

MAY 13 1993

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, D. C. 20585

Dear Mr. Shelor:

SUBJECT: TRANSMITTAL OF LETTER FROM C. JOHNSON, STATE OF NEVADA, CONCERNING  
NRC'S ABILITY TO CORRECTLY APPLY 10 CFR PART 60 TO THE  
CHARACTERIZATION OF PNEUMATIC (GAS, AIR OR VAPOR) PATHWAYS AT THE  
YUCCA MOUNTAIN SITE.

On February 4, 1993, this office received the enclosed letter from Carl A. Johnson, Administrator of Technical Programs, State of Nevada. Mr. Johnson asked the NRC staff to consider that the early excavation of the Exploratory Studies Facility (ESF) may preclude the adequate characterization of pneumatic (gas, air or vapor) pathways at the Yucca Mountain site, and that the staff may be prevented from making a finding on the issue of the fastest pathway for radionuclide release.

Mr. Johnson presented a series of arguments in his letter that suggest that a surface based exploration program, if properly designed, offers the only opportunity to characterize the vadose zone with respect to the pneumatic properties of the site at the required performance scale. His position is that the ESF should not take precedence over a properly designed surface based exploration program. He concluded by stating that an early tunnelling program at Yucca Mountain may preclude the collection of pneumatic data necessary for addressing key site performance issues and satisfying NRC regulations.

The NRC staff has expressed similar concerns in its Site Characterization Analysis (SCA comment 123), Phase I review of Study Plan 8.3.1.2.2.5, "Diffusion Tests in the Exploratory Studies Facility" and review of Progress Reports (PR) 6 and 7. We expect that DOE will respond to the concerns expressed by the staff before starting operations with the tunnel boring machine. The staff considers that the site characterization program, and a demonstration of how a potential repository will meet 10 CFR Part 60 requirements in the license application should be addressed by DOE. Therefore, Mr. Johnson's letter is enclosed for your consideration.

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February 4, 1993

Mr. B. J. Youngblood, Director  
U.S. Nuclear Regulatory Commission  
High-Level Waste Management Division  
Washington, DC 20555

Dear Mr. Youngblood:

It has come to my attention that the prioritization of the Department of Energy's site characterization activities may have an effect on the NRC's ability to correctly apply 10 CFR Part 60 Regulations. The current schedule of activities for the Yucca Mountain site which includes early excavation of the Exploratory Studies Facilities (ESF) may preclude adequate characterization of pneumatic (gas, air, or vapor) pathways, and as such may prevent the NRC from making a finding on the issue of fastest pathway for radionuclide release.

The following 10 CFR Part 60 Regulations are applicable:

10 CFR 60.113(a):

(2) Geologic setting. The geologic repository shall be located so that pre-waste-emplacement groundwater travel time along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment shall be at least 1,000 years or such other travel time as may be approved or specified by the Commission.

10 CFR 60.122 (b):

(8) For disposal in the unsaturated zone, hydrogeologic conditions that provide -

(i) Low moisture flux in the host rock and in the overlying and underlying hydrogeologic units;

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(ii) A water table sufficiently below the underground facility such that fully saturated voids contiguous with the water table do not encounter the underground facility;

(iii) A laterally extensive low-permeability hydrogeologic unit above the host rock that would inhibit the downward movement of water or divert downward moving water to a location beyond the limits of the underground facility;

(iv) A host rock that provides for free drainage; or

(v) A climatic regime in which the average annual historic precipitation is a small percentage of the average annual potential evapotranspiration.

**10 CFR 60.122 (c):**

(24) Potential for the movement of radionuclides in a gaseous state through air-filled pore spaces of an unsaturated geologic medium to the accessible environment.

**10 CFR 60.2:**

"Groundwater" means all water which occurs below the land surface.

Tunnelling, before a surface-based characterization program has established a predisturbance pneumatic database, may preclude resolution of the repository scale performance of bedded zones to air and vapor release. The early tunnel excavation plan eliminates the opportunity to collect data on how the bedded zones transmit barometric pressure changes, which are already known to vary above the Tiva Canyon bedded zone. The best measure at the repository block scale for "tightness" of the bedded zones is soil gas pressure data in response to barometric pressure channels. Once a tunnel introduces atmospheric pressures and artificial ventilation pressures into the Topopah Spring's highly fractured welded tuffs, there is little or no opportunity to develop a pneumatic database at the repository scale, or even a more localized scale.

Recognizing that performance assessment scenarios are both plausible and critical to site suitability, engineering design, and thermal loading options, the site characterization program for Yucca Mountain must be planned and executed to best predict the repository scale behavior with respect to the transport of liquid and vapor through the bedded zones. This is where a major concern of the State of Nevada lies with the current DOE Plan to get

underground to "see what's there". The early tunnel exploration plan, conducted before a surface-based characterization program has established a predisturbance pneumatic database for resolution of the repository scale performance of the bedded zones to released water vapor, eliminates the opportunity to collect representative data and resolve the issue at some time in the future.

Nevada's view is that a carefully designed surface-based program offers the only opportunity to characterize the vadose zone with respect to this key aspect of hydrogeologic behavior at the required performance scale. Those that advocate early underground exploration to characterize the vadose zone appear to lack an appreciation for the scale needed to confidently predict site performance, especially with a thermal load scenario. The Desert Research Institute experience at Rainier Mesa on the Nevada Test Site, where tunnels have been studied for decades to develop hydrologic data, demonstrates the difficulty of data development at the appropriate scale from disturbed environments of tunnels and breakout zones. There are a few classes of data that are better collected by tunnelling, but these are not the critical hydrogeologic parameters required to define site performance and satisfy regulations. After a surface-based program establishes the key repository block scale databases, tunnelling may add more localized knowledge, such as additional data on localized occurrences of perched water, ephemeral fracture flow, variation in matrix saturation, water samples for hydro-geochemical studies, character of fault zones at depth, etc. These localized data, however, may be established to useful degrees from surface-based studies and therefore should not be considered to have priority when compared to the pneumatic datasets needed for repository scale predictive performance.

In summary, an early tunnelling program at Yucca Mountain may preclude the collection of pneumatic data necessary for addressing key site performance issues and satisfying NRC regulations. The NRC definition of "groundwater" includes gas, air, or vapor (pneumatic) conditions. Acquisition of data necessary to determine whether pneumatic movement of radionuclides may affect waste isolation, as required by 10 CFR 60.122(c), may not be achievable with early excavation. Acquisition of data necessary to define favorable hydrogeology conditions in the unsaturated zone, as required by 10 CFR 60.122(b), may not be achievable with early excavation. Given that the definition of groundwater includes pneumatic conditions, early excavations may preclude the collection of representative data necessary to define the pre-waste-emplacement groundwater travel time with reasonable assurance required to satisfy 10 CFR 60.113(a)(2). The State recommends the NRC carefully review this concern in the context of its future regulatory determinations.

We are available to discuss this matter with you and your staff at your convenience.

Sincerely,



Carl A. Johnson  
Administrator of Technical Programs

CAJ:jem

cc: Dade Moeller, NRC-ACNW  
John Cantlon, NWTRB  
Lake Barrett, DOE  
Steve Kraft, EEI  
Dwayne Weigel, GAO