United States Department of the Interior

GEOLOGICAL SURVEY

Yucca Mountain Project Branch
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Dr. Jean L. Younker, Manager for Systems
TRW Environmental Safety Systems, Inc.
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Subject: U.S. Geological Survey-Yucca Mountain Project Branch (USGS-YMPB) Review of Department of Energy (DOE) Draft Response to Carl Johnson Letter of February 4, 1993

Dear Dr. Younker:

As requested in your letter of May 27, 1993, senior members of my technical staff and I have examined (1) the February 4, 1993, letter from C. A. Johnson, Nevada Nuclear Waste Project Office (NWPO), to B. J. Youngblood, U. S. Nuclear Regulatory Commission (NRC); (2) correspondence between the NRC and the Department of Energy (DOE), regarding the NRC's comments on the Site Characterization Plan, the study plan "Diffusion Tests in the Exploratory Studies Facility", and DOE's SCP Progress Reports 6 and 7; and (3) a preliminary draft DOE response to these documents with respect to the characterization of pneumatic pathways at Yucca Mountain.

Based on our evaluation, I believe that both technical and regulatory issues of significance are contained in the State and NRC letters, such as the need to collect baseline information on the potential repository site area prior to ESF construction. More specifically, we share with NRC and NWPO the concern that the acquisition of minimally disturbed pneumatic and geochemical information is likely to be impaired by exploratory tunneling into the unsaturated zone at Yucca Mountain, although the degree of impairment is presently unknown.

In its Site Characterization Analysis (SCA), Comment 123, the NRC recommended an analysis, before ESF construction, of the potential effects of ESF ventilation on liquid and gas flows in the adjacent rock. In the discussion of the basis for the comment, reference is also made to possible, but unestimated, temporary and irreversible geochemical effects, a theme that NRC revisited in its May 5, 1993, comments on Progress Reports 6 and 7. The NRC staff noted (in SCA Comment 123) that Yucca Mountain Project modeling studies cited in the SCP predicted a drying front extending 2 meters into the drift wall in one year and 15 meters in 20 years. However, the staff commented that the calculations were performed using the SAGUARO code, which considers only single-phase liquid flow in porous media and thereby excludes water-vapor transport. It was concluded in the basis for the comment that the SCP analyses were not sufficient to assure that ESF construction and operation would not interfere with the ability to acquire data needed for a potential license application.

The most important additional analyses of ventilation effects since the SCA was issued are presented by Sobolik, Pewell, and Eaton (1991, SAND91-0791), although the analyses address only moisture distribution and are necessarily limited in application by quite restrictive assumptions as to fracture characteristics. The magnitudes of the effects are similar to those reported in the SCP: drying fronts advance about 6 to 12 meters into the wall rock in 10 years, reaching more than 25 meters from a shaft or drift in the Calico Hills unit by 100 years. Like the earlier analyses, the report did not consider either the movement of gases

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or of chemical or isotopic constituents by flow or diffusive processes. Given the limited scope of the existing modeling and the sparseness of subsurface data upon which these models are constructed and calibrated, their results do not demonstrate reasonable assurance that the effects of ESF ventilation are of no concern to the surface-based testing program.

Previous DOE responses to SCA Comment 123 and to later related comments by the NRC do not, in my view, provide adequate assurance that the site-characterization surface-based testing program will not be adversely affected. For example, the basis for assuring the NRC that they had grossly overestimated evaporation was that they had neglected consideration that the shaft (ramps and drifts in the current ESF design) would be lined with concrete. Present plans, however, do not call for concrete lining, although minimal use of shotcrete for safety reasons in the ramps and drifts is planned.

In our opinion, the DOE decision to minimize shotcrete lining is correct. As we have already experienced in the starter tunnel, the use of shotcrete can significantly impact geologic data collection. If a large percentage of the underground excavation is shotcrete-lined shortly after being opened, the benefits of underground inspection will be severely diminished. Also, we can't ignore the potential geochemical effects of shotcrete lining, such as the expected alteration of the rock-gas composition by shotcrete curation and the curing compounds themselves.

Also, two assurances given to the NRC that (1) monitoring of in-situ conditions during construction will identify effects and (2) potential interferences between tests will be given careful scrutiny do not appear sufficient to provide the necessary confidence that in situ test results will not be compromised. The first "assurance" is subject to the completion of an adequate monitoring system before construction proceeds. The second "assurance" fails to recognize that the most important interferences may not be at a test-to-test scale but rather at the broader scale of minimally invasive versus significantly invasive testing.

In response to your request to assist in responding to the NRC and State of Nevada concerns, I believe an appropriate and defensible DOE response would be to acknowledge that SBT has fallen behind the accelerated ESF construction, and that we now need to accelerate the SBT in order to obtain undisturbed data. We also should acknowledge that the State and NRC have stated concerns worthy of serious discussion. Such discussions would lead into consideration of work that should be completed before the potential repository perimeter is penetrated or closely approached by the ESF construction, and of the schedule adjustments that are necessary to minimize possible adverse effects.

In the process of preparing this reply to your request for assistance, the USGS-YMPB staff did develop some preliminary ideas of surface-based testing that should precede significant penetration beyond the starter tunnel. Although not yet sufficiently mature to be offered as firm proposals, the following examples should provide the nature and scope of forthcoming suggestions:

A. <u>Complete presently planned testing and monitoring</u> of gas chemistry, gas flow, and shut-in pressures in UZ16 and UZ14 using currently available packer systems, prior to stemming; same testing, using SEAMIST systems and prior to stemming where appropriate, in UZ6, UZ6s, UZ7, and SRG5/SD11; possibly same testing with SEAMIST system in more distant holes UZ4, UZ5, AND UZ13.

B. <u>Monitor gas pressure in UE25a4</u> to overlap and continue beyond gas-pressure monitoring (after stemming) in NRG6.

C. <u>Develop and implement new plans</u> as in (A) for boreholes NRG2a, NRG5, NRG6, SRG4, and SD12.

D. Develop and implement new plan to drill and test as above UZ7a in the Ghost Dance fault and a new hole closer to the ESF location.

E. Develop and implement new plans to pull casing and perform pneumatic tests in selected WT holes (e.g., WT2) near the planned ESF excavation.

Generally, the objective would be to complete the testing and obtain about one year of monitoring data before excavation closely approaches the monitored holes.

Thank you very much for giving the USGS-YMPB an opportunity to provide the above input. If you have any questions or comments on this response, please do not hesitate to contact Dr. William Dudley, USGS-YMPB Science Advisor (303-236-5048) or me (702-794-7141).

Sincerely,

Larry R. Hayes

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