



**REGULATORY CONSIDERATION OF VOLCANISM
AS IT RELATES TO LICENSING A HIGH-LEVEL
WASTE REPOSITORY**

**Presented to the United States Nuclear Waste
Technical Review Board**

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PURPOSE OF THIS PRESENTATION

Provide Overview of Volcanism Concerns at Yucca Mountain Site in Context of NRC Licensing Action

BASIC LICENSING PRINCIPLES

- Burden of proof on DOE
 - What can affect repository
 - How likely
 - Consequences
- NRC must have assurance that release of radionuclides does not provide undue risk to public health and safety

HOW CAN VOLCANIC ACTIVITY AFFECT RELEASE OF RADIONUCLIDES

1. Direct Release and Transport
2. Modification of Natural System
 - Groundwater Level
 - Groundwater and Gas Pathways
 - Thermal Environment
 - Hydrothermal Environment
 - Geochemical Environment
3. Modification of Engineered Barrier System
 - Canister
 - Other Manmade Barriers

AREAS OF INTEREST - FEATURES

Cones

Surface

Subsurface

Dikes

Solitario Canyon

Subsurface

Calderas

Timber Mt.

Tram

Claim Canyon

Crater Flat (?)

etc.

Faults/Structures

Age Determination

Other Features

AREAS OF INTEREST - ANOMALIES

Aeromagnetic

Teleseismic

Heat Flow

Seismic Reflection/Refraction

Leveling

AREAS OF INTEREST - MECHANISTIC BEHAVIOR

What is the Relationship of Structures to Volcansim?

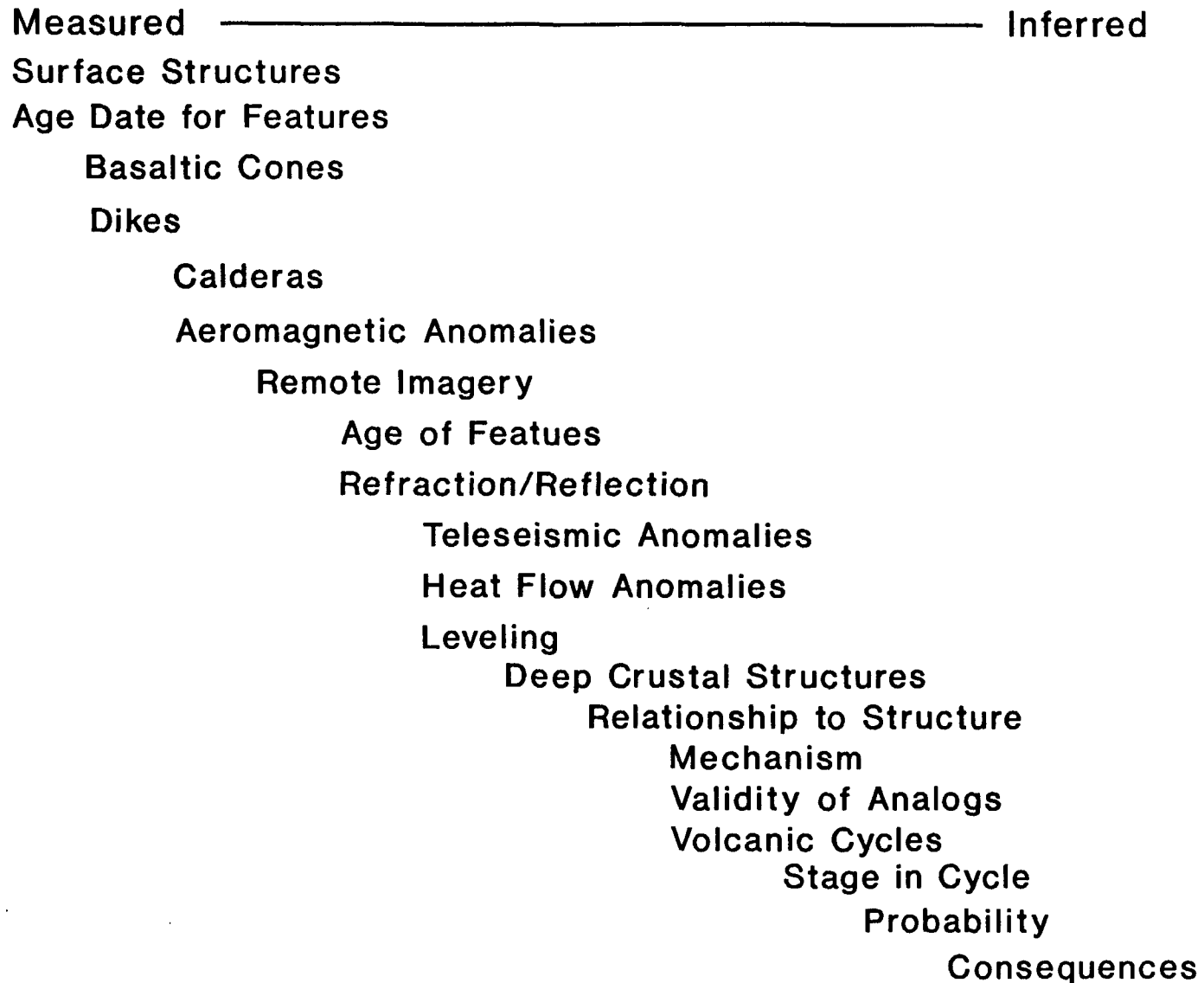
Crustal - Mantle Involvement
Magma Chambers

Volcanic Cycles
Stage in Cycles
Self-Organized Criticality
Power Laws

$$\frac{N_2}{N_1} = \frac{r_1}{r_2} d \quad d=2.147$$

Analog

VOLCANISM INFORMATION RELATIONSHIPS



Probability of Volcanism

Probability of Volcanism Occurring in Yucca Mt. Region Sometime	High ?
Probability of Volcanism occurring in Yucca Mt. Region in Next 10,000 Years	Not as High
Probability of Volcanism Affecting Repository at Yucca Mt.	Presently Unknown Therefore of Regulatory Concern
Probability of Volcanism Occurring at Yucca Mt.	Not Zero
Consequences of Volcanic Activity	?

CONCLUSIONS

The Volcanism Issue is Significant NRC Concern

NRC Licensing Decisions Must be Based on a Reasonable and Conservative Data Base. At Present, this Data Base is Limited.

The DOE Program Appears to be Aimed at Obtaining Data in the Areas of NRC Concern.

- Most Plans Have Not Been Evaluated
- Most Program Elements Have Not Been Implemented

At Present, NRC has Insufficient Information to Support Likelihood/Consequences Statements in Licensing Context

“Investigations associated with tectonic phenomena should receive early attention. At the Yucca Mountain site, thorough understanding of tectonic phenomena such as volcanism, faulting, and seismicity is critical to the identification of potentially disqualifying conditions. The NRC staff considers that a full range of tectonic models should be considered in planning the tectonic investigations. High priority should be given to conducting those investigations which can lead to a determination of whether the site is subject to an unacceptable high probability of disruption as a result of volcanism, faulting, or seismicity. These investigations need to be conducted as early as possible in site characterization.”

NRC Staff Site Characterization Analysis of the Department of Energy's Site Characterization Plan, Yucca Mountain Site, Nevada, NUREG-1347, p xi, 1989