Energy & Environmental Research Center
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October 28, 2025

Mr. Jordan Kannianen
Deputy Executive Director
North Dakota Industrial Commission
600 East Boulevard Avenue, Department 405
State Capitol, 14th Floor
Bismarck, ND 58505-0840

Dear Mr. Kannianen:

Subject: Quarterly Progress Report for the Period of July 1 – September 30, 2025, "PCOR Partnership Initiative to Accelerate CCUS Deployment"; Contract Nos. FY20-XCI-226 and G-050-096

Attached please find the Energy & Environmental Research Center (EERC) quarterly progress report for the subject project. If you have any questions, please contact me by phone at (701) 777-5236 or by email at kconnors@undeerc.org.

Sincerely,

DocuSigned by:
Kevin Connors
1D14EF7CF3CD456...

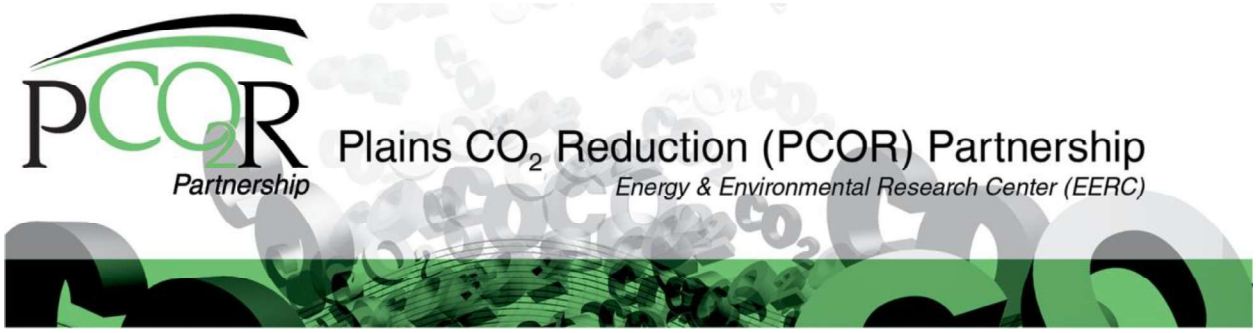
Kevin C. Connors
Assistant Director for Regulatory Compliance and Energy Policy
PCOR Partnership Program Manager

KCC/bjr

Attachment

c/att: Michael Holmes, Lignite Energy Council
Brent Brannan, North Dakota Industrial Commission (NDIC) Department of Mineral Resources, Oil and Gas Division

c: Jamie Mitzel, EERC
Kelly Haught, U.S. Department of Energy



PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT

Quarterly Technical Progress Report

(for the period July 1 – September 30, 2025)

Prepared for:

Jordan Kannianen

North Dakota Industrial Commission
600 East Boulevard Avenue, Department 405
State Capitol, 14th Floor
Bismarck, ND 58505-0840

Contract Nos. FY20-XCI-226 and G-050-096

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October 28, 2025

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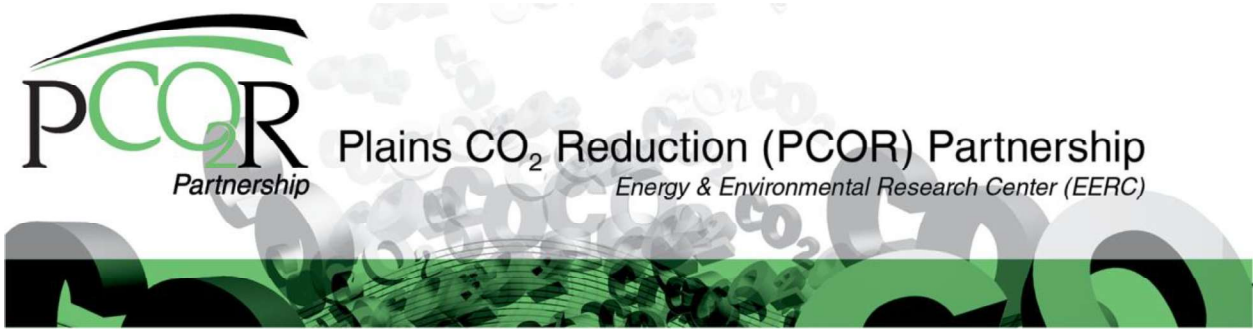


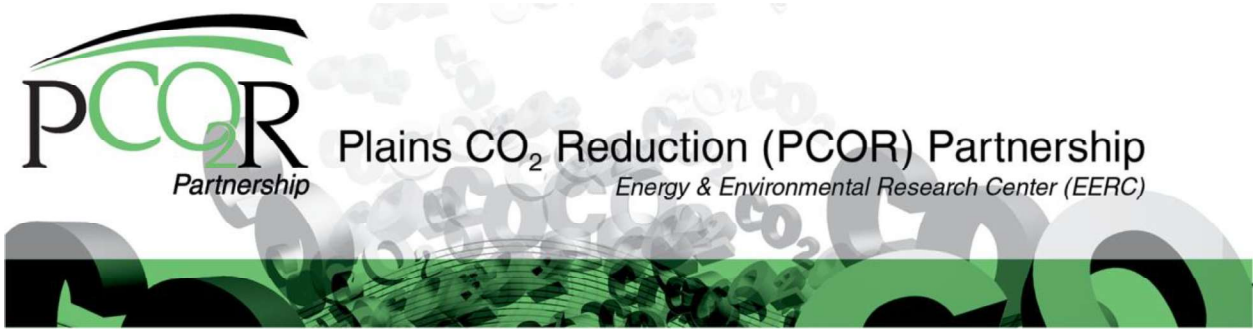
PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT
Quarterly Progress Report
July 1 – September 30, 2025

EXECUTIVE SUMMARY

The Plains CO_2 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 10 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 PCOR Partnership has held as many as 270 members to date. The PCOR Partnership welcomed one new member this quarter: Pivvot. The PCOR Partnership continued to engage with current and prospective PCOR Partnership members and carbon capture and storage (CCS) industry stakeholders. On July 16, 2025, the PCOR Partnership held a technical webinar, "Quantifying the Potential Atmospheric Leakage Risks Associated with the Geological Storage of CO_2 in Saline Aquifers," with 102 participants in attendance. On August 12, 2025, the EERC held meetings with two CCS industries: 1) Hardin International Processing, Inc., to discuss continued collaboration opportunities for processing the scalable, automated, sparse seismic array datasets at the Gevo site in Richardton, North Dakota, and 2) Global CCS Institute to discuss CO_2 pipeline safety and underground injection control regulations.

The EERC and project partners University of Wyoming and University of Alaska Fairbanks completed all technical work for this contract. The EERC technical work that was of primary focus this quarter was in Task 2.0 – Technical Challenges (Subtask 2.3 – MVA Strategies) for the SASSA monitoring. The SASSA data interpretation was completed by comparing synthetic modeling results of associated offsets to the baseline Red Trail Energy 3D volume from 2019. The EERC reported on the additional SASSA monitoring results at the Gevo site with the federal project manager and National Energy Technology Laboratory personnel, including the final U.S. Department of Energy review and project closeout meeting held on September 9, 2025. The EERC submitted the updated Deliverable (D) 16 report "Enabling Sustainable Monitoring for CCUS" to DOE and the North Dakota Industrial Commission on September 30, 2025. The EERC progressed on the final report and gathered pertinent PCOR products that will be uploaded to the Office of Scientific and Technical Information system during the next quarter.



PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT
Quarterly Progress Report
July 1 – September 30, 2025

INTRODUCTION

The Plains CO_2 Reduction (PCOR) Partnership, funded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL), the North Dakota Industrial Commission (NDIC) 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 10 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_2 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 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:

- Held regular project update meetings with federal PM. On June 25, 2025, the EERC provided a key technical presentation update to the federal PM and NETL personnel on cost-effective, low-impact monitoring techniques, and the progress of related efforts for the ongoing scalable, automated, sparse seismic array (SASSA) techniques at the Gevo site in Richardton, North Dakota.

- Held progress meetings with subrecipients UAF and UW to continue partner engagement for PCOR Partnership-related activities.

- Scheduled, coordinated, and held a virtual webinar on July 16, 2025: "Quantifying the Potential Atmospheric Leakage Risks Associated with the Geological Storage of CO_2 in Saline Aquifers." The webinar had 102 attendees.

- Prepared and submitted the quarterly research performance report for April 1 – June 30, 2025, on July 30, 2025.

- Held discussions with prospective members on a regular basis. The PCOR Partnership has held as many as 270 members to date. The PCOR Partnership welcomed one new member this quarter: Pivvot.

- The PCOR Partnership continues to engage with prospective members and carbon capture and storage (CCS) industry stakeholders.

  - Held a PCOR partner meeting with Hardin International Processing, Inc. (Hardin) on August 12, 2025, to discuss continued collaboration opportunities for processing the SASSA datasets at the Gevo site in Richardton, North Dakota.
  - Held a meeting with Global CCS Institute personnel on August 12, 2025, to discuss CO_2 pipeline safety and underground injection control regulations.

- Presented the final project closeout and technical update meeting updates to the federal PM and NETL personnel on September 9, 2025. The presentation focused on how the PCOR Partnership provided solutions in overcoming technical and regulatory challenges for CCUS.

- Submitted the final project closeout presentation slides to federal PM on September 16, 2025.

- Gathered relevant PCOR Partnership products to be submitted to the Office of Scientific and Technical Information (OSTI) system by the final project reporting period deadline. These included accepted manuscripts, journal articles, conference papers, presentations, and the final report.

- Progressed on the final report, which will be submitted next quarter to DOE and uploaded to OSTI.

- All EERC contractual project deliverables and milestones (Tables 1 and 2) are complete.

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

- Complete Task 1.0 and contractual final reporting activities.

- Continue engagement and collaboration with project partners.

- Review and approve remaining final deliverables from UAF and upload them to the PCOR partners-only site.

- Submit contractual PCOR Partnership products in categories of manuscripts, journal articles, conference papers, presentations, and the final report to OSTI.

- Complete and submit the PCOR Partnership final report to DOE, NDIC, and OSTI.

Table 1. Project Deliverables

Deliverable (D) No. and Title	Planned Completion Date	Actual Completion Date	Verification Method	Comments
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[1] 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	An updated D16 was submitted on 9/30/25 to include additional SASSA monitoring results.
D17 – PCOR Partnership Initiative Road Map	5/31/2024	5/31/2024	Topical report submitted to DOE PM	

[1] Monitoring, verification, and accounting.

Table 2. Milestone Status Report

Milestone (M) No. and Title	Planned Completion Date	Actual Completion Date	Verification Method	Comments
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.[1]
M6 – GHGT-16[2] 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 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	

[1] Energy Data eXchange.
[2] 16th Greenhouse Gas Control Technologies Conference.

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.

Progress on Task 2.0 is as follows:

- Continued collaboration for the field effort at the Red Trail Energy (RTE) CCS site.
- Completed the SASSA data interpretation by comparing synthetic modeling results of associated offsets to the baseline RTE 3D volume from 2019.
- The EERC completed and submitted the updated D16 report: Enabling Sustainable Monitoring for CCUS to DOE and NDIC on September 30, 2025.
  - The initial SASSA deployment is detailed in the previously submitted PCOR Partnership D16 deliverable, submitted in June 2024. This extension focused on a

winter 2024–2025 field test that utilized surface orbital vibe (SOV)1 and SOV2 sources and 200 autonomous seismic nodes.
- The test indicated that sparse seismic acquisition can consistently provide high-quality monitoring of the CO_2 plume at a fraction of the cost of traditional 3D surveys. The results underscore SASSA's adaptability, cost efficiency, and potential for regular, effective monitoring at CCUS sites.
- The SASSA timeline and effort is supplied (Table 3).

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

- This task is complete.

Table 3. Subtask 2.3 MVA Strategies Timeline for SASSA Effort at Gevo Site

Subtask 2.3 MVA Strategies	Timing	Status/Notes
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 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. Subsequently, the EERC reviewed the harvested data.
Paragon to Pick Up Nodes	March 2025	Completed.
Process Data Results	End of April 2025	Completed. The data was processed by Hardin with oversight from the EERC.
Interpret Data Results	September 2025	Completed. The SASSA data results were interpreted by comparing newly acquired processed datasets to those acquired from the RTE baseline 3D survey in 2019.
Begin and Finalize Reporting Results	September 30, 2025	Completed. D16 was updated with the new SASSA results and submitted to DOE/NDIC.

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_2 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:

- No activity during this reporting period.

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

- This task is complete.

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_2 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:

- UAF completed and submitted its deliverable to the EERC: "Carbon Dioxide Sequestration Potential Simulation in the Ugnu Formation During Enhanced Oil Recovery Process."
  - Note, this title was updated from the previous title: "History-Matched Reservoir Simulation Model for CO_2-Enriched Miscible Injectant Flood of a Heavy Oil Reservoir, Optimized Injection Strategy, and Data Files."

- UAF completed and reviewed its remaining final deliverable: "Updated Efficacy of Corrosion Inhibitors at Various CO_2 Concentrations and Implications for CO_2 EOR Development on the North Slope." UAF will submit to the EERC for uploading to the PCOR Products page.

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

- This task is complete.

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:

- No activity during this reporting period.

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

- This task is complete.

CHANGES/PROBLEMS

The final report and final closeout activities will be complete by next quarter.

SPECIAL REPORTING REQUIREMENTS

None.