



Department of Energy

Washington, DC 20585

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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:

Study Plans 8.3.1.2.2.3, "Characterization of the Yucca Mountain Unsaturated-Zone Percolation," 8.3.1.2.2.4, "Characterization of the Yucca Mountain Unsaturated-Zone in the Exploratory Studies Facility," 8.3.1.2.2.6, "Characterization of the Yucca Mountain Unsaturated-Zone Gaseous Phase Movement," and 8.3.1.2.2.7, "Hydrochemical Characterization of the Unsaturated Zone," provide the basis to explicitly address Site Characterization Analysis (SCA) open item, Question 25. The administrative record for the open item in the enclosure consists of: (1) the U.S. Department of Energy's (DOE) December 14, 1990, SCA response to Question 25; (2) the U.S. Nuclear Regulatory Commission's (NRC) July 31, 1991, evaluation of this response; and (3) a supplemental response with further explanation or additional information to resolve this open item.

On the basis of the information in the enclosure, DOE regards SCA Question 25 as resolved.

If you have any questions, please contact Mr. Chris Einberg of my office at 202-586-8869.

Sincerely,

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

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Enclosure:  
Administrative Record for  
SCA Question 25

cc w/enclosure:

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ENCLOSURE

SCA Question 25 and DOE Response (12/14/92)

NRC Evaluation of DOE Response (7/3/91)

Supplemental Response Relevant to SCA Question 25

ENCLOSURE

QUESTION 25

The SCP and supporting documents (e.g., Fernandez et al., 1987) emphasize characterization and design<sup>o</sup> to ensure that water will not compromise the containment and isolation of radionuclides from the accessible environment<sup>o</sup> (p. 8.3.3.1-1). How are air flow characteristics of the site, particularly faults, to be evaluated?

BASIS

- o In developing performance goals for the sealing subsystem, Fernandez et al. (1987) assume uniform air conductivities (p. 3-22) for the overlying tuff rock. However, some zones, particularly faults, may have conductivities which differ significantly from assumed uniform conductivities.
- o The SCP recognizes that the "potential for flow through discrete fractures or faults are important hydrologic aspects that require further evaluation" (p. 8.3.1-4).
- o In discussing seal subsystem concepts and performance goals for gaseous species, Fernandez et al. (1987) address goals for shafts, ramps, drifts and exploratory boreholes, but do not discuss faults explicitly.

RECOMMENDATION

The SCP updates should discuss the need for plans to characterize the site air flow conductivities and flow patterns, particularly as they relate to the gaseous outflow through faults.

REFERENCES

J. Fernandez, P.C. Kelsall, J.B. Case, and D. Meyer, Technical Basis for Performance Goals, Design Requirements, and Material Recommendations for the NNWSI Repository Sealing Program. SAND84-1895. September 1987.

RESPONSE

Several areas in the Site Characterization Plan (SCP) address the site flow properties. These areas, consider to varying degrees, the airflow properties. Relevant sections in the SCP are Study 8.3.1.2.2.4 (Characterization of Yucca Mountain percolation in the unsaturated zone--exploratory shaft facility study); Study 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone--surface-based study); Study 8.3.1.2.2.6 (Characterization of gaseous-phase movement in the unsaturated zone); and Study 8.3.1.2.2.7, (Hydrochemical characterization of the unsaturated zone). Specific details of how air flow characteristics would be determined, would be included in the Study Plans.

REFERENCES:

- DOE (U.S. Department of Energy), 1989. Study Plan 8.3.1.2.2.4, Characterization of Yucca Mountain percolation in the unsaturated zone--Exploratory Shaft Facility Study. Yucca Mountain Project Office, Las Vegas, Nev.
- DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.2.2.7, Hydrochemical characterization of the unsaturated zone. Yucca Mountain Project Office, Las Vegas, Nev.

Section 8.3.3.1 Overview of the seal program, pp. 8.3.3.1-1/4

SCA QUESTION 25

The SCP and supporting documents (e.g., Fernandez et al., 1987) emphasize characterization and design "to ensure that water will not compromise the containment and isolation of radionuclides from the accessible environment" (p. 8.3.1.1-1). How are air flow characteristics of the site, particularly faults, to be evaluated?

EVALUATION OF DOE RESPONSE

- o DOE's response states that evaluation of airflow properties, to varying degrees, are planned in a number of studies in the SCP. The studies referenced in the SCP focus on airflow properties (namely, bulk permeability and gas composition) for a rock mass with joints and fractures. These studies do not address airflow properties relating to faults.
- o Also in its response, DOE references study plans for further details on how the air flow characteristics will be determined. It is not clear whether determination of airflow properties for faults will be included.
- o Progress toward closure of the question will require DOE's submittal for NRC review of the referenced study plans to identify whether they provide adequately for characterization of potential air flows along faults and an analysis of the potential influence of airflow along faults on isolation and containment, and, if necessary, on sealing requirements.
- o The NRC staff considers this question open.

Supplemental Response Relevant to SCA Question 25

The concern of the NRC is how air flow characteristics of the site, particularly in faults, are to be evaluated. In DOE's December 1990 response to this question, it was stated that the air flow properties would be addressed, in part, in four study plans. These four study plans have been approved by DOE and sent to the NRC.

In Study Plan 8.3.1.2.2.3 (Characterization of the Yucca Mountain Unsaturated-Zone Percolation), the measurement methods for the physical properties of the media and the hydrologic processes under which liquid and vapor flow in the unsaturated zone are presented. Section 2.2 presents the objectives of the study. Study Activity 8.3.1.2.2.3.3 (Solitario Canyon Horizontal Borehole Study) will examine the extent of fracturing, brecciation, and gouge development associated with the Solitario Canyon Fault and the water movement and gas flow movement within the unsaturated zone. Section 4.0 describes the application of results as they apply to performance and design issues concerned with fluid flow (both liquid and gas).

In Study Plan 8.3.1.2.2.4, Revision 1 (Characterization of the Yucca Mountain Unsaturated Zone in the Exploratory Studies Facility), gas flow in fractures is identified as a study objective in Section 1.1.1, "Objective of the Study." Table 2.1-2 describes the associated activities in other study plans, including gas permeability and fractures. Five activities in the study will provide information and detail the fracture flow movement: 8.3.1.2.2.4.1 (Intact-Fracture Tests); 8.3.1.2.2.4.2 (Bulk Permeability Tests); 8.3.1.2.2.4.4 (Radial-Borehole Tests); 8.3.1.2.2.4.5 (Equation-Effects Tests); and 8.3.1.2.2.4.10 (Hydrologic Properties of Major Faults Encountered in the ESF).

Study Plan 8.3.1.2.2.6 (Characterization of the Yucca Mountain Unsaturated-Zone Gaseous Phase Movement) provides the plan to understand the processes that cause gaseous-phase circulation through the unsaturated rock. Section 1.2, Objective of the Study, describes the total scope for the study.

In Study Plan 8.3.1.2.2.7 (Hydrochemical Characterization of the Unsaturated Zone), the gaseous- and aqueous-phase chemical investigations are described. Section 3.1, Gaseous-Phase Chemical Investigation, describes the activity for understanding the gas-transport mechanism and provides evidence of gas-flow direction, flux, and travel time within the unsaturated zone.