Characterization of a World Class Carbon Dioxide Storage Complex in Kemper County, Mississippi, USA

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2019 Carbon Management Technology Conference, July 15-18, 2019, Houston, Texas
The Project Team, led by Southern States Energy Board, Mississippi Power Company and Southern Company Services, with technical support from Advanced Resources Inc. and a host of key subcontractors, acknowledge the valuable support provided by the U.S. DOE National Energy Technology Laboratory on this Phase 2 CarbonSAFE field project.
Disclaimer

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Kemper Storage Complex Stratigraphy

- **Storage zones**
  - Lower Tuscaloosa Grp (‘Massive’ sand)
  - Washita-Fredericksburg interval
  - Paluxy Formation

- **Confinement**
  - Tuscaloosa marine shale
  - Shale interval at **top** of the Washita-Fredericksburg
  - Shale interval at **base** of Washita-Fredericksburg
  - Shallower seals in the Selma and Midway Groups
Data Collection

- Three characterization/monitoring wells were drilled in 2017 to test and characterize geologic properties
- 200 ft of hole core was taken from the Paluxy and Washita-Fredericksburg reservoirs and the Marine Tuscaloosa shale confining unit
- Reservoir fluid sampling
- Injection tests confirm porosity/permeability
Kemper Storage Complex Geologic Structure

K-T Section

Appalachian-Ouachita Orogen

Crystalline Basement

Paleozoic Unconformity

Area of low amplitude

Area of high amplitude

Seima Chalk

Ramps and faults

~ 2 miles

Marine Tuscaloosa

Sub-Mesozoic Unconformity
Rock Properties

- 350 meters of net sand. Logs and core show sandstone average porosity of 30%(!)
- Darcy-class permeability common (up to 16 Darcies)
- Mudrock units are likely effective seals; slow permeation of the mudrock pore systems makes significant migration of injected CO₂ out of the storage complex unlikely.
Storage Complex Capacity

- Each of the three potential storage zones have commercial capacity
- Together the three storage zones result in a gigatonne capacity storage complex that has the potential to act as a regional hub

<table>
<thead>
<tr>
<th>CO₂ Storage Reservoir</th>
<th>( P_{10} ) Capacity (MMmt)</th>
<th>( P_{50} ) Capacity (MMmt)</th>
<th>( P_{90} ) Capacity (MMmt)</th>
</tr>
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<tbody>
<tr>
<td>Massive/Dantzler</td>
<td>60</td>
<td>120</td>
<td>200</td>
</tr>
<tr>
<td>Wash.-Fred.</td>
<td>280</td>
<td>540</td>
<td>920</td>
</tr>
<tr>
<td>Paluxy</td>
<td>160</td>
<td>310</td>
<td>530</td>
</tr>
<tr>
<td>TOTAL</td>
<td>510</td>
<td>970</td>
<td>1,660</td>
</tr>
</tbody>
</table>

DOE methodology for site-specific saline storage efficiency calculation based on fluid displacement factors for clastic reservoirs where net pay, net thickness and net porosity are known of 7.4% \( (P_{10}) \), 14% \( (P_{50}) \) and 24% \( (P_{90}) \) (Goodman et al., 2011)
What in the World is a “World Class” Storage Complex?

- High permeability x net thickness
- Lower geomechanical risk
- Cheaper injection/storage costs
- Capacity to take a LOT of CO₂
Storage Costs

• Low-cost storage options occur beneath the energy facility
  o $2.00 - $4.00 USD per metric ton
• This drives the value proposition where existing Kemper infrastructure could be utilized for CO\textsubscript{2} capture, compression, transportation and storage
• Given the expanded U.S. 45Q tax credit for CO\textsubscript{2} storage, having geologic storage data and cost estimates drives ongoing:
  o Applying data to internal resource planning and modeling
  o Improving internal transportation, storage and monitoring cost information
• Evaluation of Kemper site as a regional storage hub
Regional CO$_2$ Sources

- Paluxy Formation Structure
- L. Tusc Massive Structure
- Kemper

Power Plants, 7 MMt/yr

Kemper

Power Plants and Industrial, 35 MMt/yr
Summary

A low risk CO₂ storage prospect

• Storage zones have exceptional capacity
• Caprocks are laterally continuous, confining properties are encouraging
• No structural “show stoppers”

Low storage costs drive commercial storage potential
Large point sources of CO₂ within a 100 to 200-mile radius