

U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

**NUCLEAR WASTE TECHNICAL REVIEW BOARD
STRUCTURAL GEOLOGY AND GEOENGINEERING PANEL MEETING**

**SUBJECT: USE OF PROBABILISTIC VOLCANIC
HAZARD ASSESSMENT IN THE
YUCCA MOUNTAIN PROGRAM**

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Overview

- ♣ **Objectives of probabilistic volcanic hazard assessment (PVHA)**
- ♣ **Use of PVHA in programmatic and statutory decisions**
- ♣ **Use of expert judgment**
- ♣ **Determination of when “enough is enough”**
- ♣ **Critical studies that need to be completed**

Objectives of Probabilistic Volcanic Hazard Assessment

- **Assess the probability of magmatic disruption of the potential repository and/or waste isolation system**
- **Constrain the effects of magmatic events at or near the potential repository**

Primary focus to date: Is the probability of magmatic disruption of the potential repository large enough to disqualify the Yucca Mountain site?

Use of PVHA in Programmatic and Statutory Decisions

Regulatory Requirements

10 CFR 960

- Compliance with**
 - » 40 CFR 191 total system performance requirements**
 - » 10 CFR 60**
 - Engineered barrier system containment and release rate requirements**
 - Total system performance requirements**
- Meet the postclosure tectonics qualifying condition**

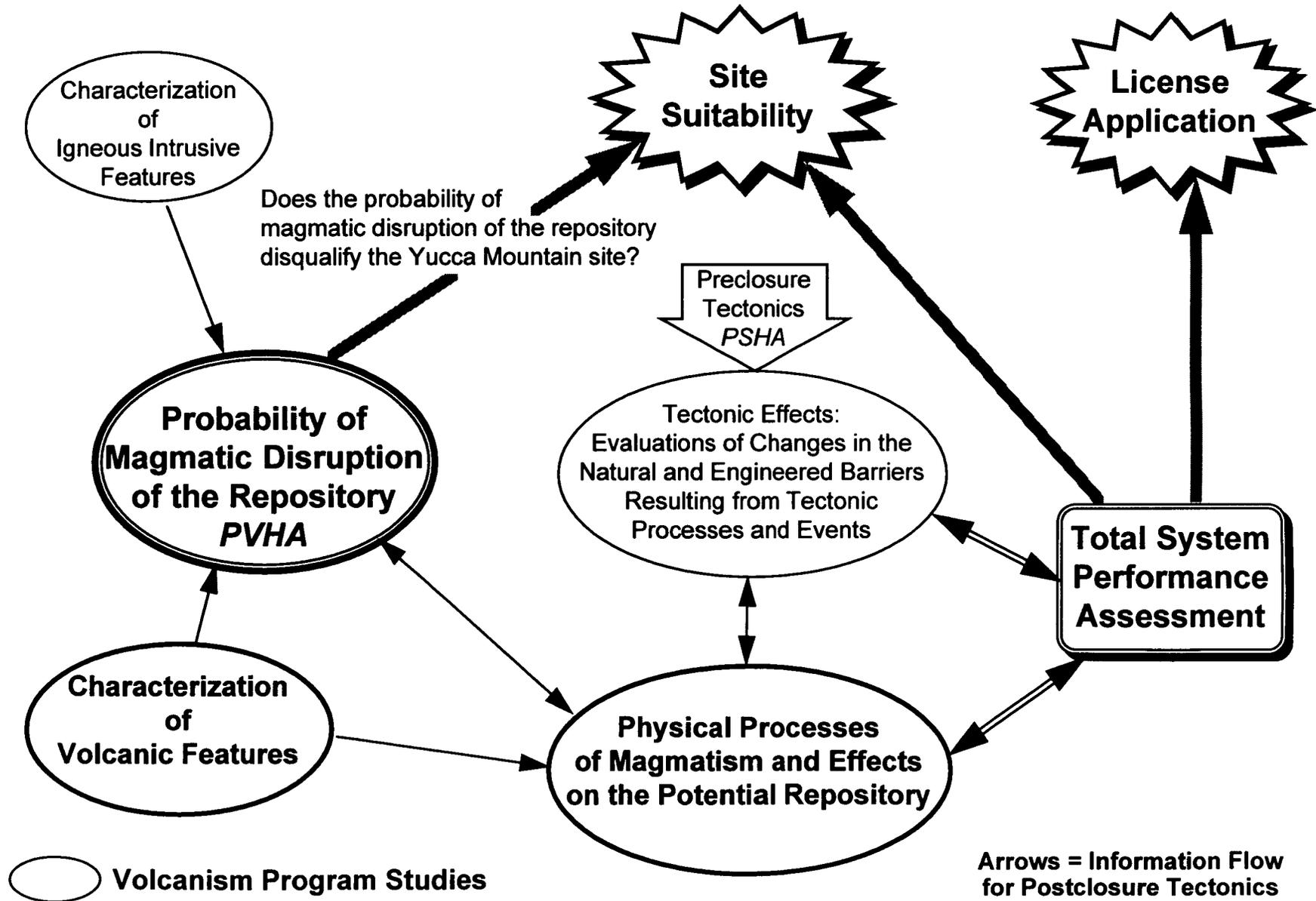
10 CFR 60

- Potentially adverse condition of volcanism does not significantly impact total system performance**

Use of PVHA in Programmatic and Statutory Decisions

- **Early Site Suitability Evaluation (1992)**
 - Tectonics qualifying condition is likely to be met (low level finding)
 - Recommendation: continue volcanism studies as planned
- **Total System Performance Assessment**
 - TSPA I (1991)
 - » **Eruptive** effects of dike intrusion into the proposed repository
 - » Consequences do not exceed regulatory release limits (*based on limited “effects” data*)
 - » Recommendations:
 - Estimate probability of occurrence of subsurface events
 - Determine quantity of debris that could be ejected from repository depths during a volcanic eruption
 - TSPA II (1993)
 - » No new volcanism information considered

Use of PVHA in Programmatic and Statutory Decisions



Determination of When “Enough is Enough”

Different perspectives = different questions

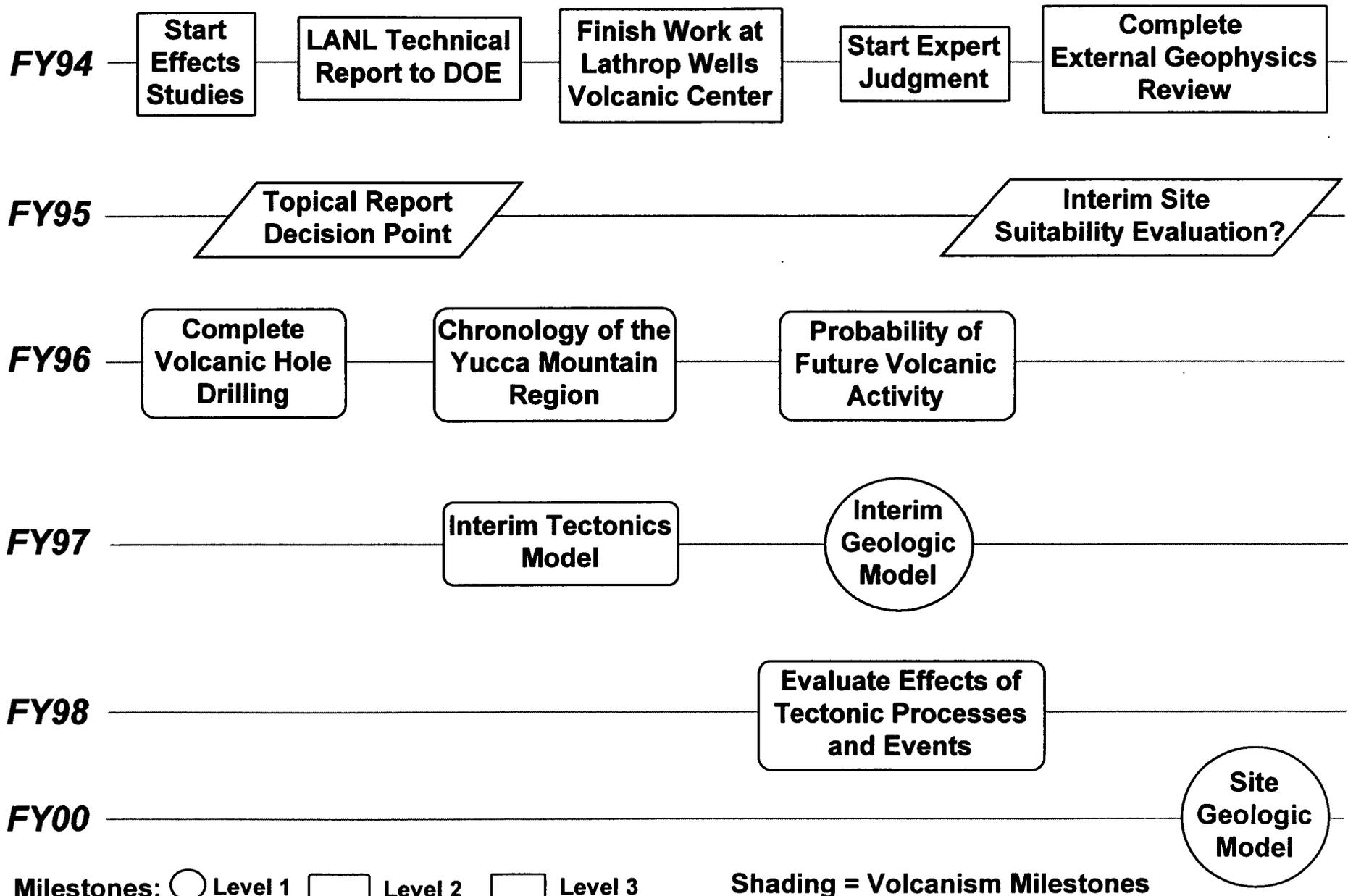
- **Principal Investigators**
 - Study plans complete?
 - Adequate confidence in results?
- **DOE**
 - Value of obtaining additional site data vs. cost?
 - Cost/benefit of additional performance assessment?
 - How strong is the case for compliance?

Determination of When “Enough is Enough”

Tools

- Interim site suitability evaluations**
- Issue resolution**
- Total system performance assessment**
- Formal peer review/expert judgment**
- Feedback from oversight groups and regulator**

Milestones



Use of Expert Judgment Yucca Mountain Volcanism Program

- **DOE experts are being used to determine adequacy of data set and analysis**
- **Independent technical review is accepted part of Yucca Mountain program**
- **Alternative mechanisms are being considered for ensuring diversity of interpretations and completeness (e.g. peer review, elicitations, etc.)**
- **Expert judgment will be used to refine volcanism probabilities**

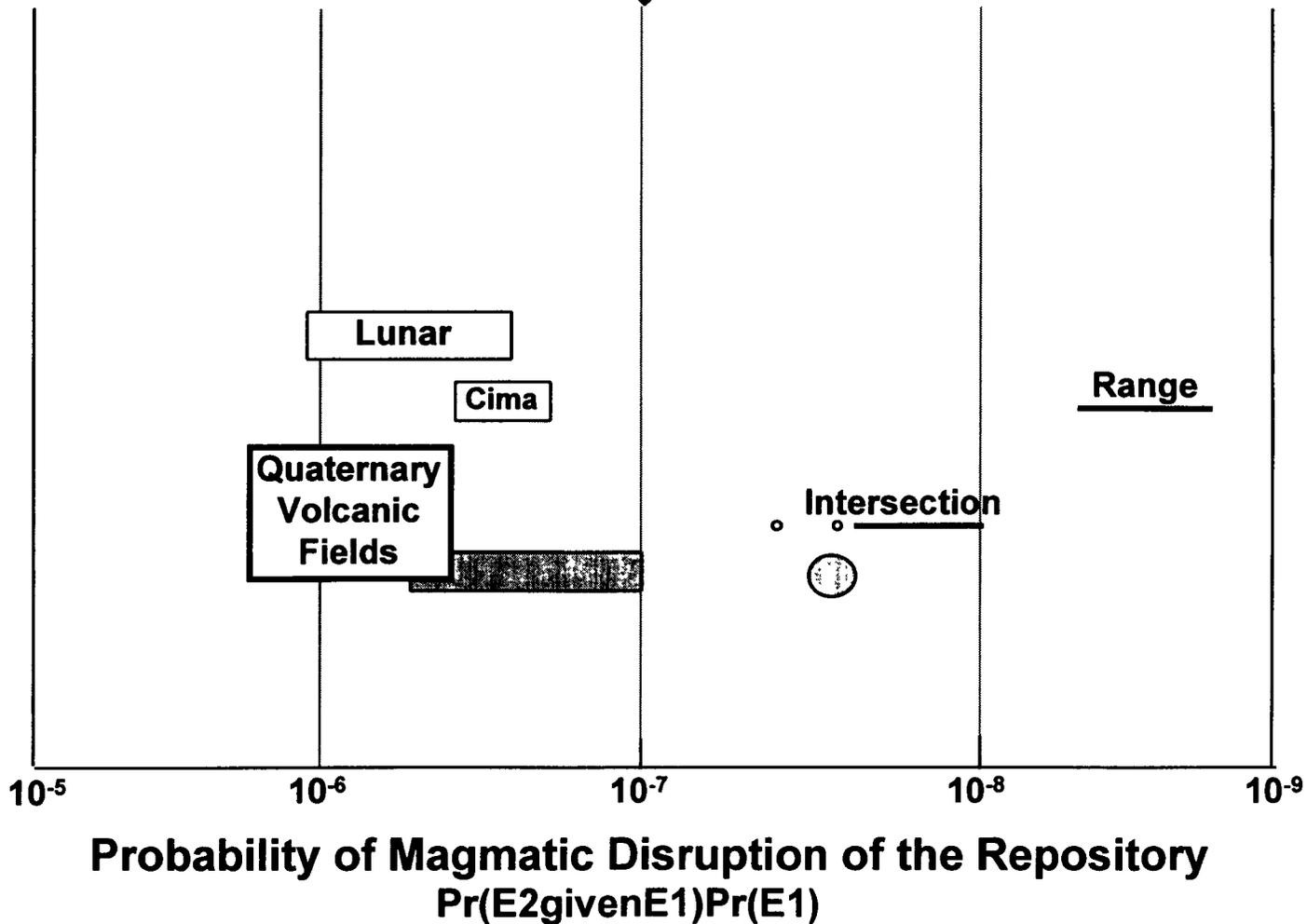
Critical Studies Still Needed

- **Subsurface effects studies**
- **Sensitivity studies**
- **Compilation of a comprehensive eruptive effects data set from natural analogs**
- **Subsurface information**
- **Probability of polycyclic volcanism**
- **Magmatic evolution model for the Crater Flat volcanic zone**

Summary

Yucca Mountain Probabilistic Volcanic Hazard Assessment

Performance Assessment
Sensitivity Studies



Priority Items for FY94 and FY95 “Effects” Studies

- **Determination of the quantity of debris that could be erupted from repository depth**
- **Determination of the spatial scales of hydrothermal processes for a relevant range of intrusion geometries and host rock properties**
- **Eruption mechanisms and volatile content issue**
 - **Follow strategy in Study Plan**
 - » **Use analog studies to determine the range of quantities of repository material that could be erupted**
 - » **IF this range is such that risk simulations suggest E3 is close to unity, then**
 - » **Pursure detailed eruption models and dispersal mechanism to further constrain E3**