



Southeast Regional Carbon Utilization and Storage Acceleration (SECARB-USA) Initiative: An Overview

Ben Wernette, Ph.D.
Southern States Energy Board
August 28, 2023

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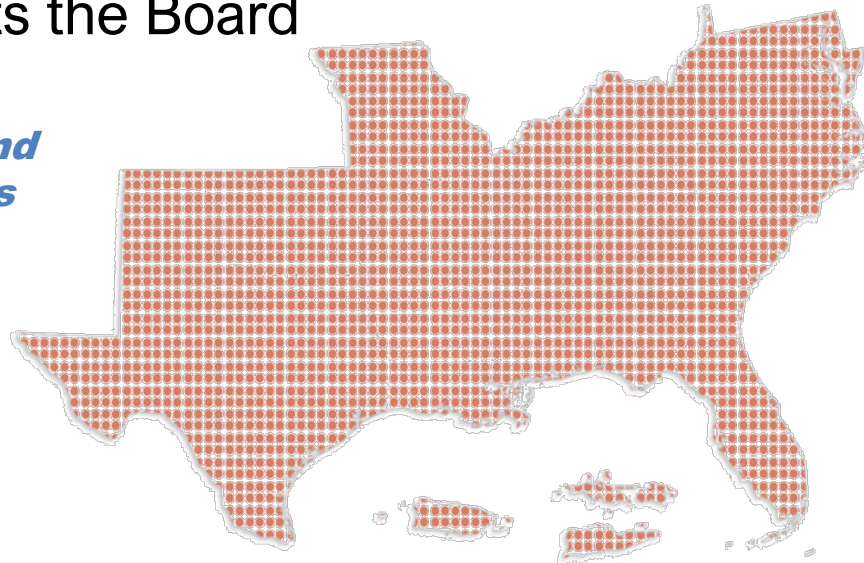
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- Interstate Compact Organization, created by state law and consented to by Congress (PL 87-563, PL 92-440)
- 16 U.S. States and Two Territories
- Each jurisdiction represented by the governor, a legislator from the House and Senate, and a governor's alternate
- Federal Representative appointed by U.S. President
- Secretary, who serves as Executive Director
- Technical staff that supports the Board

“Through innovations in energy and environmental policies, programs and technologies, the Southern States Energy Board enhances economic development and the quality of life in the South.”
SSEB Mission Statement



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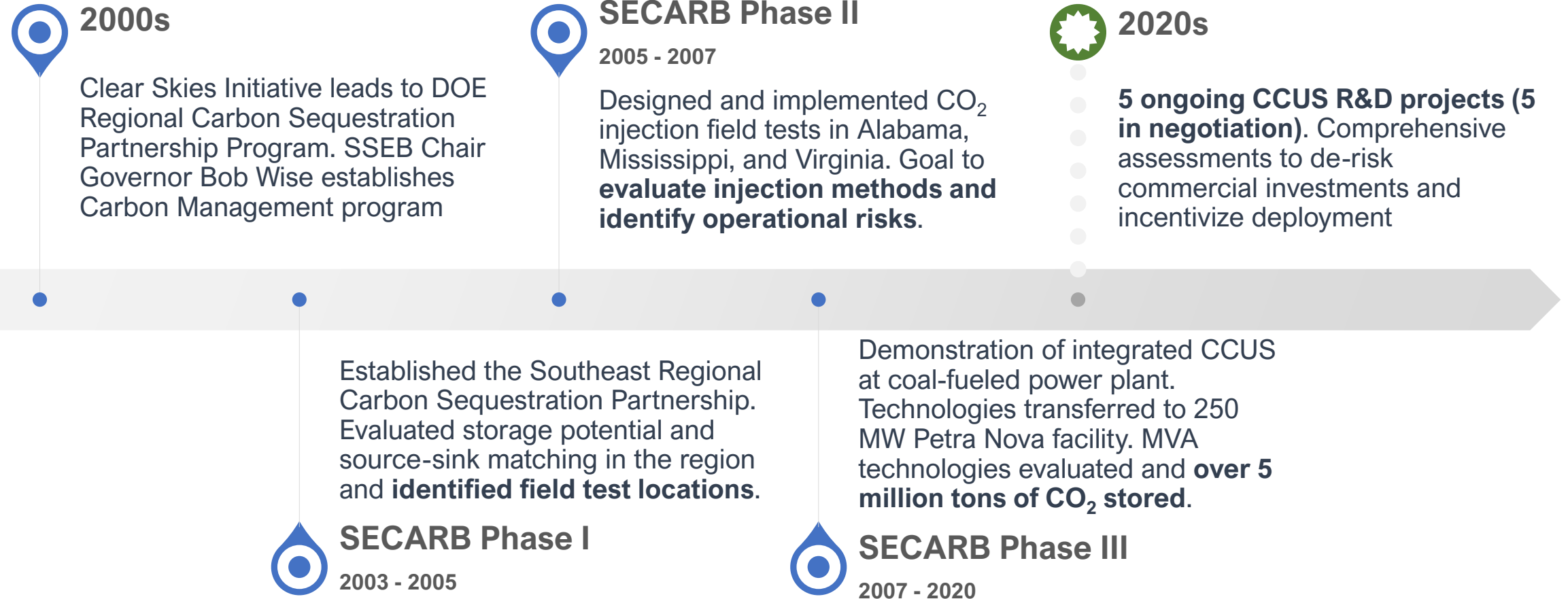


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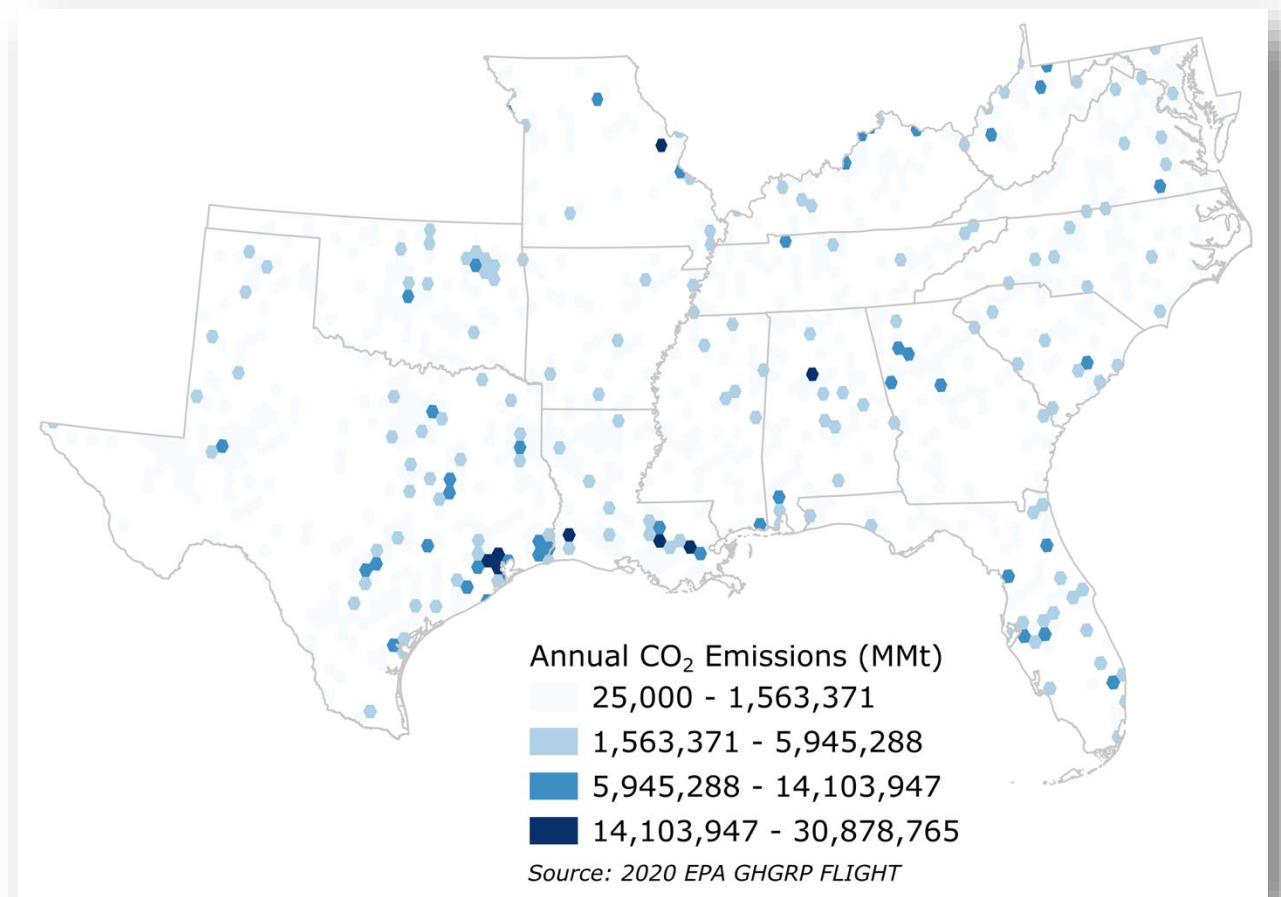
CCS – SSEB Timeline



CCS - Motivation

- Region accounts for over 1.2 billion metric tons of annual CO₂ emissions, or ~ 30% of U.S. annual emissions
 - Utility-scale electric generation
 - Industrial activities
 - Regional importance (jobs, energy security)
- Opportunity for CO₂-focused economy
- Broad industry interest in decarbonizing, and expertise

Spatial Density of CO₂ Emissions in the Southeast



SECARB-USA Partners



Student Activity



Graduate

- Chidera Iloejesi
- Jamie Newsome
- Nora Lopez Rivera
- Otis Williams

Post Doc

- Zhuofan Shi

Graduate

- Edna Rodriguez Calzado
- Yushan Li
- Angela Luciano
- Maria Madariaga
- Chinemerem Okezie

Intern

- Ethan Cavasos

Graduate

- Victor Fakeye
- Silas Samuel
- Sreejesh Sreedhar
- Megan Garrett
- Jaren Schuette

Graduate

- Lars Koehn
- Uzezi Orivri

Undergraduate

- Kristen Claye
- Nick Fowler
- Wes Godbey
- Liz Johnson
- Thea Torrisi
- Mary Verne



SECARB-USA: Past Activities

- One of four DOE Regional Initiatives tasked with identifying and removing barriers to the commercial deployment of CCUS
- Developed a needs assessment framework for prospective storage complexes in the region based on Class VI requirements
- Preliminary evaluation of regional storage potential and costs using NRAP and SCO₂T
- Identified prospective sub-basins in the region for CO₂ storage
- Coordinated with industry partners (Clear Air Task Force, Denbury, Southern Company, and others) to develop an inventory of non-technical challenges to the commercial deployment of CCS
- Completed stratigraphic test wells in Alabama and Georgia

Southeast Regional CO₂ Utilization & Storage Acceleration Partnership
SECARB-USA

The Southern States Energy Board (SSEB) is leading a coalition of technical experts to identify and address regional onshore storage and transport challenges facing commercial deployment of carbon dioxide (CO₂) capture, utilization and storage (CCUS) technologies.

The goal of the "Southeast Regional CO₂ Utilization and Storage Acceleration Partnership" (SECARB-USA) project is to help the United States meet its need for secure, affordable, and environmentally sound fossil energy supplies by utilizing the advancements made by the Regional Carbon Sequestration Partnership (RCSP) Initiative to continue to identify and address knowledge gaps.

SSEB and a select network of experienced CCUS project developers and operators will coordinate their capabilities to accelerate CCUS deployment and achieve four primary research objectives: 1) address key technical challenges; 2) facilitate data collection, sharing and analysis; 3) assess transportation and distribution infrastructure; and 4) promote regional technology transfer and dissemination of knowledge.

The SECARB-USA regional initiative encompasses the States of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and portions of Kentucky, Missouri, Oklahoma, Texas, and West Virginia. The Southern States Energy Board is the award recipient.

To date, the project team has made significant strides towards de-risking commercial investment in CCUS technologies. For example, a regional assessment of prospective storage complex subsurface data availability revealed data gaps throughout the region. It was observed that data availability is strongly correlated with historical oil and gas exploration and production. Consequently, less information is available to decision makers in and around the Appalachian fold-thrust belt, the Rome Trough, and the coastal plain of Georgia, South Carolina, North Carolina, Virginia, and Maryland. These observations supported Southern Company's stratigraphic test well drilling in the Valley and Ridge province of north-central Alabama and northwest Georgia. Broadly, the information obtained through field activities will be incorporated into the SECARB-USA knowledge base and may provide potential sinks for emitters in the area.

In addition to the technical activities highlighted above, the project team is actively engaged with industry, regulators (state and federal), legislators, and the public more broadly. In total, 186 separate engagements were documented by the project team over a one-year period (Q2 2021 through Q2 2022). Additionally, the program has supported numerous undergraduate and graduate students at the Auburn University, Oklahoma State University, the University of Texas, at Austin, and Virginia Tech.

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Southern States Energy Board
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Field Test Partners
Primary Sponsors
» US DOE
» NETL
» SSEB

Partners
» Advanced Resources International, Inc.
» Auburn University
» Bureau of Economic Geology at the University of Texas at Austin
» Crescent Resource Innovation (Gerald R Hill PhD)
» Environmental Defense Fund
» Geological Survey of Alabama
» Los Alamos National Laboratory
» Oklahoma State University
» SAS Institute, Inc.
» Virginia Center for Coal and Energy Research at the Virginia Polytechnic Institute and State University

Industry Network
» Clean Air Task Force
» Denbury Resources, Inc.
» Mitsubishi Heavy Industries America, Inc.
» Reppol
» SAS Institute, Inc.
» Southern Company

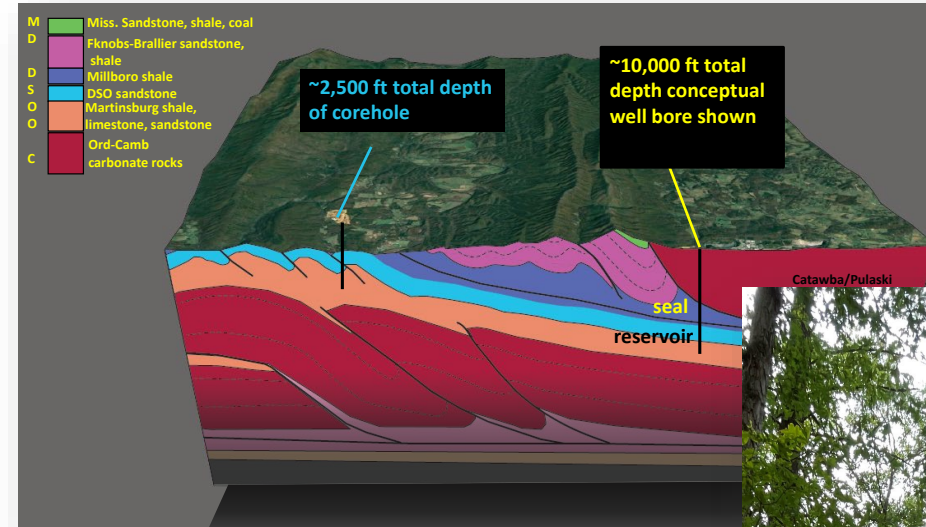
CARBON STORAGE MAP

Legend:
• SOUTHERN STATES ENERGY BOARD
• BATTELLE MEMORIAL INSTITUTE
• UNIVERSITY OF NORTH DAKOTA
• NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

SECARB-USA 2022 Fact Sheet

SECARB-USA: Ongoing Activities

- Coordinating with Titan America to evaluate subsurface storage opportunities near their Roanoke Cement Plan
- Preliminary **geologic characterization** and **reservoir modeling** shows promise as an enduring sink option
- Continuous **core drilling** is ongoing with the well currently at 1,500 feet depth of the planned **2,500 feet total depth**
 - Targeting Ordovician-Silurian sandstone and limestone formations



Subsurface model for the Valley and Ridge province of southwest Virginia. Figure Courtesy of Virginia Tech.

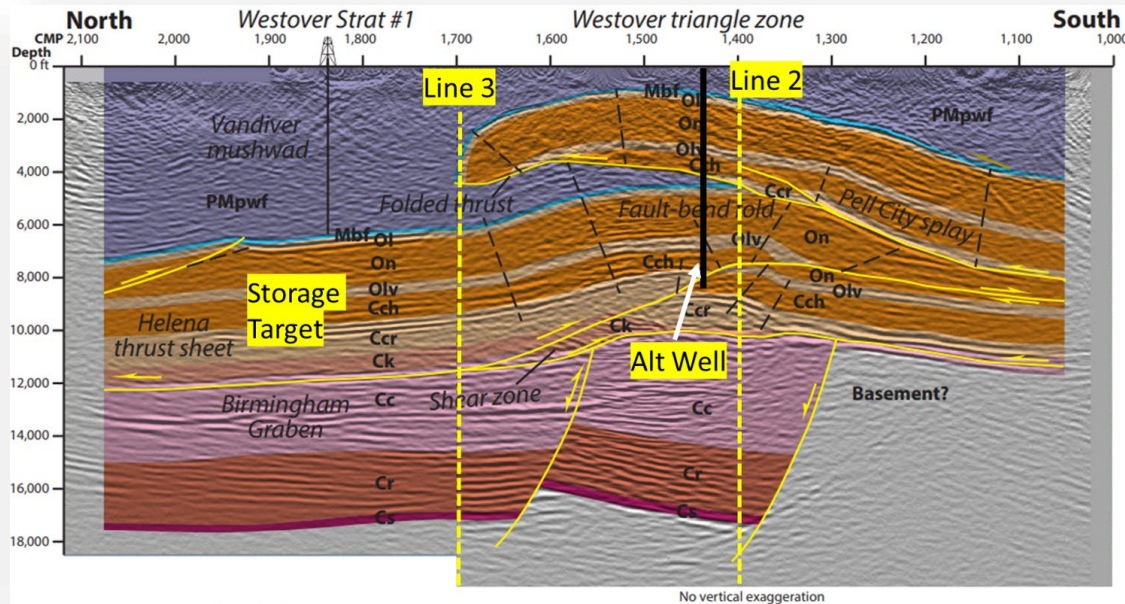


Photograph of field activities in southwest Virginia. The mineral rig is being utilized to test the subsurface for CO₂ storage suitability in an up-dip section from the Roanoke Cement facility. Image courtesy of Nino Ripepi, Virginia Tech.

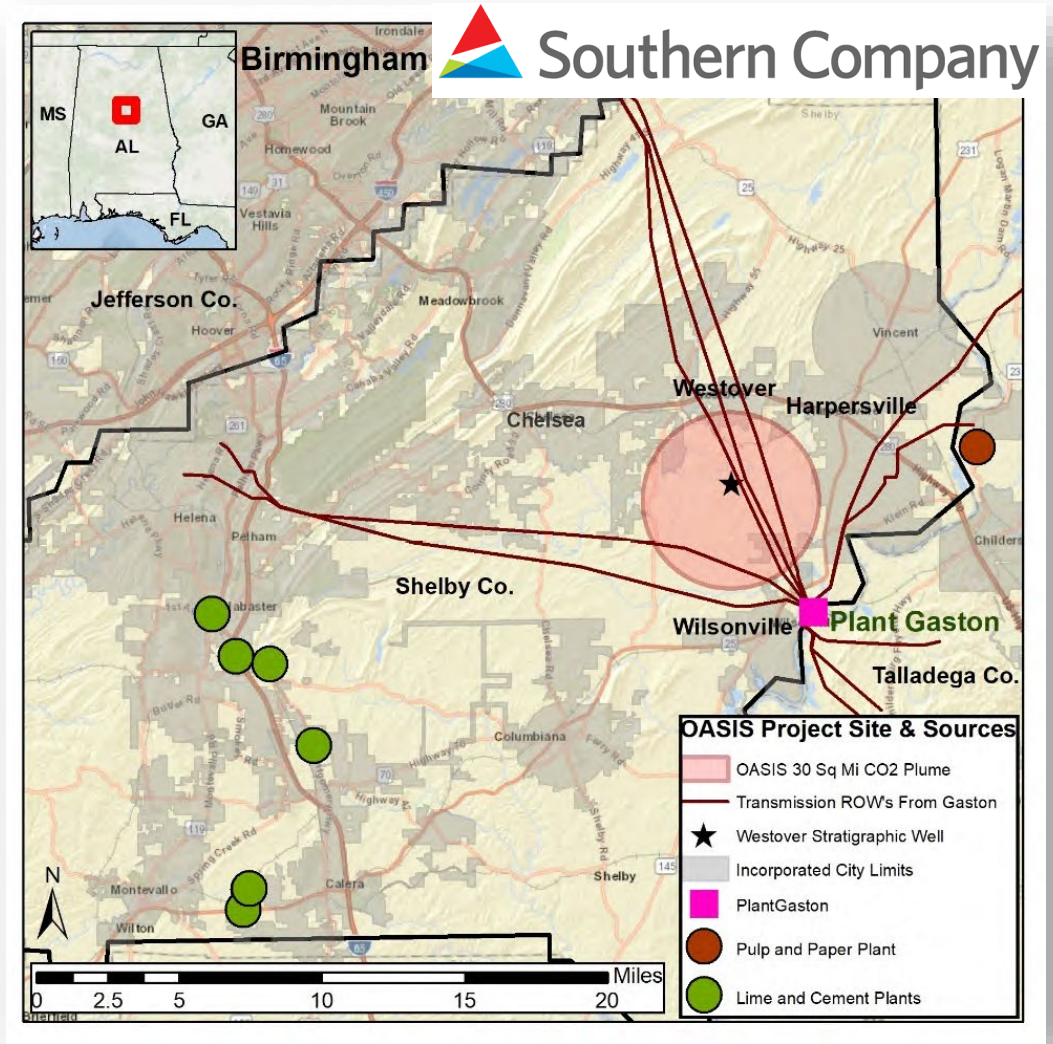
SECARB-USA: Ongoing Activities



- Seismic data acquired in the Valley and Ridge of Alabama to augment well drilling
- 2D – Pseudo 3D seismic interpretation completed on newly acquired seismic – inform past and future activities



Interpreted north-south seismic profile from Westover, Alabama.



Map of Shelby County, Alabama the prior Westover stratigraphic test and other local features.



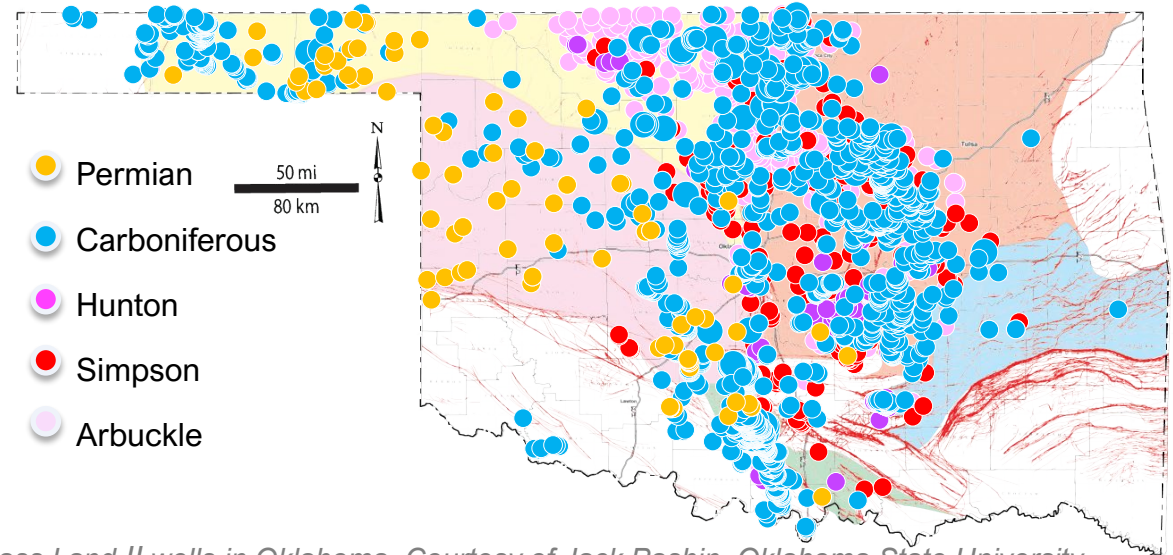
SECARB-USA: Ongoing Activities



• Oklahoma

- Numerous Class I and II injection zones in state
- Large database of injection volume, wellhead pressure, and water chemistry data
- Storage potential in Ordovician-Permian section; numerous thick reservoir seals distributed throughout section

Active injection zones

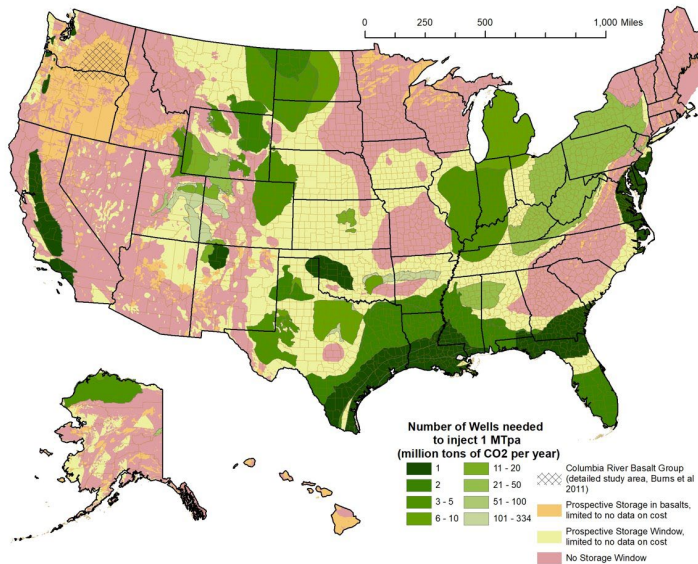


Class I and II wells in Oklahoma. Courtesy of Jack Pashin, Oklahoma State University.

• National

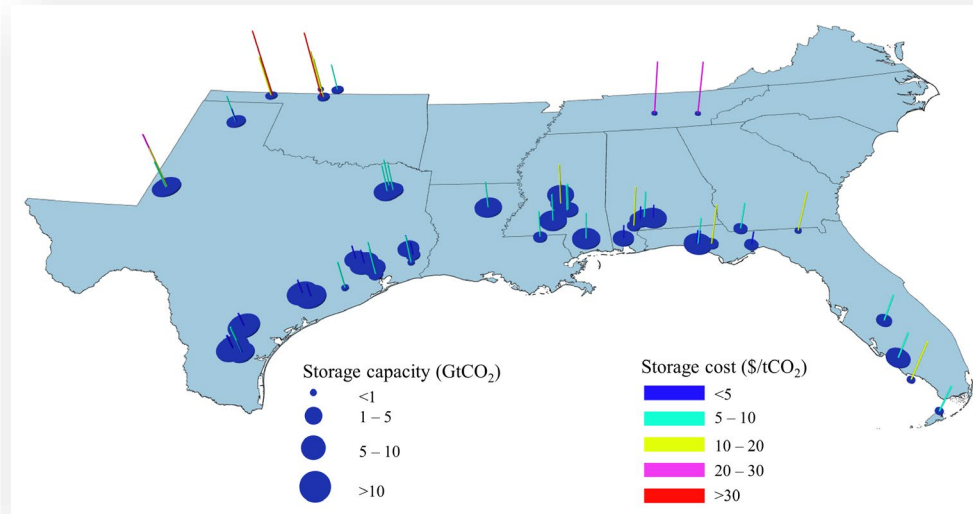
- Updates to storage window thickness and injectivity at the national level
- Lots of injectivity in the Gulf South
 - 1 or 2 injection wells required to inject 1 million metric tonnes of CO₂ annually

National injectivity map based on existing storage window thickness. Figure courtesy of UT Bureau of Economic Geology and Lawrence Livermore National Lab.



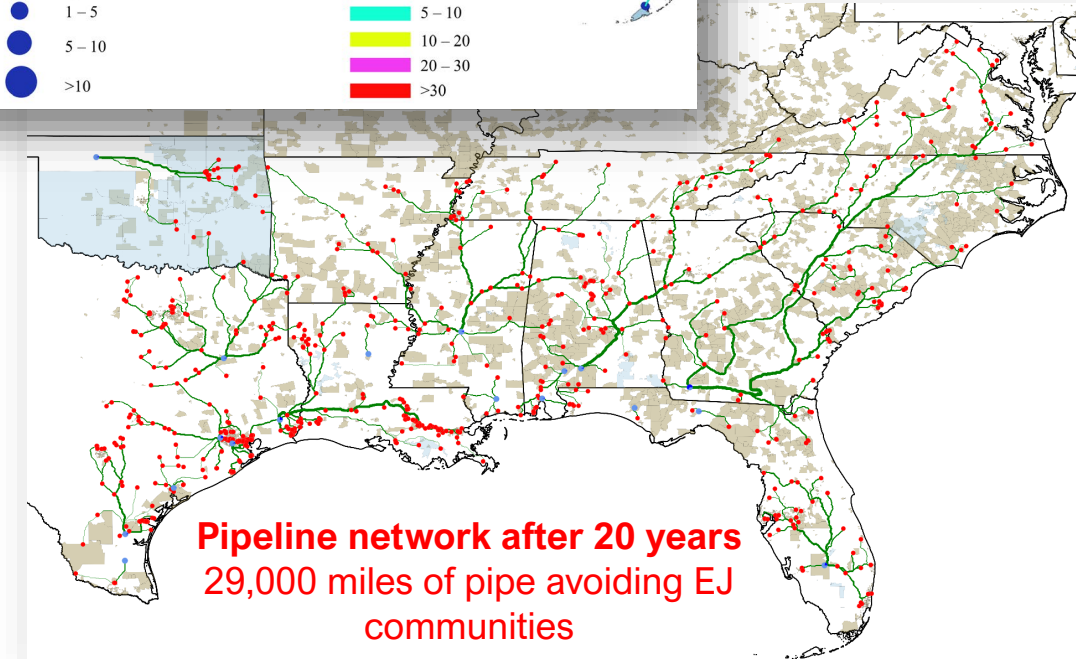
SECARB-USA: Ongoing Activities

- Evaluating regional infrastructure buildout scenarios
 - Major considerations include cost of capture, environmental justice, and environmentally sensitive areas
- **A total of 69 saline reservoirs included in the model as sinks**
- **IRA modified 45Q rules, there are 2,126 eligible point sources with cumulative emissions of 1,188 MMtCO₂/Year**
- Environmental Justice restrictions impose a <1% increase in capital costs



Map of target saline storage reservoirs for infrastructure network modeling. Bubble size corresponds to estimated capacity. Figure courtesy of Los Alamos National Laboratory.

Pipeline optimization avoiding tribal lands (blue polygons) and environmental justice communities (beige polygons). Figure courtesy of Los Alamos National Laboratory.



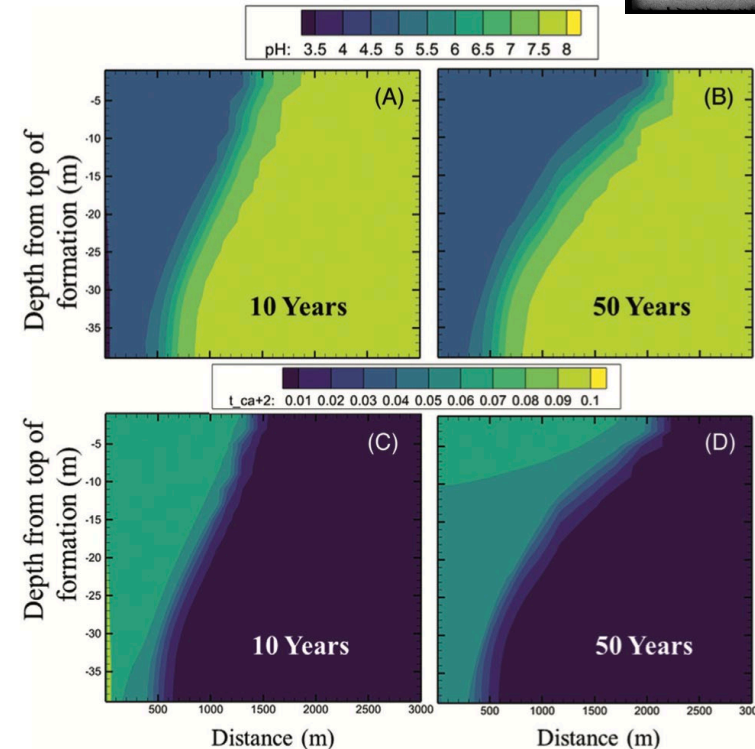
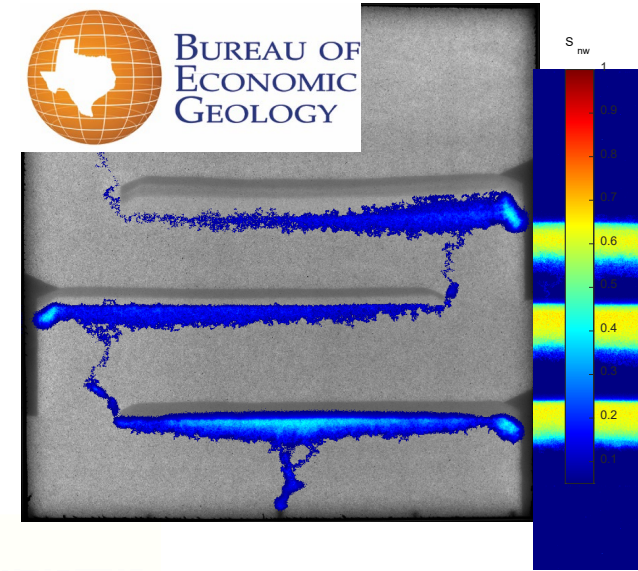
SECARB-USA: Ongoing Activities



BUREAU OF
ECONOMIC
GEOLOGY

- Ongoing experimental and modeling efforts
- Composite confining system:
 - Demonstrates permanent storage beneath a regionally continuous zone made up of multiple locally discontinuous fine grained beds
- Modeled CO₂ injection and impact on reservoir pH and mineral dissolution and precipitation using data from real samples

Tank experiment illustrating the effectiveness of composite confining system on vertical CO₂ migration. Figure courtesy of UT Bureau of Economic Geology.



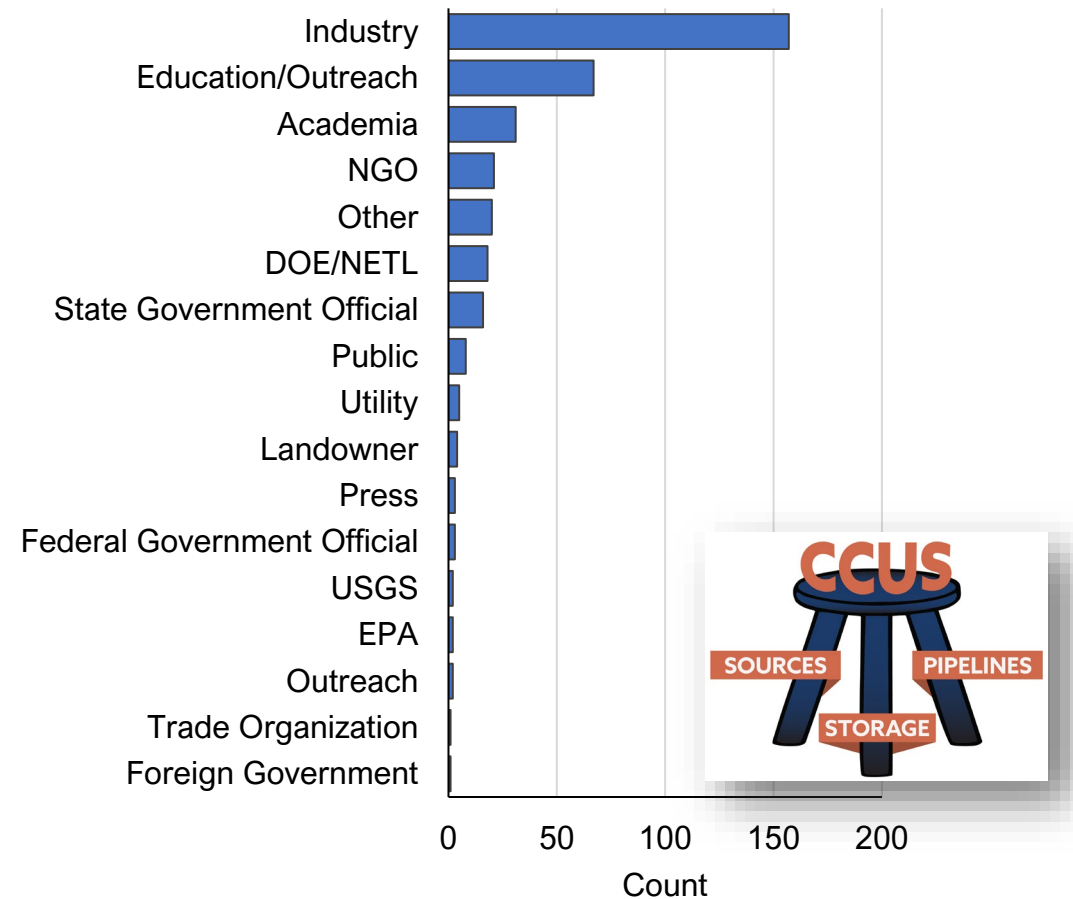
Modeling the impact of CO₂ injection on reservoir pH (A,B) and mineral dissolution and precipitation (C,D). Figure developed and courtesy of Lauren Beckingham, Auburn University.



SECARB-USA: Industry Outreach Activities

- Over 370 reported instances of outreach and engagement back to 2021
- Outreach may include general overview of regional initiatives and CCS
- Initial feasibility studies developed for pulp/paper and cement; informed programs necessary for knowledge gaps
- **Regional knowledge source for industry partners – basis for many new projects (> 15 projects)**

Engagements by Type from April 1, 2021



Other Outreach Activities

- Providing SME to regulators and identifying areas of multi-state and multi-agency collaboration
- Hosted March 2 Engagement Event in Mobile, Alabama
- Participated in the 2023 Inter-Agency RECS Workshop in Birmingham, Alabama
- Hosted July 9 Briefing to Southern Legislative Leaders in Charleston, SC

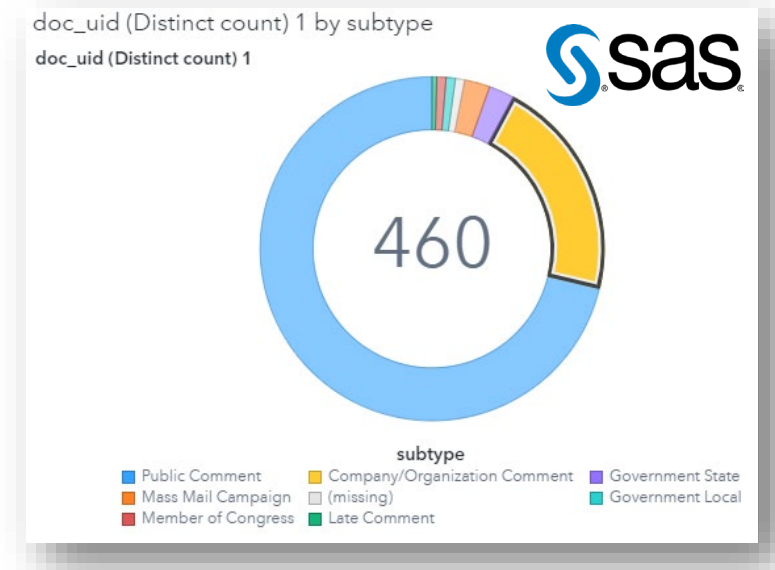
Mobile, Alabama.



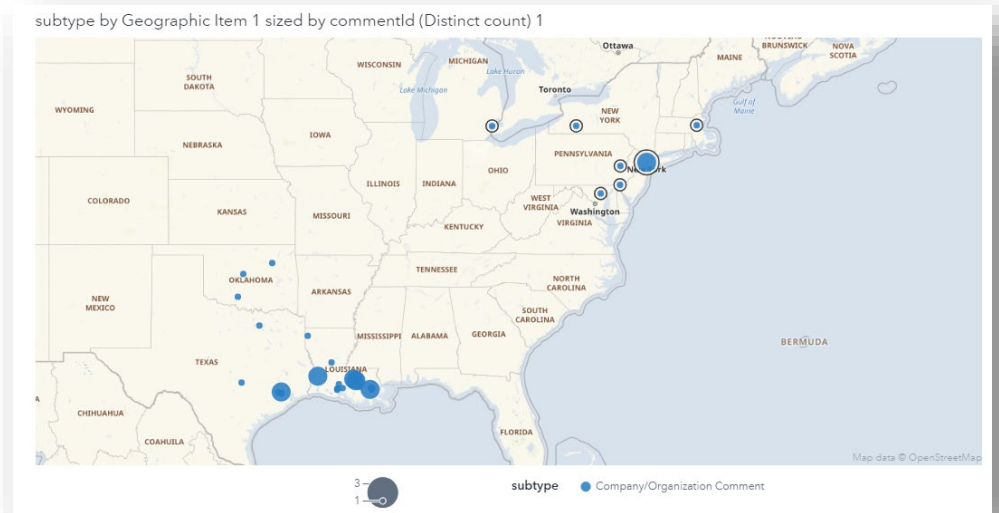
Charleston, South Carolina.

Other Outreach Activities

- Analysis of Louisiana Primacy Application Public Comments
- Insights may prove valuable to others in the region considering primacy
- Over 40k comments, around 600 are unique
- Majority private citizens, followed by companies/organizations
- Where location information is available, diverse in geography



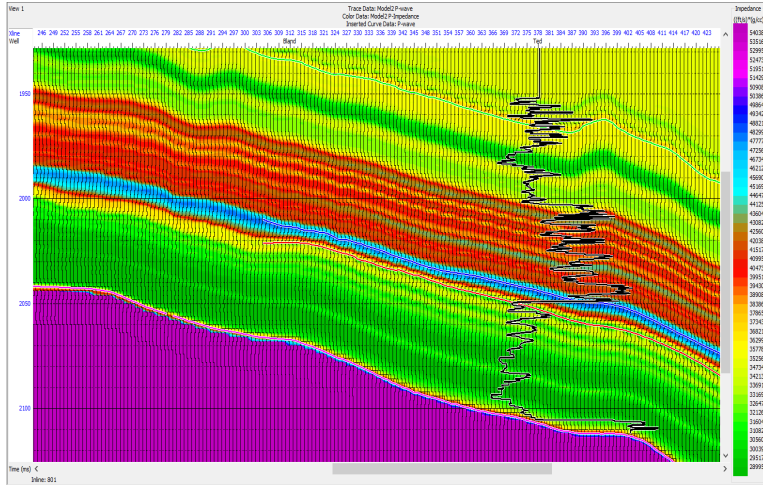
Proportion of comments by type (e.g., company, government official, private citizen). Figure courtesy of SAS.



Geographic distribution of public comments. Figure courtesy of SAS.

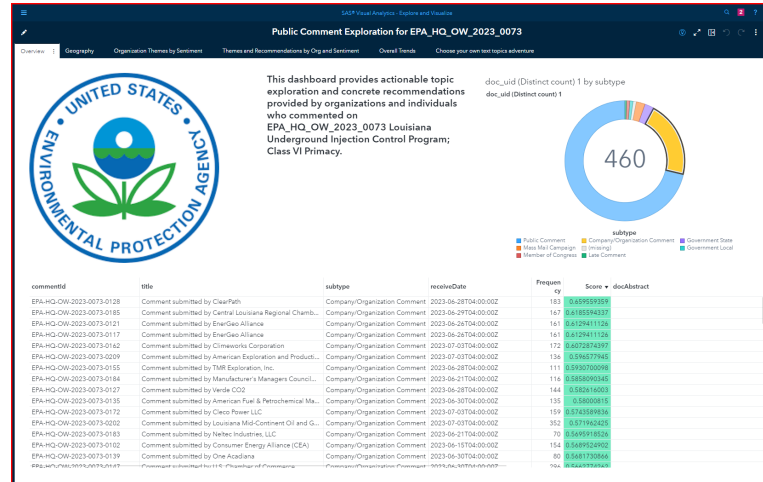
SECARB-USA: Other Activities

Regional Characterization



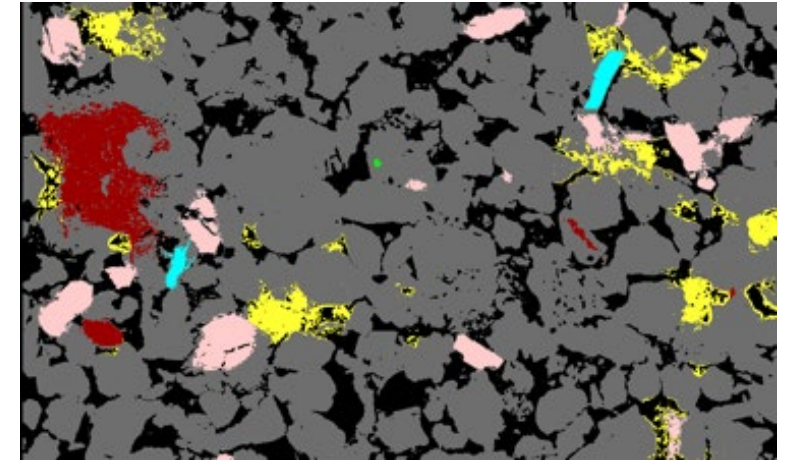
Continued characterization of storage targets utilizing existing data. Recent efforts are focused on GA, LA, OK, TX, and VA.

Dashboard Development



Building out dashboards to analyze public comments in response to Louisiana's Class VI application.

Pore-Scale Impacts



Evaluating pore-scale impact of CO₂ on storage reservoir and cap rock integrity. Utilizing known regional targets and cap rocks.

SECARB-USA: Moving Forward

- Collaborate with industry partners to evaluate CO₂ storage feasibility near existing assets and to assist in the development of business plans, many of which involve multiple companies (hub concept) - **ongoing**
- Build out a more robust stakeholder engagement and outreach plan, focusing on disadvantaged communities and tribal lands - **ongoing**
- Build on existing infrastructure assessments and development cost models – **ongoing working with FEED studies to update capture data**
- Develop an interactive dashboard for educational purposes that includes infrastructure scenarios, costs, risks, societal considerations and impacts (energy and environmental justice; and diversity, equity, inclusion and accessibility), and workforce readiness and development – **ongoing**
- **Continue field efforts in collaboration with industry in Alabama, Georgia, Oklahoma, and Virginia - ongoing**

SECARB-USA Project Timeline	Start Date	End Date	Phase I												Phase II									
			Budget Period 1												Budget Period 2									
			YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5					
TASK DESCRIPTIONS	Start Date	End Date	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
TASK 1.0: PROJECT MANAGEMENT AND PLANNING	10/1/19	9/30/24																						
Milestone: Implement Project Management Plan	11/1/19	11/1/19	◆																					
Decision Point 1: Negotiation/Implementation of PMP	10/1/19	10/1/19	●																					
Decision Point 2: Negotiation /Implementation of Phase II/BP2	9/30/22	9/30/22													●									
TASK 2.0: TECHNICAL CHALLENGES	10/1/19	9/30/24																						
Subtask 2.1: Needs Assessment Framework for Storage Complexes	10/1/19	9/30/22																						
Milestone: Complete Needs Assessment Framework for Storage Complexes	9/30/21	9/30/21																						
Subtask 2.2: Expanded Regional Characterization	10/1/19	9/30/22																						
Subtask 2.3: Optimization, Containment, Verification Strategies Update and Application	10/1/20	9/30/22																						
Subtask 2.4: Risk Needs for 2025 Commercial Deployment	10/1/21	9/30/24																						
Milestone: Host First Partners Meeting on Risk Needs for 2025 Commercial Deployment	9/30/21	9/30/21													◆									
TASK 3.0: DATA COLLECTION, SHARING, AND ANALYSES	10/1/19	9/30/24																						
Subtask 3.1: Data Management Plan	10/1/19	9/30/24																						
Subtask 3.2: Analyze and Update Existing CO2 Source and Sink Databases	10/1/19	9/30/23																						
Subtask 3.3: Regional Assessment Toolset(s) Validation	10/1/19	9/30/22																						
Subtask 3.3.1: Assembling the Scenario Library	10/1/19	9/30/20																						
Subtask 3.3.2: SCO2T Tool Application	4/1/20	9/30/22																						
Subtask 3.3.3: Analysis Using NRAP Tool(s)	10/1/21	9/30/24																						
Subtask 3.4: Machine Learning Initiative	10/1/19	9/30/24																						
TASK 4.0: REGIONAL INFRASTRUCTURE	10/1/19	9/30/24																						
Subtask 4.1: Infrastructure Assessment	10/1/19	9/30/22																						
Milestone: Completed Infrastructure Assessment	9/30/22	9/30/22													◆									
Subtask 4.2: Regional Site Readiness	10/1/19	9/30/22																						
Subtask 4.2.1: Data Quality Methodology	10/1/19	9/30/20																						
Subtask 4.2.2: Storage Complex Data Readiness Evaluation	4/1/20	9/30/22																						
Milestone: Completed Storage Complex Data Evaluation	9/30/22	9/30/22													◆									
Subtask 4.2.3: Storage Complex Readiness Validation, Valuation, and Augmentation	10/1/21	9/30/22																						
Subtask 4.2.4: Regional Application of Storage Complex Readiness	1/1/22	9/30/22																						
Subtask 4.3: Socioeconomic Impacts of CCUS and Workforce Readiness	10/1/21	9/30/23																						
Milestone: Report on Socioeconomic Impacts of CCUS and Workforce Readiness	9/30/23	9/30/23													◆									
Subtask 4.4: Identification of Potential New CCUS Projects	10/1/19	9/30/24																						
Milestone: Completed Final Regional Commercialization Plan	9/30/24	9/30/24													◆									
TASK 5.0: REGIONAL TECHNOLOGY TRANSFER	10/1/19	9/30/24																						
Subtask 5.1: Stakeholder Engagement Plan	10/1/19	9/30/24																						
Subtask 5.2: Non-Technical Challenges to CCUS Deployment	1/1/20	9/30/24																						
Milestone: Inventory Initial List of Non-Technical Challenges for CCUS	9/30/20	9/30/20													◆									
Subtask 5.3: CCUS Business Cases Under New and Existing Tax Policies	1/1/20	9/30/24																						
Subtask 5.4: CCUS Educational Series	10/1/19	9/30/24																						
Subtask 5.5: Technology Transfer and Knowledge Dissemination	10/1/19	9/30/24																						
Milestone: Participate in Project Kickoff Meeting	12/31/19	12/31/19	◆																					
Milestone: Host Stakeholders Meeting to Share Results from BP1	9/30/23	9/30/23													◆									



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