

An Assessment of Geological Carbon Sequestration Options in the Illinois Basin

A DOE Regional Sequestration Partnership

Current Status: May 2005

MGSC Project Team



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Midwest Geological
Sequestration Consortium



Midwest Geological Sequestration Consortium (MGSC) A DOE Regional Partnership

- Led by Illinois State Geological Survey in collaboration with the Indiana and Kentucky Geological Surveys
- Subcontractors at BYU (geophysics), SIU (coal adsorption), D.J. Nyman & Assoc. (transportation [Houston]) and Dr. Dave Thomas (advisor [Chicago])

Midwest Geological Sequestration Consortium Partners

- Three utility partners: Ameren, Louisville Gas and Electric, and Cinergy
- Five industry partners: American Air Liquide, Peabody Energy, Power Holdings, Aventine Renewable Energy, and LincolnLand Agri-Energy
- Trade groups and consortia: IL, IN, and KY Oil & Gas Associations, ICGA, EPRI, IOGCC
- Illinois Office of Coal Development, DCEO
- Illinois Department of Natural Resources

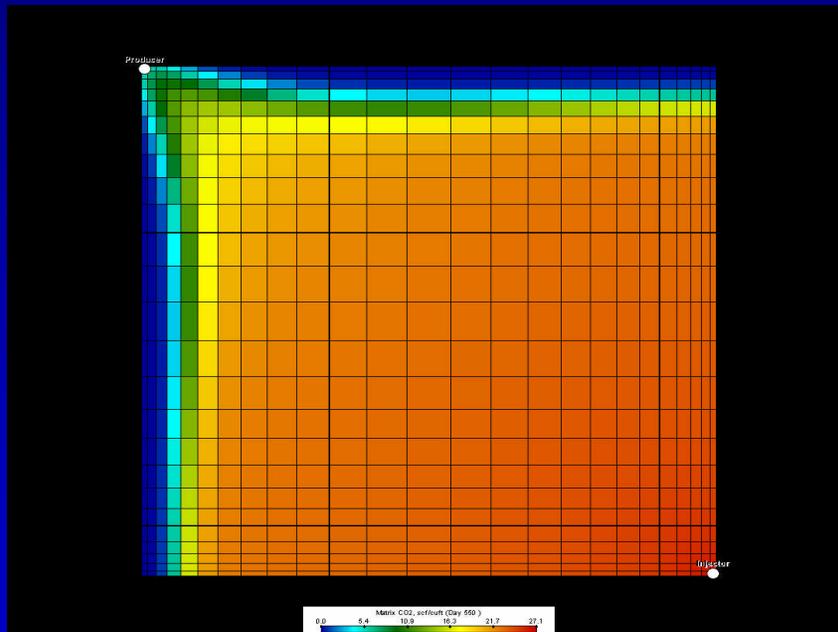
Recent Areas of Focus

- Major focus on reservoir characterization for:
 - coal seams
 - oil reservoirs
 - deep saline reservoirs
- Structural characterization using seismic data
- Capture and transportation moving toward optimization process
- Outreach and web site enhancement

CBM and ECBM COMET Flow Modeling

High Permeability

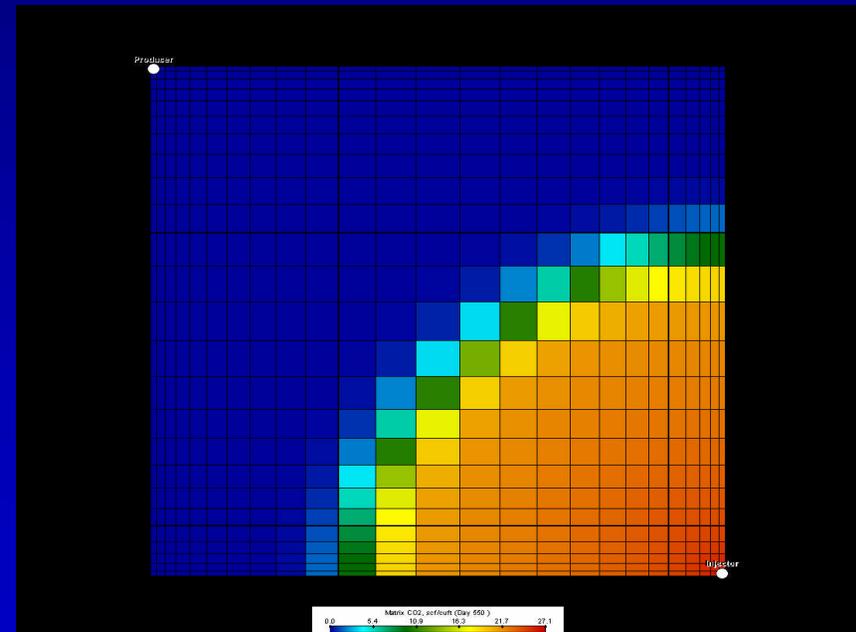
RF: 0.710, SF: 0.890, k: 50 md
CO₂ Breakthrough: 546 days



t: 550 days

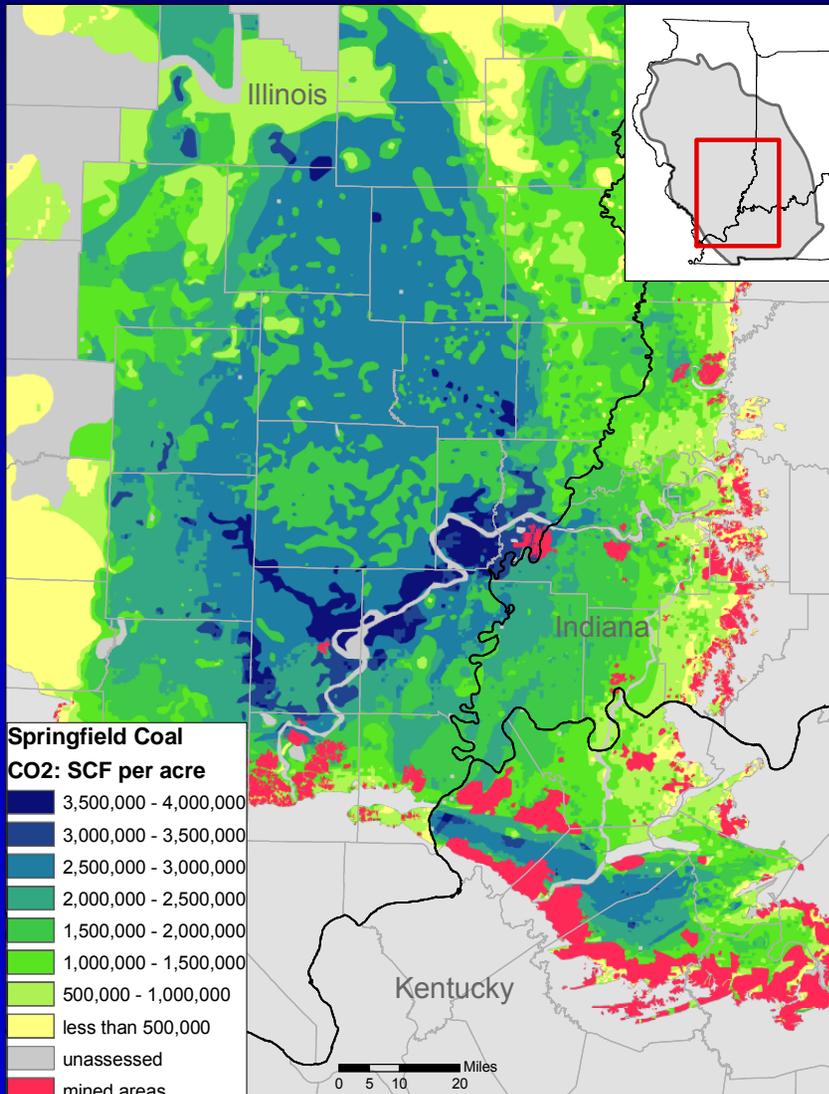
Low Permeability

RF: 0.763, SF: 0.894, k: 15md
CO₂ Breakthrough: 1765 days



t: 550 days

Final Product CO₂ ECBM and CSCCV Estimates

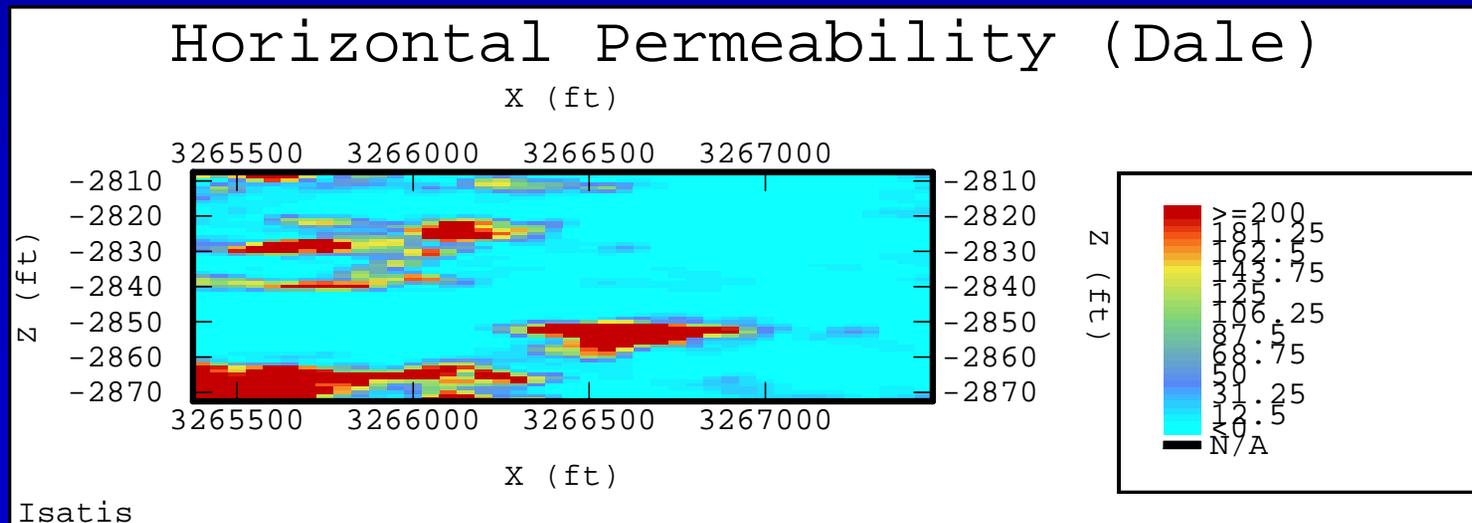
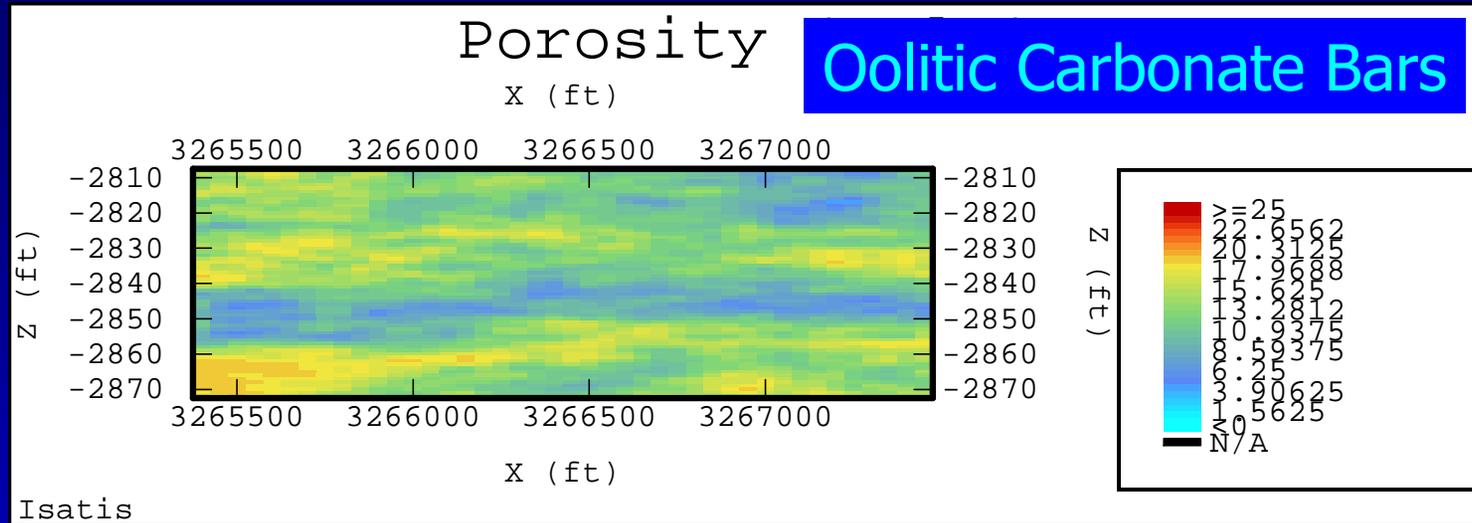


Zone	CSCCV Mtonne	ECBM Tscf
Springfield	720	1.3
Herrin	520	0.9
Seelyville	<i>c</i>	<i>y</i>
Davis	<i>d</i>	<i>z</i>

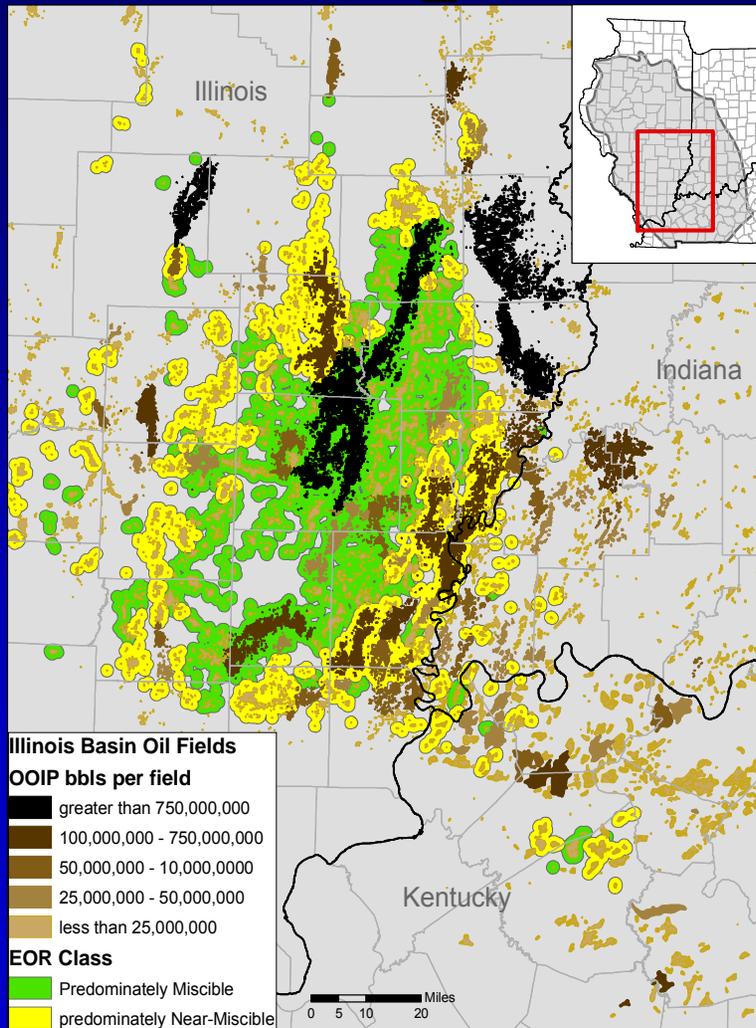
Estimating Oil Recovery and CO₂ Sequestration Factors

- Landmark software (Geographix and VIP)
- Recovery factors based on most prolific Illinois Basin oil-producing formations
 - Aux Vases
 - Cypress
 - St. Genevieve
- Structure and isopach: Deterministic
- Porosity and permeability: Statistical

Dale Field St. Genevieve Limestone Reservoir Model



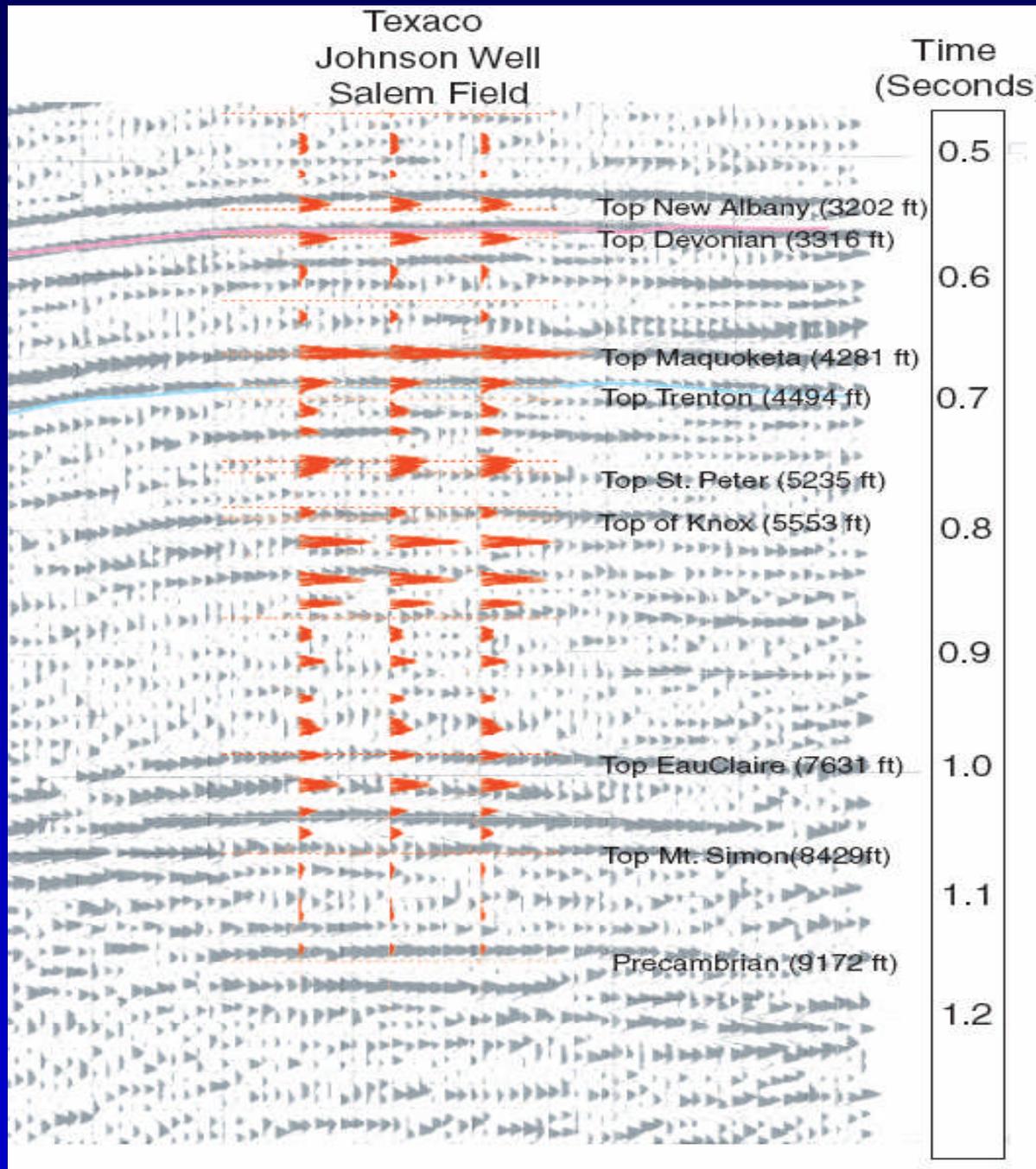
Final Product CO₂ EOR and OSCV Maps



Condition	CO ₂ Mtonne	EOR Bstb
Miscible	92-180	0.30- 0.35
Near	79-160	0.25- 0.30
Immiscible	140- 280	0.45- 0.53
Total	310- 620	1.00- 1.2

Maps and tables for EOR and OSCV

West Texas CO₂ EOR Rules-of-Thumb



Synthetic
Seismic
Traces Match
Time to
Depth and
Confirm Mt.
Simon
Seismic
Signature

Saline Formation Storage: Impact of Vertical No-Flow Barriers

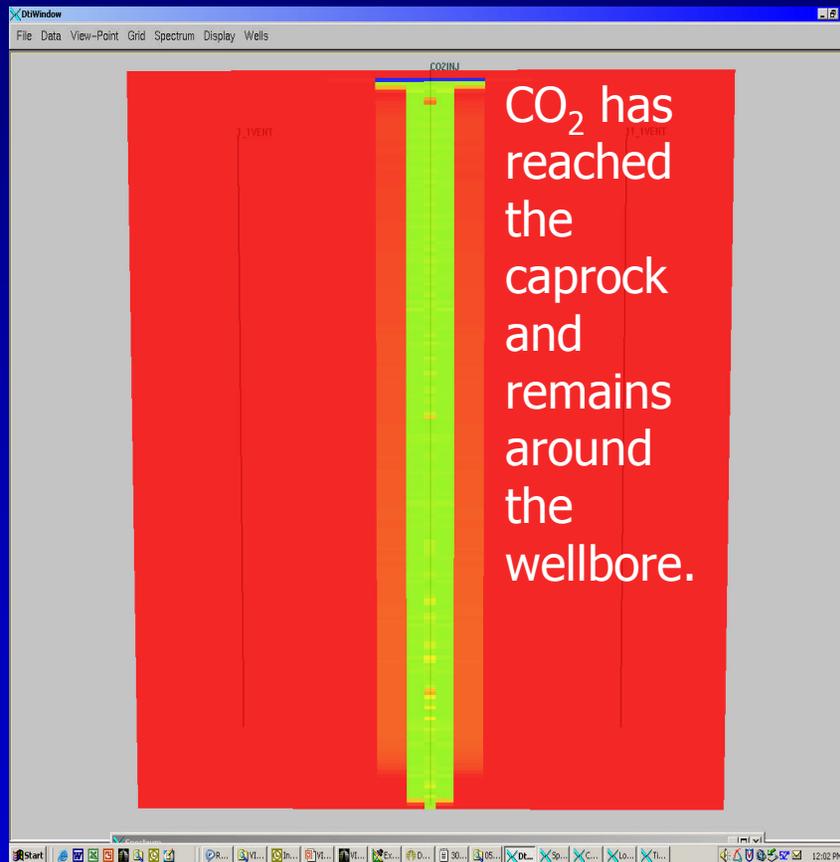
- 5000' x 5000' x 1000' modeled area
- $k_h = 10$ md; $k_v = 1$ md; $\phi = 8\%$
- depth = 6000 ft; $p_i = 2400$ psia
- Open system modeled (only modest pressure increase)
- Injection at base of 1000 ft interval
- Trapped gas 18%

Observations

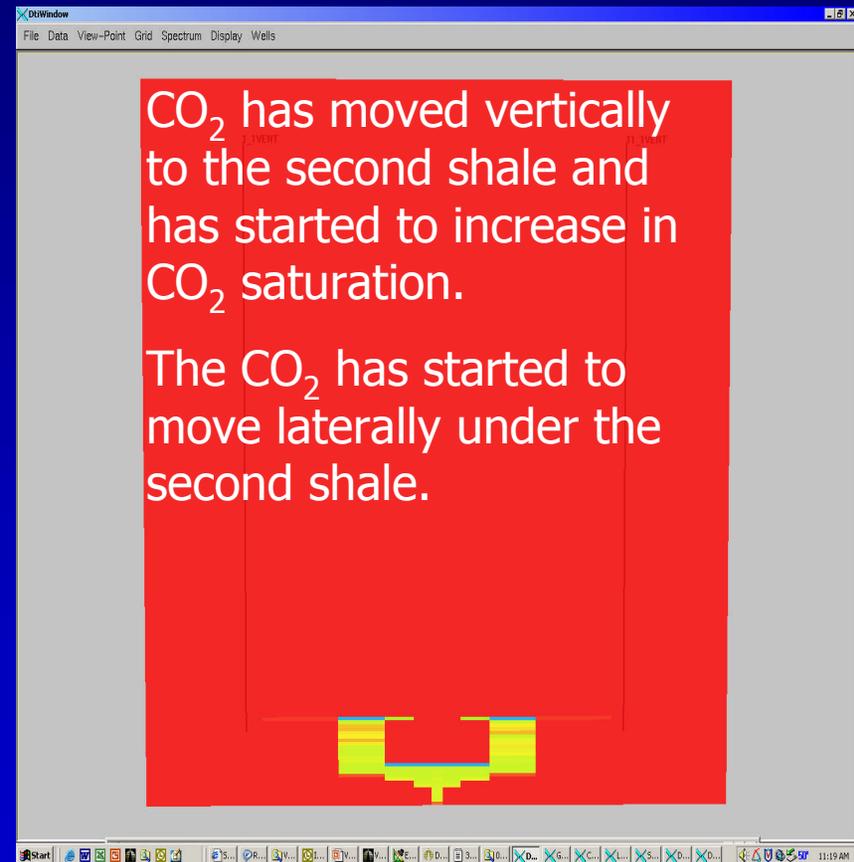
- No-flow barriers (within-reservoir shales or siltstones) allow saturation buildup and store more CO₂ in smaller areas
- Importance of reservoir characterization with respect to local storage in a large structure

Impact of Vertical No-Flow Barriers

No shale present

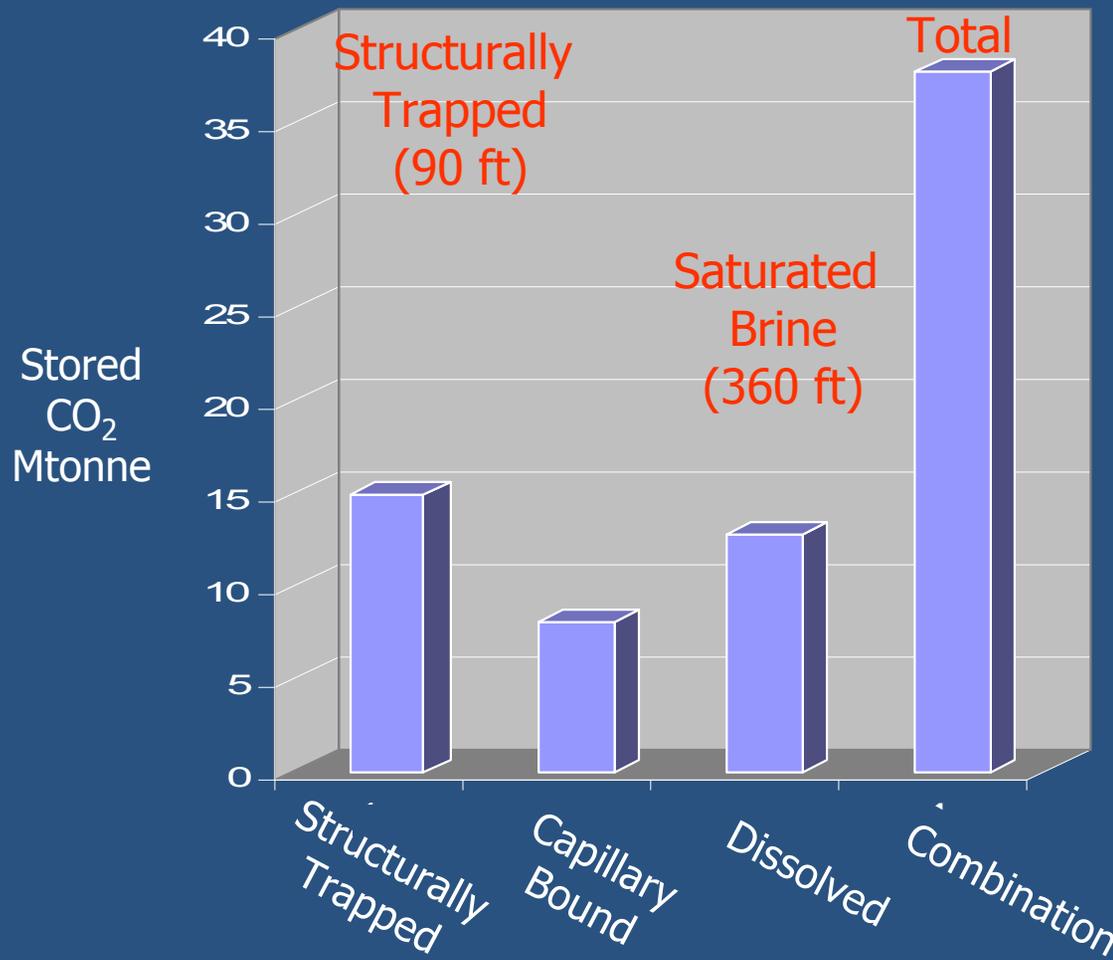


Shale present



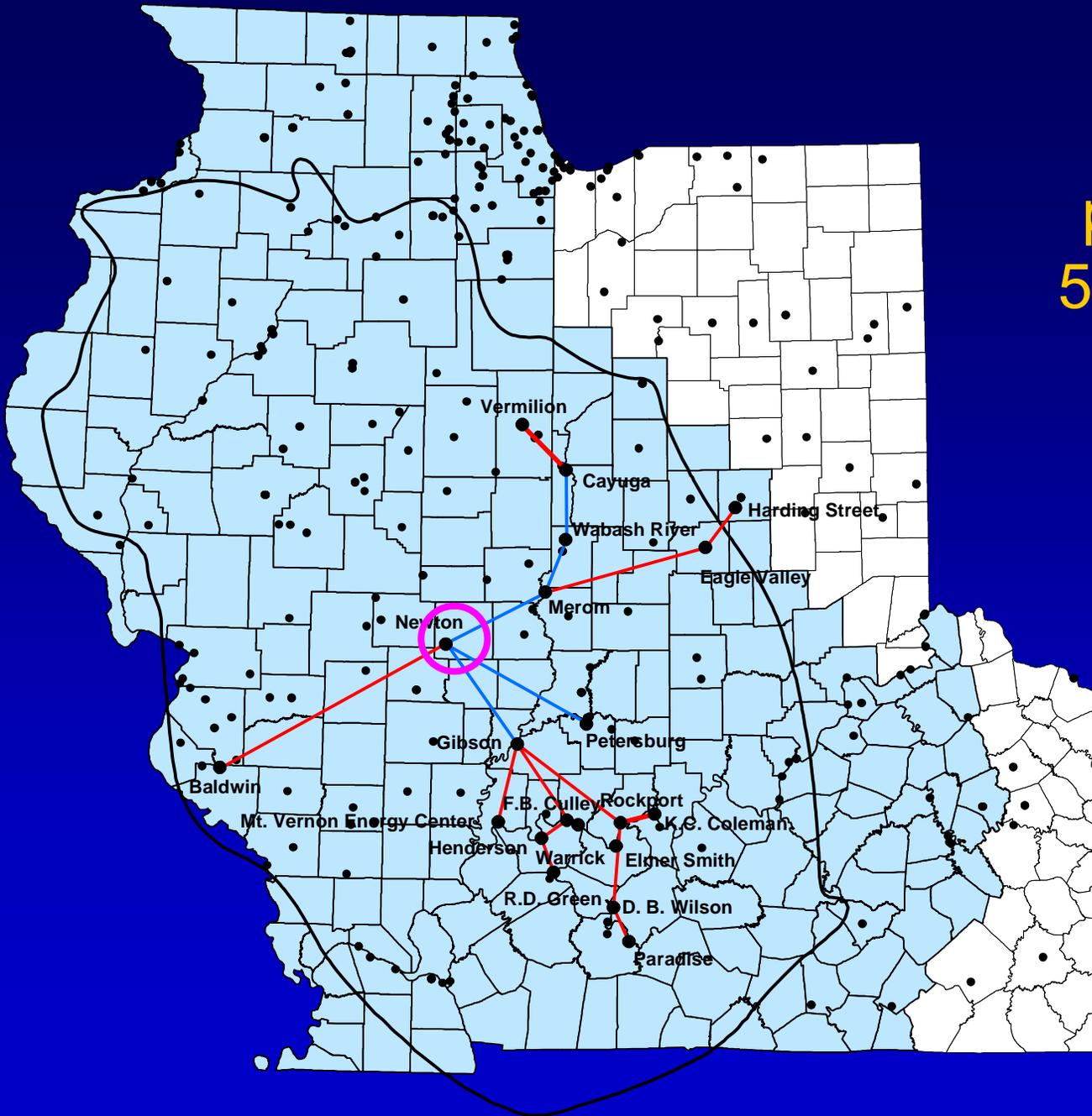
100 yrs shut-in following 30 years injection

Underground Gas Storage Analog



A Manlove analog should hold up to 36 Mtonnes of CO₂

Scenario for
25% (blue
pipelines) and
50% (blue plus
red pipelines)
Utility CO₂
Emission
Storage



MGSC: Seeking Optimal Sinks

- High CO₂ storage capacity
- High CO₂ injection rate
- Storage mechanism assessment
- Five recommended field test sites due at the end of Phase I
- Six field tests proposed from portfolio of 34 potential field test sites among 10 oil operators and Ameren for Phase II activities



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www.sequestration.org

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