

## PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT

Research Performance Progress Report (quarterly)

*(for the period January 1 – March 31, 2025)*

*Prepared for:*

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April 30, 2025

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TABLE OF CONTENTS

LIST OF TABLES ..... i

EXECUTIVE SUMMARY ..... ii

INTRODUCTION ..... 1

ACCOMPLISHMENTS ..... 2

    Task 1.0 – Project Management and Planning ..... 2

    Task 2.0 – Technical Challenges ..... 3

    Task 3.0 – Data Collection, Sharing, and Analysis ..... 6

    Task 4.0 – Regional Infrastructure ..... 6

    Task 5.0 – Technology Transfer ..... 7

CHANGES/PROBLEMS ..... 8

SPECIAL REPORTING REQUIREMENTS ..... 8

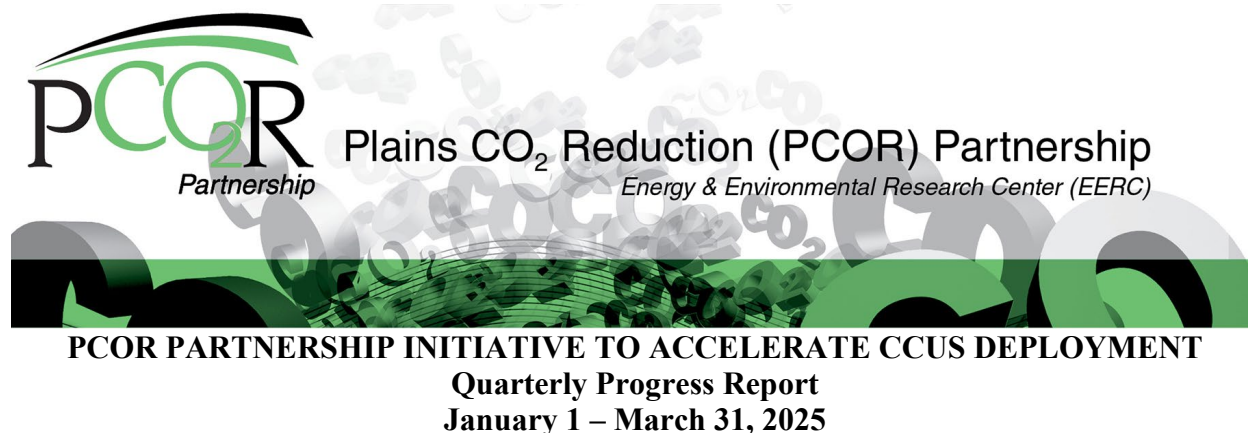
BUDGETARY INFORMATION ..... 9

LIST OF TABLES

1     Project Deliverables ..... 4

2     Milestone Status Report ..... 5

3     Subtask 2.3 Monitoring, Verification, and Accounting Strategies Timeline for SASSA  
      Effort at RTE ..... 6



## EXECUTIVE SUMMARY

The Plains CO<sub>2</sub> Reduction (PCOR) Partnership, funded by the U.S. Department of Energy National Energy Technology Laboratory, the North Dakota Industrial Commission Oil and Gas Research Program and Lignite Research Program, and more than 260 public and private partners, is accelerating the deployment of carbon capture, utilization, and storage (CCUS) technology. The PCOR Partnership is focused on a region comprising ten U.S. states and four Canadian provinces in the upper Great Plains and northwestern regions of North America. It is led by the University of North Dakota Energy & Environmental Research Center (EERC), with support from the University of Wyoming and the University of Alaska Fairbanks.

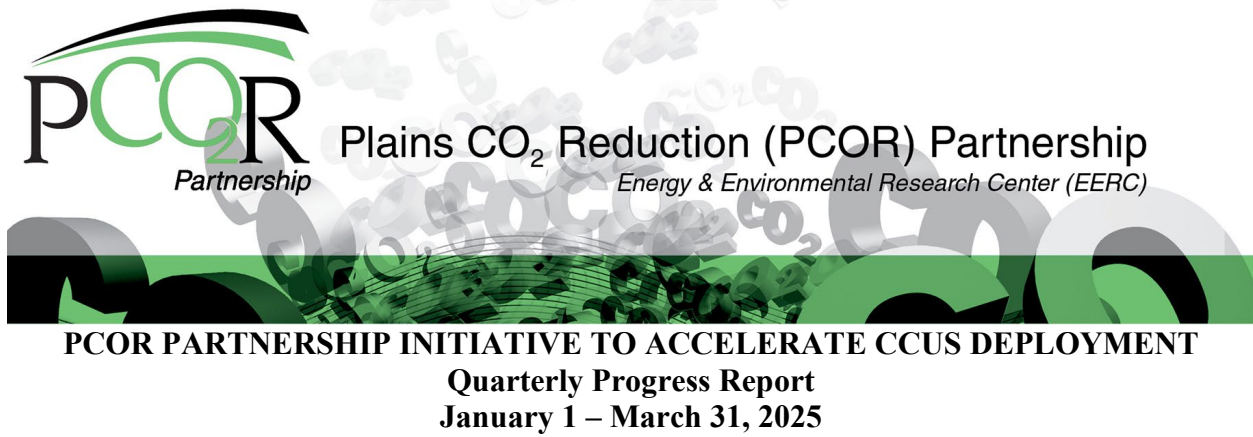
The EERC welcomed two new members, ESG Solutions and California Resources Corporation, to the PCOR Partnership this quarter, bringing the membership to 266. The EERC held discussions with current and prospective PCOR Partnership members. On January 14, 2025, the EERC held a meeting with prospective member Coffman Engineers. The EERC held a meeting with PCOR Partnership member Marubeni-Itochu Tubulars America on pipe grades and Class VI applications for casing materials and testing applications on February 14, 2025. The EERC discussed and presented to the U.S. Department of the Interior's Bureau of Offshore Energy Management (BOEM) regarding North Dakota CCUS strategies. The EERC shared PCOR Partnership products with BOEM that focused on regulatory topics, monitoring wells and strategies, risk management, and project economics.

The PCOR Partnership held two technical webinars. "Screening Assessment of Prospective CO<sub>2</sub> Storage Resource Potential in Saline Carbonate Systems, Central North Dakota Region" was held on January 16, 2025, with 136 attendees. "Lessons Learned from Drilling and Characterizing 16 Stratigraphic Test Wells from CarbonSAFE to Commercial Projects" was held on March 19, 2025, with 140 attendees.

The EERC continued collaboration for the field effort at the Red Trail Energy, LLC, carbon capture and storage site. Data harvesting was completed by Paragon of the scalable, automated, sparse seismic array (SASSA) survey. The SASSA covered approximately 2.3 square miles, and 200 Sercel WiNG nodes were deployed by Paragon. The EERC and Paragon completed quality control of the 200 stations and reviewed the harvested data. After harvested data were reviewed, Paragon picked up the nodes. The harvested data will undergo process and

interpretation by a third-party company, Class VI Solutions, Inc., with oversight from the EERC next quarter. Results will be summarized in an appended D16 deliverable by the end of Task 2.0.

The EERC continued to advance activities within Task 5.0. The EERC worked on content for the *PCOR Pioneer* news blog announcement to PCOR partners. Key spotlights included Rock Flow Dynamics and Carbon Vault, LLC. The *PCOR Pioneer* was shared with PCOR partners on January 23, 2025. The EERC submitted and presented slides for the CCUS 2025 conference in Houston, Texas, on March 3–5, 2025. The abstract submitted and accepted at the conference was submitted in September 2024: “A Road Map for Growth of Commercial CCUS Projects in the Upper Great Plains and Northwestern Regions of North America.”



## INTRODUCTION

The Plains CO<sub>2</sub> Reduction (PCOR) Partnership, funded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory, the North Dakota Industrial Commission Oil and Gas Research Program and Lignite Research Program, and more than 260 public and private partners, is accelerating the deployment of carbon capture, utilization, and storage (CCUS) technology. The PCOR Partnership is focused on a region comprising ten U.S. states and four Canadian provinces in the upper Great Plains and northwestern regions of North America. It is led by the University of North Dakota Energy & Environmental Research Center (EERC), with support from the University of Wyoming (UW) and the University of Alaska Fairbanks (UAF).

The goal of the PCOR Partnership is to identify and address regional capture, transport, and storage challenges facing commercial deployment of CCUS in a region greater than past Regional Carbon Sequestration Partnership project phases. To achieve this goal, the PCOR Partnership will meet the following objectives:

1. Address key technical challenges by advancing critical knowledge and capabilities.
2. Facilitate data collection, sharing, analysis, and collaboration.
3. Evaluate regional infrastructure challenges/needs and promote infrastructure development.
4. Promote regional technology transfer.

The project goal and objectives will be accomplished through five tasks over two budget periods (BPs), corresponding to a 6-year period of performance. The EERC and project partners will collaborate to identify and address technical challenges facing deployment of CCUS in multiple categories, including stacked storage opportunities, CO<sub>2</sub> storage performance and monitoring, and risk assessment. The EERC will work with PCOR Partnership members and regional stakeholders to promote the development of infrastructure and large projects within the PCOR Partnership region. This development will then provide best practices throughout the United States for wide-scale deployment of CCUS technologies. Existing datasets and technologies will be analyzed and evaluated to highlight current challenges limiting commercial

adoption of CCUS and to identify potential solutions. The project team will support DOE's National Risk Assessment Partnership (NRAP) and machine learning (ML) initiatives by drawing on datasets and experience available through the team. Assessments of infrastructure, site readiness, techno-economics, and socioeconomics will provide an overview of the CCUS landscape within the defined PCOR Partnership region. Potential business case scenarios will be evaluated, accounting for current economic incentives to identify opportunities in CCUS project development. Technology transfer activities will inform and educate CCUS stakeholders of project learnings through annual meetings, regulatory roundup meetings, technical advisory board meetings, webinars, reports, and conference presentations/papers. These activities will facilitate knowledge sharing and support DOE program goals.

## **ACCOMPLISHMENTS**

### **Task 1.0 – Project Management and Planning**

The objective of Task 1.0 is to manage and direct the project in accordance with a project management plan (PMP) to meet all technical, schedule, and budget objectives and requirements. Activities will be coordinated to effectively accomplish the work. The project manager (PM) will ensure that project plans, results, and decisions are appropriately documented and project reporting and briefing requirements are satisfied.

Significant accomplishments for Task 1.0 during the reporting period include the following:

- Traveled and participated at the CCUS 2025 conference in Houston, Texas, on March 3–5, 2025. Presented “A Road Map for Growth of Commercial CCUS Projects in the Upper Great Plains and Northwestern Regions of North America.”
- Scheduled, coordinated, and held two virtual webinars.
  - “Screening Assessment of Prospective CO<sub>2</sub> Storage Resource Potential in Saline Carbonate Systems, Central North Dakota Region,” held on January 16, 2025, with 136 attendees.
  - “Lessons Learned from Drilling and Characterizing 16 Stratigraphic Test Wells from CarbonSAFE to Commercial Projects,” held on March 19, 2025, with 140 attendees.
- Held progress meetings with subrecipients UAF and UW to continue partner engagement for PCOR Partnership-related activities.
- Continued correspondence with federal PM. On February 5, 2025, the regular update series was canceled per direction from the federal PM.
  - Virtual meetings were on pause this quarter. They will remain on pause until directed by the federal PM.
- Prepared and submitted the quarterly research performance report for October 1 – December 31, 2024, on January 29, 2025.



- Held discussions with prospective members on a regular basis. The PCOR Partnership currently has 266 members. The PCOR Partnership welcomed new two new members this quarter: ESG Solutions and California Resources Corporation. The partnership continues to engage with prospective members and carbon capture and storage (CCS) industry stakeholders.
  - On January 14, 2025, the EERC met with prospective member Coffman Engineers.
  - The EERC met with PCOR Partnership member Marubeni-Itochu Tubulars America on pipe grades and Class VI applications for casing materials and testing applications on February 14, 2025.
  - The EERC discussed and presented to the U.S. Department of the Interior’s Bureau of Offshore Energy Management (BOEM) regarding North Dakota CCUS strategies. The EERC shared PCOR Partnership products with BOEM that focused on regulatory topics, monitoring wells and strategies, risk management, and project economics.
- All EERC contractual project deliverables and milestones (Tables 1 and 2) are considered complete.

Next steps to accomplish the goals under Task 1.0 in the coming quarter include the following:

- Continue engagement and collaboration with project partners.
- Review and approve remaining final deliverables from UAF.
- Once the remaining deliverables from UAF are considered complete, upload them to the PCOR Partners-only site.
- Generate input, develop, and contribute material to the PCOR Partnership final report.

## **Task 2.0 – Technical Challenges**

In Task 2.0, the project team will support regional deployment of CCUS programs by focusing on key technical challenges in the PCOR Partnership region related to stacked storage opportunities, storage performance, MVA technology, and subsurface integrity. The EERC will collaborate with PCOR Partnership members to identify knowledge gaps and address regional challenges through targeted webinars, workshops, reports, and papers.

**Table 1. Project Deliverables**

<b>Deliverable (D) No. and Title</b>	<b>Planned Completion Date</b>	<b>Actual Completion Date</b>	<b>Verification Method</b>	<b>Comments</b>
D1 – PMP	30 days after contract definitization	2/21/2020	PMP file submitted to DOE PM	
D2 – Report – Storage Optimization	4/30/2021	4/30/2021	Topical report submitted to DOE PM	Moved from 12/31/2020.
D3.A – Report – Stacked Storage Opportunity Assessment	8/31/2021	8/31/2021 (E.S.) 11/12/2021 (full report)	Topical report submitted to DOE PM	Moved from 6/30/2021.
D3.B – Report – Stacked Storage Scenario Geomechanical Modeling	3/31/2022	3/31/2022	Topical report submitted to DOE PM	Created a second D3 report.
D4 – Report – Regional Business Case Assessment	12/31/2021	12/17/2021	Topical report submitted to DOE PM	Moved from 3/31/2021.
D5 – Report – Subsurface and Legacy Well Integrity	12/31/2021	12/30/2021	Topical report submitted to DOE PM	
D6 – Report – MVA <sup>1</sup> Strategies	6/30/2022	6/30/2022	Topical report submitted to DOE PM	
D7 – Report – Evaluation of Risk Management	9/30/2022	9/30/2022	Topical report submitted to DOE PM	
D8 – Report – Regional Permitting Guidance	9/30/2022	9/30/2022	Topical report submitted to DOE PM	Two reports submitted for D8.
D9 – Report – Infrastructure, Scale-Up, and Techno-Economic Assessments	3/31/2023	3/31/2023	Topical report submitted to DOE PM	
D10 – Report – NRAP Testing and Validation	3/31/2023	12/17/2021 (Part 1) 3/31/2023 (Part 2)	Topical report submitted to DOE PM	Provided in two parts.
D11 – Report – Basement Faulting and Stress State, Induced Seismicity	12/1/2023	11/27/2023 (original) 2/7/2024 (revised)	Topical report submitted to DOE PM	A revised D11 was resubmitted on 2/7/24 to account for updated figures and tables.
D12 – Report – Regional Socioeconomic Assessments	12/1/2023	11/27/2023	Topical report submitted to DOE PM	A request to move the due date to 12/1/23 was made; a revised PMP was submitted to DOE on 9/29/23.
D13 – Report – Updated Regional Business Case Assessment	12/31/2023	12/22/2023	Topical report submitted to DOE PM	
D14 – Report – Risk-Based Area of Review	1/31/2021	1/29/2021	Topical report submitted to DOE PM	Moved from 12/31/2020.
D15 – PCOR Partnership Atlas	6/30/2021 and 3/31/2024	6/30/2021 (BP1) 3/28/2024 (BP2 update)	Atlas submitted to DOE PM	
D16 – Enabling Sustainable Monitoring for CCUS	6/30/2024	6/28/2024	Topical report submitted to DOE PM	
D17 – PCOR Partnership Initiative Road Map	5/31/2024	5/31/2024	Topical report submitted to DOE PM	

<sup>1</sup> Monitoring, verification, and accounting.

**Table 2. Milestone Status Report**

<b>Milestone (M) No. and Title</b>	<b>Planned Completion Date</b>	<b>Actual Completion Date</b>	<b>Verification Method</b>	<b>Comments</b>
M1 – Regulatory Roundup Scheduled	2/29/2020	3/31/2020	Reported in subsequent quarterly report	
M2 – Initial Techno-Economic Framework Established	4/30/2020	4/28/2020	Reported in subsequent quarterly report	
M3 – Annual Meeting Scheduled	3/31/2021	3/29/2021	Reported in subsequent quarterly report	
M4 – Regulatory Roundup Scheduled	3/31/2021	3/29/2021	Reported in subsequent quarterly report	
M5 – Data Share with National Lab for NRAP Assessment	6/30/2021	6/30/2021	Reported in subsequent quarterly report	Files added to EDX. <sup>1</sup>
M6 – GHGT-16 Abstract Submitted	1/31/2022	1/14/2022	Reported in subsequent quarterly report	
M7 – BP1 EDX Submitted	3/31/2022	3/31/2022	Reported in subsequent quarterly report	
M8 – Draft Journal Article Completed	11/30/2022	9/30/2022	Reported in subsequent quarterly report	
M9 – Regulatory Roundup Scheduled	3/31/2023	3/31/2023	Reported in subsequent quarterly report	
M10 – GHGT-17 <sup>2</sup> Abstract Submitted	1/31/2024	1/15/2024	Reported in subsequent quarterly report	
M11 – Annual Meeting Scheduled	3/31/2024	3/26/2024	Reported in subsequent quarterly report	
M12 – BP2 EDX Submitted	6/30/2024	6/28/2024	Reported in subsequent quarterly report	

<sup>1</sup> Energy Data eXchange.<sup>2</sup> 17<sup>th</sup> Greenhouse Gas Control Technologies Conference.

Progress on Task 2.0 is as follows:

- Continued collaboration for the field effort at the RTE CCS site.
- Updates to the scalable, automated, sparse seismic array (SASSA) effort are supplied (Table 3).

Next steps to accomplish the goals under Task 2.0 in the coming quarter include the following:

- Continue research monitoring activities at the RTE site, including data collection, testing the SASSA technique, and disseminate results once available.
  - The data will be processed by a third-party processing company, Class VI Solutions, Inc., with oversight from the EERC. Processing will begin within 2 weeks of pickup of nodes. First results are estimated to be interpreted by the end of April 2025.
  - The resulting dataset will be interpreted by the EERC, and a report will be assembled to communicate results.
  - A report summarizing these supplemental RTE monitoring efforts will be generated by the completion of Task 2.0 as a supplement to D16 within an updated appendix.

**Table 3. Subtask 2.3 MVA Strategies Timeline for SASSA Effort at RTE**

<b>Subtask 2.3 MVA Strategies</b>	<b>Timing</b>	<b>Status/Notes</b>
Initiated Permitting SASSA Survey	October 2024	Completed
Paragon Sent Permit Forms and Fact Sheet to State	October 14, 2024	Completed
Estimated Permit Completion	October 25, 2024	Completed
Paragon Deployment	November 16–17, 2024	Completed. The EERC has designed a SASSA survey covering ~2.3 square miles with 200 Sercel WiNG nodes, which Paragon deployed.
Paragon Troubleshooting	December 5, 2024	Completed. The Paragon crew completed quality control of the 200 stations and verified they were good.
Data Harvesting	January 2025	Completed. Paragon harvested a subset of data from several WiNG nodes. The EERC will review the harvested data.
Paragon to Pick Up Nodes	March 2025	Completed.
Process and Interpret Data Results	End of April 2025	The data will be processed by a third-party processing company, Class VI Solutions, Inc., with oversight from the EERC.
Begin and Finalize Reporting Results	On or before September 30, 2025	This will be accomplished on or before the completion of Task 2.0.

### **Task 3.0 – Data Collection, Sharing, and Analysis**

In Task 3.0, the project team will collaborate with other DOE Office of Fossil Energy and Carbon Management (FECM)-funded researchers to improve understanding of CO<sub>2</sub> injection and storage impacts. The project team will work with national laboratories to facilitate data sharing, support the development and validation of NRAP tools with site-specific data, and participate in development of ML-based tools/methods in a commercial setting.

Progress on Task 3.0 is as follows:

- All deliverables and milestones are completed in Task 3.0. All EDX datasets have been uploaded to complete the task.

Next steps to accomplish the goals under Task 3.0 in the coming quarter include the following:

- Continue to engage with project partners to track progress on data sharing opportunities, including ML, and incorporate learnings into the PCOR Partnership region.

### **Task 4.0 – Regional Infrastructure**

The objective of Task 4.0 is to evaluate the regional needs, challenges, and potential economic impacts related to the development of safe and environmentally sound CO<sub>2</sub>

transportation infrastructure to accelerate commercial CCUS project deployment. This evaluation will be accomplished by assessing existing infrastructure, scale-up challenges and needs, and techno-economic and socioeconomic impacts in the PCOR Partnership region and will be communicated through outreach activities.

Progress on Task 4.0 is as follows:

- UW completed the final deliverable to advance the PCOR Partnership knowledge in topics under Task 4.0:
  - “Updated Wyoming Pipeline Initiative Summary” – This deliverable includes an assessment of steps for operators seeking to develop pipelines within the Wyoming Pipeline Corridor to obtain the necessary permits and regulatory review. UW partnered with the Enhanced Oil Recovery Institute on this task.
  - The deliverable was provided to the EERC on January 30, 2025, and uploaded to the PCOR Products database.
- UAF continued work on its final two deliverables to advance the PCOR Partnership knowledge in topics under Task 4.0. The deliverables are undergoing final review:
  - “History-Matched Reservoir Simulation Model for CO<sub>2</sub>-Enriched Miscible Injectant Flood of a Heavy Oil Reservoir, Optimized Injection Strategy, and Data Files”
  - “Updated Efficacy of Corrosion Inhibitors at Various CO<sub>2</sub> Concentrations and Implications for CO<sub>2</sub> EOR Development on the North Slope”

Next steps to accomplish the goals under Task 4.0 in the coming quarter include the following:

- Continue to engage with UW and UAF to track progress and complete remaining products.

## **Task 5.0 – Technology Transfer**

Task 5.0 will inform and educate stakeholders about CCUS technologies. Nontechnical challenges to CCUS deployment in the PCOR Partnership region will be identified and assessed, with an emphasis on regulatory issues and solutions. Business case scenarios for CCUS projects will be identified, reviewed, and developed. Outcomes of this task will be transferred to stakeholders through meetings, presentations, and webinars. Developed materials will be shared with DOE to support its broader FECM program goals.

Progress on Task 5.0 is as follows:

- Worked on content for the *PCOR Pioneer* news blog announcement to PCOR partners.
  - Key spotlights were Rock Flow Dynamics and Carbon Vault, LLC.
  - Shared with PCOR partners on January 23, 2025.
- Generated and updated the PCOR Partnership prospectus for new partners.

- UAF continues to engage with the PCOR Partnership on outreach opportunities and build off work from the PCOR Road Map (D17).
- Presented at the CCUS 2025 conference in Houston, Texas, on March 3–5, 2025, for the submitted abstract: “A Road Map for Growth of Commercial CCUS Projects in the Upper Great Plains and Northwestern Regions of North America.”

Next steps to accomplish the goals under Task 5.0 in the coming quarter include the following:

- Distribute the next *PCOR Pioneer* newsletter to PCOR Partnership partners, anticipated for May 2025.
- Continue to collaborate with UW and UAF.

### **CHANGES/PROBLEMS**

- On February 5, 2025, the regular update series was canceled per direction from the federal PM.
  - Virtual meetings were on pause this quarter. They will remain on pause until further directed by the federal PM.

### **SPECIAL REPORTING REQUIREMENTS**

None.

## BUDGETARY INFORMATION

**ENERGY & ENVIRONMENTAL RESEARCH CENTER**  
**PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP INITIATIVE TO ACCELERATE CARBON CAPTURE, UTILIZATION, AND STORAGE**  
**DEPLOYMENT**  
**DE-FE0031838**  
**Project-to-Date Financial Report at March 31, 2025**

(\$K)	Q2 Apr - Jun 2022	Q3 Jul - Sep 2022	Q4 Oct - Dec 2022	Q1 Jan - Mar 2023	Q2 Apr - Jun 2023	Q3 Jul - Sep 2023	Q4 Oct - Dec 2023	Q1 Jan - Mar 2024	Q2 Apr - Jun 2024	Q3 Jul - Sep 2024
<b>Baseline Cost Plan</b>										
Federal Share	1813.5	1166.4	1230.6	1009.7	1122.8	676.2	653.7	316.2	256.3	51.4
Nonfederal Share	337.0	185.0	491.2	463.1	194.1	192.5	131.2	43.5	20.3	2.9
Total Planned	2150.5	1351.4	1721.8	1472.8	1316.9	868.7	784.9	359.7	276.6	54.3
Cumulative Federal	7922.4	9088.8	10319.4	11329.1	12451.9	13128.1	13781.8	14098.0	14354.3	14405.7
Cumulative Nonfederal	1844.0	2028.9	2520.1	2983.3	3177.4	3370.0	3501.1	3544.6	3564.9	3567.8
Cumulative Baseline Costs	9766.4	11117.8	12839.6	14312.4	15629.4	16498.1	17283.0	17642.6	17919.2	17973.5
<b>Actual Incurred Cost</b>										
Federal Share	1823.3	1157.3	1223.0	979.6	1078.5	755.3	656.7	316.2	259.0	57.0
Nonfederal Share	335.8	195.6	489.0	454.5	191.6	212.1	114.1	43.5	20.3	3.9
Total Incurred Costs	2159.1	1352.9	1712.0	1434.1	1270.1	967.5	770.7	359.6	279.3	61.0
Cumulative Federal	7931.5	9088.9	10311.9	11291.5	12370.0	13125.3	13781.9	14098.1	14357.0	14414.1
Cumulative Nonfederal	1842.7	2038.3	2527.3	2981.9	3173.5	3385.7	3499.7	3543.2	3563.5	3567.4
Cumulative Incurred Costs	9774.2	11127.1	12839.2	14273.3	15543.5	16510.9	17281.6	17641.3	17920.6	17981.5
<b>Variance</b>										
Federal Share	(9.8)	9.1	7.6	30.1	44.3	(79.1)	(3.0)	0.0	(2.7)	(5.6)
Nonfederal Share	1.2	(10.6)	2.2	8.6	2.5	(19.6)	17.1	(0.0)	(0.1)	(1.0)
Total Variance	(8.6)	(1.5)	9.8	38.7	46.8	(98.7)	14.1	0.0	(2.7)	(6.7)
Cumulative Federal	(9.1)	(0.0)	7.6	37.7	82.0	2.8	(0.1)	(0.1)	(2.7)	(8.4)
Cumulative Nonfederal	1.3	(9.3)	(7.2)	1.4	3.9	(15.7)	1.4	1.4	1.4	0.3
Cumulative Variance	(7.8)	(9.4)	0.4	39.1	85.9	(12.8)	1.3	1.4	(1.4)	(8.1)

**ENERGY & ENVIRONMENTAL RESEARCH CENTER**  
**PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP INITIATIVE TO ACCELERATE CARBON CAPTURE, UTILIZATION, AND**  
**STORAGE DEPLOYMENT**  
**DE-FE0031838**  
**Project-to-Date Financial Report at March 31, 2025**

(\$K)	Q4 Oct - Dec 2024	Q1 Jan - Mar 2025	Q2 Apr - Jun 2025	Q3 Jul - Sep 2025
<b>Baseline Cost Plan</b>				
Federal Share	148.6	148.6	148.6	148.6
Nonfederal Share	68.0	40.5	38.4	38.4
Total Planned	216.5	189.0	187.0	187.0
Cumulative Federal	14554.3	14702.8	14851.4	15000.0
Cumulative Nonfederal	3635.7	3676.2	3714.6	3752.9
Cumulative Baseline Costs	18190.0	18379.0	18566.0	18752.9
<b>Actual Incurred Cost</b>				
Federal Share	72.3	9.4		
Nonfederal Share	31.7	0.0		
Total Incurred Costs	104.0	9.4		
Cumulative Federal	14486.4	14495.8		
Cumulative Nonfederal	3599.1	3599.1		
Cumulative Incurred Costs	18085.6	18094.9		
<b>Variance</b>				
Federal Share	76.2	139.2		
Nonfederal Share	36.3	40.5		
Total Variance	112.5	179.7		
Cumulative Federal	67.9	207.0		
Cumulative Nonfederal	36.6	77.0		
Cumulative Variance	104.4	284.1		