CarbonSAFE Illinois
East Sub-Basin
Project Number DE-FE0029445

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Carbon Storage and Oil and Natural Gas Technologies Review Meeting
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Presentation Outline

- Goals of Project
- Technical Status
- Accomplishments
- Lessons Learned
- Synergy Opportunities
- Project Summary
Goals of Project

- Project will conduct a pre-feasibility assessment for commercial-scale geologic carbon storage (CO₂) complexes in the East sub-basin of Illinois.
- Address gaps in experience and knowledge about scaling up from demonstration to commercial-scale storage for more than 50 million tonnes of CO₂ injection from one or more industrial sources.
Location of East Sub-Basin

MGSC CO₂ sources
- Primary Aluminum
- Cement
- Chemical
- Agricultural Processing
- Ethanol
- Nat. Gas Processing/Distribution
- Petroleum Refineries
- Iron and Steel
- Industrial/Manufacturing
- Electricity Generation
- Other
Technical Status

• A high-level technical evaluation of potential storage sites in the East sub-basin in Illinois is in progress.

• Evaluation includes subsurface characterization within the storage complex, risk identification, and an assessment of the potential industrial CO$_2$ source.
Location of East Sub-Basin

Abbott Power Plant
Stratigraphic column showing distribution of Storage Complexes present in the East sub-Basin

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>GROUP</th>
<th>FORMATION</th>
<th>Storage Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordovician</td>
<td>Maquoketa</td>
<td>Brainard</td>
<td>Secondary Seal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ft. Atkinson</td>
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<tr>
<td></td>
<td></td>
<td>Scales</td>
<td></td>
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<tr>
<td></td>
<td>Galena</td>
<td>Kimmswick</td>
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<tr>
<td></td>
<td></td>
<td>Decorah</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plateville</td>
<td>Joachim</td>
<td>Potential target</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St. Peter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ancell</td>
<td>Shakoppee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knox</td>
<td>New Richmond</td>
<td>Secondary Seal/Reservoir</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oneota</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gunter</td>
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<td></td>
<td>Eminence</td>
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<td></td>
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<td>Potosi</td>
<td>Potential target</td>
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<tr>
<td></td>
<td></td>
<td>Franconia</td>
<td></td>
</tr>
<tr>
<td>Cambrian</td>
<td>Ironton-Galesville</td>
<td>Eau Claire</td>
<td>Primary Seal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mt. Simon</td>
<td>Target reservoir</td>
</tr>
<tr>
<td>Precambrian</td>
<td></td>
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</tbody>
</table>
Thickness of the Mt. Simon Sandstone

Mt. Simon can have up to 30% porosity
Elevation of the top of Mt. Simon Sandstone

Depth (ft.)
- Less than 1,000
- 1,000.000001 - 2,000
- 2,000.000001 - 3,000
- 3,000.000001 - 4,000
- 4,000.000001 - 5,000
- 5,000.000001 - 6,000
- 6,000.000001 - 7,000
- 7,000.000001 - 8,000
- 8,000.000001 - 9,000
- 9,000.000001 - 10,000
- 10,000.000001 - 11,000
- 11,000.000001 - 12,000
- 12,000.000001 - 13,000
- 13,000.000001 - 14,000
- 14,000.000001 - 15,000
- 15,000.000001 - 16,000
Thickness of the St. Peter Sandstone

St. Peter Sandstone can have up to 25% porosity
Thickness of the Cypress Sandstone

Thick Cypress can have up to 20% porosity
Cypress Saline Reservoir
Enhanced Oil Recovery

EOR (MMstb) per field:
- Greater than 50
- 25 to 50
- 10 to 25
- 2.5 to 10
- Less than 2.5
Accomplishments to Date

- Project kickoff meeting has been completed as a milestone.
- Updated the GIS layer showing all of the potential CO$_2$ sources in the states of Illinois and Indiana.
- Regional structure and isopach of key formations (seals and potential reservoirs) has been completed.
- Begin to evaluate the relative merits and/or risks of different focal areas within or near the main sub-basin study area; work from regional screening toward preliminary site candidates or Site Feasibility.
- Begin preliminary discussions with operators of the different sources
## Progress on Tasks

<table>
<thead>
<tr>
<th>Task #</th>
<th>Description</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project management and planning</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Establish CCS Coordination Team</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Develop Plan to Address Challenges of Commercial-Scale CCS Project</td>
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<tr>
<td>4</td>
<td>Conduct High-Level Technical Sub-Basin Evaluation</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>CO₂ Source and Transportation Assessment</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>National Risk Assessment Partnership (NRAP) Screening</td>
<td>0</td>
</tr>
</tbody>
</table>
Task 3: Develop Plan to Address Challenges of commercial-scale CCS

3.1 Business & Financial Case Study
   - ISGS
   - IEc

3.2 Policy, regulatory, legal and permitting case study
   - Indiana Geological Survey
     - PRI
     - ISGS
     - PNNL
     - U of Wyoming

3.3 Conduct stakeholder analysis and outreach planning
   - ISGS
     - ISGS
     - Indiana GS
     - SCS
     - IEc
     - Trimeric

3.4 Scenario Development of integrated CCS complex
   - ISGS
   - IEc
   - Trimeric
Task 3 Develop Plan to Address Challenges of Commercial Scale CCS Project

• Literature search on other CCS project and their costs, benefits, and get estimates from other CCS projects.

• Use Illinois Basin Decatur Project (IBDP) as the model to understand permitting, regulatory and legal issues.

• Will use the IBDP as a model for identifying best practices for communication and engagement.

• Scenario Development of Integrated CCS Storage Complex will integrate all of the tasks of East Sub-Basin into a final report.
Lessons Learned

– Greatest challenge is making an economic model from storage into saline reservoirs
– A lack of deep well data near industrial CO$_2$ sources makes storage and injection analysis difficult
– There is an opportunity to work on the economic feasibility of CCS with the other participants in the CarbonSAFE program.
– Learn different approaches to evaluating potential sites for large scale CCS projects.
– Many of the industrial sources are along the Illinois-Indiana-Kentucky border motivating further collaboration between state research institutes
– National Risk Assessment Partnership (NRAP) Screening
Project Summary

- Data has been gathered and partly assessed for potential CCS sites near industrial CO$_2$ sources
- Based on available data, two sites have been selected for further evaluation.
- Subsurface characterization of potential storage complexes will commence
- Static and dynamic geologic models of storage complexes will be developed for commercial CCS deployment
- NRAP coordination is starting
Appendix

- These slides will not be discussed during the presentation, but are mandatory.
Benefit to the Program

Identifying geological storage sites suitable for storage of over 50 million tonnes of CO$_2$ is essential for developing commercial-scale CCS projects to address greenhouse gas emissions from industrial sources. There are relatively few large carbon storage projects in deep saline reservoirs, and this gap in development knowledge will be addressed by the research in this project. Our work will address improving our storage capacity estimates to attain an industry standard of ±30% or better for investment decisions. The data from this study will be used within the NRAP Toolkits to move toward validating technologies to ensure storage permanence and to improve reservoir storage efficiency. The knowledge gained will contribute to best practice manuals about CCS technology and issues that will be of broad use to other sites and future commercialization efforts.
Project Overview
Goals and Objectives

- Describe the project goals and objectives in the Statement of Project Objectives.
  - Present information on how the project goals and objectives relate to the program goals and objectives.
  - Identify the success criteria for determining if a goal or objective has been met. These generally are discrete metrics to assess the progress of the project and used as decision points throughout the project.
A Gantt chart is shown with project tasks and milestones. The chart covers tasks such as:

- Task 1: Project Management & Planning
  - 1.1 Manage Project Activities
  - 1.2 Project Management Plan
  - 1.3 Knowledge sharing and best practices manuals
  - 1.4 Communications
  - 1.5 Data management
  - 1.6 Advisory Board
  - MILESTONE: Establish Advisory Board

- Task 2: Establish CCS Coordination Team
  - 2.1 Identify and Develop CCS Coordination Team
  - 2.2 Design and Implement Team Activities
  - MILESTONE: Complete CCS Coordination Team Plan

- Task 3: Develop Plan to Address Challenges of commercial-scale capture
  - 3.1 Business & Financial Case Study
  - 3.2 Policy, regulatory, legal and permitting case study
  - 3.3 Conduct stakeholder analysis and outreach planning
  - 3.4 Scenario Development of integrated CCS complex

- Task 4: Conduct High-level technical sub-basin evaluation
  - 4.1 Data Collection
  - 4.2 Data Evaluation & Screening
  - 4.3 Geological Characterization
  - 4.4 Risk Assessment
  - MILESTONE: Complete Data Gap Analysis
  - MILESTONE: Risk Assessment Summary
  - 4.5 Develop Site Feasibility Plan
  - MILESTONE: Complete Site Feasibility Plan and NEPA

- Task 5: CO2 Source & Transportation Assessment
  - 5.1 CO2 Source Assessment
  - MILESTONE: Complete CO2 Source Assessment
  - 5.2 Transportation & Infrastructure
  - MILESTONE: Complete Transportation/Infrastructure Assessment
  - 5.3 Development Regional Roadmap for Source Network
  - MILESTONE: Complete Network Expansion Roadmap

- Task 6: NRAP Screening
  - 6.1 NRAP toolkit assessment
  - MILESTONE: Conduct NRAP Tool Evaluation
Bibliography

- No publications have been generated since project is just beginning implementing the research goals.