

JUN 21 1994

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: STATE OF NEVADA CONCERN ON PNEUMATIC PATHWAYS

In a January 25, 1994, letter to B.J. Youngblood, who was then Director of the Nuclear Regulatory Commission's former Division of High-Level Waste Management, Robert R. Loux, Director of the Nevada Nuclear Waste Projects Office, asserted that the U.S. Department of Energy (DOE) had inadequately responded to a pneumatic pathway concern identified by the State of Nevada. Specifically, Mr. Loux stated that construction of the Experimental Studies Facility (ESF) will preclude the characterization of potential barriers to the flow of air (gas, vapor) through Yucca Mountain. Mr. Loux proposed that the NRC should create a formal objection¹ to the construction of the ESF. In a letter to Mr. Loux dated March 31, 1994, Mr. Youngblood stated that the NRC staff had concluded that there was not sufficient technical information on the State of Nevada's pneumatic pathway concern to support a formal objection. However, while the staff could not support an objection at that time; it promised to investigate the issues raised in the State's pneumatic pathways concern.

Based on a number of interactions and communications, it is the understanding of the NRC staff that the State of Nevada has identified three locations which warrant investigation, because of their potential to act as pneumatic barriers. These areas are: the Paintbrush nonwelded unit overlying the Topopah Spring welded unit; the Topopah Spring welded unit outcrop in Solitario Canyon; and the Solitario Canyon fault in Solitario Canyon. The NRC understands the State's position to be that adequate characterization of these potential flow barriers is necessary to model the post-closure movement of water vapor. This concern is based on the State's observation that all proposed repository designs will heat the rock and some of the proposed designs may move large amounts of vapor. As a result, the State is concerned that large amounts of water will be redistributed in the mountain and that barriers to gas flow could significantly affect that distribution.

The State of Nevada has proposed that large scale tests are needed to

¹Objections are primarily for concerns with activities, tests, and analyses which, 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 (programmatic fatal flaws). Appendix B to "Review Plan for NRC Staff Review of DOE Study Plans," Revision 2, March 3, 1993.

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adequately characterize the mountain with respect to the possible existence of flow barriers. These are tests that would reflect the bulk pneumatic properties of large volumes of rock. The State has proposed that air pressure and chemistry data be obtained from units above, below, and in the Paintbrush nonwelded unit in the areas of interest (i.e., Yucca Mountain and Solitario Canyon). Further, the pressure data should be collected long enough to record pressure changes during periods when weather conditions are causing significant air pressure changes over the site. This would allow a large volume of rock to experience significant pressure changes, so that air pressures in and on either side of a potential flow barrier can be monitored for changes. The State is concerned that excavation of the ESF below the Paintbrush nonwelded unit could make it impossible to use this technique. The State is also concerned that excavation of the ESF below the Paintbrush nonwelded unit could make it impossible to use differences in gas chemistry above and below potential pneumatic barriers to determine if such barriers exist. It is feared that the ESF could "short circuit" the influence of the potential Paintbrush nonwelded unit barrier by causing large scale pressure and air chemistry changes below the Paintbrush nonwelded unit.

The DOE response to the State of Nevada's concern is contained in your two letters to me, one dated September 17, 1993, and another dated August 20, 1993. In these letters, you state that "although data are not yet available to show definitely how ESF construction will affect existing pneumatic or geochemical conditions, DOE has committed to monitor the effects of ESF excavation on this data-gathering program as construction proceeds." The plan proposed in your August 20, 1993, letter identifies drill holes that will be tested and monitored for gas chemistry data. Six holes are identified; UZ16, UZ14, UZ6, UZ6s, UZ7, and SRG5/SD11 along with possible sampling of 3 more holes; UZ4, UZ5, and UZ13. However, the plan offers no explanation of how the collection of this data will address the State's concern.

Representatives of DOE presented an Accelerated Surface Based Testing Plan on three occasions, including: an NRC/DOE Technical Exchange, from October 4-5, 1993; a meeting of the Nuclear Waste Technical Review Board, from October 19-20, 1993; and a Scientific Roundtable Interaction on Yucca Mountain Pneumatic Continuity, from January 26-27, 1994. At these presentations an Accelerated Surface Based Testing Plan was described that had the objective of addressing the State of Nevada's concern. From these meetings, it appears the plan has been expanded from the plan described in your August 20, 1993, letter. However, again at these presentations no explanation was provided on how the accelerated surface based testing plan would address the State's concern.

To investigate the State of Nevada's concern, the NRC staff needs a description of potential ESF interference effects on the collection of ambient air pressure and air chemistry data (if any). If possible, the description should include the degree of interference or why the interference is or is not expected. The staff also needs the current description of the accelerated surface based testing program and an explanation of why the DOE feels that the accelerated surface based testing plan will address this concern. In other words the explanation should include a description of the logic and reasoning

which support how the Accelerated Surface Based Plan will address this concern. If possible, the explanation should include:

1. A discussion of how the plan will be able to characterize potential pneumatic barriers; focusing on the Paintbrush nonwelded unit over the site, the Topopah Spring unit outcrop in Solitario Canyon, and the Solitario Canyon fault.
2. Information on the schedule of hole drilling and the frequency of gas sampling and air pressure data collection.
3. Information on the schedule of data analysis relative to estimated ESF construction.
4. A description of drill hole locations (map), geohydrologic units sampled, along with the type of sample (water or air) for each drill hole, the type of gases to be sampled and the pneumatic properties to be determined.
5. An estimate of the length of time needed to collect air pressure data using barometric changes to characterize potential pneumatic barriers. Include a discussion of the estimated time available to complete this type of testing. The following questions are offered as help in supplying this information. How important is it to have winter weather systems to serve as the driving force for barometric pumping? Would smaller weather systems during the rest of the year suffice? Would intense thunderstorms provide useful stresses?

In addition, should the ESF cause large scale air pressure effects; the staff would like to know to what extent the effects could be mitigated or the data collected by other approaches. If possible, the explanation should include:

1. A discussion of the potential to factor in tunnel effects to interpret air pressure data relative to describing potential pneumatic barriers.
2. Or alternatively, a discussion of the possibility of using the tunnel to provide a useful pressure stress for testing in a way that would add to, rather than detract from, the data collection?
3. A discussion of the likelihood of sealing or isolating a portion of all of the ESF, should investigators want to isolate it from barometric pressure variations.
4. A discussion of the effectiveness of alternative data collection methods to characterize potential pneumatic barriers (such as borehole air injection tests or core sample testing). The NRC staff is particularly interested in learning if vertical air permeability data determined from barometric changes will be significantly better than air permeability data determined from air injection tests?

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The NRC staff would also like a discussion of the anticipated effect of low permeability layers on repository performance? Specifically:

1. Would a low permeability layer above the repository negatively affect it's performance by providing a barrier to vapor transport away from the near field, leading to such consequences as earlier than predicted rewetting, or adverse flow-back of condensed water?
2. Would a low permeability layer significantly restrict the transport to the atmosphere of gaseous ¹⁴CO₂?

In a separate letter, I will be discussing two staff concerns related to this subject (the disposition of the staff's Question 1 from Site Characterization Plan Progress Reports 6 and 7 and Site Characterization Analysis Comment 123). You may find it useful to coordinate your review and any response to these two letters.

If you have any questions regarding this letter or would like to discuss this concern further, please contact Mark Delligatti, of my staff. Mr. Delligatti can be reached at (301) 415-6620.

Sincerely,
JS
 Joseph Holonich, Chief
 High-Level Waste and Uranium Recovery
 Projects Branch
 Division of Waste Management
 Office of Nuclear Material Safety
 and Safeguards

cc: See attached list

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Mr. Dwight Shelor

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cc: List

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