

MAR 5 1993

MEMORANDUM FOR: Joseph Holonich, Director
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Division of High-Level Waste Management

FROM: Margaret V. Federline, Chief
Hydrology and Systems Performance Branch
Division of High-Level Waste Management

SUBJECT: HYDROLOGY AND SYSTEMS PERFORMANCE BRANCH REVIEW OF DOE
PROGRESS REPORTS ON SITE CHARACTERIZATION, YUCCA MOUNTAIN,
NEVADA, NUMBERS 6 AND 7

The Hydrology and Systems Performance Branch has reviewed the DOE Progress Reports on Site Characterization for Yucca Mountain, Nevada, Numbers 6 & 7. Our review was conducted in accordance with the "Review Plan for NRC Staff Review of DOE Site Characterization Reports," issued August 10, 1990. These reports were reviewed by J. Bradbury, D. Chery, N. Coleman, V. Colten-Bradley, J. Pohle, W. Ford (Coordinator HT Section), D. Fehringer, and J. Park (Coordinator PA Section).

The Branch has concerns about the content and structure of Site Characterization Progress Reports. Site Characterization Progress Reports do not appear to provide the integrated information needed to evaluate ongoing efforts to identify and resolve potential licensing issues. As structured, the reports fail to address progress in site characterization activities and their impact upon repository performance in an integrated fashion which would allow an evaluation of the progress in addressing potential licensing issues. However, we are also concerned that the NRC Review Plan of DOE Site Characterization Plan Progress Reports (August 10, 1990) may have similar problems in that activities may not be structured to facilitate an integrated review to accomplish the stated purpose. Therefore, we do not have specific recommendations for an improved structure at this time. Rather, we suggest this topic be discussed at a future team meeting to explore what action, if any, should be taken.

Our review has produced one question concerned with the content of future Site Characterization Plan Progress Reports (enclosed). The DOE did not propose to close any open items that are the responsibility of the Hydrology and Systems Performance Branch. In addition, our review produced three recommendations (also enclosed); one concerned with the potential effects of the Exploratory

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Studies Facility on geochemical sampling, one with the relationship between site investigations and a program of periodic total system performance assessments, and one recommending that progress reports thoroughly cover results to date of ongoing work. We would like the DOE to consider our recommendation about potential Exploratory Studies Facility effects on geochemical sampling in a timely manner.

/s/

Margaret V. Federline, Chief
Hydrology and Systems Performance Branch
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**Site Characterization Progress Reports: Yucca Mountain, Nevada
Reports 6 & 7, Table 2.1**

QUESTION

What specific plans and studies are proposed to address NRC's Site Characterization Analysis open items?

BASIS

In Section 2.2 of the "Review Plan for NRC Staff Review of DOE Site Characterization Plan Progress Reports," one of the objectives of the NRC staff review is to "evaluate material related to potential resolution of existing NRC concerns being tracked in the OITS." In the progress reports Table 2.1 provides a status of progress towards resolution of NRC OITS concerns. The table includes a key identifying proposed methods to resolve NRC OITS concerns. Unfortunately, the key is so general that it is unclear what specific activities of the site characterization program will address a particular open item. For example, resolution code #5, one of the more common codes, means that an open item would be addressed by implementing a project plan, study plan, or other technical design study. However, the specific plan or study that would address an individual open item is not identified. Identification of a plan or study, would inform the NRC staff about which studies are intended to address various open items.

RECOMMENDATION

The NRC staff recommends that, where available, specific references be provided to identify draft and final reports intended to resolve open items. The NRC staff also recommends that activities responding to SCA and study plan concerns include a reference to the concern in the summary and a brief statement about any progress toward its resolution.

**OBSERVATIONS AND RECOMMENDATIONS
BY HLHP ON DOE PROGRESS REPORTS ON SITE CHARACTERIZATION,
YUCCA MOUNTAIN, NEVADA, NUMBERS 6 & 7**

Our review produced three recommendations; one concerned with the potential effects of the Exploratory Studies Facility on geochemical sampling, one with the relationship between site investigations and a program of periodic total system performance assessments, and one recommending that progress reports thoroughly cover results to date of ongoing work.

1. In reviewing these progress reports, we noticed that NRC Comment 123, which focuses on the Exploratory Studies Facility (ESF) has not been addressed. Comment 123 (U.S. NRC, 1989) observes that "The effects of ventilation of the exploratory shafts and the underground testing rooms may have been underestimated in the evaluation of the potential interference with testing and the potential for irreversible changes to baseline site condition; also, there is not an adequate analysis of the effects of ventilation in the ESF on the ability of the site to isolate waste." Furthermore, the comment suggests that "at an early date, but before construction of the exploratory shafts is begun, DOE should provide an analysis that considers the effects on ventilation of the ESF, including both liquid and gas flows, on the rock adjacent to the ESF."

The staff has an observation related to an aspect of this comment. If surface-based tests are planned, which will obtain chemical data necessary for site characterization and could suffer significant and irreversible/ unmitigatable effects from the construction of the ESF, we recommend this data be collected before it can be compromised. This recommendation should be considered before significant construction of the ESF is begun.

Our recommendation is motivated by our concern that excavation of the ESF could compromise surface-based tests, by allowing air to circulate from the ESF through the rocks of Yucca Mountain. Study Plan 8.3.1.2.2.7 (U.S. DOE, 1990) identifies chemical species that will be sampled in the Yucca Mountain unsaturated zone. Some of these chemical species such as ^2H , ^3H , Freon-11, Freon-12, ^{39}Ar , ^{14}C , and ^{18}O can move through the unsaturated zone in both liquid and gas phases. If air from the tunnels moves significant distances along paths of high air permeability, such as open fractures, gases from the tunnel could mix with liquids and gases in the rock. At locations where this occurs, future geochemical sampling of predisturbance baseline conditions could be compromised.

Current estimates of air flow through the ESF suggest that a significant volume of rock could come in contact with air containing different concentrations and types of chemical species. For example, a presentation by John Peters (1992), estimated that 264,533 cubic ft./min. (cfm) of air may eventually circulate through the ESF with 178,000 cfm used by internal combustion engines. Alternatively, in Dennis, 1991 (p. B-67), it is estimated that air fluxes in the main

tunnel could range from 300,000 cfm to 500,000 cfm.

While we are aware that two studies have been completed estimating the extent of ESF dewatering (Hopkins, 1987 and Sobolik, 1991); these investigations do not address the concern motivating our recommendation. In addition, we have been unable to find where this concern is addressed by the Site Characterization Plan (U.S. DOE, 1989) , or Study Plans 8.3.1.2.2.1 (U.S. DOE, 1990a), 8.3.1.2.2.3 (U.S. DOE, 1991), 8.3.1.2.2.4 (U.S. DOE, 1992) and 8.3.1.2.2.7 (U.S. DOE, 1990).

Study Plan 8.3.1.2.2.7 (U.S. DOE, 1990) references geochemical tests to characterize the Yucca Mountain site. Of the tests described in this study plan, we are particularly concerned with surface-based tests using boreholes, such as geochemical sampling associated with the deep unsaturated zone boreholes described in Study Plan 8.3.1.2.2.3 (U.S. DOE, 1991).

The DOE should consider this recommendation in a timely manner. Furthermore, we would like to know what the DOE decides about this recommendation and the basis for the decision.

2. Another observation concerns the relationship between site investigations and a program of periodic total system performance assessments. The staff welcomes DOE's initial iteration of the Total System Performance Assessment (TSPA), results of which were published by Sandia National Laboratories (Barnard, 1992) and Pacific Northwest Laboratory (Eslinger, 1993). The staff considers that this work demonstrates progress toward resolution of SCA Comment #1 (U.S. NRC, 1989), which addresses the need for DOE to provide early and iterative evaluations of the adequacy of data being gathered and the ability of the site to meet the 10 CFR Part 60 performance objectives.

In Progress Reports 6 and 7, analyses, results, and preliminary conclusions from the TSPA are discussed. From these discussions, it is not clear to the staff the extent to which analyses conducted under site characterization have been factored into the TSPA calculations. For example, in Progress Report #7, under Study 8.3.1.8.1.2 - Physical Processes of Magmatism and Effects on the Repository (p. 2-98), presentation of a paper describing studies of possible eruptive and subsurface effects of Yucca Mountain site disruption by basaltic volcanism is mentioned. However, what it is not discussed, either under this study or in the performance assessment section (2.7), is whether this work was factored into the TSPA analyses on volcanism and if so, how it was.

A second example concerns the evaluations of the effects of various repository heat loadings on hydrologic flow, conducted at LLNL and SNL and extensively discussed in Progress Report #7 (Study 1.10.4.2 - Hydrologic Properties of Waste Package Environment, pp. 2-151-155). Again, it is not clear from this discussion or from the discussion of performance assessment-related activities in Section 2.7 of the report, the extent to which this work was used or referenced in the TSPA

the extent to which this work was used or referenced in the TSPA calculations.

The staff recommends that future Progress Reports attempt to describe more explicitly the implementation of the link between site characterization and performance assessment activities, both in cases (1) when analyses conducted under site characterization are used or factored into performance assessment calculations and (2) when results and preliminary conclusions from performance assessment analyses have, are, or will be influencing on-going and future site characterization activities.

3. The staff repeated the following observation, which was also made in our review of Progress Report Number 5. While the progress report includes summaries of results of ongoing work, there are instances where the results summarized appeared minimal compared to the number of publications that were either finalized or in the review pipeline. It is recommended that summaries thoroughly cover results to date.

REFERENCES

- Barnard, R.W., et al, 1992, TSPA 1991: An Initial Total-System Performance Assessment for Yucca Mountain, Sandia National Laboratories, SAND91-2795.
- Dennis, A.W., 1991, Exploratory Studies Facility Alternatives Study Final Report, vol. 2, Sandia National Laboratories, SAND91-0025, p. B-67.
- Eslinger, P.W., et al, 1993, Preliminary Total-System Analysis of a Potential High-Level Nuclear Waste Repository at Yucca Mountain, Pacific Northwest Laboratories, PNL-8444.
- Hopkins, P., 1987, Effect of Drift Ventilation on Repository Hydrology and Resulting Solute Transport Implications, Sandia National Laboratories, SAND86-1571.
- Peters, J.W., 1992, Ramp Sizing by Ventilation Requirements, Presentation to Nuclear Waste Technical Review Board Structural Geology & Geoengineering Panel Meeting, Las Vegas, Nevada, Nov. 4-5, 1992.
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- U.S. DOE, 1990, Hydrochemical Characterization of the Unsaturated Zone, Study 8.3.1.2.2.7, Revision 0.
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