



Preliminary TOUGH2 Model of King Island CO₂ Injection

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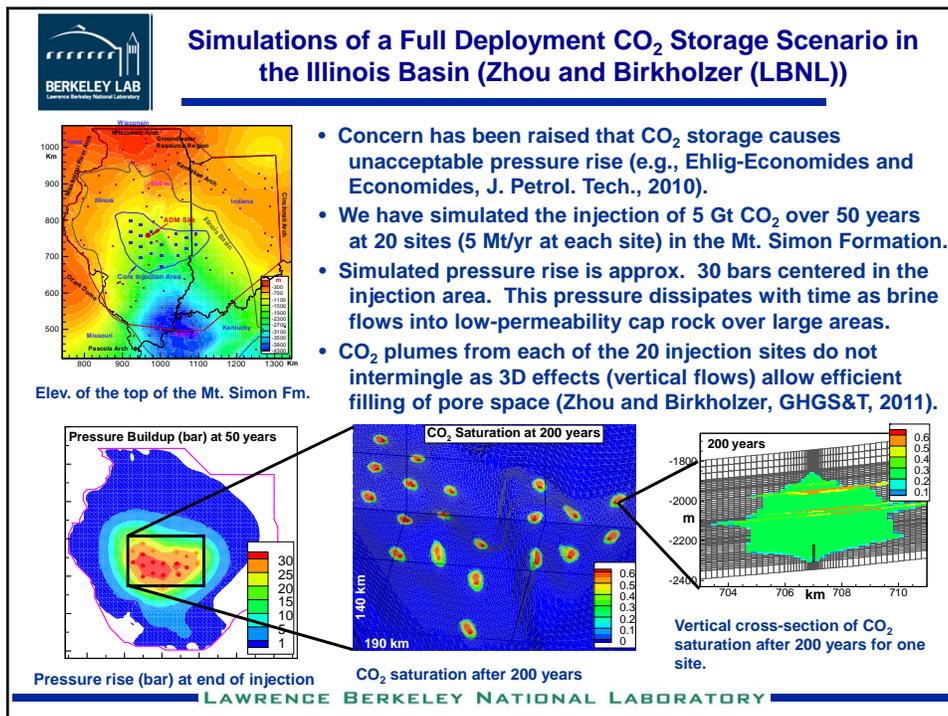
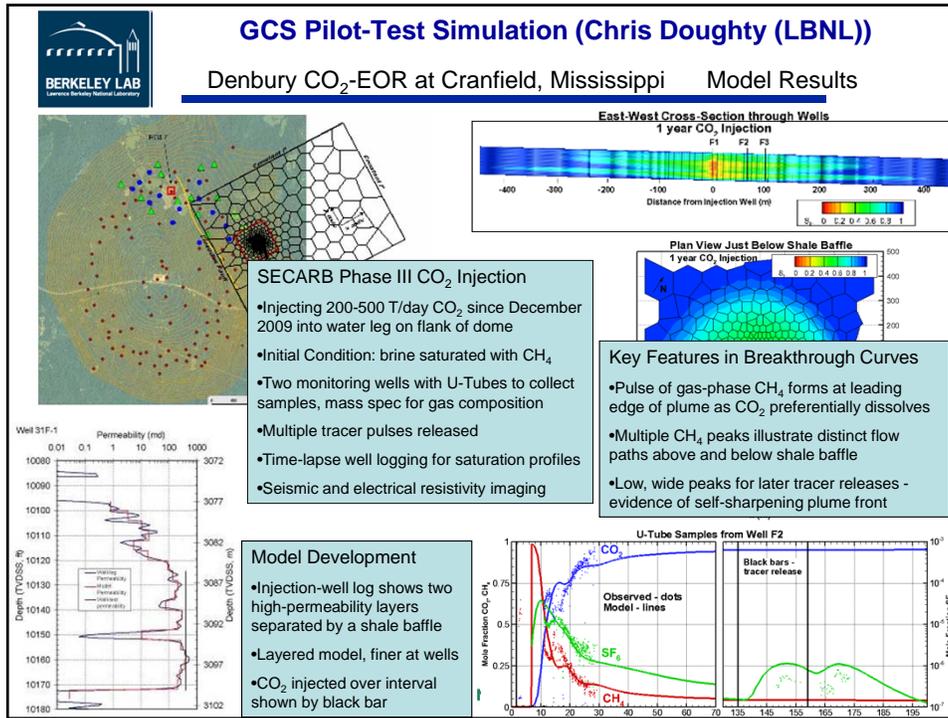


Modeling Approach

- **Characterization study—no injection**
- **But injection can be simulated**
- **Properties obtained from nearby wells, core, well logging, and surface seismic can be used to define the model system**
- **Simulation of injection at Phase III scale or industrial scale can be carried out to understand local site and regional performance**
- **Two examples from other regions, one at each scale**
- **Preliminary King Island simulation results**

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 **King Island Location Map**



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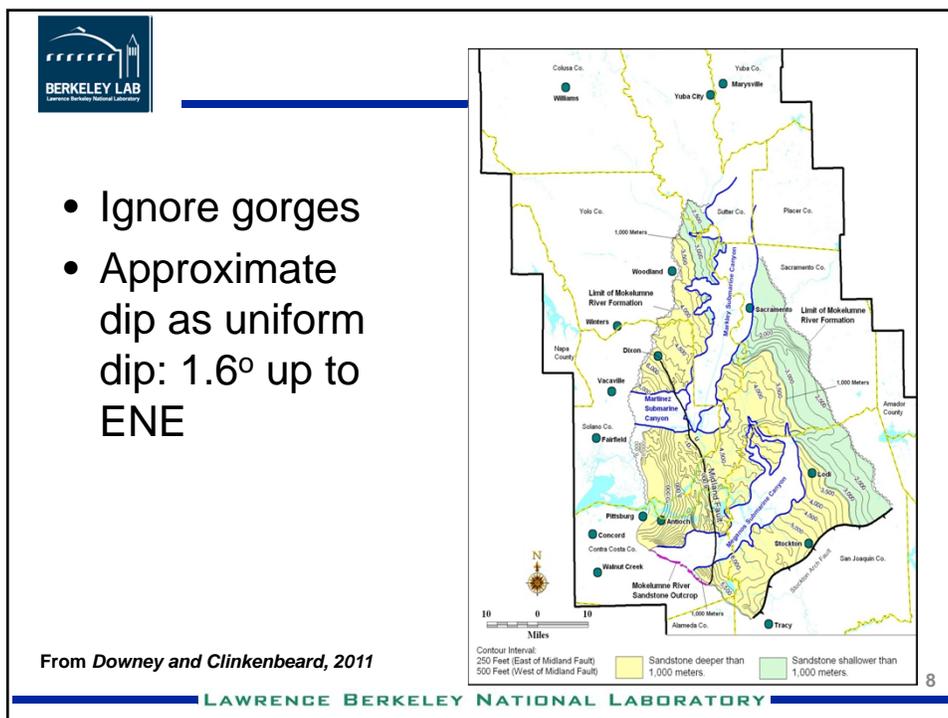
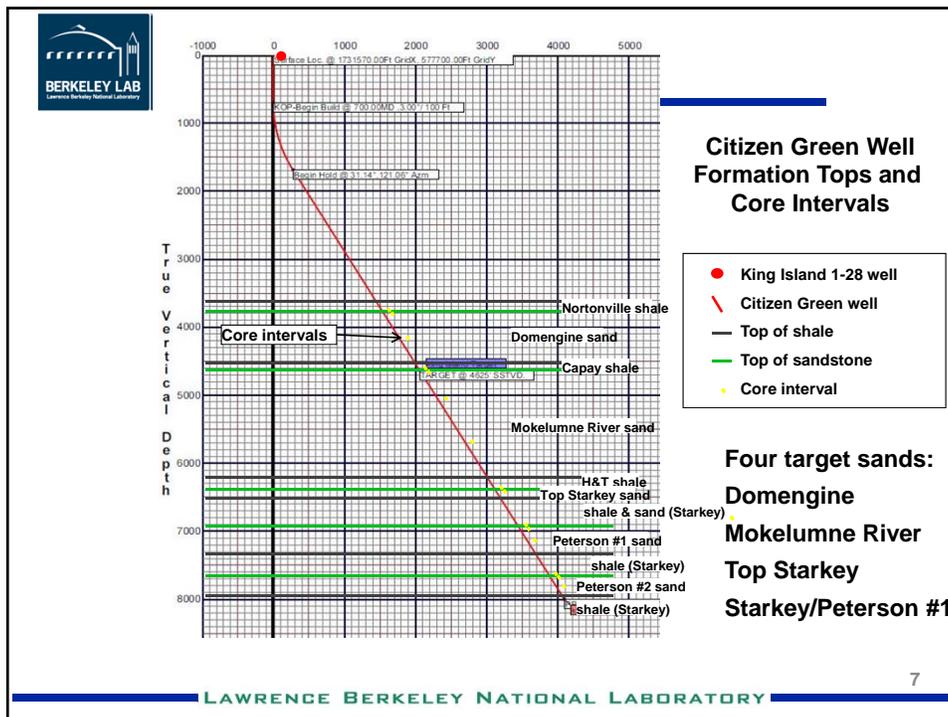
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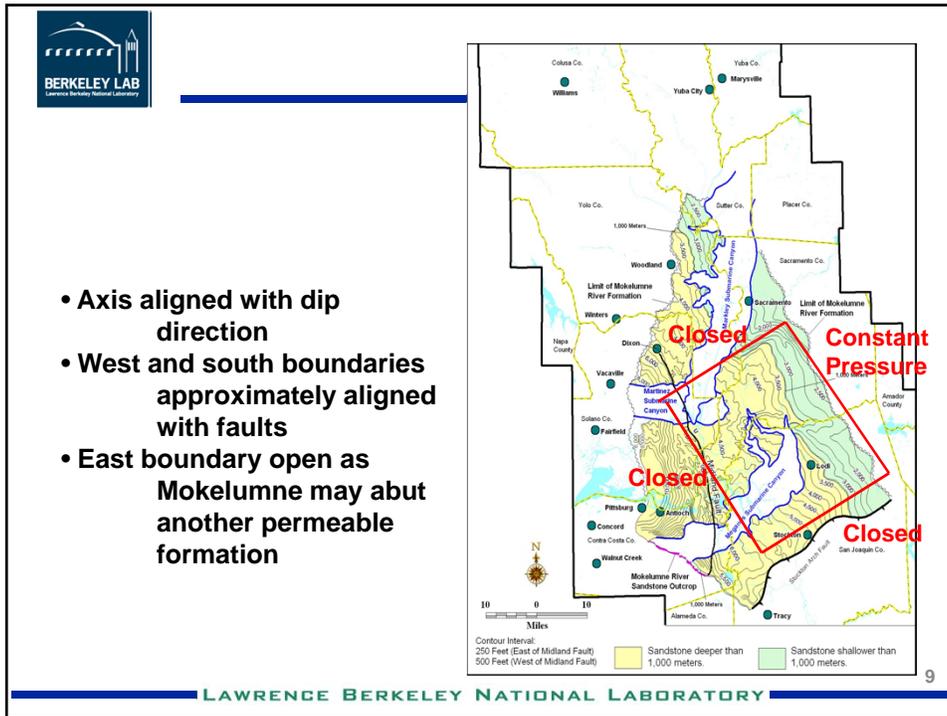
 **Preliminary Model Development**

- Vertical Layering
- Structure
- Lateral Extent and Boundary Conditions
- Material Properties
- Initial Conditions
- Grid and Representation of well

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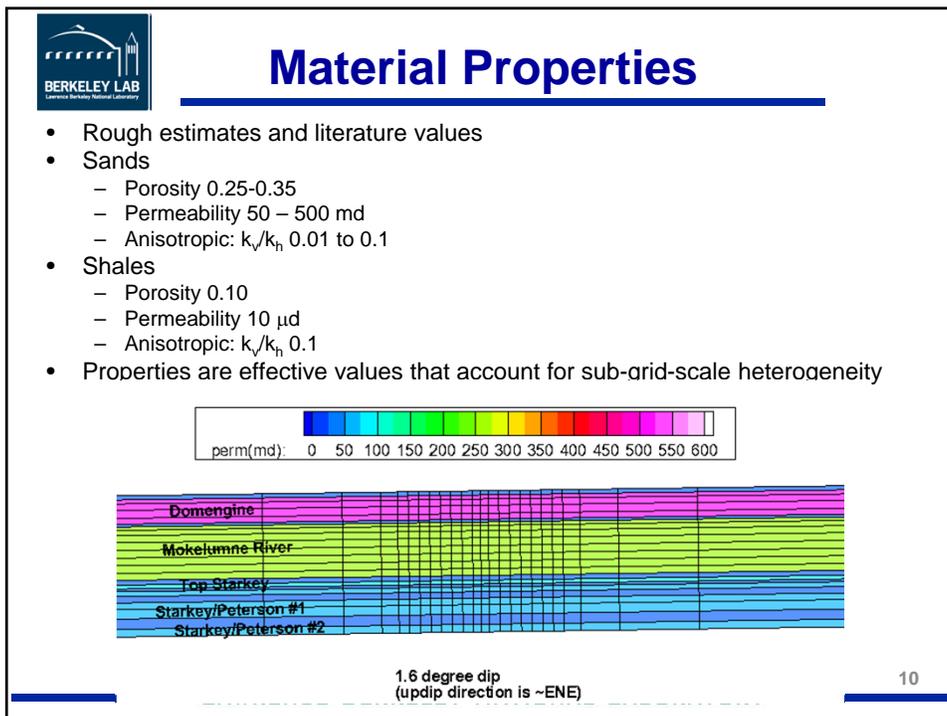
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- Axis aligned with dip direction
- West and south boundaries approximately aligned with faults
- East boundary open as Mokelumne may abut another permeable formation

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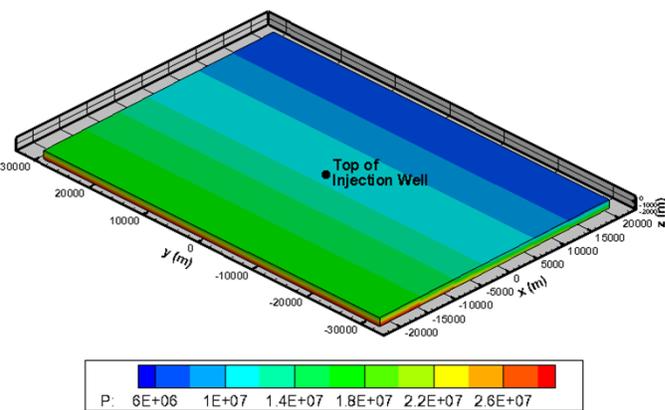




Initial Conditions

- Single-phase liquid brine (salinity 0.05, or 50,000 ppm)
- Hydrostatic pressure profile
- Geothermal temperature gradient

Initial hydrostatic pressure distribution



P: 6E+06 1E+07 1.4E+07 1.8E+07 2.2E+07 2.6E+07

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Grid and Representation of Well

- Rectangular grid
 - 24 layers
 - 31 by 30 grid blocks per layer, 100 m resolution at well
- Diagonal well represented by “stair-steps” in rectangular grid
- Injection partitioned among grid block representing well according to permeability-thickness product
 - Does not account for different pressure gradients in well (CO₂) and formation (brine)
 - Over-estimates injection at greater depth

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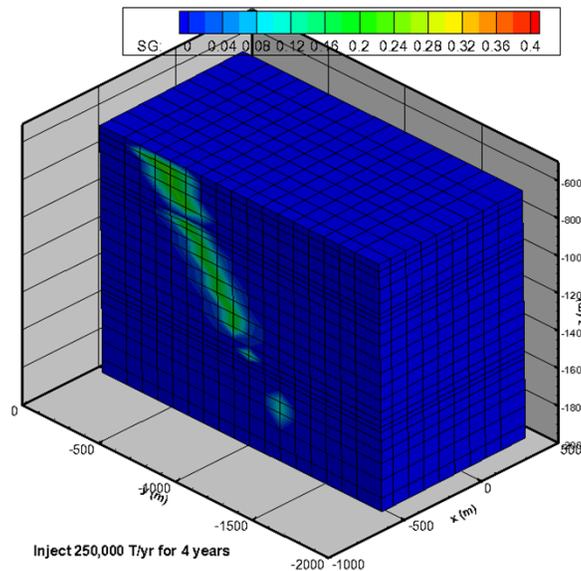


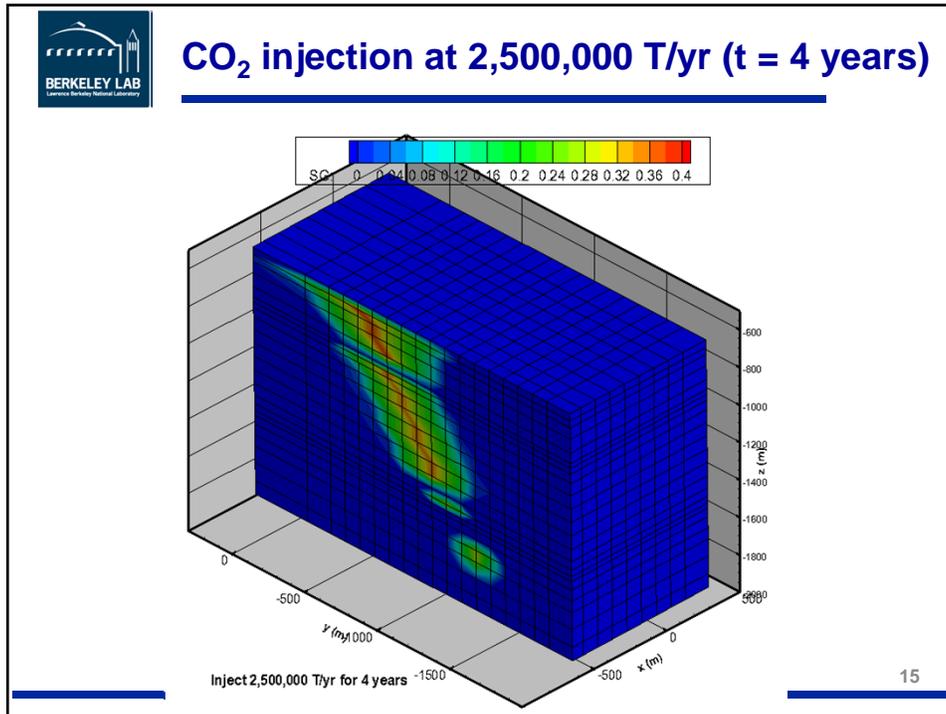
Simulation of CO₂ Injection

- TOUGH2 numerical simulator
- Fully coupled multiphase fluid flow
- Isothermal simulations
- CO₂ exists as a supercritical phase and dissolves in brine
- Two cases
 - 1 MT over 4 years (phase 3 size)
 - 10 MT over 4 years (better problem for coarse grid)

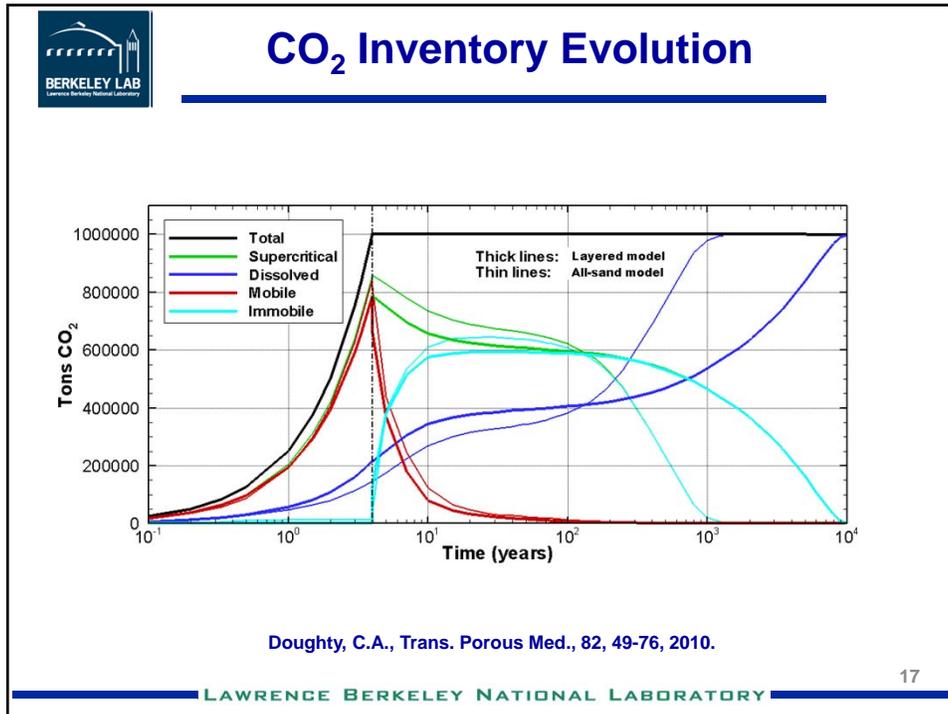


CO₂ injection at 250,000 T/yr (t = 4 years)





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- ### Future work
- Incorporate actual geology
 - Refine grid
 - Simulate different injection depths
 - Simulate post-injection period to study trapping
 - Incorporate sub-grid-scale heterogeneity
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Acknowledgments

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