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WMHT: 3103

MEMORANDUM FOR: Hubert J. Miller, Chief
High-Level Waste Technical
Development Branch
Division of Waste Management

FROM: Robert J. Wright
Senior Technical Advisor
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Division of Waste Management

SUBJECT: PEER REVIEW OF NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS, AUGUST 24-28, 1981

The 1981 peer review of NNWSI was notable in two ways: (1) it was open to the public and (2) it was the most comprehensive review to date, requiring three concurrent sessions on some days to cover all subjects.

WM was represented by myself; Verne Hooker, U.S. Bureau of Mines (under the NRC/USBM interagency agreement); Richard Gates, F. Marinelli and D. Findley of Golder Associates Inc. (under Contract No. NRC-02-81-037). Hooker had accompanied the NRC site review team when we visited the project in February 1981.

The peer review provided a good opportunity for an update on the project since the February visit. Some significant developments were noted. In the numbered paragraphs below, there is a discussion of several matters of particular interest to NRC, based on observations of the individuals named in the preceding paragraph. The discussion does not attempt to provide a comprehensive critique of the project.

1. <u>Progress has been made in areas covered by the observations in the report on the February visit by NRC.</u>

a) The Bullfrog tuff is being reassessed as to its strength in relation to the predicted stresses in the openings of a repository. b) Considerable

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attention is being given to the requirements of 10 CFR 60. c) Quality Assurance was mentioned as an integral part of several studies. d) The parameters of seismic exploration are being studied on Yucca Mountain to determine whether a refined seismic survey can work. e) There is an improvement in the integration of program elements.

2. In the site characterization report only that part of in situ testing to be done in Phase I of the exploratory shaft will be discussed.

As now planned, the site characterization report will present only a portion of the in situ testing plans: only Phase I of the work to be done from the exploratory shaft will be described. This is reported to include limited drifting, drilling, and rock mechanics and hydrologic testing. Nothing is expected to be said about Phase II of the testing or about the work to be done in an "at depth test facility" with two shafts.

Such a site characterization report would be incomplete, from the standpoint of NRC licensing needs. The first phase of the exploratory shaft testing will not generate all of the information that is expected to be obtained from in situ testing. Therefore, the first phase does not constitute the full program of site characterization that must be covered in the SCR. Without a minimal presentation of follow-on in situ testing it would be impossible for NRC to evaluate the appropriateness of the Phase I work or the total in situ test effort. Further, the conceptual repository design, in the SCR, could not be analyzed as to its physical relationship to the exploratory shafts and testing excavations. The linkage between design parameters and the planned tests could not be identified. Due to these gaps in information, there is no way that NRC could develop assurance that the in situ investigations can be expected to yield, during site characterization, the information needed at licensing.

3. Properties of the Bullfrog tuff need careful analysis to determine whether it can qualify as a repository host rock

Current values for unconfined compressive strength of the Bullfrog tuff are on the order of 30 MPa (4,350 psi). At repository depth (2,400 feet), with an extraction ratio of 20 percent, the average pillar safety factor is estimated to be about two for compressive failure. U.S. Bureau of Mines studies indicate that such a safety factor is satisfactory only for rocks having a high RQD index (say, in the 50 to 100 range). It is

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questionable whether the Bullfrog values for RQD are in this range. (As of February, 1981 RQD values had not been determined). What is needed is a concentrated effort to apply all presently available information to determine whether the properties of the Bullfrog disqualify it as a repository host rock. If so, attention could then be focused on other candidate rocks in Yucca Mountain.

4. Measurements should be made of vertical hydraulic permeability

In the Yucca Mountain tuffs the interstitial permeability is very low, and water flow is dominantly through joints and fractures, which are mostly vertical or near-vertical. The exploratory drill holes are also vertical. While tests in such holes can be expected to provide a means of testing horizontal permeability, the tests are relatively insensitive to vertical permeability. In order to understand the groundwater flow pattern, measurements are needed of the vertical permeability of the hydrostratigraphic units. Such tests could be done by high volume pump tests, with observation wells. Alternatively, single well tests could be run in inclined holes.

5. Improved straddle packers are needed.

Some hydrologic test results, in holes G1 and H1 are not reliable because of packer leakage. A thorough search for available packers that could alleviate the problem is needed. Without improvement in test technique it will difficult to adequately characterize the ground water flow system.

6. There may be a rock stress problem at Yucca Mountain

Underground stress determinations at the Climax stock and at several sites in Ranier Mesa demonstrate that the horizontal compressive stresses are strongly bi-axial, at least 4-to-1. Elsewhere, this condition causes unstable conditions in coal mines and could cause a problem at Yucca Mountain, if the stress field is similar there. Priority should be given to stress measurements. Also, an engineering analysis should be made of the effect on repository design of such a 4-to-1 stress field, if present.

7. The reported negative coefficient of thermal expansion for nonwelded tuff may be incorrect

It is unlikely that the reported negative coefficient of thermal expansion is a true material property of tuff. Perhaps the indication is due to

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release of water during testing. Further examination of this property is needed. Meanwhile, its use in modeling is questionable.

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