UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, DC 20555 - 0001

ACWNR-0264

June 6, 2007

The Honorable Dale E. Klein
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: IGNEOUS ACTIVITY AT YUCCA MOUNTAIN: TECHNICAL BASIS FOR DECISION MAKING

Dear Chairman Klein:

The Advisory Committee on Nuclear Waste and Materials (the Committee) is pleased to forward the attached report "Igneous Activity at Yucca Mountain: Technical Basis for Decision Making." This report was prepared by the Committee at the request of the Commission in SRM M060111B, February 9, 2006, "to provide the Commission with an analysis of the current state of the knowledge regarding igneous activity which the Commission can use as a technical basis for its decisionmaking." The report presents a review and analysis of the range of current technical views on the nature, likelihood, and potential consequences of future igneous activity at the proposed repository. The Committee appreciates the ongoing dialogue with the U.S. Nuclear Regulatory Commission (NRC) staff regarding alternative igneous activity views presented in the report.

The Committee considered the full range of current views on igneous activity when it determined its general observations, presented in the Executive Summary of the report. Briefly summarized, these observations are as follows:

1. *The nature and consequences of an igneous event in the Yucca Mountain vicinity lead to differing professional judgments and alternative views on the expected impacts of igneous activity on the proposed high-level waste repository. As a result, evaluation of risk from an igneous event requires quantitative consideration of credible alternative views.*

2. *Despite the broad range of conceptual models and parameters used there is general agreement on many aspects of the nature of potential igneous events and the range of probability of these events in the future.*

3. *The consequences of an igneous event on the repository are more controversial and less well understood than other aspects of igneous activity, but consequence models are evolving through consideration of magma physics. The significance to risk of differences in these views is not well documented.*

4. *Limitations in fundamental information and knowledge of consequence processes result in inherent uncertainties in evaluating igneous activity models. Application of the principles of magma physics as illustrated in this report can constrain uncertainties in consequence analyses that can minimize the need for conservatisms in performance assessment.*

5. *Both the extrusive (volcanic) and intrusive igneous scenarios are credible at Yucca Mountain. The extrusive scenario is likely to cause the larger relative risk and the effect is greatest within the first thousand years after closure of the repository. On the other hand, the maximum risk from the intrusive scenario would not occur for several tens of thousands of years.*

6. *Preliminary performance assessment indicates that the consequences from either scenario would be only a fraction of the dose standard.*

7. *Future igneous activity in the Yucca Mountain region will likely be similar to the small-volume, single-episode basaltic Lathrop Wells volcano and would likely occur within basins rather than on ridges. Certain styles of volcanism are not expected. For example, large-volume felsic volcanism which formed the rocks of Yucca Mountain is not anticipated and conditions necessary for explosive phreatic eruptions (maar volcanism, involving heating and expansion of ground water) do not exist at Yucca Mountain.*

8. *General, but not total, agreement is that the igneous activity at Yucca Mountain is waning, with the probability that future igneous activity intersecting the repository in the range of 10^{-9} to 10^{-7}/yr. The ongoing expert elicitation of volcanic experts in the DOE's Probabilistic Volcanic Hazard – Update which incorporates the latest geophysical and drilling data will be the most up to date, credible estimate of the range of igneous activity intersection with the proposed repository. The results of the drilling have reduced uncertainty about the number and age of buried basalts near Yucca Mountain.*

9. *Significant disagreement exists regarding the extent of flow of magma into drifts of the repository during a possible intrusive igneous event and the number of waste packages destroyed by invading magma. However, magma physics indicates that flow of intruding magma into drifts would be limited and a secondary (satellite) vent branching from a drift (including the "dogleg" scenario) is unlikely to form at any time in the style of volcanism expected at Yucca Mountain.*

10. *The current technical bases of several aspects of igneous activity appear to be insufficiently developed or supported by available information and analyses. These include the range of waste particle sizes in the ash, the effects of large floods on the volume and distribution of contaminated ash in the vicinity of the RMEI, the amount of waste incorporated into ash versus lava during early eruptive phase of the extrusive scenario, and the importance of setbacks of the repository from faults and fractured zones.*

The NRC staff has committed to brief the Committee regarding their analysis of alternative views on igneous activity issues and the related risk significance using the newest version of the NRC Total-System Performance Assessment code. This information together with the attached report will be the basis for the Committee's evaluation of risk-significant topics pertinent to decisionmaking on igneous activity at Yucca Mountain that will be reported to the Commission.

Sincerely,

/RA/

Michael T. Ryan
Chairman

Attachment:
As stated

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Sincerely,

/RA/

Michael T. Ryan
Chairman

Attachment:
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NAME	NColeman	ADias	FGillespie	FPG for MTR
DATE	6/05/07	6/06/07	6/06/07	6/06/07

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