Ralph Stein, Acting Associate Director
Office of Systems Integration and Regulation
Office of Civilian Radioactive Waste Management
U.S. Department of Energy RW-20
Washington, D.C. 20585

Dear Mr. Stein:

SUBJECT: RESPONSE TO DOE LETTER (STEIN TO YOUNGBLOOD, UNDATED) ON CHARACTERIZATION OF THE REPOSITORY BLOCK AT YUCCA MOUNTAIN

REFERENCES:
(1) Letter, Linehan (NRC) to Gertz (DOE), dated August 28, 1987
(2) Letter, Stein (DOE) to Youngblood (NRC), undated (received by NRC March 11, 1988)
(3) Letter, Browning (NRC) to Stein (DOE), dated May 11, 1988 transmitting NRC staff point papers on the DOE Consultation Draft Site Characterization Plan (CDSCP) Yucca Mountain, Nevada
(4) Summary of NRC/DOE Meeting on Proposed Changes to the Nevada Nuclear Waste Storage Investigations (NNWSI) Exploratory Shaft Facility (ESF), April 14-15, 1987

In Reference 1 the NRC staff communicated to the DOE a concern over whether proposed drifting from the main test level of the Exploratory Shaft Facility (ESF) would enable the NNWSI Project to gather data representative of the entire repository block. This concern was an outgrowth of the April 14-15, 1987 NRC/DOE meeting in which proposed changes to plans for the ESF were outlined by DOE. In Reference 2 the DOE responded to the NRC concern. During the March 21-24, 1988 NRC/DOE meeting to review NRC's draft point papers on the CDSCP, DOE representatives requested an early reply from NRC to DOE's letter so that the results can be considered in preparation of the Site Characterization Plan (SCP). This letter contains the NRC staff response to the DOE letter.

Before presenting the staff response to the technical material in DOE's letter, I wish to address the statement in the first paragraph of the letter that "Based on the April 14-15, 1987 meeting record DOE has proceeded with design efforts with the understanding that NRC had generally agreed with the overall concept proposed by DOE as well as the specific changes presented." The NRC did not endorse the 5,600 feet of drifting as all that might be required to characterize the repository block. The meeting notes (reference 4) state that "The NRC strongly feels that the proposed changes with regard to fault characterization using exploratory drifts represent an improvement over the original concept of using long exploratory boreholes. Thus, the DOE's proposal of constructing exploratory drifts for the purposes of investigating the three fault areas (Ghost Dance fault, Drill Hole Wash, and the imbricate normal fault system) is reasonable." However, the investigation of the three fault areas mentioned is restricted to the northern part of the repository block; and during discussions at the meeting the NRC staff expressed concern over the lack of drifting to examine significant faulting in the southern part of the block. At the request of DOE, further discussion was confined to the changes proposed

by DOE rather than to consideration of further changes or expansions that might be warranted. Hence, while NRC did agree that the proposed changes from long boreholes to drifts was an improvement, and that the drifting to the three fault zones targeted would be beneficial, the NRC did not indicate nor was it asked to agree at the meeting that the drifting laid out constituted an acceptable program for sampling the entire repository block. Further details concerning the meeting discussion are contained in Enclosure 1 to this letter.

Regarding the technical substance of DOE's response to the NRC concern about the representativeness of the data to be collected in the ESF, the NRC staff review has resulted in the conclusion that the NRC concern has not been resolved. The NRC staff still considers that the DOE's site characterization program may not provide reasonable assurance that the data derived from the proposed drifting and surface-based tests will be sufficient to establish the geologic conditions and the ranges of those parameters at this site.

Specifically, the DOE addressed the NRC concern by: 1) citing test programs identified in the CDSCP to characterize the area within and adjacent to the repository block; and 2) suggesting that the NRC staff may have used an outdated outline of the repository in the basis for its concern. With respect to the testing programs outlined in the CDSCP, the NRC staff in its review of the CDSCP expressed continuing concern that the testing program outlined might not adequately characterize the entire repository block. This concern, based on the inherent problems of using boreholes to define structural features, is outlined in Comments 28 and 100 and Question 13 in Reference 3.

With respect to the outline of the repository, the NRC staff used the reference document for the April 14-15, 1987, NRC/NNWSI project Exploratory Shaft Facility meeting, which eliminated the southernmost tail from the primary repository area, as the reference for boundaries of the repository. The boundaries for the repository shown in this document are similar to those shown in the CDSCP. DOE's elimination of the southernmost part of the primary repository area does not resolve the NRC concern. The NRC questions whether the southern part of the primary repository block as depicted in the CDSCP will be investigated adequately. This concern is based on 10 CFR Part 60.2, which requires that the geologic conditions and ranges of those parameters at the site be established, and 10 CFR Part 60.122(a)(2)(i), which requires that potentially adverse conditions be adequately investigated, including the extent to which the condition may be present and still be undetected.

The NRC staff has two recommendations for consideration by the DOE to substantively address the concern about the representativeness of the data collected during site characterization. The first recommendation is that the DOE implement the recommendations outlined in NRC staff Comments 28 and 100 and Question 13 on the CDSCP. Specifically, the DOE should:

1) Demonstrate that the program of drifting and systematic drilling will provide the information necessary to ensure that conditions and processes

encountered are representative of conditions and processes throughout the repository;

2) Compare and evaluate the relative benefits and disadvantages with respect to data derived and effects on performance of more extensive drifting during site characterization (including supplemental horizontal core drilling) versus the surface-based systematic drilling program proposed in the CDSCP.

The second recommendation is that if the DOE has further questions about the NRC concern, a meeting between NRC and DOE be arranged to address those questions.

Enclosure 1 to this letter provides detailed responses to specific items raised in the DOE's letter (Reference 1). Because the DOE's "Specific Responses to NRC Concerns" in Enclosures 1 and 2 to Reference 1 referred to plans in the CDSCP upon which comments have previously been made in the NRC staff point papers on the CDSCP or which were based on an apparent misunderstanding of the basis for our concerns, no specific response to items in Enclosures 1 and 2 was deemed necessary.

If you have any questions concerning the contents of this letter or its enclosures, please contact John Linehan (492-0411) of my staff.

Sincerely,

B. Joe Youngblood, Chief
High Level Operations Branch
Division of High Level Waste
Management
Office of Nuclear Material
Safety and Safeguards

Enclosure:
As stated

cc: C. Gertz, DOE-NV/WMPO
R. Loux, State of Nevada

*See previous concurrence

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Enclosure:
As stated

cc: C. Gertz, DOE-NV/WMPO
R. Loux, State of Nevada

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ENCLOSURE 1

Responses to Specific Items in R. Stein's Letter to B.J. Youngblood

DOE Item: (Page 1, 1st para., 4th sentence) "...DOE has proceeded with design efforts with the understanding that the NRC had generally agreed with the overall concept proposed by DOE as well as the specific changes presented."

During discussions at the April 14-15, 1987, meeting the NRC noted that no drifting was planned to explore the southern and western portions of the proposed repository. NRC staff expressed concern over the increase in the effects of faulting in the southern part of the repository as noted in technical reports by Scott and Bonk (1984) and Scott and Castellanos (1984). At that time the DOE stated that details of the surface-based exploration program, to include the southern part of the repository, would appear in the SCP. As this topic, and the topic of representativeness of the proposed insitu/surface-based testing program was not considered to be a specific part of the agenda and beyond the scope of the meeting, the topic was left open. The topic of representativeness of data derived during site characterization is a CDSCP-related open item needing to be resolved and may require interaction between NRC and DOE prior to issuance of the SCP.

DOE Item: (Page 1, 2nd para., 2nd sentence) "These staff comments appear to be based on the assumption that the NNWSI project repository outline shown in the Environmental Assessment (EA) corresponds to the more recent Site Characterization Plan (SCP) Conceptual Design Report."

The NRC staff has been aware of the changes made to the proposed repository outline from that defined in the Environmental Assessment. Comments made in the staff analysis in the August 28, 1987, letter to Mr. Carl Gertz were, in part, derived from extrapolation northward from Scott and Bonk's (1984) C-C' cross section with the assumption that geologic features, particularly fault zones, do not abruptly end but might continue northward to the repository block. This assumption is based, in part, on the higher dips on the primary foliation noted in the southeastern part of the repository block (i.e., 13° and 19° vs. 5° to 7° on Yucca Mountain crest) and the apparent reversal in dip of the Ghost Dance fault from west to east (Scott and Bonk, 1984). Scott and others (1983) indicate that where dips exceed approximately 10° to 20°, abundant small-displacement north-northwest-striking faults appear.

In addition, while the DOE indicates that "The current placement of the perimeter drift for the underground facility specifically excludes the densely faulted area ..." (R. Stein letter to Mr. B.J. Youngblood, undated, document control date: 3/11/88), Appendix M of the SCP-Conceptual Design report indicates that the area southeast of the current repository

including the imbricate fault zone outlined on Scott and Bonk's map could be an extension to the primary repository block if qualified during site characterization.

DOE Item: (Page 1, 2nd para., 6th sentence) "...the DOE has recently completed a consultation draft of the Site Characterization Plan (SCP/CD) for the Yucca Mountain site which describes the plans to obtain information relevant to your concerns."

The NRC staff has reviewed the Consultation Draft Site Characterization Plan and has commented (Comments 28 and 100) that "The program of drifting and Systematic Drilling (designed to acquire site-specific subsurface information) outlined in the CDSCP appears inadequate to provide the lithologic and structural information necessary ..." and "Borehole penetrations into the main waste storage area ... may not provide the representative information needed to construct a three-dimensional geologic model of the repository block and to evaluate ranges of parameters that could affect repository performance."

Generally, the basis for these comments is derived from the uncertainty in detecting significant structural and lithologic features in boreholes. Many of the difficulties in using boreholes to detect structural and lithologic features are outlined in the CDSCP and referred to in CDSCP Point Papers, Comment 28 and Question 13.

References:

DOE, 1987, Proposed changes to the Nevada Nuclear Waste storage investigations Project exploratory shaft facility: background paper for the U.S. Nuclear Regulatory Commission and State of Nevada Agency for Nuclear Projects, Nuclear Waste Project Office.

Scott, R.B., and Bonk, J., 1984, Preliminary geologic map of Yucca Mountain Nye County, Nevada with geologic sections: U.S. Geological Survey Open-File Report 84-494, Scale 1:12,000.

Scott, R.B., and Castellanos, M., 1984, Stratigraphic and structural relations of volcanic rocks in drill holes USW GU-3 and USW G-3, Yucca Mountain, Nye County, Nevada: U.S. Geological Survey Open-File Report 84-491, 121 p.

Scott, R.B., Spengler, R.W., Diehl, S., Lappin, A.R., and Chornak, M.P., 1983, Geologic character of tuffs in the unsaturated zone at Yucca Mountain, southern Nevada, in Mercer, J.W., Rao, P.S.C., and Marine, I.W., eds., Role of the unsaturated zone in radioactive and hazardous waste disposal: Ann Arbor Science Publishers, Ann Arbor, Michigan, p. 289-335.