

PRESENTATION TO THE NUCLEAR WASTE
TECHNICAL REVIEW BOARD



ANALYSES FOR IGNEOUS ACTIVITY
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OUTLINE OF PRESENTATION

- IGNEOUS ACTIVITY:
 - 1) Basis for Criteria with Respect to Volcanism
 - 2) Acceptance Criteria for Data and Analysis (When 'enough is enough')
 - 3) NRC's Review of DOE's Progress to Date
 - 4) Investigations that are Needed for Hazard Assessment

BASIS FOR NRC CRITERIA WITH RESPECT TO IGNEOUS ACTIVITY

- Criteria with respect to probabilistic analysis of igneous activity relate primarily to determining compliance with the overall system performance objective (60.112); however, the results of these analyses are not, by themselves, the sole criteria by which decisions will be made.
- Associated criteria must also be addressed. For example, those related to the investigation of the site, including the requirements of 60.122 (i.e., Potentially Adverse Conditions) that require DOE to:
 - A. provide information to determine whether, and to what degree igneous activity is present
 - B. provide information to determine to what degree igneous activity is present, but undetected
 - C. assure the lateral and vertical extent of data collection is sufficient to determine the presence of igneous activity
 - D. evaluate information with assumptions and analysis methods that adequately describe igneous activity

ACCEPTANCE CRITERIA FOR IGNEOUS ACTIVITY

- The Staff considers the following to be minimum requirements for determining when "Enough is Enough."
 1. Collection of data used in support of the probabilistic analysis is sufficient to support assumptions made in the analysis.
 2. Expert judgement has not been used as a substitute for field or experimental data, or other more technically rigorous information that is reasonably available or obtainable.

NRC ACCEPTANCE CRITERIA FOR IGNEOUS ACTIVITY (Cont.)

3. Analyses are transparent, sensitivity analyses have been performed, alternative models (e.g., statistical and conceptual) have been identified and evaluated, and the results of analyses of individual alternative models are explicitly treated.
4. Analyses clearly reflect the uncertainty in the understanding of tectonic processes.

(Site-specific acceptance criteria are being identified during development of the License Application Review Plan)

- Ultimately, the final determination will be an assessment of repository performance and full consideration of uncertainty.

NRC'S REVIEW OF DOE'S PROGRESS TO DATE

DOE has made progress towards an acceptable PVHA, however,

- DOE's approach does not consider all significant processes and events in the analysis of igneous activity:
EXAMPLE: The Tripartite probability addresses only a subset of significant processes and events that must be considered.
- Data presented to date to support probabilistic analyses are not sufficient to meet Part 60 requirements:
EXAMPLE: Geophysical testing to date has not established the extent to which the condition may be present, but undetected or the potential for and extent of structural control.
- DOE's approach appears to emphasize tests and analyses to confirm a preferred model to the detriment of testing alternative models and approaches:
EXAMPLE: Analyses by CNWRA indicate that homogeneous Poisson models are not suitable for use at YM and other statistical models may affect probability calculations.

NRC'S REVIEW OF DOE'S PROGRESS TO DATE

- Probabilistic models used to date are not transparent and do not address the uncertainty in the analysis.
EXAMPLE: the CNWRA has demonstrated that uncertainty in ages for basaltic events causes variation in the results of probabilistic analyses. The staff expects the license application to contain this type of uncertainty analysis.
- Probabilistic models used to date are largely based on statistical models and do not adequately incorporate geologic processes and the uncertainty in understanding of those processes.
EXAMPLE: The potential for structural control and the extent and significance of low velocity zones at depth have not been adequately factored into DOE's analysis.

CRITICAL INVESTIGATIONS AND ANALYSES

Although many critical investigations are ongoing, the following need to be done:

- An assessment of geophysical techniques to determine the level of detection for Quaternary igneous features.
- An appropriate range of tectonic models that address potential for structural control at depth and near the surface.
- A more robust incorporation of geologic data into the statistical analysis forming the basis of probabilities.
- Site-specific subsurface information on the significance of low-velocity zones at depth at Yucca Mountain.
- Petrologic, mineralogic, and geochemical analyses that adequately test alternative hypotheses used in models.
- A transparent analysis that includes sensitivity analyses to determine the important sources of uncertainty.
- An analysis that includes both direct and indirect effects of igneous activity.