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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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MEMORANDUM FOR: Mysore S. Nataraja, Project Manager
High-Level Waste Technical Development Branch
Division of Waste Management, NMSS

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THRU: Leon L. Beratan, Chief
Earth Sciences Branch
Division of Health, Siting, and Waste Management, RES

FROM: Thomas J. Schmitt, Geologist
Earth Sciences Branch
Division of Health, Siting, and Waste Management, RES

SUBJECT: REVIEW OF BWIP SITE CHARACTERIZATION REPORT

As per request of John Greeves, I have reviewed the BWIP SCR. Attached are my comments which I have restricted to the technical aspects of Chapter 4, Geoengineering, and Chapter 10, Design.

In my opinion, technical issues exist in both the Geoengineering and Design chapters. The difference between the laboratory and in situ rock properties is not adequately addressed. No analysis on the extreme variation in Goodman Jack Modulus is described. No discussion of RQD is made. While any discussion of those issues would be concerning the NSTF, I gather the purpose of the NSTF is to develop transferrable information.

The design is apparently based on a simple elastic model that assumes laboratory derived material properties for rock mass behavior. This is despite the experience at the NSTF which documents the inapplicability of simple elastic analysis. There are accepted methods for "reducing" laboratory moduli in light of field data. While none are perfect, any would yield realistic estimates for conceptual design purposes.

Thank you for the opportunity to comment on the document.

Thomas J. Schmitt

Thomas J. Schmitt, Geologist
Earth Sciences Branch, RES

cc: John Greeves, NMSS

Attachment:
As stated

00145

Comments - Set 4

Section	Page	Comment
4.2.3	4.2-5	Jointed Block Test The jointed block test is the single most important Geomechanics test yet conducted. However, critical information necessary for assessment of plans is neglected. The purpose of these tests is to test the rock mass, which include the dis-continuities and anisotropies. No geologic map of the test area is given. It is not possible to determine if this is a representative sample of the basalt or a unique sample of the basalt.
4.2.2	4.2-2	Borehole Jacking Test The borehole jacking test on the entablature zone of the Pomona flow yields an average moduli between .62 and 18.75 GPa. The laboratory measured samples for the same flow indicate a modulus of 85 GPa (Table 4-2(2)). The preliminary data for the jointed block test indicate a modulus of 40-44 GPa. This data range is not unlikely, however, there is insufficient data to evaluate the range. In situ moduli are often only 10% of the laboratory moduli; however, such a reduction is usually predictable on the basis of RQD. Although RQD is not perfect, however, lacking a detailed geologic investigation, it would be extremely useful in assessing the meaning of a variation from .62 to 85 GPa. The moduli from the jointed block test are at the upper range of the Goodman Jack data given in table 4-4. It would be nice to know the RQD correlation. General Comments - Moduli Moduli variation is an issue in any construction. The relation of moduli variation to an easily observable concept such as RQD or fracture density is important.

Section	Page	Comment
4.5.1	4.5-1	Importance of Discontinuities for Thermal Behavior Bullets 1 and 2 state that a problem occurred in thermomechanical testing because relationships between laboratory and field behavior have not been determined and the relative importance of discontinuities had not been established. This is the whole reason for in situ testing and should not be stated as a problem in testing.
4.5.2	4.5-2	Full-Scale Heater Tests Base assumptions in the thermal modeling were not described.
4.5.2	4.5-8 Para. 1	Thermomechanical Displacements No data on extensometer placement is given. It is noted that there is a "problem" with the thermomechanical response yet the data is not presented. The issues for resolution can not be adequately assessed without the data.
4.6.2	4.6-	In Situ Stress There are a number of other stress measurements in the region. How do the measurements at BWIP compare to those measurements?
4.8.2	4.8-1	Existing Basalt Construction Experience Have there been some tunnels in Japan in basalt? Have there been railroad tunnels in Deccan, India?

Chapter 10

I have limited the design questions to rock mechanics and other underground aspects.

Section	Page	Comment
10.2.2	10.2-6	Fig. 10-5 - There will be a lot of force on those 4 small support posts. Also, unless they are placed at "balance points" the weight could cause stress problems in a hot canister, (depending on the alloy).
10.5	10.5-1	Strength and Modulus of the Rock Mass The strength of the rock mass assumed is essentially the same as the laboratory determined values (200 MPa compressive, 14 MPa tensile). The Youngs modulus assumed is 67 Pa, this is in excess of the values determined by the Goodman Jack and the jointed block test in the NSTF. It is about $\frac{3}{3}$ of the intact laboratory modulus. This is critical because in section 10.5.1 the design stresses at the storage holes is indicated at 186 MPa; and the placement room crowns to be 156-167 MPa. This is a very small safety margin. It is even more critical because experience shows that the laboratory strength is generally significantly higher than the in situ strength.
10.5.1	10.5-3	Rock Stress Analysis No description of the method of thermomechanical response modeling is given. Apparently it involves linear elastic modeling. This is quite a significant simplification as it is explained in section 4.5.2 that the thermal mechanical response in the NSTF was not predictable.
10.5.3	10.5-9	Rock Support The need for rock support is identified, however, no supporting analysis are given. The thermal load will be such that the empirical placement techniques will not be adequate. This should be identified as an issue.

Section	Page	Comment
10.7.2	10.7-2	Backfill The backfilling procedures involve a yet-to-be developed machine. What performance, i.e., amount of consolidation, is required of the machine? Even if further details are not known, the performance requirements should be known.