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MAY 10 1993

NOTE TO: Joseph Holonich, HLPD

FROM: Ronald Ballard, HLGE

SUBJECT: DETAILED REVIEW OF DOE STUDY PLAN 8.3.1.4.2.1, REV. 2
"CHARACTERIZATION OF THE VERTICAL AND LATERAL DISTRIBUTION OF
STRATIGRAPHIC UNITS WITHIN THE SITE AREA"

Enclosed with this note are the results of the HLGE staff detailed review of the subject study plan. The review was conducted in accordance with the procedures presented in the "Review Plan for NRC Staff Review of DOE Study Plans," Rev. 1, December 1990. DOE did not request the resolution of any open items based on the information presented in the study plan. The review identified no information that would lead to the full or partial resolution of open items of either the Geology/Geophysics Section or the Geotechnical Engineering Section.

Study plan Revisions 1 and 2 were received by the NRC subsequent to the December 14, 1992, letter from Holonich to Roberts transmitting NRC's Phase 1 review to DOE. The revisions are minor, dealing mainly with reference-related suggestions made by the NRC in the December 14 letter. NRC's suggestions were fully adopted by DOE and require no further action from NRC.

On March 22, 1993, DOE transmitted its responses to three informal comments embodied within the December 14, 1992, NRC to DOE Phase 1 study plan review letter (see Attachment A). The comment responses addressed the following: (1) study plan references, (2) borehole sealing and, (3) geophysical survey coverage of the Little Skull Mountain earthquake area. The NRC's evaluation of the DOE's responses to the above Phase 1 informal comments follows. With respect to Item (1) DOE's response was satisfactory and is considered resolved. On the other hand, DOE's response to Item (2), although informative, was insufficient to resolve NRC's Phase 2 (detailed) questions on that subject as described in Attachment B. We agree with DOE's assertion that Item (3) regarding geophysical survey coverage is more appropriately addressed in the review of Study Plan 8.3.1.17.4.3, currently undergoing review by the Staff. We, therefore, will address the geophysical survey coverage concern in the review of that Study Plan.

Within its March 22, 1993, letter DOE identifies those study plans under which the above Items (2) and (3) are addressed. For issue resolution tracking purposes, those studies designated by DOE as appropriate for addressing borehole sealing have been identified on the two attached detailed questions. As indicated in the previous paragraph Item 3 (preclosure tectonics - Little Skull Mountain earthquake area) will be addressed by the Staff during its review of Study Plan 8.3.1.17.4.3 (Quaternary Faulting Within 100 km of Yucca Mountain, including the Walker Lane).

Based upon its detailed review of the study plan, the staff has developed two questions (see Attachment B) with these concerns focusing on the sealing of boreholes. The borehole sealing questions are summarized below.

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Joseph Holonich

Borehole sealing was identified in the course of the Phase I review wherein DOE indicates (study plan p. 2-17) that drilling and coring operations, although recognized as having a potential impact on the site area, would have no adverse effect on the proposed site because the boreholes would be sealed. To NRC's knowledge, no borehole seal design has been proposed either in the Site Characterization Plan (SCP) or in subsequent documents. The SCP identifies (pp. 8.4.3-38 through 8.4.3-43) potentially adverse effects associated with unsealed boreholes (both shallow and deep) and, to our knowledge, provides no guidance as to those portions of the site for which no borehole seal design is required. Although no borehole seal design has been proposed by DOE, a number of boreholes have nevertheless been plugged (sealed). Accordingly, we recommend that DOE consider: (1) providing information such as the seal design(s), (2) providing a description of how sealing mitigates the adverse effects of drilling and coring operations, and (3) describing its procedures/rationale for discriminating between (a) boreholes requiring a designed seal and (b) boreholes that are plugged with a variety of materials and apparently require no designed seal.

Finally, the HLGE staff believes that Site Characterization Analysis (SCA) Comment 51 is relevant to this study plan. In Comment 51 the staff recommended that DOE consider (1) revising the planned layout of its geophysical surveys to that of a grid in order to achieve the study plan's stated goal of acquiring a reliable three dimensional characterization of the rock units and (2) the integration of geophysical surveys conducted under Study Plan 8.3.1.4.2.2 (Characterization of Structural Features Within the Site Area) with those surveys planned for this study plan. We suggest that DOE be informed that SCA Comment 51 is applicable to this study plan and remains open.

The review was conducted by Dr. A. K. Ibrahim (504-2523) and H. E. Lefevre (504-3464) of the Geology and Geophysics Section and by Dr. W. J. Boyle (504-2547) of the Geotechnical Engineering Section.

Original signed by:
Ronald L. Ballard, HLGE

Enclosures: As stated

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Department of Energy

Washington, DC 20585

MAR 22 1993

ATTACHMENT A

Mr. Joseph J. Holonich, 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. Holonich:

Enclosed are the U.S. Department of Energy's (DOE) responses to three comments from the U.S. Nuclear Regulatory Commission's (NRC) Phase I review of Study Plan 8.3.1.4.2.1, "Characterization of Vertical and Lateral Distribution of Stratigraphic Units within the Site Area," (enclosure 1). Enclosure 2 contains the response to these comments.

The NRC's first comment concerns six references cited either in the study plan text or the reference list. Potential changes have been identified, as stated in enclosure 2, to correct these omissions and needed clarifications. The second comment concerns the sealing of boreholes. No aspect of borehole sealing is covered by this study plan. Important aspects of the borehole sealing program will be discussed in Study Plan 8.3.3.2.2.1, "Seal Materials Property Development," which has yet to be developed. The third comment is concerned with whether the areal extent of the surface-based geophysical survey is extensive enough to include the area of Little Skull Mountain. This study does not extend to include the area of Little Skull Mountain, and DOE is not planning to expand the studied area for this study plan. However, other studies under preclosure tectonics (SCP Section 8.3.1.17) will cover the area of Little Skull Mountain. DOE awaits NRC's Phase II comments and plans no revision of the study plan to be undertaken at this time.

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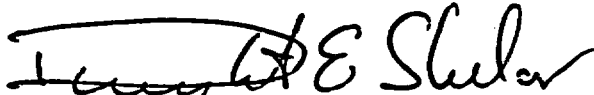
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If you have any questions, please contact Mr. Chris Einberg of my office at 202-586-8869.

Sincerely,



Dwight E. Shelor
Associate Director for
Systems and Compliance
Office of Civilian Radioactive
Waste Management

Enclosures:

1. Ltr, 12/14/92, Holonich to Roberts,
w/encl
2. Responses to NRC Comments

cc w/enclosures:

C. Gertz, YMPO
T. J. Hickey, Nevada Legislative Committee
R. Loux, State of Nevada
D. Bechtel, Las Vegas, NV
Eureka County, NV
Lander County, Battle Mountain, NV
P. Niedzielski-Eichner, Nye County, NV
W. Offutt, Nye County, NV
C. Schank, Churchill County, NV
F. Mariani, White Pine County, NV
V. Poe, Mineral County, NV
J. Pitts, Lincoln County, NV
J. Hayes, Esmeralda County, NV
B. Mettam, Inyo County, CA
C. Abrams, NRC



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

DEC 14 1992

Mr. John P. Roberts, Acting Associate Director
for Systems and Compliance
Office of Civilian Radioactive Waste Management
U.S. Department of Energy, RW 30
Washington, DC 20585

Dear Mr. Roberts:

SUBJECT: PHASE I REVIEW OF U.S. DEPARTMENT OF ENERGY (DOE) STUDY PLAN
"CHARACTERIZATION OF VERTICAL AND LATERAL DISTRIBUTION OF
STRATIGRAPHIC UNITS WITHIN THE SITE AREA"

On July 6, 1992, DOE transmitted the study plan, "Characterization of Vertical and Lateral Distribution of Stratigraphic Units within the Site Area" (Study Plan 8.3.1.4.2.1) to the U.S. Nuclear Regulatory Commission for review and comment. NRC has completed its Phase I Review of this document using the Review Plan for NRC Staff Review of DOE Study Plans, Revision 1 (December 6, 1990). The material submitted in the study plan was considered to be consistent, to the extent possible at this time, with the NRC-DOE agreement on content of study plans made at the May 7-8, 1986, meeting on Level of Detail for Site Characterization Plans and Study Plans.

Among the references listed for this study plan are three which are cited within the study plan text, but are not listed in the study plan References section, and three which are cited in the References section, but do not appear in the text (See Enclosure). Due to insufficient information on the three references not listed in the References section of the study plan, the NRC staff is unable to determine whether or not they are readily obtainable. We therefore request that DOE either 1) provide the NRC with copies of the references listed in the Enclosure or 2) provide the full reference citation if the references are considered to be readily available.

A major purpose of the Phase I Review is to identify concerns with studies, tests, or analyses that, if started, could cause significant and irreparable adverse effects on the site, the site characterization program, or the eventual usability of the data for licensing. Such concerns would constitute objections, as that term has been used in earlier NRC staff reviews of DOE's documents related to site characterization (Consultation Draft Site Characterization Plan and the Site Characterization Plan for the Yucca Mountain site).

It does not appear that the conduct of the activities described in this study plan will have significant adverse impacts on repository performance and the Phase I Review of this study plan identified no objections with any of the activities proposed. This decision was based on the following considerations: 1) the information from this study plan is important to site characterization; 2) there does not appear to be a noninvasive method of collecting the data; and 3) the study plan commits to sealing each borehole within the Conceptual Perimeter Drift Boundary. The NRC staff expects that proper sealing of boreholes will be performed consistent with 10 CFR 60.134(a) which states,

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Enclosure 1

Mr. John P. Roberts

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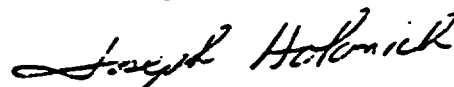
"Seals for shafts and boreholes shall be designed so that following permanent closure they do not become pathways that compromise the geologic repository's ability to meet the performance objectives for the period following permanent closure." These conclusions regarding boreholes described in this study plan should not be construed to mean that the NRC has reached the same conclusions with respect to additional or other boreholes not identified in this study plan.

After completion of the Phase I Review, selected study plans are to receive a second level of review, called a Detailed Technical Review, based on the relationship of a given study plan to key site-specific issues or NRC open items, or its reliance on unique, state-of-the-art test or analysis methods. Based on these criteria, we have decided to proceed with a Detailed Technical Review of this study plan and will provide DOE with staff comments as soon as that review is completed.

During the Phase I review the staff identified a concern related to the scope of Activity 8.3.1.4.2.1.2, "Surface-Based Geophysical Studies." In light of the June 29, 1992, Little Skull Mountain earthquake, the areal extent of the geophysical surveys shown on Figure 2.2-1 appears to be insufficient to encompass the Little Skull Mountain aftershock region. We recommend that DOE consider expanding the area of investigation to gain a better understanding of the source (geologic structure) of this event as well as the aftershocks. This comment will be included in the Detailed Technical Review of the study plan. We include it as part of this letter, because DOE plans to initiate activities related to this study plan in the near future.

If you have any questions concerning this letter, please contact Charlotte Abrams (301) 504-3403 of my staff.

Sincerely,



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

Enclosure: As stated

cc's: See next page

CC's for letter to John P. Roberts from Joseph J. Holonich, subject:
PHASE I REVIEW OF U.S. DEPARTMENT OF ENERGY (DOE) STUDY PLAN "CHARACTERIZATION
OF VERTICAL AND LATERAL DISTRIBUTION OF STRATIGRAPHIC UNITS WITHIN THE SITE
AREA" dated _____

cc: R. Loux, State of Nevada
T. J. Hickey, Nevada Legislative Committee
C. Gertz, 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. Poo, 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
E. Holstein, Nye County, NV.

ENCLOSURE

REFERENCES CITED IN STUDY PLAN TEXT AND NOT LISTED IN REFERENCES SECTION .

Barbier, 1983 - Pages 2-10 and 3-15

Brocher, et al, 1990 - Page 3-14

Howard, et al, 1990 - Page 1-3

REFERENCES NOT CITED IN STUDY PLAN

Longman, I.M., 1959, Formulas for computing the tidal accelerations due to the moon and sun: Journal of Geophysical Research, v. 64, p. 2351-2355.

U.S. Department of Energy, 1990, Review Record Memorandum: Geologic and geophysical evidence pertaining to structural geology in the vicinity of the proposed exploratory shaft, Rev. 0, YMP/90-2, Nevada Operations Office, Yucca Mountain Project Office, Las Vegas, Nevada.

Zumberge, M.A., Harris, R.N., Oliver, H.W., Sasagawa, G.S., and Ponce, D.A., 1988, Preliminary results of absolute and high-precision gravity measurements at the Nevada Test Site and vicinity, Nevada: U.S. Geological Survey Open-File Report 88-242, 29 p.

PHASE I COMMENTS ON STUDY PLAN 8.3.1.4.2.1
(CHARACTERIZATION OF VERTICAL AND LATERAL DISTRIBUTION
OF STRATIGRAPHIC UNITS WITHIN THE SITE AREA)

NRC Comment 1: Among the references listed for this study plan are three which are cited within the study plan text, but are not listed in the study plan References section, and three which are cited in the References section, but do not appear in the text (See Enclosure). Due to insufficient information on the three references not listed in the References section of the study plan, the NRC staff is unable to determine whether or not they are readily obtainable. We therefore request that DOE either 1) provide the NRC with copies of the references listed in the Enclosure or 2) provide the full reference citation if the references are considered to be readily available.

DOE Response to NRC Comment 1:

The NRC is concerned with three references cited in the text but that are not listed in the study plan references. Two of the cited references are being added to the list of references for Study Plan 8.3.1.4.2.1:

Barbier, M. G., 1983, The Mini-Sosie Method: International Human Resources Development Corporation, Boston, Massachusetts, 90 p.

Brocher, T. M., Hart, P. E., and Carle, S. F., 1990, Feasibility Study of the Seismic Profile Method in Amargosa Desert, Nye County, Nevada: U.S. Geological Survey Open-File Report 89-133, 150 p.

The citation to "Howard, et al., 1990" (on pages 1-3) should read "Oliver, et al., 1990," which was correctly cited elsewhere in the study plan and correctly included in the list of references. These changes will be made in a future revision of the study plan. The Barbier reference is in the not-readily-available category. Please be advised that this is a copyrighted book (see attached copy of title page and copyright note) and should not be copied by NRC unless a specific waiver is acquired. DOE is currently seeking a copyright clearance to copy this document. If approval is given by the publisher, DOE will provide the NRC with a copy.

Three additional references are identified by the NRC which are listed in the study plan, but not cited in the text. Those references will be deleted from the reference list in any future revision of the study plan.

NRC Comment 2: The NRC staff expects that proper sealing of boreholes will be performed consistent with 10 CFR 60.134(a) which states, "Seals for shafts and boreholes shall be designed so that following permanent closure they do not become pathways that compromise the geologic repository's ability to meet the performance objectives for the period following permanent closure." These conclusions regarding boreholes described in this study plan should not be construed to mean that the NRC has reached the same conclusions with respect to additional or other boreholes not identified in this study plan.

DOE Response to NRC Comment 2:

DOE agrees with the NRC staff that proper sealing of boreholes must be performed consistent with 10 CFR 60.134 (a). The borehole sealing program is being developed by Sandia National Laboratories. Important aspects of this program will be discussed in Study Plan 8.3.3.2.2.1 Seal Material Properties Development, "Development of Strategy to Seal Boreholes" (SAND report expected in May 93) and other documents. Detailed information about the requirements for sealing boreholes will be presented in these documents.

NRC Comment 3: During the Phase I review the staff identified a concern related to the scope of Activity 8.3.1.4.2.1.2, "Surface-Based Geophysical Studies." In light of the June 29, 1992, Little Skull Mountain earthquake, the areal extent of the geophysical surveys shown on Figure 2.2-1 appears to be insufficient to encompass the Little Skull Mountain aftershock region. We recommend that DOE consider expanding the area of investigation to gain a better understanding of the source (geologic structure) of this event as well as the aftershocks. This comment will be included in the Detailed Technical Review of the study plan. We include it as part of this letter, because DOE plans to initiate activities related to this study plan in the near future.

DOE Response to Comment 3:

The area of this study plan is the site area only. Work under this study is not planned to be extended out to the Little Skull Mountain. However, several studies will cover the area of Little Skull Mountain. These include Study Plan 8.3.1.17.4.3 (Quaternary Faulting Within 100 km of Yucca Mountain, Including the Walker Lane) and 8.3.1.17.4.1 (Historic and Current Seismicity). In addition, DOE has prepared two reports on the Little Skull Mountain earthquake and has supplied the NRC with copies in transmittals on July 22, 1992, and August 31, 1992.

ATTACHMENT B

Study Plan 8.3.3.2.2.1 Seal Material Properties Development

Study Plan 8.3.1.4.2.1 Characterization of the Vertical and Lateral Distribution of Stratigraphic Units Within the Site Area

QUESTION 1

What is the status of the seal design for boreholes, and when will a seal design for the boreholes be submitted for staff review and comment?

BASIS

- The study plan states on page 2-17, "The drilling and coring operations, which may have some impact on the site area, are being conducted independently of the activity here being described." No reference is given to an activity that describes what the impacts are and how they might be mitigated.
- The SCP in pages 8.4.3-38 through 8.4.3-43 states that boreholes will not have adverse effects on performance because the boreholes will be sealed. The SCP does not describe the sealing system that will prevent adverse effects.
- In a February 12, 1992, letter from L. S. Costin of Sandia National Laboratories (SNL) to J. Russell Dyer of the Yucca Mountain Site Characterization Project Office, regarding a performance assessment for borehole UE25 VSP-2 (UZ-16), it is stated, "the borehole should be sealed upon closure, as it may represent a potential preferential pathway for gaseous radionuclides".
- In Appendix D of a January 31, 1992 memo to Steven R. Sobolik of SNL from Joseph A. Fernandez of SNL and John B. Case of ITC, it is shown that the design of a seal has an impact on the performance of the seal.
- On Page 2-143 of the *Site Characterization Progress Report: Yucca Mountain, Nevada, April 1, 1992 - September 30, 1992, Number 7*, it is stated, "A review of technologies to seal underground openings continued."
- In its March 22, 1993, letter (Shelor to Holonich) DOE indicated that (1) borehole sealing is not covered by Study Plan 8.3.1.4.2.1 (Characterization of the Vertical and Lateral Distribution of Stratigraphic Units Within the Site Area), and (2) important aspects of the sealing program will be covered under the not-yet-developed Study Plan 8.3.3.2.2.1 (Seal Material Properties Development) and the Sandia National Laboratory report "Development of Strategy to Seal Boreholes" which is expected in May 1993.

- It is recognized by the staff that Study Plan 8.3.3.2.2.1 and the above Sandia National Laboratory report will provide information on borehole sealing, but it is not clear that even when these documents become available that they will address the design concerns of the NRC staff regarding borehole sealing.

RECOMMENDATION

Given the recognition that boreholes and the adequacy of their seals could have an impact on the performance of the site, it is recommended that DOE discuss how Study Plan 8.3.3.2.2.1 and the above Sandia report will satisfy the requirements of 10 CFR 60.15(c)(1), which states that site characterization activities should be conducted as to limit the adverse effects on long-term performance. It is also recommended that DOE discuss how the seal design for these activities meets the design criteria requirements of 10 CFR 60.134(a). The discussion should include (1) a description of the seals for boreholes that would help limit the adverse effects, and (2) a description of the analyses of the adequacy of the seal design.

Study Plan 8.3.3.2.2.1 Seal Material Properties Development

Study Plan 8.3.1.4.2.1 Characterization of the Vertical and Lateral Distribution of Stratigraphic Units Within the Site Area

QUESTION 2

Although a borehole seal design has not yet been provided, a number of boreholes have recently been sealed (plugged). Lacking a borehole seal design, what specifications are being used for the sealing (plugging) of these boreholes?

BASIS

- The SCP in pages 8.4.3-38 through 8.4.3-43 states that boreholes will not have adverse effects on performance because the boreholes (both shallow and deep) will be sealed. The SCP describes three categories of borehole-related impacts. The potential impact categories include those associated with three types of disturbances (hydrologic, geochemical and thermal/mechanical). No seal design is proposed in the SCP. Additionally, the SCP does not describe or demonstrate how the sealing system will prevent adverse effects.
- The SCP (pages 8.4.3-38 through 8.4.3-43) does not identify the type of borehole for which a designed seal is not required.
- The summary of the Field Testing Coordination Meeting of January 28, 1993, indicates that six repository surface facilities boreholes (RF3, RF3B, RF5, RF9, RF10 and RF11) have been plugged.
- The June 1992 map entitled "Existing and Proposed Drillholes Within 10 Km of the Site" (YMP-92-080-0) indicates that the depths of the plugged boreholes range from 60 feet to 301 feet.
- In a February 12, 1992, letter from L. S. Costin of Sandia National Laboratories (SNL) to J. Russell Dyer of the Yucca Mountain Site Characterization Project Office, regarding a performance assessment for borehole UE25 VSP-2 (UZ-16), it is stated, "no grout should be placed in selected sealing areas which contain fractures, to ensure that introduction of potentially unsuitable grouts into those sealing areas containing fractures does not occur."
- In its March 22, 1993, letter (Shelor to Holonich) DOE indicated that (1) borehole sealing is not covered by Study Plan 8.3.1.4.2.1 (Characterization of the Vertical and Lateral Distribution of Stratigraphic Units Within the Site Area), and (2) important aspects of the sealing program will be covered under the not-yet-developed Study Plan 8.3.3.2.2.1 (Seal Material Properties Development) and the Sandia National Laboratory report "Development of Strategy to Seal Boreholes" which is expected in May 1993.

- It is recognized by the staff that Study Plan 8.3.3.2.2.1 and the above Sandia National Laboratory report will provide information on borehole sealing, but it is not clear that even when these documents become available that they will address the concerns of the NRC staff regarding borehole sealing that are identified in this question.

RECOMMENDATION

Although borehole seal design has not yet been completed, a number of boreholes have recently been sealed (plugged). DOE should consider providing (1) the bases for sealing of boreholes prior to the design of the seal and (2) the bases for discriminating between those boreholes requiring sealing and those boreholes for which sealing is not required. Further, DOE should also consider describing the results and potential effect on repository performance resulting from the plugging of boreholes prior to development of the seal design.