intervals of time", the Topical Report states (p. 31) that "The erosion rates calculated in this study are long-term erosion rates that average the effects of processes operating on these hill-slopes through at least several, probably many, cycles of hill-slope aggradation and degradation." With respect to the above term "substantial changes" the staff believes that, in considering extreme erosion, the maximum amount of vertical and lateral change in the earth's surface (as a result of the mechanical destruction of the land and removal of the material through erosion) that can reasonably be

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determined to have occurred at, and near the flanks of Yucca Mountain, Nevada, should be defined. Furthermore, the staff believes that "relatively short intervals of time" refers to those intervals having occurred during the Quaternary period which approximate the regulatory period of performance (i.e., 10,000 to 100,000 years). The staff believes that DOE may be unable to demonstrate the absence of the PAC if the assessment relies on average denudation estimates over long intervals of time (i.e., in excess of 100,000 years).

2. Reliance upon a Single Controversial Dating Method

The conclusions reached in the Topical Report are supported entirely through the dating of boulder rock varnish by the varnish cation ratio (VCR) dating method. Considering the controversial nature of this method the staff considers that the varnish cation ratio methodology should be thoroughly documented and supported, including the extent to which uncertainties inherent in the methodology may contribute to underestimating the presence of the PAC.

The staff considers that neither the Topical Report nor subsequent documents submitted in response to the staff's October 15, 1993, acceptance letter to the Department of Energy provide data sufficient to support the conclusions regarding the age of boulder deposits as described in the Topical Report. For example, the raw data for tests conducted on two of the points presented on the rock varnish calibration dating curve were not submitted. In order for the staff to complete its review, DOE should provide such data and the data selection criteria used by DOE to support its analyses.

Specifically, the information/data needed by the staff centers on: (1) the identification of which data were used by DOE to obtain the mean VCR's presented in the Topical Report, (2) the DOE's rationale explaining why some data for the 12 boulder-mantled geomorphic surfaces were discarded, and (3) DOE providing the VCR data for the Red Cone/Black Cone data points used on the calibration curve. In order to minimize the impact on the NRC's review schedule, the staff requests that the information/data described above be transmitted by DOE as soon as possible.

3. The Qualification of Existing Data on Erosion

Much of the data used in the Topical Report was collected prior to NRC's acceptance of DOE's QA procedures. As a result, these pre-existing data must be qualified for use in the licensing process. The Topical Report indicates that data can be qualified through two methods - peer review and technical assessment - and that both methods were utilized in the qualification of erosion data.

DOE's technical assessment team, which cites NUREG-1298 (Qualification of Existing Data for High-Level Nuclear Waste Repositories), determined that the QA program in place at the time of acquisition of the rock-varnish data had produced results equivalent to data which would result from currently existing, NRC-approved QA procedures. Although the staff agrees with this conclusion reached by DOE's technical assessment team based on the actions of the team as described in Appendix A of the Topical Report, the staff does not believe that the 1989 Peer Review Report for the cation ratio dating method has provided the "in-depth" review specified in the staff's two generic technical positions - NUREGs 1297 and 1298. These generic technical positions address the above data qualification methods (peer review and technical assessment). NUREG-1297 (Peer Review for High-Level Nuclear Waste Repositories) specifies that: "the peer review group should evaluate and report on: (a) validity of assumptions; (b) alternative interpretations; (c) uncertainty of results and consequences if wrong; (d) appropriateness and limitations of methodology and procedures; (e) adequacy of application; (f) accuracy of calculations; (g) validity of conclusions; (h) adequacy of requirements and criteria." NUREG-1298 specifies that a peer review of existing data is an in-depth (emphasis added) critique of assumptions, calculations, extrapolations, alternative interpretations, methodology, and acceptance criteria employed and of conclusions drawn in the original work. The staff considers that DOE's Peer Review Group did not adequately address most of the factors identified in NUREG-1297. Moreover, there is no indication in the Topical Report that two recommendations made by the Peer Review Group (that more calibration points be included on the curve and that additional confirmatory absolute dating methods be used) have been acted upon, or addressed, by DOE since first identified by the Peer Review Group in 1989. Furthermore, the charter of the 1992 technical assessment team apparently did not include addressing technical recommendations made by the 1989 Peer Review Group.

4. Comprehensiveness of the Data Submitted

A geomorphic map is an important factor in the evaluation and determination of the presence, or absence, of geomorphic processes such as extreme erosion. The Topical Report surficial deposits map (Figure 7) lacks sufficient detail for the staff's analysis.

Aside from the data that has been submitted in support of the varnish cation ratio dating method, no data has been received that addresses other aspects relevant to "extreme erosion" such as the data from which the above geomorphic map would be derived and the data supporting the two Fortymile Wash stream incision scenarios presented in Topical Report Figure 13.

In addition to the above four principal concerns another matter (non-technical) is brought to DOE's attention. In the future, key data that are used in support of conclusions made in a report, such as that used in the

Mr. Dwight E. Shelor

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cation ratio rock varnish analyses, should be provided in tabular form either in the Topical Report itself or as an appendix. This would reduce the need for the staff to conduct extensive literature surveys to confirm the results of analyses presented in the Topical Report.

These concerns were conveyed to DOE during a December 20, 1993, conference call which included participation by representatives of the State of Nevada and affected counties. The purpose of the call was to identify agenda topics appropriate for discussion and field observation during the February 1994 NRC/DOE interaction at Yucca Mountain and vicinity. As desired by interested parties, the NRC staff will provide additional details relative to these concerns at the scheduled February interaction.

If you have any questions related to this letter, please contact Mr. Paul Prestholt of my staff at (301) 504-3810.

Sincerely,

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B. J. Youngblood, Director
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

- cc: R. Loux, State of Nevada
- T. J. Hickey, Nevada Legislative Committee
- J. Meder, Nevada Legislative Counsel Bureau
- R. Nelson, DOE/NV
- 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
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NRC/DOE INTERACTIONS FOR JANUARY - JUNE 1994

Topic: "Evaluation of the Potentially Adverse Condition 'Evidence of Extreme Erosion During the Quaternary Period' at Yucca Mountain, Nevada" (Erosion Topical Report, March 1993) (Technical Exchange/Site Visit)

Objective: To discuss preliminary staff questions developed during the review of the subject topical report and to visit, in the field, specific locations/features relevant to the staff's preliminary concerns. The purpose of the technical exchange is to better understand the field relations used to support the analyses presented in the topical report, thereby possibly expediting the review process. This technical exchange would be a precursor to facilitate development of the safety evaluation.

Scope: This technical exchange would focus on questions resulting from the staff's review of the subject topical report. The scope should include discussion of the staff's questions as well as field visits to key exposures and sample localities that form the basis for analyses made in the DOE report.

Date: February 1-2, 1994 (Based on receipt of questions from NRC staff 30 days in advance of interaction)

Location: Las Vegas, NV/Yucca Mountain, NV

Topic: Exploratory Studies Facility (ESF) Status Update (Technical Meeting)

Objective: To provide an update of activities related to the design and construction of the ESF.

Scope: To be negotiated during an NRC/DOE teleconference prior to the meeting.

Date: February 9, 1994

Location: Washington, D.C.

Topic: Status of Work Relevant to Characterization of the Saturated and Unsaturated Zone Flow (Technical Exchange)

Objective: To discuss the status of DOE's efforts relevant to data collection and modeling of groundwater flow at Yucca Mountain.

Scope: This technical exchange will focus on the current understanding of hydrological flow in the saturated and unsaturated zone at Yucca Mountain, and the work being conducted by DOE to progress toward developing a methodology for determining groundwater travel time.

Date: March 15-16, 1994

Location: Denver, CO

Topic: DOE's Approach to the Characterization of Faults and Fractures Near Yucca Mountain and the Stratigraphy, Structure, and Rock Properties Along the North Ramp of the ESF (Site Visit)

Objective: To discuss DOE's progress in the characterization of faults and fracture networks at Yucca Mountain as described in the Site Characterization Plan (SCP) and Study Plan 8.3.1.4.2.2. and to apprise the NRC staff of the current understanding of stratigraphic and structural data collected along the path of the ESF prior to initiation of large-scale tunnel boring activities. To facilitate staff reviews of DOE ESF documents and study plans and address concerns raised in reviews of the SCP and related study plans.

Scope:

This site visit would focus on DOE's efforts to characterize faults and fracture networks at the Yucca Mountain site and on DOE's efforts to characterize the stratigraphy, structure, and rock properties in advance of the construction of the ESF. The visit would include an update of DOE efforts to characterize faults in the Yucca Mountain region. Additionally, in its review of Study Plan 8.3.1.4.2.2 (Rev. 2), the staff notes that there are several activities still in the testing phase in which DOE will assess the adequacy of data collection methodologies. This site visit would update the NRC staff on the progress made in the characterization of faulting and fracture networks, including the final results of photo-grammetric mapping of the ESF starter tunnel, the results of testing the seismic tomography/vertical seismic profiling methods, and the results of surface fracture network studies performed on Fran Ridge. The scope of discussions would include information related to the characterization of faults and fractures, and how these data are being incorporated into models used for geohydrology, geology, thermomechanical testing, and engineering design. Because stratigraphic and structural factors play a key role in the configuration of the ESF, the site visit would also include discussions of the results of drilling of the North Ramp-Geologic Holes and Systematic Drilling hole SD-12, as well as any trenching activities. Discussions would also address stratigraphic and structural modeling (including cross-sections and 3-point problems) and the analysis of rock characteristics used in support of ESF design activities. Anticipated revisions in stratigraphy of the site or stratigraphic nomenclature would also be discussed. Additionally, anticipated encounters with fault zones and testing activities associated with those faults would be discussed.

Date: May 3-5, 1994

Location: Yucca Mountain, NV

Topic: ESF Status Update (Technical Meeting)

Objective: To provide an update of activities related to the design and construction of the ESF.

Scope: To be negotiated during an NRC/DOE teleconference prior to the meeting.

Date: May 26, 1994

Location: Las Vegas, NV

Topic: Total System Performance Assessment (TSPA) (Technical Exchange)

Objective: To provide an update on the progress achieved by NRC and DOE in the area of TSPA.

Scope: To discuss the preliminary results of DOE's TSPA, the integration of site characterization results into the TSPA, DOE's scenario methodology, and radionuclide release modeling. NRC will present Iterative Performance Assessment, Phase 2 and DOE will present TSPA, Phase 2. The respective parties will discuss the results of their assessments and plans to incorporate further improvements in subsequent iterations, including ways to use the results of TSPA to direct the collection of data in order to reduce uncertainty.

Date: June 20-21, 1994

Location: Washington, D.C.
