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STATE OF NEVADA

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6-12-95

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June 2, 1995

John T. Greeves, Director
Division of Waste Management
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Greeves:

In a letter dated May 12, 1995 from yourself to R. Milner, Office of Civilian Radioactive Waste Management, U.S. Department of Energy (DOE), the NRC staff concluded that an "objection" level concern did not exist relative to the concern that the Exploratory Study Facility construction might compromise the ability to collect and analyze pneumatic pathway data, and that it was DOE's decision when to release the hold point at the geologic contact between the Tiva Canyon welded unit and the Paintbrush non-welded unit. The State of Nevada has comments and concerns with the findings and conclusions expressed by the NRC staff. This letter discusses the State's views on the pneumatic pathway issue as addressed in the NRC letter.

The May 12 NRC letter contains two "objection" findings and seven conclusions relative to the pneumatic pathways issue and the Department of Energy's March 31, 1995 letter on the subject. The following discussion addresses each finding and conclusion and gives the State's response.

Finding 1. The technique of collecting soil gas pressure data in response to barometric pressure changes from the land surface is not necessary to license the site. This conclusion is based on the observation that modeling of gas flow through the mountain is heavily dependent on data from other tests which are not impacted by ESF construction.

Response to Finding 1. The State of Nevada believes the NRC finding to be an error in technical judgment on an issue that is critical to the determination of site performance and the issuance of a site license. The State of

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Nevada believes that useful modeling of undisturbed gas phase circulation can only be accomplished with the collection and analysis of site-wide, three-dimensional, undisturbed soil gas pressure data. The State of Nevada urges the NRC to "demonstrate" how the data from other tests may be used to model gas flow, particularly in terms of establishing bulk pneumatic permeability values of geologic units, fault zones, and low permeability boundaries determined at the repository modeling scale.

Finding 2. The technique of collecting soil gas pressure data in response to barometric pressure changes from the land surface is mitigatable and is not irreparable. Furthermore, ESF construction effects on this characterization technique will not physically preclude obtaining information necessary for licensing. This is because some of this data will be collected before it can be impacted by the ESF, the characterization program will be looking to quantify the extent of any impact by the ESF, and pneumatic pathway data can be collected using other techniques that are not impacted by ESF construction.

Response to Finding 2. The State of Nevada requests explanations of how NRC arrives at "mitigatable" and "not irreparable." Since the original letter to the NRC in February 1993 which articulated the State's pneumatic pathway concern, the basis of the State's concern was that TBM penetration through the PTn unit could create an artificial pathway and prevent the collection of undisturbed pneumatic information. Once the tunnel penetrates both very small and very large permeability boundaries, these features can never be detected, or tested, at a useful scale. Likewise, once the undisturbed geochemistry of the soil gas is disrupted by the mixing of atmospheric gas through the tunnel, there is no way in the future to sample the background soil gas for verifying regions of no mixing, partial mixing, and direct atmospheric circulation. In the State's view, such a penetration presents an irreparable situation and cannot be mitigated. The State of Nevada sees no scientific basis for the NRC's finding.

Conclusion 1. The conceptual model of gas flow through Yucca Mountain is reasonable, given the present state of knowledge about the mountain.

Response to Conclusion 1. A "reasonable" conceptual model must be tested by appropriate field data. The "conceptual model" is that of compartmentalization, and the only demonstrated manner for verification of the degree of lateral reduction of permeability in the fault zones is through large-scale observations of the barometric signals on either side of the faults, with a minimum of two installations per side of the fault to confirm effects of the assumed lateral boundary (fault or fault zone). The most confident approach is a combination of vertical profiles of pressure data and vertical profiles of the geochemistry of the soil gas, neither of which has been accomplished to a minimal density, nor can be accomplished if the ESF introduces atmospheric gas and pressures to highly permeable zones or layers (i.e., fault zones, layers of highly fractured welded tuff). Given the present state of knowledge, these highly permeable zones are likely present and widespread.

Conclusion 2. The collection of undisturbed soil gas pressure data in response to barometric pressure changes from the land surface provides useful information to help characterize pneumatic pathways.

Response to Conclusion 2. The collection of undisturbed soil gas pressure data in response to barometric pressure changes from the land surface provides the only demonstrated databases capable of documenting repository scale boundary conditions.

Conclusion 3. The DOE plans to collect soil gas pressure data in response to barometric pressure changes from the land surface, before it can be disturbed by ESF construction.

Response to Conclusion 3. This is a false conclusion based on a series of assumptions of relatively low lateral bulk permeabilities and undocumented boundary conditions. DOE assumes, and therefore the NRC assumes, that the soil gas pressure data will be collected before it can be disturbed by the ESF. Absent any data to the contrary, a 25-foot

diameter, artificially ventilated penetration into the Topopah Spring unit could result in lasting disturbance on a site-wide basis.

Conclusion 4. While the collection of undisturbed soil gas pressure data in response to barometric pressure changes from the land surface does provide useful information to help characterize pneumatic pathways, most of the information to characterize pneumatic pathways will come from tests, which are not impacted by ESF construction.

Response to Conclusion 4. NRC is mistaken as to the utility of the localized testing associated with study plans cited in the enclosure to the NRC letter. These studies will not provide databases that define boundary conditions at a useful repository modeling scale in the highly fractured and faulted layered and varied lithologic units. Only two general databases will prove useful at the repository modeling scale for gas phase circulation modeling: undisturbed gas geochemistry and the vertical pressure profiles. These databases must be reasonably comprehensive throughout the repository block and adjacent areas if NRC desires to understand predisturbance soil gas circulation and repository performance with above boiling water vapor migration. The State of Nevada views this information as fundamental to site characterization.

Conclusion 5. Should construction of the ESF preclude the collection of additional undisturbed soil gas pressure data in response to barometric pressure changes from the land surface, other characterization activities should be able to characterize pneumatic pathways.

Response to Conclusion 5. This statement is not scientifically credible. If the NRC believes that other characterization activities can characterize pneumatic pathways, then the NRC has the obligation to describe how these other activities will accomplish the characterization of pneumatic pathways. Neither DOE nor NRC documents describe how other studies expect to accomplish this characterization. The State of Nevada requests detailed clarification, particularly the scale of test influence and density of testing.

Conclusion 6. The DOE plan to collect soil gas pressure data is designed so that interference effects by the ESF on gas pressures may provide additional information relevant to pneumatic pathways.

Response to Conclusion 6. The basic undisturbed pressure and soil gas chemistry needs to be fully developed before the ESF precludes confident determination of vertical and lateral boundary conditions.

Conclusion 7. A significant amount of the data to characterize pneumatic pathways comes from the ESF. Therefore, delays in ESF construction could have significant impacts on pneumatic pathway characterization.

Response to Conclusion 7. Both DOE and NRC need to itemize what <u>significant data on pneumatic pathways</u>, other than the ESF itself becoming a pneumatic pathway, will come from the ESF tests. The scales at which <u>all</u> ESF testing are conducted leads the State of Nevada to conclude only highly localized properties related to pneumatic continuity will be determined. Surface-based monitoring allows for large scale, up to repository scale, monitoring if the surface-based facilities are emplaced prior to ESF disruption of pneumatic continuity and on-site gas geochemistry. Both DOE and NRC have failed to recognize the critical aspect of "scale" when dealing with gas phase flow and fractured/faulted terrain. <u>Only</u> surface-based testing using atmospheric pressure changes gives a scale of stress appropriate for the recognition of boundary conditions and large scale, useful, pneumatic properties of the media.

Presently DOE has data from drillholes NRG-6 and NRG-7A. Nye County has data from drillhole NRG-4. The State of Nevada has not formally received nor analyzed any data from these drillholes. Preliminary analysis of barometric pressure data plots prepared by the U.s. Geological Survey and presented at the February DOE Technical Program Review suggests a lag in pressure data between the atmospheric signal and the Topopah Springs unit beneath the PTn. Similar observations have been made at NRG-4 by Nye County. However, the lag times vary significantly among the three drillholes. Therefore, it seems that, on the basis of these initial databases, the three-dimensional confinement is variable and needs a database density much better developed to determine lateral and vertical boundary conditions. NRC must demonstrate how this will be accomplished if not through the surface-based program with more database points.

NRC remains silent as to the importance of locating the surface expression and distribution of soil gas discharge (exchange). This is a critical part of the third dimension of natural and induced gas phase circulation. NRC must demonstrate how three-dimensional data can be obtained to establish useful model boundary conditions without soil gas discharge information.

In summary, the NRC letter does not present a credible scientific justification for a "no objection" decision to DOE's release of the TBM hold point. The letter presents no data analysis or methodology analysis to support the staff's decision. The State of Nevada continues to emphasize the potential of irreparable loss of undisturbed gas phase circulation data if the TBM is allowed to penetrate through the PTn prior to an adequate collection and analysis of site-wide barometric pressure data, or surface exchange data. The staff's decision, if not reversed, will likely lead to legal challenges during the licensing process. Contrary to the staff's view, the State of Nevada believes that gas phase circulation from the repository to the ground surface is a public health and safety issue at Yucca Mountain, and any repository thermal loading strategy that creates mobilized water vapor, or any engineered barrier design that may result in gas phase radionuclide releases, underscores the justification for this belief.

Sincerely,

Robert R. Loux
Executive Director

RRL/mjj
cc: R. Milner, DOE-OCRWM
M. Steindler, NRC-ACNW
J. Cantlon, NWTRB
L. Bradshaw, Nye County