

September 24, 2002

George M. Hornberger, Chairman  
Advisory Committee on Nuclear Waste  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

SUBJECT: IGNEOUS ACTIVITY ISSUES AT YUCCA MOUNTAIN

Dear Dr. Hornberger:

This letter responds to your letter of August 1, 2002, to the Chairman, regarding "Igneous Activity Issues at the Proposed Yucca Mountain Repository." Your letter contained three main conclusions on the: 1) probability of igneous activity; 2) analysis of magma drift interactions; and 3) adequacy of igneous activity agreements with the U.S. Department of Energy (DOE). This response addresses each of your main conclusions. In addition, igneous activity issues will be discussed further during your November meeting as the staff is scheduled to update the Committee on its activities at that time.

### **Probability of Igneous Activity**

The staff agrees with the Committee that when new geophysical information becomes available, it needs to be evaluated to determine possible changes in the appropriate probability range for igneous events. Any resulting changes in the probability range should then be propagated in performance assessment and the corresponding risk significance be analyzed. The staff recognizes the reviews performed by the Committee's consultants to provide additional views on the igneous activity issue, specifically the recently completed aeromagnetic surveys<sup>1</sup> and the work by Smith, *et al.* (2002).<sup>2</sup> While DOE is performing an evaluation of how these recently available studies could potentially change the probability range for igneous events and the performance assessment results, the staff is performing an independent evaluation to ensure the relevant information is used to review DOE's work. Currently, initial staff evaluations support the alternative hypotheses, contained in Hill and Stamatakos (2002),<sup>3</sup> that indicate that the effect on the probability values of the new aeromagnetic data could range from negligible to an order of magnitude increase in probability values. The staff expects that

G. M. Hornberger -2-

---

<sup>1</sup> Blakely, R.J., V.E. Langenheim, D.A. Ponce, and G.L. Dixon, "Aeromagnetic Survey of the Amargosa Desert, Nevada and California: A Tool for Understanding Near-Surface Geology and Hydrology," Denver, Colorado, U.S. Geological Survey Open-File Report 00-188, 2002.

<sup>2</sup> Smith, E., I., D.L. Keenan, and T. Plank, "Episodic Volcanism and Hot Mantle: Implications for Volcanic Hazard Studies at the Proposed Nuclear Waste Repository at Yucca Mountain, Nevada," *GSA Today*, 12 [4]:4-10, [April] 2002.

<sup>3</sup> Hill, B. E., and J.A. Stamatakos, "Evaluation of Geophysical Information Used to Detect and Characterize Buried Volcanic Features in the Yucca Mountain Region," San Antonio, Texas, Center for Nuclear Waste Regulatory Analyses, June 2002. [Prepared for the NRC.]

these evaluations will lead to a better assessment of the uncertainty in the probability of igneous events used in performance calculations.

The staff continues to review information presented in Smith *et al.* (2002), which suggests higher recurrence rates are possible for the YMR basaltic system. Although the staff does not agree with the process model proposed by Smith *et al.* (2002), there are complexities to the model that need to be evaluated by DOE prior to submitting a potential license application, and by NRC during a potential licensing review.

### **Analyses of Magma Drift Interactions**

The staff agrees that the models of Woods, *et al.* (2002)<sup>4</sup> are idealized and should not be used directly in any performance assessment, although footnote 2 and the last paragraph of your letter may be construed that the work by Woods, *et al.* were developed for use in performance assessment.<sup>5</sup> This first-of-a-kind work represents a simplified model that was used to obtain a significantly better understanding of an extremely complex process and was not developed for direct use in performance assessment. The results of Woods, *et al.* and associated studies provide useful information for interpreting some of the possible effects of magma flow into intersected drifts. As a result of the insights obtained, work this year is focusing on the effects of convecting magma, rather than initial conditions, as this appears to be the more risk-significant process.

As the work progresses in magma-drift interactions, the performance assessment models will be updated, as appropriate, to reflect the linkage between probability and consequences and to provide our best understanding of the risk significance of all appropriate processes related to igneous activities.

### **Igneous Activity Agreements with DOE**

The staff also agrees with the Committee that the agreements in place between DOE and NRC provide a reasonable basis for proceeding with the evaluation of a potential license application, and that the work of Woods, *et al.* (2002) helped to obtain these agreements. We also note that the agreement on magma-drift interactions is a major focus of the ongoing DOE peer review of igneous activity and that the interim report<sup>6</sup> recommends further careful study of the dog-leg (magma-drift interaction) scenario.

---

<sup>4</sup> Woods, A.W., S. Sparks, O. Bokhove, A-M. Lejeune, C. Connor, and B.E. Hill, "Modeling Magma-Drift Interaction at the Proposed High-Level Radioactive Waste Repository at Yucca Mountain, Nevada, USA," *Geophysical Research Letters*, Vol. 29, No. 13, 2002.

<sup>5</sup> Based on discussions between the staff and the Committee during the Igneous Activity letter writing session, it is the staff's understanding that these comments in your letter are generic observations that apply to all disciplines that are part of performance assessment modeling.

<sup>6</sup> Budnitz, R.J., E. Detournay, L. Mastin, J.R.A. Pearson, and F. Spera, "Yucca Mountain Igneous Consequences Peer Review Panel Interim Report" prepared for Bechtel SAIC Company for the Office of Civilian Radioactive Waste Management of the U.S. Department of Energy, 2002

G. M. Hornberger

- 3 -

As stated above, the staff will present an update of the Igneous Activity program to the Committee during the November meeting. Potential items of discussion include: 1) review of DOE aeromagnetic studies; 2) results of DOE-sponsored peer review of its program in igneous activity; and 3) discussion of the latest results from our studies on magma-repository interactions.

The staff recognizes that there will continue to be specific technical areas which would benefit from continued discussions between the staff and the Committee. We look forward to these discussions as a means to improve all parties' understanding of the Igneous Activity issues at Yucca Mountain and to help the staff prepare for its review of a potential license application.

Sincerely,

*/RA/*

William D. Travers  
Executive Director  
for Operations

cc: Chairman Meserve  
Commissioner Dicus  
Commissioner Diaz  
Commissioner McGaffigan  
Commissioner Merrifield  
SECY

G. M. Hornberger

- 3 -

As stated above, the staff will present an update of the Igneous Activity program to the Committee during the November meeting. Potential items of discussion include: 1) review of DOE aeromagnetic studies; 2) results of DOE-sponsored peer review of its program in igneous activity; and 3) discussion of the latest results from our studies on magma-repository interactions.

The staff recognizes that there will continue to be specific technical areas which would benefit from continued discussions between the staff and the Committee. We look forward to these discussions as a means to improve all parties' understanding of the Igneous Activity issues at Yucca Mountain and to help the staff prepare for its review of a potential license application.

Sincerely,

*/RA/*

William D. Travers  
Executive Director  
for Operations

cc: Chairman Meserve  
Commissioner Dicus  
Commissioner Diaz  
Commissioner McGaffigan  
Commissioner Merrifield  
SECY

**DISTRIBUTION: G20020484**

File Center      NMSS r/f      NMSS Dir Off r/f      DWM r/f      EDO r/f      HLWB r/f  
PTressler      WTravers      CPaperiello      BFleming      SECY-LTR-02-0536

**ADAMS Accession No. ML022490403** \*see previous concurrence

OFC	HLWB		Tech Ed		HLWB		HLWB	
NAME	J. Trapp*		E. Kraus*		L. Campbell*		J. Schlueter*	
DATE	08/28/02		08/26/02		09/05/02		09/06/02	
OFC	DWM		NMSS		DEDMRS		EDO	
NAME	J. Greeves*		M. Virgilio		C. Paperiello		W. Travers	
DATE	09/13/02		09/18/02		09/24/02		09/24/02	