



Department of Energy
Washington, DC 20585

AUG 30 1993

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 (DOE) responses to the two questions from U.S. Nuclear Regulatory Commission's (NRC) June 22, 1993, Phase II review of study plan 8.3.1.4.2.1, "Characterization of the Vertical and Lateral Distribution of Stratigraphic Units within the Site Area" (enclosure 1). Enclosure 2 contains responses to these comments.

The NRC's two questions are concerned with the status of the seal design for boreholes and the design of the plugs used for boreholes that have already been plugged. A borehole sealing strategy document (SAND93-1148) is in the final stages of preparation. This document will describe the rationale, performance requirements, and strategy for sealing boreholes. The DOE will send the report to NRC after DOE has reviewed and approved it. The boreholes that have already been plugged are located off the repository block and are shallow. To date, seven boreholes have been plugged. Whether or not they are sealed requires an examination of the manner in which they were plugged against the requirements of our sealing strategy.

If you have any questions, please contact Ms. Sheila Long at 202-586-1447.

Sincerely,

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

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Enclosures:

1. Ltr, 06/22/93, Holonich to Shelor, w/encl
2. Response to NRC Comments
3. Waste Isolation Analysis

cc:

- C. Gertz, YMPO w/o enclosures
- 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
- L. Bradshaw, 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. 20555-0001

JUN 22 1993

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

Dear Mr. Shelor:

SUBJECT: REVIEW OF U.S. DEPARTMENT OF ENERGY (DOE) STUDY PLAN
"CHARACTERIZATION OF THE VERTICAL AND LATERAL DISTRIBUTION OF
STRATIGRAPHIC UNITS WITHIN THE SITE AREA," REVISION 2

In a letter to the U.S. Department of Energy (DOE) dated December 14, 1992, the Nuclear Regulatory Commission informed DOE that the NRC staff's Phase I review had identified no objections with any of the activities proposed in the study plan, "Characterization of Vertical and Lateral Distribution of Stratigraphic Units within the Site Area" (Study Plan 8.3.1.4.2.1). At that same time, NRC also indicated that it had decided to proceed with a Detailed Technical Review of that study plan, using the Review Plan for NRC Staff Review of DOE Study Plans, Revision 1 (December 6, 1990).

Revisions 1 and 2 of this study plan were received by the NRC staff subsequent to the December 14, 1992, letter. Those revisions were considered by the staff as part of its detailed technical review.

On March 22, 1993, DOE transmitted its responses to three informal comments embodied within the December 14 letter. Those responses addressed 1) study plan references, 2) borehole sealing, and 3) geophysical survey coverage of the Little Skull Mountain earthquake area. The staff agrees that the reference-related concern has been resolved based on changes in Revisions 1 and 2 of the study plan. The staff also agrees to defer its concern regarding geophysical survey coverage to Study Plan 8.3.1.17.4.3, currently undergoing review by the NRC staff.

Based on its detailed review of the subject study plan, the staff has identified two concerns in the form of questions related to the sealing of boreholes. To the staff's knowledge, no borehole seal design has been proposed either in the Site Characterization Plan (SCP) or in subsequent documents. The SCP identifies (pages 8.4.3-38 to 8.4.3-43) potentially adverse effects associated with unsealed boreholes (both shallow and deep). To the staff's knowledge, the SCP 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 already been plugged or sealed. Therefore, the staff recommends that DOE provide information on the seals design(s), describe how proposed sealing will be used to mitigate adverse effects of drilling and coring operations, and describe procedures and rationale for discriminating between boreholes requiring a designed seal and those that are plugged with a variety of materials and apparently require no designed seal.

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Enclosure 1

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BAP

The questions related to this study plan will be tracked by the NRC staff as open items similar to Site Characterization Analysis (SCA) objections, comments, and questions. NRC recommends timely resolution of these open items due to their importance to site characterization activities.

The staff also believes that SCA Comment 51 is relevant and should be considered in future revisions to the subject study plan. Comment 51 recommends that DOE consider 1) revising the planned layout of its geophysical surveys to that of a grid in order to achieve the study plans'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 the subject study plan.

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

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

Enclosure: As stated

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. Waigel, 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
L. Fiorenzi, Eureka County, NV
L. Vaughan II, Esmeralda County, NV
C. Shank, Churchill County, NV
L. Bradshaw, Nye County, NV

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?

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 potential impacts are and how they might be mitigated.
- The SCP (DOE, 1988), 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 (SNL) from Joseph A. Fernandez (SNL) and John B. Case (IT Corporation), it is shown that the design of a seal has an impact on the performance of the seal.
- On Page 2-143 of Progress Report Number 7 (DOE 1992), 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 a SNL 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 SNL 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 SNL borehole seal strategy 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 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 analysis of the adequacy of the seal design.

REFERENCES

- Sandia National Laboratories, 1992a, Letter from L. S. Costin, SNL, to J. R. Oyer, DOE; Subject: Performance assessment evaluation of impacts of drilling, testing, and operations on waste isolation for proposed borehole UE25 VSP-2 (UZ-16), dated February 12, 1992, 2 p., 1 enclosure with attachment.
- Sandia National Laboratories, 1992b, Appendix D from the Memorandum from J. A. Fernandez, SNL, and J. B. Case, ITC, to S. R. Sobolik; Subject: Evaluation of the performance of UZ-16, dated January 31, 1992, p. 30-39.
- U.S. Department of Energy, 1992a, Letter from D. E. Shelor, DOE, to J. J. Holonich, NRC; Subject: Responses to three comments contained in the U.S. Nuclear Regulatory Commission's December 14, 1992, letter to J. P. Roberts, DOE, transmitting NRC's Phase I review of Study Plan 8.3.1.4.2.1, dated March 22, 1993, 2 p., 2 enclosures.
- U.S. Department of Energy, 1992b, Site characterization progress report: Yucca Mountain, Nevada, April 1, 1992 - September 30, 1992, number 7: Office of Civilian Radioactive Waste Management, Washington, D.C.
- U.S. Department of Energy, 1988, Site characterization plan: Yucca Mountain Site, Nevada Research and Development Area, Nevada: DOE/RW-0199, Office of Civilian Radioactive Waste Management, Washington, D.C.

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 (DOE, 1988) 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 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 (DOE, 1993) indicates that six repository surface facilities boreholes (RF3, RF3B, RF5, RF9, RF10 and RF11) have been plugged.
- The map entitled "Existing and Proposed Drillholes Within 10 Km of the Site" (DOE, 1992) 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. R. 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 a SNL 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 SNL 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 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.

REFERENCES

- Sandia National Laboratories, 1992, Letter from L. S. Costin, SNL, to J. R. Dyer, DOE; Subject: Performance assessment evaluation of impacts of drilling, testing, and operations on waste isolation for proposed borehole UE25 VSP-2 (UZ-16), dated February 12, 1992, 2 p., 1 enclosure with attachment.
- U.S. Department of Energy, 1988, Site characterization plan: Yucca Mountain Site, Nevada Research and Development Area, Nevada: DOE/RW-0199, Office of Civilian Radioactive Waste Management, Washington, D.C.
- U.S. Department of Energy, 1992, Existing and proposed drillholes within 10 km of the site: Map - YMP-92-081.0, compiled in June 1992 by EG&G/EM Remote Sensing Laboratory.
- U.S. Department of Energy, 1993a, Letter from D. E. Shelor, DOE, to J. J. Holonich, NRC; Subject: Responses to three comments contained in the U.S. Nuclear Regulatory Commission's December 14, 1992, letter to J. P. Roberts, DOE, transmitting NRC's Phase I review of Study Plan 8.3.1.4.2.1, dated March 22, 1993, 2 p. 2 enclosures.
- U.S. Department of Energy, 1993b, Yucca Mountain Project Office, Las Vegas, Nevada, field testing coordination meeting summary, surface based testing field activities: Miscellaneous Investigations, January 28, 1993, 3 p.

Enclosure 2

U.S. DEPARTMENT OF ENERGY (DOE) RESPONSE TO
U.S. NUCLEAR REGULATORY COMMISSION (NRC) PHASE II COMMENTS ON
STUDY PLAN 8.3.1.4.2.1 (CHARACTERIZATION OF THE VERTICAL AND LATERAL
DISTRIBUTION OF STRATIGRAPHIC UNITS WITHIN THE SITE AREA), REVISION 2

NRC Question 1

What is the status of the seal design for boreholes?

DOE Response to NRC Question 1

The sealing strategy for boreholes will be presented in a Sandia National Laboratories document (SAND93/1148) that is due into the Yucca Mountain Site Characterization Project Office by the end of fiscal year 1993. The document will describe in detail the rationale, performance requirements, and strategy for sealing boreholes drilled for this and other geologic and hydrologic studies. Existing and new (post-July 1991) boreholes will need to be sealed. Each borehole will be evaluated and seals will be designed based on the unique rock conditions encountered downhole and records for how the hole was constructed. The DOE will send the report to NRC after DOE has reviewed and approved it for issue.

NRC 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?

DOE Response to NRC Question 2

DOE is aware that boreholes have been plugged without the completion of the borehole sealing strategy and that the strategy document would post-date the first operational need for a sealing methodology. The boreholes at issue are all in Midway Valley and include six shallow RF holes and one North Ramp Geology hole (UE-25 RF #3, UE-25 RF #3B, UE-25 RF #5, UE-25 RF #9, UE-25 RF #10, UE-25 RF #11, and UE-25 NRG 1) that now lie beneath the Exploratory Studies Facility north portal pad. Although an explicit sealing strategy has yet to be published, a waste isolation evaluation was conducted by the Civilian Radioactive Waste Management System Management and Operating Contractor prior to the plugging of the boreholes. Based on the evaluation of potential impacts to waste isolation performance, these shallow, off-block holes will not pose any significant risk to the performance of a repository. All of these factors were weighed in the decision to proceed with pad construction in November 1992.

With respect to the plugging of the holes listed above, a mixture of cement grout was piped to the bottom of the hole by means of a tremie pipe. As cement was extruded through this pipe into the hole, the tremie pipe was pulled up the hole. After the borehole sealing strategy is approved by DOE, we will determine whether the plugs meet the requirements for sealing. If not, remedial action will be taken.

REFERENCES:

Civilian Radioactive Waste Management System, Management and Operating Contractor, December, 1992, Waste Isolation Impact Evaluation, Plugging of Boreholes UE-25 NRG 1, and UE -25 RF 3, 3B, 5, 9, 10, and 11.

December 15, 1992

Contract #: DE-AC01-91-RW00134
LV.SYRL.JLY.12/92-070

Carl P. Gertz, Project Manager
U.S. Department of Energy
Yucca Mountain Site Characterization Project Office
P.O. Box 98608
Las Vegas, NV 89193-8608

Attention: J. Russell Dyer, Director
Regulatory and Site Evaluation Division

Subject: Waste Isolation Impact Evaluation of the Plugging of Boreholes
UE-25 NRG 1 and UE-25 RF 3, 3B, 5, 9, 10 and 11.

References:

1. "Request for Test-to-Test Interference and Waste Isolation Evaluation for the Plugging of UE-25 NRG 1: Test Planning Package 92-1, Revision 2, Job Package 92-2," Letter from J. Russell Dyer, YMPO, to L. D. Foust, CRWMS M&O, November 10, 1992 (received November 16, 1992).
2. "Request for Test-to-Test Interference and Waste Isolation Evaluations for the Plugging of UE-25 RF 3, 3B and 5." Letter from J. R. Dyer, YMPO, to L. D. Foust, CRWMS M&O, November 25, 1992 (received November 30, 1992).
3. "List of Tracers, Fluids, Materials Assessment for UE-25 Borehole (NRG-1)," Memorandum from H. Kalia, LANL, to L. D. Foust, CRWMS M&O, November 24, 1992 (received November 25, 1992).
4. "Addendum to Test Interference Evaluation Update for the Construction of North Portal Drillhole UE-25 NRG-1, etc.," Letter from L. D. Foust, CRWMS M&O, to C. P. Gertz, YMPO, November 23, 1992.

In response to References 1 and 2 and a verbal request from D. R. Williams, attached is our evaluation of potential impacts on waste isolation of the planned plugging of boreholes UE-25 NRG 1 and UE-25 RF 3, 3B, 5, 9, 10 and 11.

ENCLOSURE 3

09-01-1993 14:26

December 15, 1992

Page 2

The plugging of NRG 1 was first addressed in an attachment to Reference 3. The attached new report includes a revised discussion of NRG 1 plus the addition of the RF boreholes. This report responds also to the request in Reference 3 to evaluate the use of cement for the planned plugging of NRG 1.

There is no change in our original conclusion that the proposed activity, including the use of the planned cement slurry for NRG 1 and the listed RF boreholes will not adversely impact waste isolation for the current conceptual repository. Because borehole RF 5 is located above a potential repository expansion area, however, removing the casing and using an improved-quality grout as identified in the attached report should be considered for that borehole.

This work was performed under CRWMS M&O QAP-3-5, Development of Technical Documents. Due to the limited scope of the evaluation and since no new quantitative analyses were performed, the document was given an abbreviated review as provided by QAP-3-5.

In order to expedite future evaluations and improve coordination, I would like to suggest that we automatically include tracers, fluids and materials (TFM) evaluations whenever we receive a request for test interference and waste isolation evaluations and forward a copy of our evaluations to LANL. Your request letters could indicate that TFM evaluations should be included and that supporting information would be provided by LANL. If LANL is on the distribution of your letter, it would alert LANL to provide us the TFM information required for our evaluations.

If you have any questions, please contact Albin Brandstetter of my staff at 702-794-7279.

Sincerely,



L. Dale Foust, Manager, Nevada Site
Technical Project Officer
Management and Operating Contractor

Enclosure: Waste Isolation Impact Evaluation -- Waste Isolation Impact
Evaluation of the Plugging of Boreholes UE-25 NRG 1 and
UE-25 RF 3, 3B, 5, 9, 10 and 11.

cc w/encl:

M. E. Abhold, M&O/TRW, Las Vegas, NV
J. M. Boak, YMP, Las Vegas, NV
A. Brandstetter, M&O/INTERA, Las Vegas, NV
C. E. Bruch, M&O/INTERA, Las Vegas, NV
L. S. Costin, SNL, 6313, Albuquerque, NM
B. W. Distel, M&O/VCFS, Las Vegas, NV
J. R. Dyer, YMP, Las Vegas, NV
C. L. Johnson, M&O/TRW, Las Vegas, NV
B. R. Justice, M&O/Duke, Las Vegas, NV
H. N. Kalia, LANL, Las Vegas, NV
H. L. Lohn, SAIC, Las Vegas, NV
R. W. Nelson, M&O/TRW, Las Vegas, NV
C. M. Newbury, YMP, Las Vegas, NV
D. W. Schutt, M&O/TRW, Las Vegas, NV
S. C. Smith, SAIC, Las Vegas, NV
A. E. Van Luik, M&O/INTERA, Las Vegas, NV
J. D. Weaver, SAIC, Las Vegas, NV
D. R. Williams, YMP, Las Vegas, NV
J. L. Younker, M&O/TRW, Las Vegas, NV