



Department of Energy

Washington, DC 20585

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Mr. John Linehan, 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. Linehan:

Two issues of interest to the U.S. Nuclear Regulatory Commission arose in association with the U.S. Department of Energy (DOE)/U.S. Nuclear Regulatory Commission (NRC) Exploratory Shaft Facility (ESF) meeting, held on January 29-31, 1991. The first of these issues focused on the availability of the Calico Hills Risk/Benefit Analysis (CHRBA) Record of Memorandum (RM); the second issue was related to NRC's understanding of the value and contribution of the Value of Information (VOI) model to the CHRBA. Regarding the first issue, immediately prior to the ESF meeting, DOE provided NRC with a copy of the CHRBA RM.

The NRC review of the Site Characterization Plan/Consultation Draft (SCP/CD) contained an objection (Objection #2) which maintained that the plans for excavation and testing in the Calico Hills Unit were not based on adequate analysis of the risks and benefits of alternative methods for obtaining the needed information. Objection #2 to the SCP/CD was closed when DOE committed to perform an analysis of the benefit, to the testing program, of penetrating the Calico Hills unit, compared to the possible risks to site performance. In addition to performing the analysis, DOE committed to consult with NRC, prior to initiation of construction. DOE, therefore, produced the CHRBA to take into consideration NRC comments in making the decision of how best to characterize the Calico Hills unit and, eventually, to respond to NRC concerns.

Enclosure 1 includes NRC's CDSCP (SCP/CD) Objection No. 2 with Action Items in Italics. Enclosure 2 is a copy of the written commitment made by the DOE in response to the NRC objection on the CDSCP. This response was provided to NRC on December 28, 1988 as an enclosure to the letter transmitting DOE's Site Characterization Plan. Similarly, Enclosure 3 provides the requested "roadmap" indicating which sections of the CHRBA respond to NRC's objection.

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With respect to the question regarding the contribution of the VOI model to the CHRBA, several important general points may be made. Considerable additional information, and the supporting rationale, is contained in the Record of Memorandum, and in the relevant references and transcripts. These documents explain the results of both the VOI and the Multi-Attribute Utility Analysis (MUA) studies in detail.

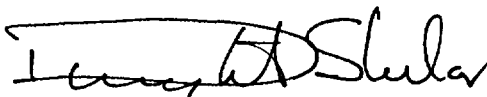
Several important results emerged from the VOI study. In particular, the estimates of impacts to the waste isolation capability of the site (judged to be very small) were developed as part of the VOI portion of the study. In addition, the VOI results demonstrated how, and by how much, the test program could improve performance predictions. It is true that the VOI model indicated that testing had no value, as value was narrowly defined in the study (i.e., the likelihood of changing decisions as a result of testing, based on revised predictions of performance). However, the cumulative results of the study, which captured in the MUA values associated with testing not recognized by the VOI model, strongly support the recommendation. The MUA defined value in testing in attributes such as increased scientific confidence, and an enhanced ability to demonstrate reasonable assurance with respect to predictions of site performance. DOE has, therefore, recommended that the NRC staff not focus on the "no testing" result of the VOI model.

DOE does not believe the CHRBA VOI results are a substitute for formal PA efforts. In fact, the CHRBA RM recommends that DOE continue conducting Performance Assessment (PA) exercises (particularly with respect to impacts on waste isolation) throughout design and site characterization. It is important to note, however, that there are no currently available PA models at the DOE, or elsewhere, that are well suited to directly addressing the question that the CHRBA studied -- that is, what is the appropriate testing program for the Calico Hills? Current PA models are very useful for identifying information needs, and assessing impacts to performance, but balancing the risks and benefits requires judgement, particularly with respect to how much information will be required to license the site, should it be found suitable by the DOE.

Finally, DOE believes that the geotechnical inputs to the VOI model are important because the multi-disciplined team used available data to evaluate both site performance and impacts to waste isolation from testing, considering both expected and disturbed site conditions. These evaluations indicate that the contribution of impacts to isolation from testing is a small fraction of total system releases, and both are far below the Environmental Protection Agency (EPA) limits (for aqueous transport). The process used to develop the estimates of impacts accounted for uncertainty and included conservatism.

If have any questions regarding the DOE position on these two issues, please contact Cori Macaluso of my staff on (202) 586-2837 or Dave Dobson of the Project Office on (702) 794-7940.

Sincerely,



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

Enclosures: As stated

cc w/enclosures:

- R. Loux, State of Nevada
- C. Gertz, DOE/YMPO/NV
- M. Baughman, Lincoln County, NV
- D. Bechtel, Clark County, NV
- S. Bradhurst, Nye County, NV

NRC'S CDSCP OBJECTION NO. 2 WITH ACTION ITEMS IN ITALICS

OBJECTION 2

The NRC staff considers that the need for extending the Exploratory shaft 1 (ES-1) approximately 400 ft below the proposed repository horizon into the zeolitic zone of the Calico Hills unit has not been established in the CDSCP, nor has the need been established for tests requiring drifting (horizontal excavation) through the Calico Hills unit. It has not been demonstrated that the proposed shaft (ES-1) penetration into the Calico Hills unit (an important barrier between the repository horizon and the underlying groundwater table) or the proposed drifting through it will not have potential adverse impacts on the waste isolation capability of the site.

- 1. Establish the need for extending ES-1 approximately 400 ft below the proposed repository horizon into the zeolitic zone of the Calico Hills unit.*
- 2. Establish the need for tests requiring drifting through the Calico Hills unit.*
- 3. Demonstrate that the ES-1 penetration into the Calico Hills unit or the proposed drifting through it will not have potential adverse impacts on the waste isolation capability of the site.*

BASIS

- o 10 CFR 60.17(a)(2)(iv) requires that, "The SCP shall contain plans to control any adverse impacts from such site characterization activities that are important to waste isolation."
- 4. Develop plans to control any adverse impacts from such site characterization activities that are important to waste isolation.*
- o The last tentative goal on page 8.3.2.5-21 indicates that high confidence is needed that ES-1 will terminate no less than 150 m above groundwater table. It does not appear that this goal would be reached under the present ES-1 design.

5. *Will the goal stated on page 8.3.2.5-21 of the CDSCP be met? (Goal: ES-1 shaft termination no less than 150 m above ground-water table)*

- o The CDSCP has not identified associated site characterization activities whose benefits would outweigh potential adverse impacts of penetrating the Calico Hills unit, an important barrier below the proposed repository horizon. The CDSCP has not provided a detailed discussion of the need for conducting the identified activities from within the Calico Hills rather than obtaining the necessary data by alternate means that meet isolation constraints.

6. *Identify associated site characterization activities whose benefits would outweigh potential adverse impacts of penetrating the Calico Hills unit.*

7. *Provide a detailed discussion of the need for conducting the identified activities from within the Calico Hills rather than obtaining the necessary data by alternate means that meet isolation constraints.*

- o Sections 8.3.5.13 (Total System Performance) and Sections 8.3.5.12 (Groundwater Travel Time) identify the Calico Hills unit as a primary barrier. Section 8.3.1.2.2.4.6 (Calico Hills Test In The Exploratory Shaft Facility, page 8.3.1.2-242) states that "it is critical to have high confidence in the understanding of these aspects of the unit" (Calico Hills), but "on the other hand exterior penetration or excavation of the unit for testing purposes may jeopardize the integrity of the unit as a barrier." This section also states that the preferred approach to testing in the Calico Hills unit is to drift horizontally from the shaft in the up-dip direction, through the Ghost Dance fault. However, the CDSCP does not consider the effects of drifting on the Calico Hills unit, nor does it consider alternative means of obtaining the necessary data that meet isolation constraints.

8. *Consider the effects of drifting on the Calico Hills unit.*

9. *Consider alternate means of obtaining the necessary data that meet isolation constraints.*

- o The CDSCP does not consider potential connection of flow-paths from underneath the repository waste emplacement areas to the proposed ES-1 excavation below the repository horizon or to the proposed drifts in the Calico Hills unit.

10. Consider potential connection of flow-paths from underneath the repository waste emplacement areas to the proposed ES-1 excavation below the repository horizon.

11. Consider potential connection of flow-paths from underneath the repository waste emplacement areas to the proposed drifts in the Calico Hills unit.

RECOMMENDATION

- o The SCP should consider plans for characterizing the Calico Hills unit to the extent necessary without having to penetrate and damage portions of this important barrier between repository horizon level and the groundwater table. If alternative plans cannot be developed, it should justify the need for destructive testing of the Calico Hills unit and analyze the consequences of possible pathway connections from the proposed waste emplacement areas to both the lower portion of the ES-1 and to the proposed drifts in the Calico Hills unit.

12. Consider plans for characterizing the Calico Hills to the extent necessary without having to penetrate and damage portions of this important barrier between repository horizon level and the groundwater table.

13. Justify the need for destructive testing of the Calico Hills unit if alternative plans cannot be developed.

14. Analyze the consequences of possible pathway connections from the proposed waste emplacement areas to both the lower portion of the ES-1 and to the proposed drifts in the Calico Hills unit if alternative plans cannot be developed.

DECEMBER 1986

RESPONSE TO NRC OBJECTION #2

OBJECTION #2

The NRC staff considers that the need for extending the Exploratory shaft 1 (ES-1) approximately 400 ft below the repository horizon into the zeolitic zone of the Calico Hills unit has not been established in the CDSCP, nor has the need been established for tests requiring drifting (horizontal excavation) through the Calico Hills Unit. It has not been demonstrated that the proposed shaft (ES-1) penetration into the Calico Hills unit (an important barrier between the repository horizon and the underlying groundwater table) or the proposed drifting through it will not have potential adverse impacts on the waste isolation capability of the site.

DOE RESPONSE

The DOE approach to resolution of this objection is described in Section 8.4.2.1.6.1 (Characterization of Calico Hills) of the SCP. Briefly, the DOE will defer the decision on penetrating and drifting in the Calico Hills unit from exploratory shaft 1 pending completion of analyses comparing (1) the needed data, (2) the alternative means of obtaining the data, (3) the benefits of obtaining the data in terms of reducing uncertainty about site performance, and (4) the risks to site performance by obtaining the data.

The DOE recognizes that additional information on hydrologic parameters and processes, as well as radionuclide retardation parameters and processes, will be needed to adequately understand the role the Calico Hills unit will play in isolation. The various alternatives available for reducing uncertainty include data collection from outcrops and surface-based boreholes and in situ testing in the Topopah Spring Member or the Calico Hills unit. The potential benefits in terms of reducing uncertainty in travel-time and radionuclide retardation predictions through testing in the Calico Hills unit will be weighed against an assessment of the potential risks in terms of compromising site performance associated with such testing.

The NRC will be consulted before a decision is made on penetrating the Calico Hills unit. Should a decision be made to proceed, the design and layout of the exploratory shaft facility are sufficiently flexible so that the shaft could be extended and additional drifting could be accommodated without a major redesign of the facility.

**ACTION ITEMS FROM NRC'S CDSCP
OBJECTION NO. 2**

**REFERENCES TO CHRBA¹ THAT
RESPOND TO ACTION ITEMS**

1. Establish the need for extending ES-1 approximately 400 ft below the proposed repository horizon into the zeolitic zone of the Calico Hills unit.

The need for excavation into the Calico Hills unit was established by the technical and management panels reviewing the VOI model results. See pp 2.6.1.8-12, 2.6.1.8-13, and Appendix C. Also see Section 2.2.

2. Establish the need for tests requiring drifting through the Calico Hills unit.

The need for drifting through the Calico Hills unit was established by the results of the MUA - a preference for modified versions of Strategies 2 or 5. See Section 2.6.2.3.3, p 2.6.2.3.3-1.

3. Demonstrate that the ES-1 penetration into the Calico Hills unit or the proposed drifting through it will not have potential adverse impacts on the waste isolation capability of the site.

Potential adverse impacts are discussed in Section 2.6.1.6 (p 2.6.1.6-1) and are summarized in Section 2.6.1.6.5 (p 2.6.1.6-36).

4. Develop plans to control any adverse impacts from such site characterization activities that are important to waste isolation.

Section 2.6.1.6.2 provides an analysis of groundwater flow in excavated openings relative to plans for backfilling and sealing.

5. *Will the goal stated on page 8.3.2.5-21 of the CDSCP be met? (Goal: ES-1 shaft termination no less than 150 m above ground-water table)*

The goal stated in the CDSCP was changed in the SCP to: "The thickness between the bottom of ES-1 or any exploratory shaft facility (ESF) drifting and the ground-water table should be greater than the minimum thickness of the Calico Hills above the water table anywhere within the repository boundary." This goal is incorporated in the descriptions of preferred strategies 2 and 5. See pp 2.4-20 and 2.4-23.

6. *Identify associated site characterization activities whose benefits would outweigh potential adverse impacts of penetrating the Calico Hills unit.*

Information needed to characterize the Calico Hills unit are correlated to the various testing techniques in Section 2.3 (p 2.3-1). As noted above, potential adverse impacts are discussed in Section 2.6.1.6 (p 2.6.1.6-1) and are summarized in Section 2.6.1.6.5 (p 2.6.1.6-36).

7. *Provide a detailed discussion of the need for conducting the identified activities from within the Calico Hills rather than obtaining the necessary data by alternate means that meet isolation constraints.*

That discussion is provided in Section 2.7 (p 2.7-1) where tradeoffs between the various strategies are discussed.

8. *Consider the effects of drifting on the Calico Hills unit.*

See Item 3, above.

9. *Consider alternate means of obtaining the necessary data that meet isolation constraints.*

Alternate means are considered in Section 2.3 (see Item 6, above) and 2.7 (see Item 7, above).

10. Consider potential connection of flow-paths from underneath the repository waste emplacement areas to the proposed ES-1 excavation below the repository horizon.

Potential flow paths are discussed in general in Section 2.6.1.6.2 (p 2.6.1.6-4) and Section 2.6.1.6.3 (p 2.6.1.6-18) and are applied to each strategy in Section 2.6.1.6.4 (p 2.6.1.6-24).

11. Consider potential connection of flow-paths from underneath the repository waste emplacement areas to the proposed drifts in the Calico Hills unit.

See Item 10, above.

12. Consider plans for characterizing the Calico Hills to the extent necessary without having to penetrate and damage portions of this important barrier between repository horizon level and the groundwater table.

Section 2.3 evaluates test techniques other than direct excavation. Also, see Items 7 and 9, above.

13. Justify the need for destructive testing of the Calico Hills unit if alternative plans cannot be developed.

See Items 1 and 6, above.

14. Analyze the consequences of possible pathway connections from the proposed waste emplacement areas to both the lower portion of the ES-1 and to the proposed drifts in the Calico Hills unit if alternative plans cannot be developed.

See Item 9, above.

1. Yucca Mountain Site Characterization Project, Record Memorandum, Risk/Benefit Analysis of Alternative Strategies for Characterizing the Calico Hills Unit at Yucca Mountain, Rev. 0, January 1991.