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# Longleaf CCS Hub (DE-FE0032341) DOE-NETL Kickoff January 18, 2024

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# Contacts

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# Project Motivation

- The Longleaf CCS Hub seeks to develop a $CO_2$ storage facility near Bucks, Alabama
- Builds on the successful SECARB injection demonstration at the Anthropogenic Test Site, conducted at nearby Citronelle, Alabama
- Opportunity to decarbonize the many industrial facilities in Mobile County
- **Motivated project owner and developer in Tenaska**
- **36-month period of performance**

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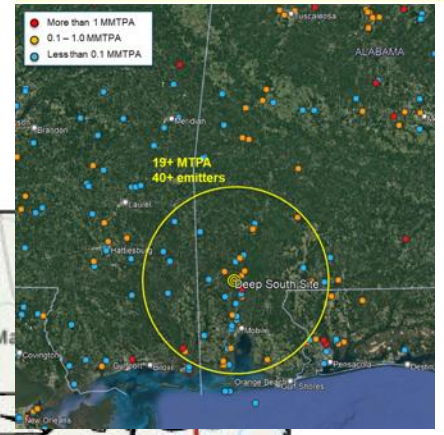
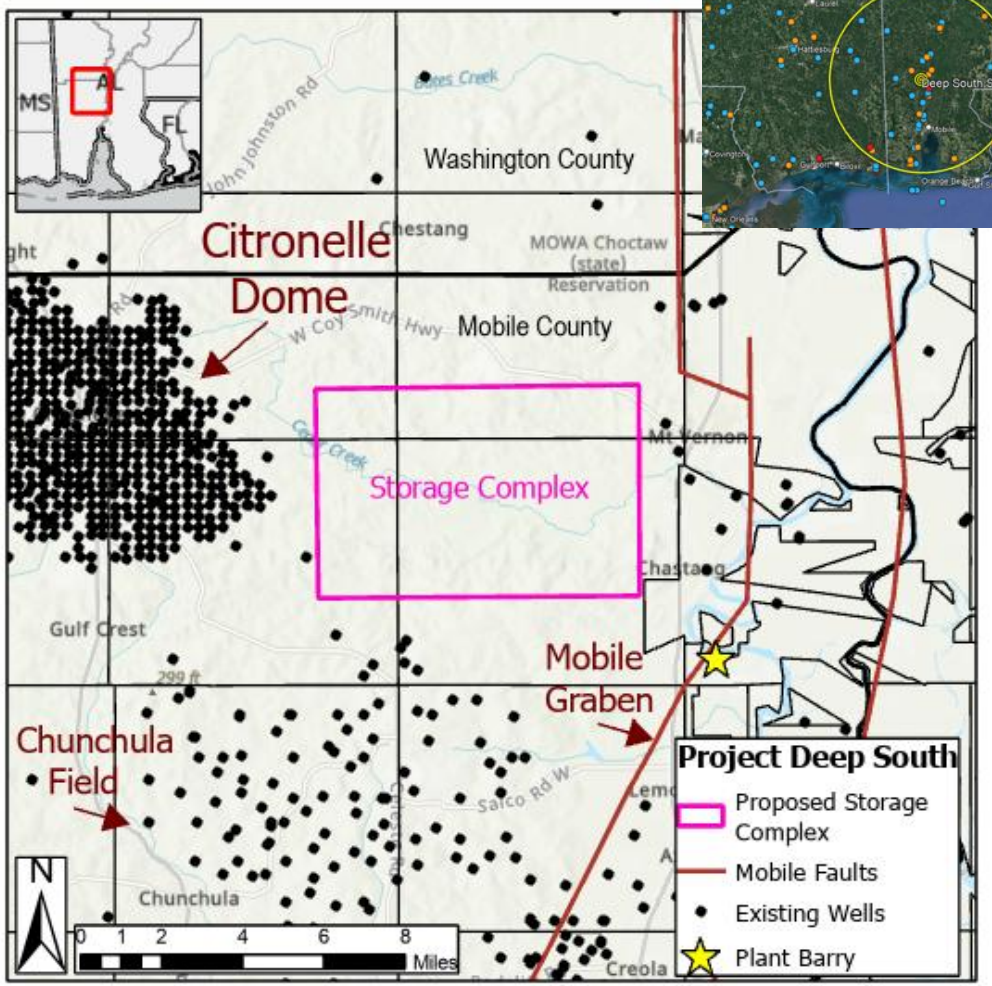
**DOE Funding:** $17,984,523
**Non-DOE Funding:** $5,924,074
**Total Value:** $23,908,597

# Location

- The proposed storage complex site is located north of Mobile, Alabama
- The complex will provide storage options for $CO_2$ emissions captured from regional emitters along the Mobile River corridor and to the south
  - > 19 MMtonnes per year from 40+ emitters
  - Located 5 miles to the east of the SECARB Anthropogenic test site at Citronelle

*Regional emitters in the Gulf South that may wish to explore opportunities to decarbonize.*




*Map of the Longleaf CCS storage complex in northern Mobile County.*

# Sources

- Over 19 MMTs of $CO_2$ emitted from over 28 industrial sources
- Diverse industrial sources participating in the project

| Company | Industry | $CO_2$ Emissions Tons/Yr | Letter of Support |
|---|---|---|---|
| Calvert | Steel | 500,000 | Received |
| Calysta | Sustainable Protein | 500,000 | Received |
| Plant Barry | Power Generation | 1,500,000 | Received |
| Williams | Natural Gas Processing | 100,000 | Received |

*Regional emitters that have agreed to participate in project activities.*

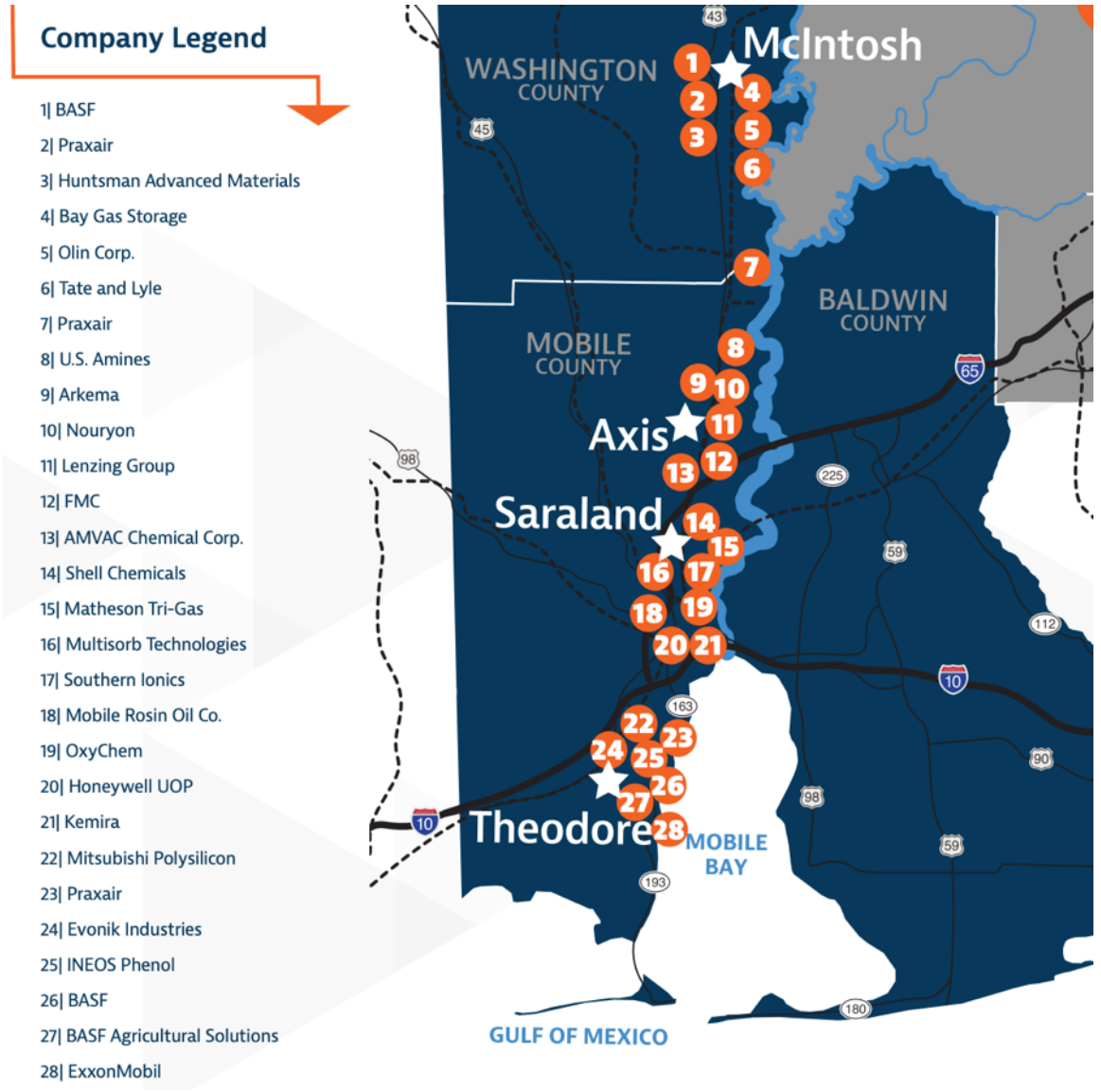
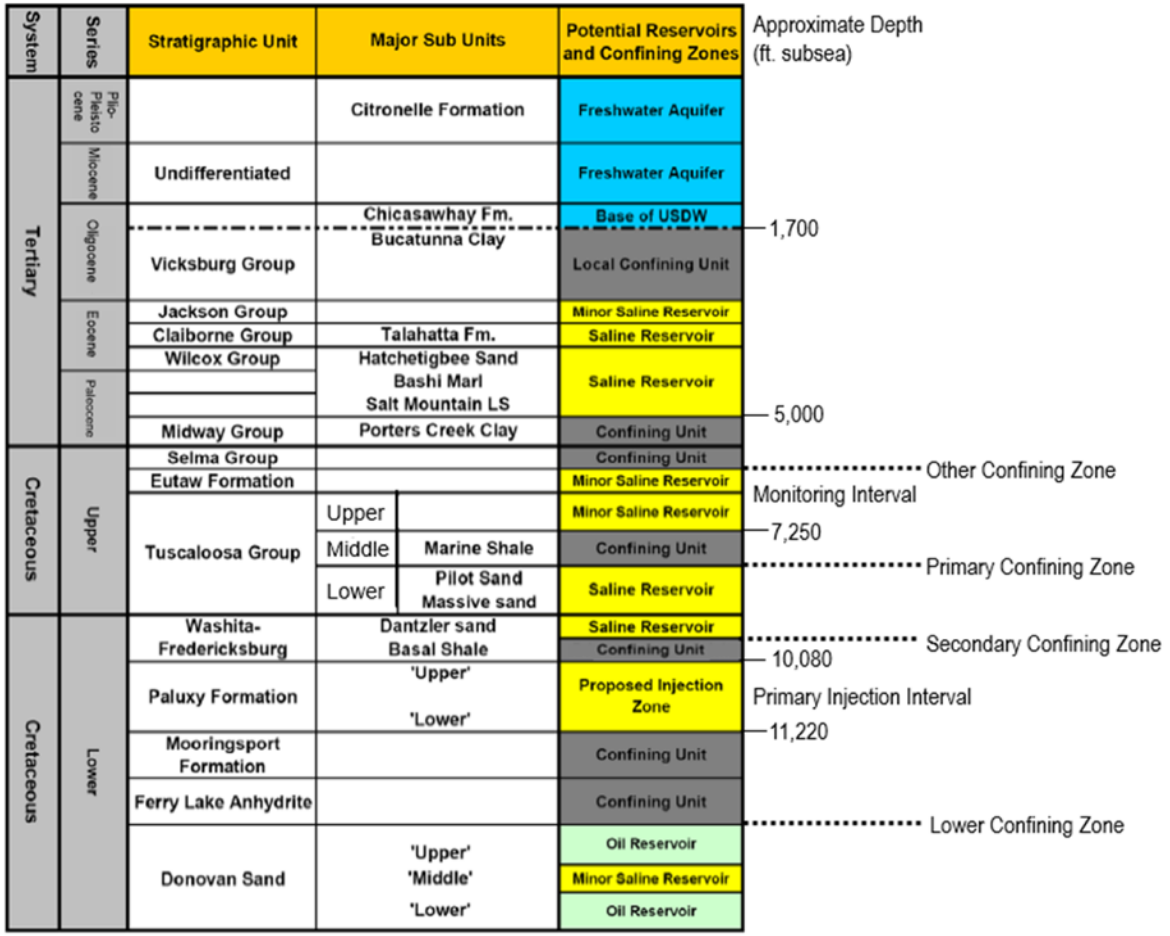



*Illustration of the MAST chemical corridor, and the potential demand for decarbonization solutions.*

# Geology

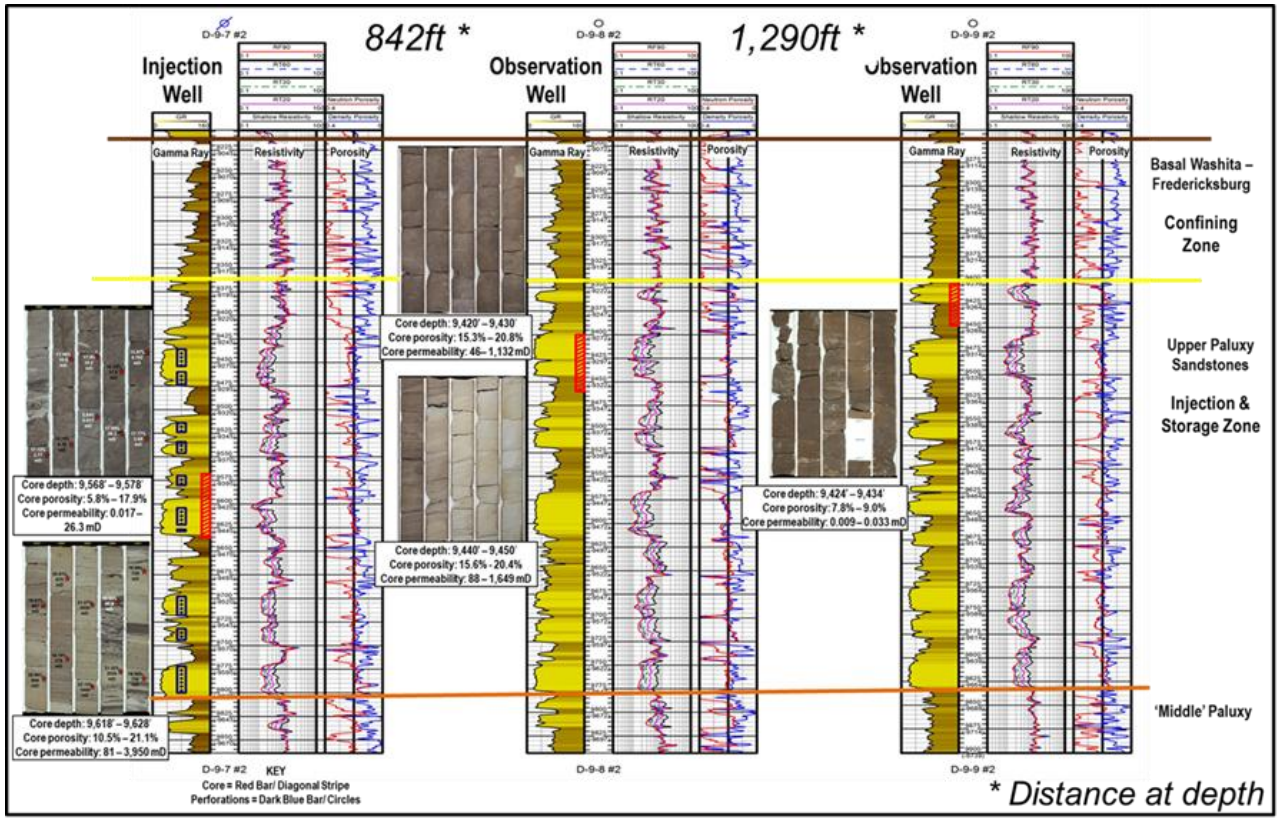
- Project will initially target the Paluxy Formation, a widespread saline aquifer comprised of porous fluvial sandstone and interfluvial mudstones
  - 470 ft of net sandstone
  - sandstone reservoir values commonly exceed 20% and 200 mD
  - 2.3 to 7.4 million metric tons of storage resource per square mile
- The Tuscaloosa Marine Shale (TMS), a regionally significant sealing formation, will serve as the primary confining zone
- Saline aquifers above the Paluxy provide opportunities for expansion of storage resources at the Longleaf CCS Hub and are part of the Phase III data collection efforts

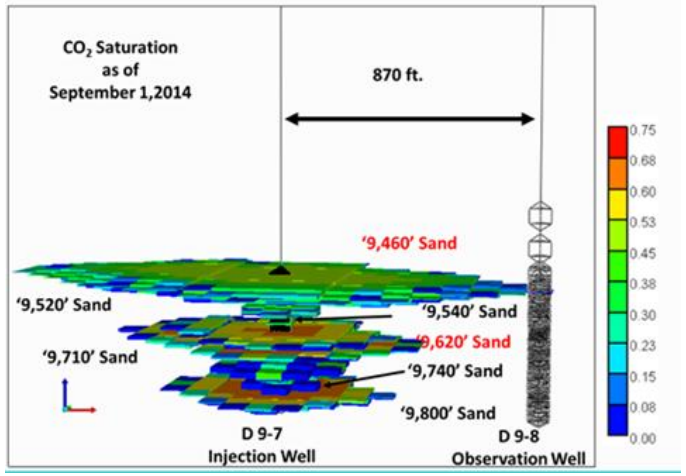


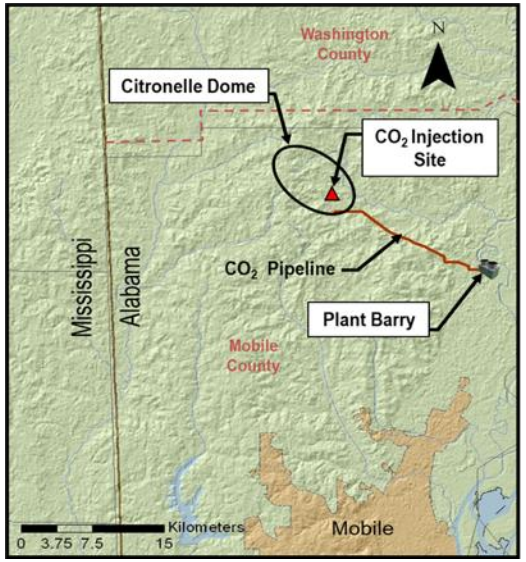

(modified from Pashin et al., 2008)

# Geology

- The site characterization for the Longleaf CCS Hub builds off previous work conducted as part of the DOE and EPRI supported SECARB Phase III Anthropogenic $CO_2$ injection demonstration at the Citronelle Dome
- Geologic and injection performance data from this demonstration are the foundation for our knowledge of Paluxy $CO_2$ storage

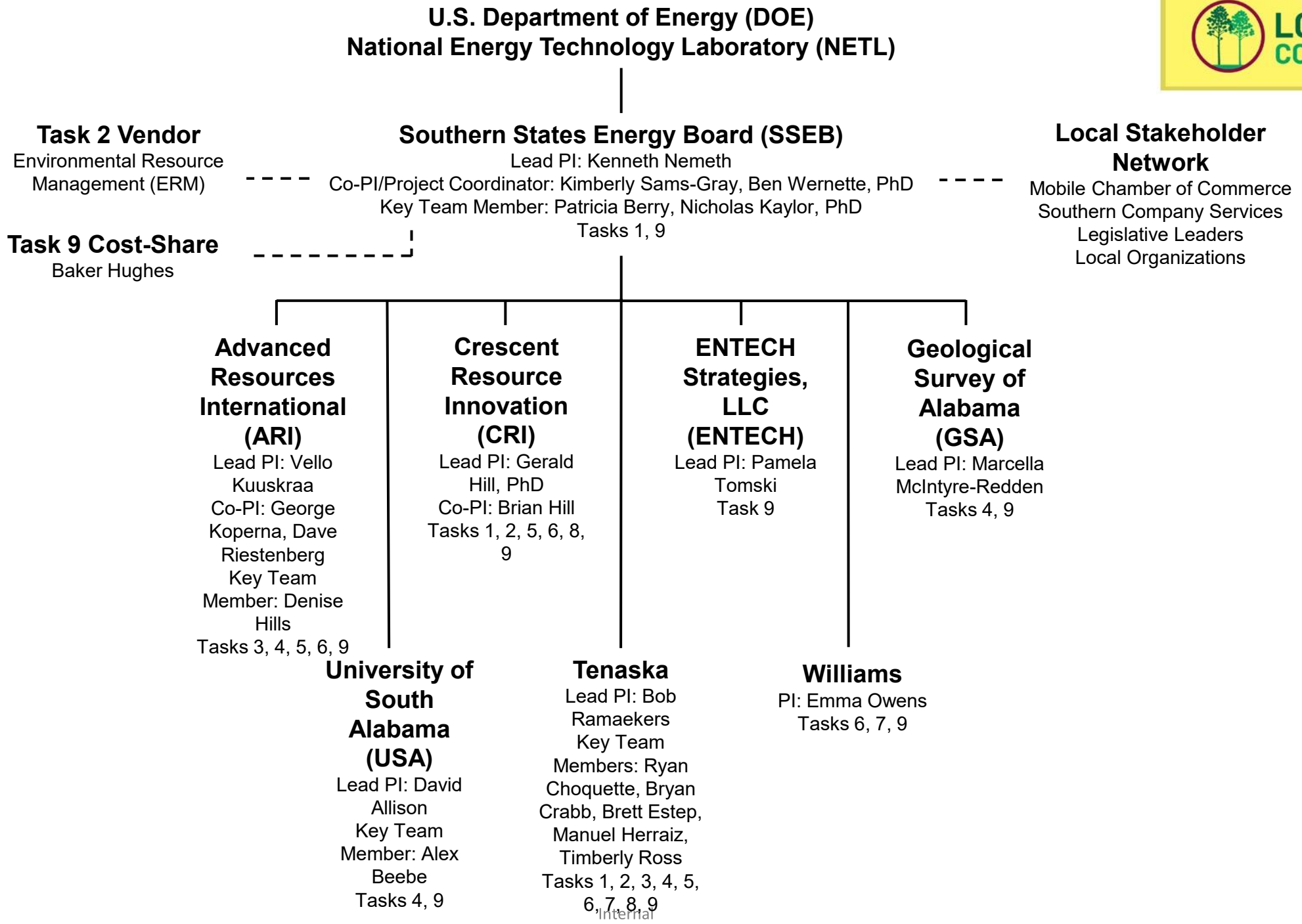


# Project Objectives

- Rigorously characterize the subsurface for large-scale storage
- Develop a comprehensive community benefits plan
- Finalize Paluxy Class VI UIC well permits
- Identify $CO_2$ sources and transportation
- Facilitate storage field development
- Develop risk assessment
- Complete NEPA EIV for the integrated project


U.S. Department of Energy (DOE)
National Energy Technology Laboratory (NETL)
LONGLEAF CCS HUB
Task 2 Vendor
Environmental Resource Management (ERM)
Task 9 Cost-Share
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Southern Company Services
Legislative Leaders
Local Organizations
Advanced Resources International (ARI)
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Co-PI: George Koperna, Dave Riestenberg
Key Team Member: Denise Hills
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Co-PI: Brian Hill
Tasks 1, 2, 5, 6, 8, 9
ENTECH Strategies, LLC (ENTECH)
Lead PI: Pamela Tomski
Task 9
Geological Survey of Alabama (GSA)
Lead PI: Marcella McIntyre-Redden
Tasks 4, 9
University of South Alabama (USA)
Lead PI: David Allison
Key Team Member: Alex Beebe
Tasks 4, 9
Tenaska
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Key Team Members: Ryan Choquette, Bryan Crabb, Brett Estep, Manuel Herraiz, Timberly Ross
Tasks 1, 2, 3, 4, 5, 6, 7, 8, 9
Williams
PI: Emma Owens
Tasks 6, 7, 9

# Tasks

Task 1 – Project Management and Planning

Task 2 – National Environmental Protection Act

Task 3 – UIC Class VI Authorization to Construct

Task 4 – Detailed Site Characterization of a Commercial-Scale $CO_2$ Storage Site

Task 5 – Storage Field Development Plan

Task 6 – $CO_2$ Source(s) Feasibility Study

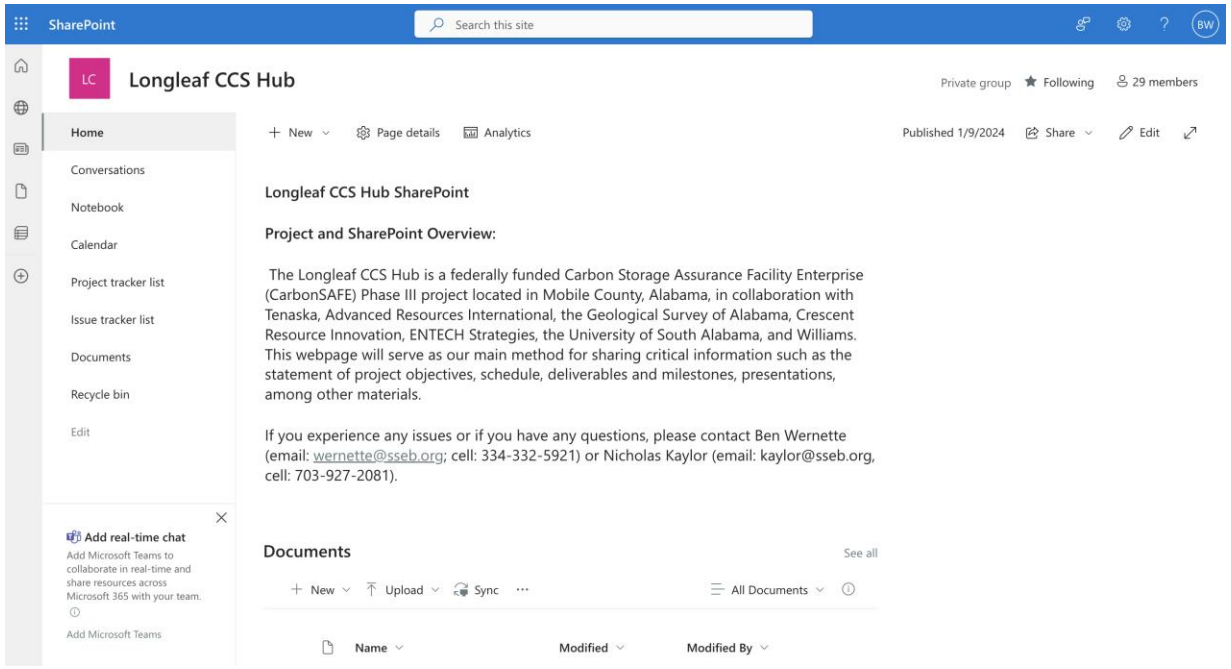
Task 7 – Pipeline FEED Study

Task 8 – Business and Financial Plans and Arrangements

Task 9 – Community Benefits Plan

# Task 1 – Project Management

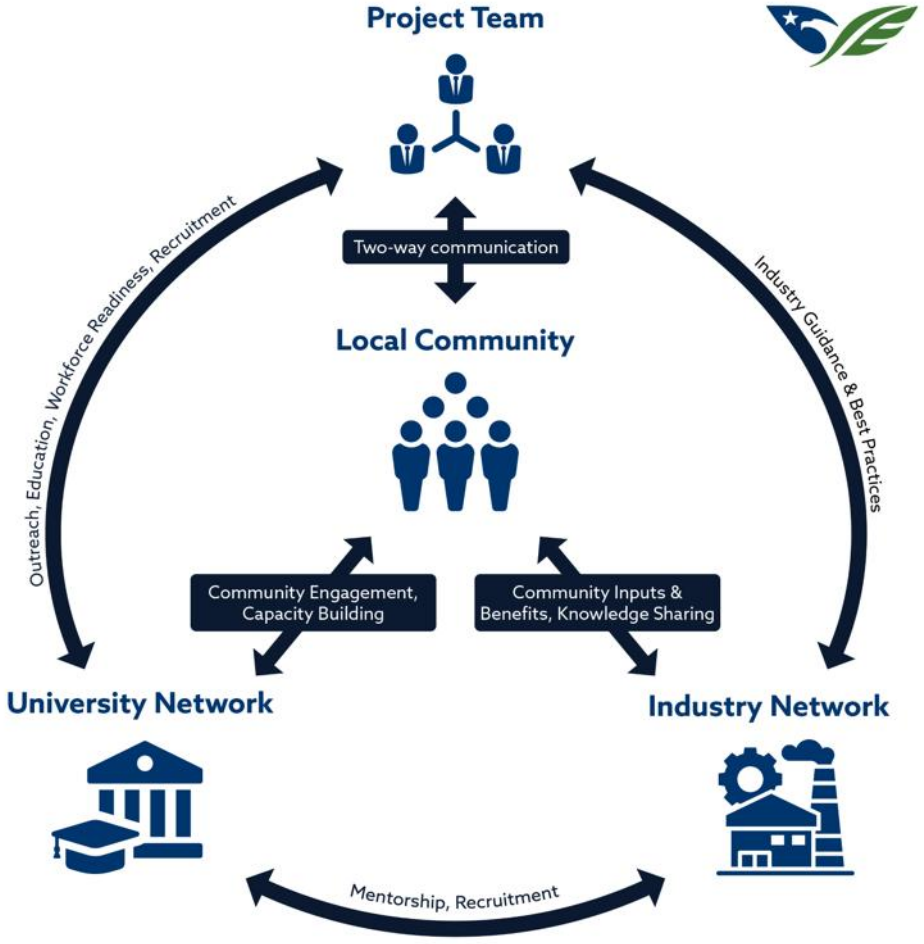
- Award date of October 1, 2023
- Sub-Recipient Agreements finalized in early December
- Held our initial team kickoff meeting on December 19, 2023
- Recurring Bi-Weekly calls with core decision making team
- Webpage has been developed to share information and track issues
- Robust financial and technical oversight




*Longleaf CCS Hub SharePoint homepage.*

# Task 9 – Community Benefits Plan

- Establish necessary framework to support subsequent phases and commercialization
- High-level objectives
  - Community engagement and involvement in long-term decision making
  - Support educational and career opportunities by working with participating academic institutions
    - Training and capacity building
    - Networking
  - Engage with regional industry interested in decarbonization
  - Communicate project progress with regulators and other stakeholders



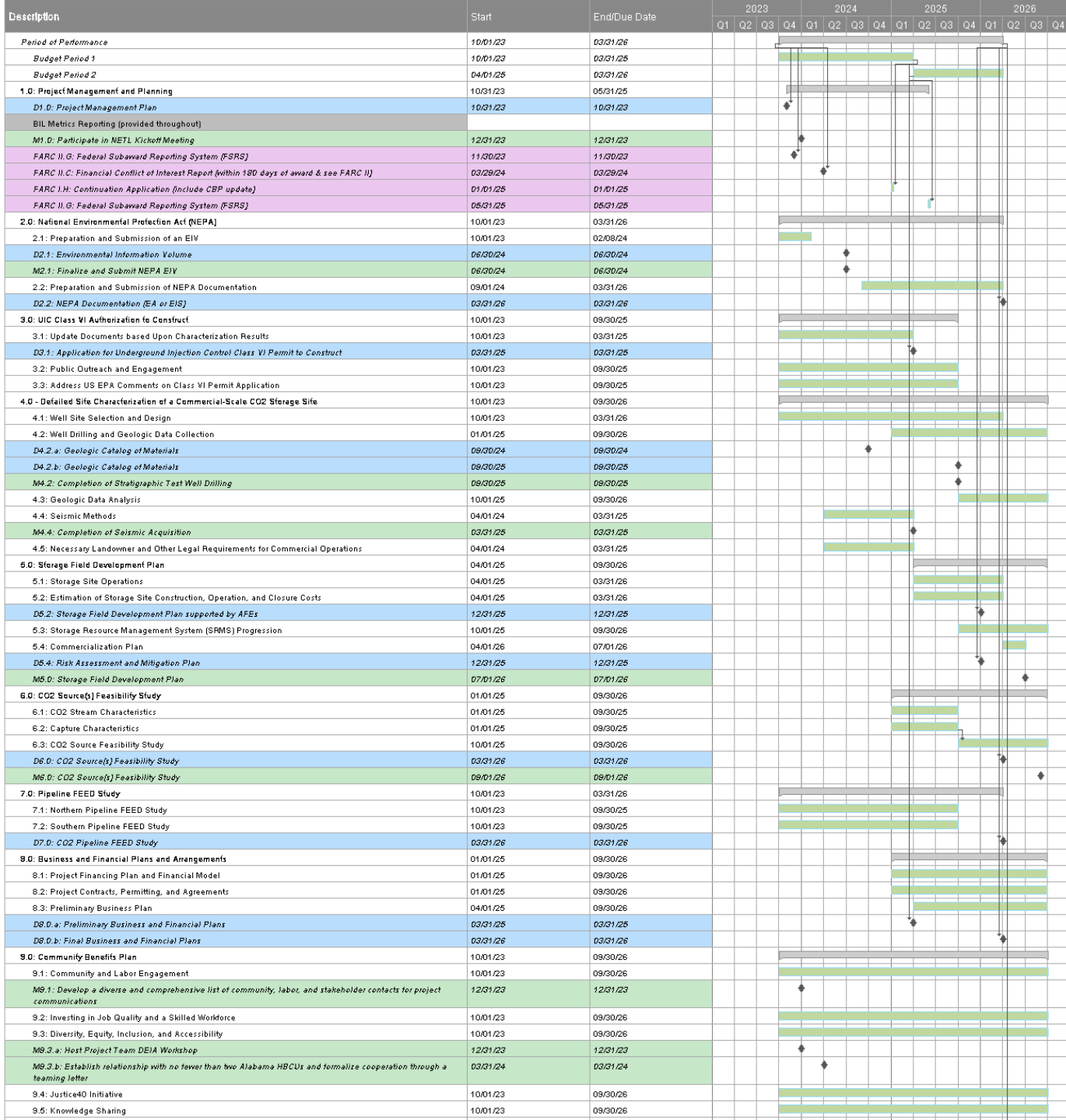

*Project OASIS approach to community engagement.*

# Project Success Criteria

| Decision Point | Date | Success Criteria |
|---|---|---|
| BP1 | 3/31/2025 | • All project milestones are achieved and verified.<br>• All project deliverables are completed and submitted to DOE/NETL.<br>• Achieve BP1 objectives, include:<br>  ○ Submit NEPA Environmental Information Volume;<br>  ○ Complete Seismic Acquisition;<br>  ○ Host Initial Project DEIA Workshop;<br>  ○ Host Community Engagement event and incorporate into Project Decision Making; and<br>  ○ Initiate Community Benefits Plan |
| Project Completion | 9/30/2026 | • All project milestones are achieved and verified.<br>• All project deliverables are completed and submitted to DOE/NETL.<br>• Achieve all project objectives, including:<br>  ○ Demonstrate that the subsurface saline formations at the Storage Complex can store at least 50 million metric tons of captured $CO_2$ safely and permanently over a 30-year period;<br>  ○ Conduct meaningful engagement and two-way communications with communities and stakeholders, execute far-reaching educational and career program;<br>  ○ Obtain Class VI UIC permit;<br>  ○ Mature understanding of regional $CO_2$ sources<br>  ○ Develop a comprehensive pipeline FEED to support future pipeline construction;<br>  ○ Develop storage field development plan<br>  ○ Identify commercial project risks and develop a comprehensive mitigation strategy; and<br>  ○ Complete the NEPA process |

# Schedule

- Period of Performance: October 1, 2023, to September 30, 2026
- Initial kickoff meeting on December 19, 2023
  - Initial DEIA workshop
- NEPA EIV originally due March 31, 2024
  - Adjusting to account for kickoff delays to June 30, 2024
- Preparation for engagement event on March 22, 2024

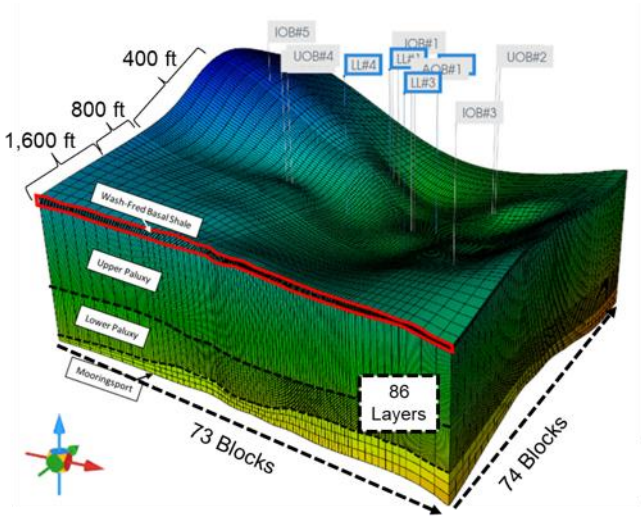


| | Description | Start | End/Due Date |
|---|---|---|---|
| 1 | *Period of Performance* | *10/01/23* | *03/31/26* |
| 2 | *Budget Period 1* | *10/01/23* | *03/31/25* |
| 3 | *Budget Period 2* | *04/01/25* | *03/31/26* |
| 4 | **1.0: Project Management and Planning** | 10/31/23 | 05/31/25 |
| 5 | *D1.0: Project Management Plan* | *10/31/23* | *10/31/23* |
| 6 | BIL Metrics Reporting (provided throughout) | | |
| 7 | *M1.0: Participate in NETL Kickoff Meeting* | *12/31/23* | *12/31/23* |
| 8 | *FARC II.G: Federal Subaward Reporting System (FSRS)* | *11/30/23* | *11/30/23* |
| 9 | *FARC II.C: Financial Conflict of Interest Report (within 180 days of award & see FARC II)* | *03/29/24* | *03/29/24* |
| 10 | *FARC I.H: Continuation Application (include CBP update)* | *01/01/25* | *01/01/25* |
| 11 | *FARC II.G: Federal Subaward Reporting System (FSRS)* | *05/31/25* | *05/31/25* |
| 12 | **2.0: National Environmental Protection Act (NEPA)** | 10/01/23 | 03/31/26 |
| 13 | 2.1: Preparation and Submission of an EIV | 10/01/23 | 02/08/24 |
| 14 | *D2.1: Environmental Information Volume* | *06/30/24* | *06/30/24* |
| 15 | *M2.1: Finalize and Submit NEPA EIV* | *06/30/24* | *06/30/24* |
| 16 | 2.2: Preparation and Submission of NEPA Documentation | 09/01/24 | 03/31/26 |
| 17 | *D2.2: NEPA Documentation (EA or EIS)* | *03/31/26* | *03/31/26* |
| 18 | **3.0: UIC Class VI Authorization to Construct** | 10/01/23 | 09/30/25 |
| 19 | 3.1: Update Documents based Upon Characterization Results | 10/01/23 | 03/31/25 |
| 20 | *D3.1: Application for Underground Injection Control Class VI Permit to Construct* | *03/31/25* | *03/31/25* |
| 21 | 3.2: Public Outreach and Engagement | 10/01/23 | 09/30/25 |
| 22 | 3.3: Address US EPA Comments on Class VI Permit Application | 10/01/23 | 09/30/25 |
| 23 | **4.0 - Detailed Site Characterization of a Commercial-Scale CO2 Storage Site** | 10/01/23 | 09/30/26 |
| 24 | 4.1: Well Site Selection and Design | 10/01/23 | 03/31/26 |
| 25 | 4.2: Well Drilling and Geologic Data Collection | 01/01/25 | 09/30/26 |
| 26 | *D4.2.a: Geologic Catalog of Materials* | *09/30/24* | *09/30/24* |
| 27 | *D4.2.b: Geologic Catalog of Materials* | *09/30/25* | *09/30/25* |
| 28 | *M4.2: Completion of Stratigraphic Test Well Drilling* | *09/30/25* | *09/30/25* |
| 29 | 4.3: Geologic Data Analysis | 10/01/25 | 09/30/26 |
| 30 | 4.4: Seismic Methods | 04/01/24 | 03/31/25 |
| 31 | *M4.4: Completion of Seismic Acquisition* | *03/31/25* | *03/31/25* |
| 32 | 4.5: Necessary Landowner and Other Legal Requirements for Commercial Operations | 04/01/24 | 03/31/25 |
| 33 | **5.0: Storage Field Development Plan** | 04/01/25 | 09/30/26 |
| 34 | 5.1: Storage Site Operations | 04/01/25 | 03/31/26 |
| 35 | 5.2: Estimation of Storage Site Construction, Operation, and Closure Costs | 04/01/25 | 03/31/26 |
| 36 | *D5.2: Storage Field Development Plan supported by AFEs* | *12/31/25* | *12/31/25* |
| 37 | 5.3: Storage Resource Management System (SRMS) Progression | 10/01/25 | 09/30/26 |
| 38 | 5.4: Commercialization Plan | 04/01/26 | 07/01/26 |
| 39 | *D5.4: Risk Assessment and Mitigation Plan* | *12/31/25* | *12/31/25* |
| 40 | *M5.0: Storage Field Development Plan* | *07/01/26* | *07/01/26* |
| 41 | **6.0: CO2 Source(s) Feasibility Study** | 01/01/25 | 09/30/26 |
| 42 | 6.1: CO2 Stream Characteristics | 01/01/25 | 09/30/25 |
| 43 | 6.2: Capture Characteristics | 01/01/25 | 09/30/25 |
| 44 | 6.3: CO2 Source Feasibility Study | 10/01/25 | 09/30/26 |
| 45 | *D6.0: CO2 Source(s) Feasibility Study* | *03/31/26* | *03/31/26* |
| 46 | *M6.0: CO2 Source(s) Feasibility Study* | *09/01/26* | *09/01/26* |
| 47 | **7.0: Pipeline FEED Study** | 10/01/23 | 03/31/26 |
| 48 | 7.1: Northern Pipeline FEED Study | 10/01/23 | 09/30/25 |
| 49 | 7.2: Southern Pipeline FEED Study | 10/01/23 | 09/30/25 |
| 50 | *D7.0: CO2 Pipeline FEED Study* | *03/31/26* | *03/31/26* |
| 51 | **8.0: Business and Financial Plans and Arrangements** | 01/01/25 | 09/30/26 |
| 52 | 8.1: Project Financing Plan and Financial Model | 01/01/25 | 09/30/26 |
| 53 | 8.2: Project Contracts, Permitting, and Agreements | 01/01/25 | 09/30/26 |
| 54 | 8.3: Preliminary Business Plan | 04/01/25 | 09/30/26 |
| 55 | *D8.0.a: Preliminary Business and Financial Plans* | *03/31/25* | *03/31/25* |
| 56 | *D8.0.b: Final Business and Financial Plans* | *03/31/26* | *03/31/26* |
| 57 | **9.0: Community Benefits Plan** | 10/01/23 | 09/30/26 |
| 58 | 9.1: Community and Labor Engagement | 10/01/23 | 09/30/26 |
| 59 | *M9.1: Develop a diverse and comprehensive list of community, labor, and stakeholder contacts for project communications* | *12/31/23* | *12/31/23* |
| 60 | 9.2: Investing in Job Quality and a Skilled Workforce | 10/01/23 | 09/30/26 |
| 61 | 9.3: Diversity, Equity, Inclusion, and Accessibility | 10/01/23 | 09/30/26 |
| 62 | *M9.3.a: Host Project Team DEIA Workshop* | *12/31/23* | *12/31/23* |
| 63 | *M9.3.b: Establish relationship with no fewer than two Alabama HBCUs and formalize cooperation through a teaming letter* | *03/31/24* | *03/31/24* |
| 64 | 9.4: Justice40 Initiative | 10/01/23 | 09/30/26 |
| 65 | 9.5: Knowledge Sharing | 10/01/23 | 09/30/26 |

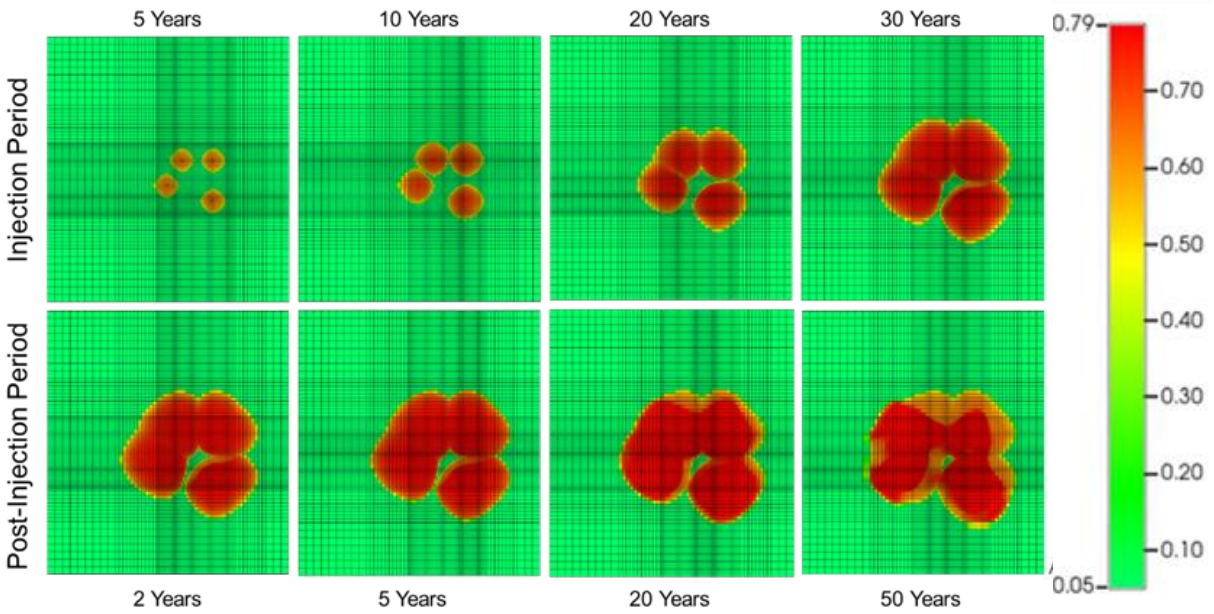
# Tasks 3 and 4 – Class VI Permitting and Site Characterization

- Project owner and developer Tenaska has secured land rights for a storage complex in northern Mobile County, AL
- Paluxy Class VI UIC permit application submitted to EPA Region 4 in Spring 2023
  - Deemed administratively complete
  - Ongoing discussions with EPA and others
- Augment with stratigraphic test well drilling data acquisition
- Seismic acquisition

*Paluxy Geocellular Model*




*$CO_2$ Plume Modeling; 150 Million Metric Tons*



# Task 9 – Community Benefits Plan

- Tenaska has been actively engaged with state legislative leaders, local officials, among others
- Project aligns with the Mobile Chamber's goals to support existing business and attract new industry to South Alabama
- Goals of CBP
  - Increase community involvement in project decision-making
  - Increasing access to educational and career opportunities for those from disadvantaged and/or minority communities
  - Promoting diversity, equity, inclusion, and accessibility across the full value chain of the project
  - Delivering and tracking benefits to the community to support the Justice40 Initiative

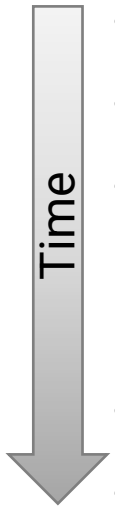

*Tenaska personnel engaging with community members in Mobile, Alabama.*

# Task 9 – Community Benefits

- Discussions with local stakeholders dating to 2022
  - Mobile County leaders, emergency management, water authority, school district, Mobile Baykeeper, Mobile Chamber and many others
  - Incorporation of local feedback into project plans
- Project website: https://longleafccs.com/
- Local representative added to team in Q3 2023
- Local project office opening in January 2024
- Planning underway for community engagement event – including news conference and media availability – in March 2024

# Next Steps

## Project




- Continue local outreach efforts in and around Mobile County
- Support the development of materials for a March 2024 outreach event
- Finalize the development of the pipeline route
  - Begin the pipeline FEED study
  - Develop the NEPA Environmental Information Volume for the integrated project
- Acquire seismic data
- Drill stratigraphic test well (BP2)

## Scale up potential

- Lots of interest in solutions from local emitters
- Location of the TA-2 Southeast Direct Air Capture Hub (in negotiation)
- Opportunity to support a carbon management ecosystem in Mobile County

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# Questions?