



U.S. Department of Energy
Office of Civilian Radioactive Waste Management



Consequences of Igneous Activity

Presented to:

Nuclear Waste Technical Review Board

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Outline

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- **DOE View of NRC Models for Magma-Drift Interactions**
- **DOE Plans to Address Magma-Drift Interactions**
- **Schedule for Documentation**
- **Igneous Activity and Site Suitability**
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Overview

- **At the June 20-21, 2001 Technical Exchange, an igneous activity consequences model that depicts the magma-repository interactions more mechanistically was described by the NRC**
- **Due to DOE's concerns with the model, no agreements were reached at the June Technical Exchange**
- **At the September 5, 2001 Technical Exchange, DOE and NRC reached four agreements regarding igneous consequences. As a result, the Igneous Activity KTI is now closed-pending**

DOE View of the NRC Model for Magma-Drift Interactions

- **Idealized conceptual model**
- **Contains simplified assumptions**
 - Smooth-walled, closed-end, one dimensional flow-tube model
 - Does not consider major elements of the repository system
 - Preferential diversion of ascending dike into drifts
 - Dike does not continue to the surface between drifts
 - Explosive decompression and propagation of supersonic shock wave in drifts
 - Inundation of drifts by pyroclastic flow
 - Repressurization of drifts to allow dike to re-establish flow at points remote from location of initial intersection
- **No probabilities have been associated with the model scenarios**



DOE Plans to Address Magma-Drift Interactions

- **DOE's objective is to have a risk-informed, defensible basis for licensing**
- **DOE acknowledges that additional work to evaluate the new consequence model may be warranted and desirable to support any potential license application**
- **A plan have been developed to address the NRC concerns**
- **The main focus of the plan is on magma-drift, magma-waste package and magma-waste form interactions and tephra remobilization**

Schedule for Documentation

- **Results of studies will be documented in the following analysis and model reports for license application:**
 - **Eruptive Processes and Soil Redistribution**
 - **Dike Propagation and Interaction with Drifts**
 - **Waste Package Behavior in Magma**
 - **Waste Form Behavior in Magma**
- **Completion dates are to be determined, License Application planning in progress**

Igneous Activity and Site Suitability

- **Postclosure, probability-weighted dose estimates for the eruptive and intrusive release scenarios are well below the final Environmental Protection Agency standards and proposed NRC regulatory dose limits for individual protection**
- **DOE believes that the Probabilistic Volcanic Hazard Analysis (PVHA) estimate of the volcanic hazard remains robust and adequately captures the inherent uncertainties**
- **DOE notes that intersection of the repository by a volcanic event is highly unlikely**
- **Scoping calculations based on current DOE methodology and assuming all packages in intersected drifts are erupted results in a peak mean probability-weighted dose of approximately 2 mrem to 3 mrem**

Igneous Activity and Site Suitability

(Continued)

- **Conservative assumptions in current DOE eruptive analysis**

- **Assumes any future eruption would be violent strombolian**
- **Wind direction assumed to be toward the location of the critical group (5x)**
- **Use of transition phase biosphere dose conversion factors (BDCFs) indefinitely**

Dose Comparison

	Eruptive Release Scenario		Intrusive Release Scenario	
	Peak Mean Prob-Weighted Dose	Mean Conditional Dose, Eruption at 100 Years	Peak Mean Prob-Weighted Dose	Mean Conditional Dose
TSPA-SR	0.004 mrem/yr at 300 Years	13 rem/yr	0.2 mrem/yr at >10,000 Years	500 mrem/yr at <10,000 Years
SSPA Vol. 2	0.1 mrem/yr at 300 Years	325 rem/yr**	0.05 mrem/yr at >10,000 Years	125 rem/yr** at >10,000 Years

** SSPA conditional doses are estimated simply by scaling from the TSPA-SR results

Summary

- **DOE is concerned that the NRC model is simplified, and thus overly conservative for consequence calculations, and relies on assumptions that do not appropriately consider the major elements of the repository system**
- **DOE proposes to strengthen its analysis and reduce uncertainty for the license application**
- **DOE's igneous consequences analyses provide a defensible basis for the Site Recommendation**
- **DOE expects planned studies to show that the consequences of an igneous event release scenario will continue to produce probability-weighted doses that are below the regulatory dose limits**

