

# The Role of the Saturated Zone in Waste Isolation

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How is the saturated zone important?

Criterion	Time period	
	10,000 years or less	100,000 years or more
cumulative release	transport time important	SZ probably has little impact on cum. release*
individual dose	transport time important	dilution important

\*Repository thermal effects could possibly  
increase impact.

Some results from TSPA-1993

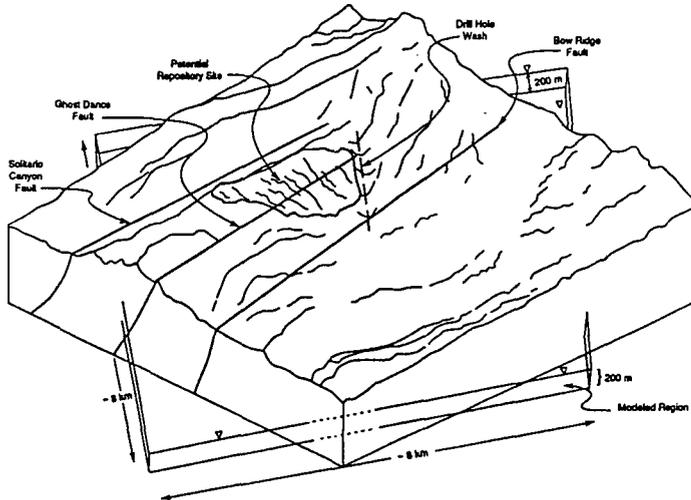
- 3-dimensional saturated-zone model
- Effects of climate change on the saturated zone
- Activities that provide key information to PA

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### 3-dimensional saturated-zone model for TSPA-1993 (G. E. Barr)

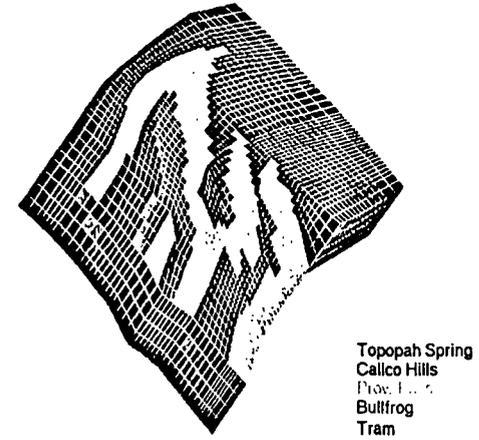
- Equivalent continuum model of flow and transport
- Used to examine consequences of different assumptions
  - Model based on work by Czarnecki, Ervin, and others
  - Alternative model based on proposal by Fridrich et al. ("drain")

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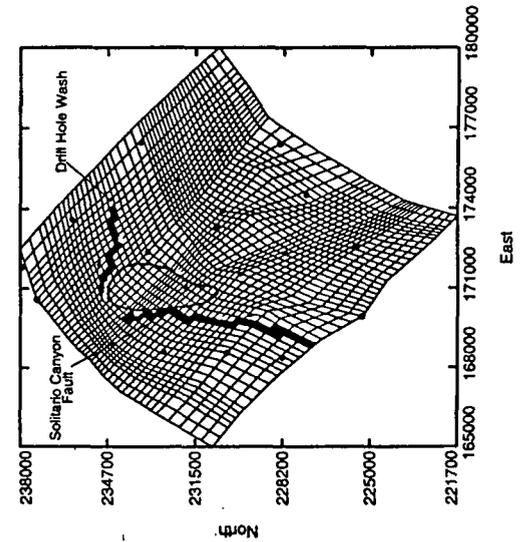
### Finite-element mesh

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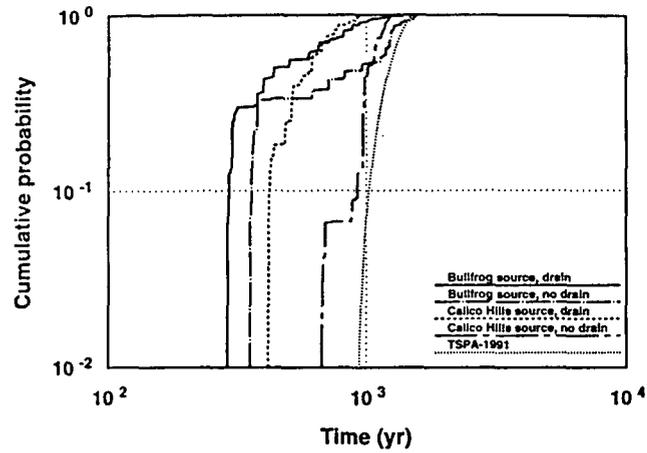
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### Numerical grid showing important features



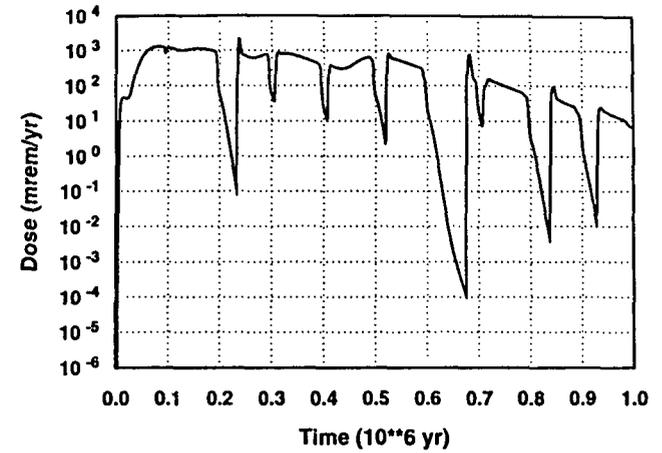
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### Breakthrough curves for an unretarded tracer



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### Typical TSPA-1993 dose calculation



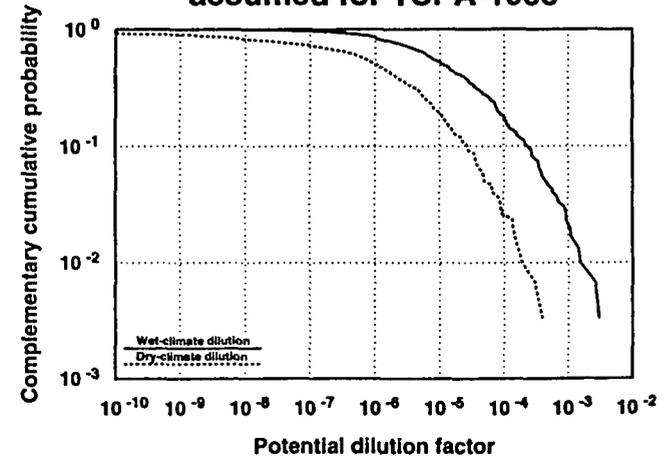
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### Effects of climate change on the saturated zone

- How much does the water table rise, and over what period of time?
- Are the flux and mixing depth affected?
- Do different flow channels become active?

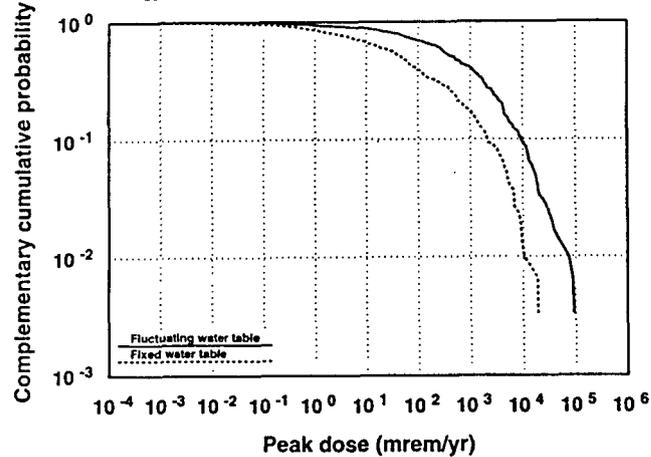
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### Effect of climate change on dilution assumed for TSPA-1993



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### Effect of water-table fluctuation on dose assumed for TSPA-1993



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### Important saturated-zone issues

- What is the overall SZ groundwater flux?
- Is transport well mixed or highly channeled?
- How do climate changes affect transport time and dilution?

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### Activities that provide key information to PA

- Characterize Solitario Canyon fault.  
[Solitario Canyon Fault Study (wells H-7, WT-8, WT-9)]
- Characterize Drill Hole Wash fault.  
[Potentiometric Levels Study (wells WT-23, WT-24)]
- Characterize the “large hydraulic gradient”.  
[Potentiometric Levels Study (as above); site geologic studies (well G-5 and seismic line)]
- Determine horizontal and vertical mixing characteristics.  
[Potentiometric Levels Study (as above); C-wells complex studies; site process models]

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### Activities that provide key information to PA (continued)

- From the geological record, determine effects of climate changes:
  - Search for paleosprings and determine history of water-table-height fluctuations.  
[Past Discharge Areas Study In Climate Program]
  - Determine effect of climate changes on mixing lengths and transport time.  
[Effects of Future Climate Study In Climate Program; site process models]