REVIEW OF ANALYSIS AND MODEL REPORTS (AMRs)

- Disruptive Events Processes at Yucca Mountain -- ANL-WIS-MD-000005

OVERVIEW

Included in the packet are each of the original AMRs, a copy of each with my brief annotations and a summary sheet for each that reveals the purpose and principal conclusions, as excerpted from the original, as well as my comments.

The AMRs were reviewed during October 2000. Each of the AMRs relies principally upon geologic data, much of which is derived from field studies. In view of the lack of 1) extensive, three-dimensional rock exposures and 2) full geochemical, chronologic, petrologic and other information necessary to completely characterize the geologic evolution of this region, the analyses and models are heavily dependent upon well constrained interpretations. In general, thorough and fully considered analyses are contained in this group of AMRs. My comments generally reflect a difference of opinion leading to an alternative interpretation rather than an error or omission in the AMR.

DISRUPTIVE EVENTS PROCESSES AT YUCCA MOUNTAIN
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INTRODUCTION

This AMR is part of the process followed by the U.S. Department of Energy in the effort to provide reasonable assurance that the performance objectives for the Yucca Mountain Project can be achieved for a 10,000-year post-closure period. This assurance must be demonstrated in the form of a performance assessment that (1) identifies the features, events, and processes (FEPS). The primary purpose of this AMR is to identify and document the analysis, Screening Decision, and Total System Performance Assessment (TSPA) disposition or Screening Argument for the 21 Features, Events, Processes (FEPS) that have been recognized as Disruptive Events FEPS. In the original FEPS assignment, 26 FEPS were originally designated as Disruptive Events FEPS. Five of the FEPS were subsequently reassigned to the System Level FEPS report. This AMR addresses the remaining 21 Primary FEPS (Table 1) that have been identified as Disruptive Events FEPS.

Table 1. Primary Disruptive Events FEPs

YMP FEP Database Number	FEP Name
1.2.01.01.00	Tectonic activity-large scale
1.2.02.01.00	Fractures
1.2.02.02.00	Faulting
1.2.02.03.00	Fault movement shears waste container
1.2.03.01.00	Seismic activity
1.2.03.02.00	Seismic vibration causes container failure
1.2.03.03.00	Seismicity associated with igneous activity
1.2.04.01.00	Igneous activity
1.2.04.02.00	Igneous activity causes changes to rock properties
1.2.04.03.00	Igneous intrusion into repository
1.2.04.04.00	Magma interacts with waste
1.2.04.05.00	Magmatic transport of waste
1.2.04.06.00	Basaltic cinder cone erupts through the repository
1.2.04.07.0	Ashfall

1.2.10.01.00	Hydrologic response to seismic activity
1.2.10.02.00	Hydrologic response to igneous activity
2.1.07.01.00	Rockfall (large block)
2.1.07.02.00	Mechanical degradation or collapse of drift
2.2.06.01.00	Changes in stress (due to thermal, seismic, or tectonic effects) change porosity and permeability of rock
2.2.06.02.00	Changes in stress (due to thermal seismic, or tectonic effects) produce change in permeability of faults

COMMENT

A comprehensive, if not exhaustive, consideration of features, events and processes (FEPS) that may affect (disrupt) the Yucca mountain repository site. The method used for this analysis is a combination of qualitative and quantitative screening of FEPs. Four general assumptions used in screening of the Disruptive Events FEPS are:

1) the evolution of the geologic setting is consistent with present knowledge of natural processes, an outgrowth of which is the assumption that the tectonic strain rates at Yucca Mountain will remain unchanged through the repository performance period;
2) design parameters may be used to justify an *exclude* FEP screening decision, if the design parameter eliminates of alleviates the FEP;
3) the repository will bee constructed, operated, and closed according to the design used as the basis for the FEP screening;
4) for seismic-related FEPs, it is assumed that the probability criterion of 10\-4/10\4 yr refers to the probability of unacceptable performance, which for seismic events, is the product of the hazard level (e.g. ground motion) and the consequences (e.g., unacceptable damage to the drip shield).

The principal criticism that pertains to my area of expertise has to do with the discussion of Fault Types and Mechanisms (p 34-36). The question of detachment faulting beneath yucca Mountain is addressed as follows: 1) a detachment faulting configuration for Yucca Mountain is purely conjectural; 2) geophysical data do not indicate a detachment beneath Crater Flat or Yucca Mountain; and 3) local earthquakes indicate steeply-dipping planar fault mechanisms to depths as great as 11 km (Smith et al., 1995, p. 15). At some level, in this case below 11 km, a detachment must exist unless a hole is torn in the crust and a magma chamber is breached or unless extension is distributed throughout a zone within which ductile deformation accommodates stretching (in this case detachment between brittle and ductile rocks may be difficult to

recognize but does take place).