



Energy & Environmental Research Center

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October 28, 2022

Ms. Karlene Fine
Executive Director
North Dakota Industrial Commission
600 East Boulevard Avenue, Department 405
State Capitol, 14th Floor
Bismarck, ND 58505-0840

Dear Ms. Fine:

Subject: Quarterly Progress Report for the Period of July 1 – September 30, 2022, “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:


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Kevin C. Connors

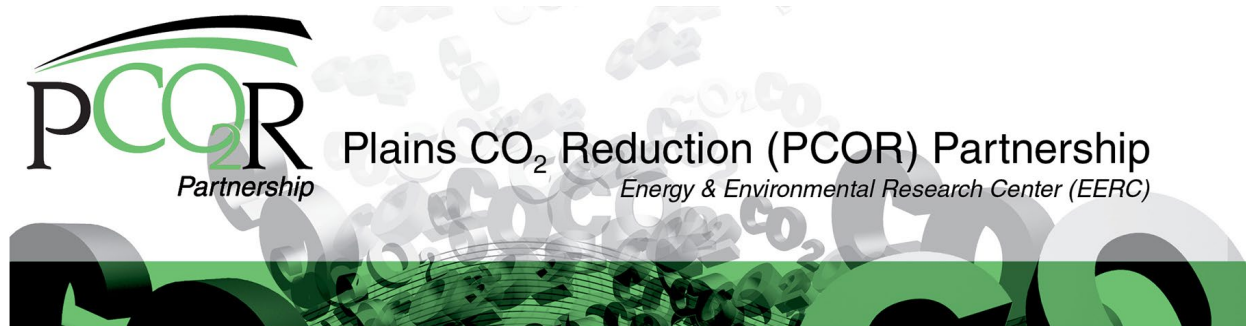
Assistant Director for Regulatory Compliance
and Energy Policy

KCC/kal

Attachment

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

c: Corey Irion, EERC



PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT

Quarterly Technical Progress Report

(for the period July 1 – September 30, 2022)

Prepared for:

Karlene Fine

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-050-96

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October 2022

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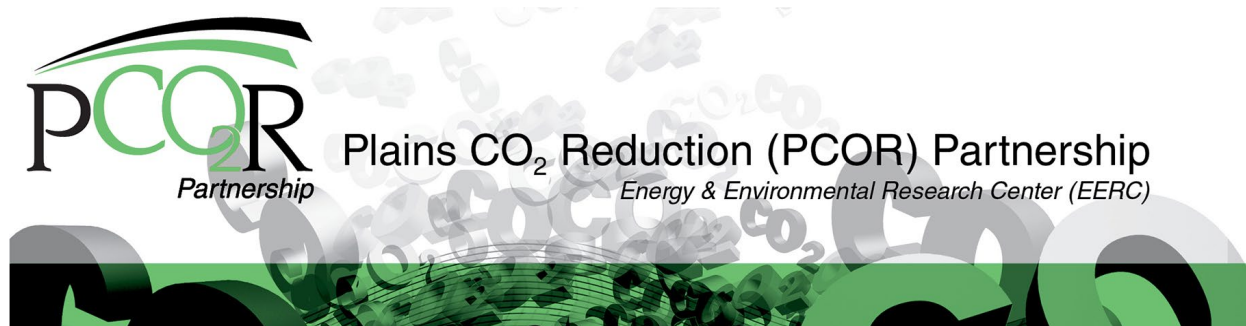
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PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT

Quarterly Progress Report

July 1 – September 30, 2022

EXECUTIVE SUMMARY

The Plains CO₂ Reduction (PCOR) Partnership, funded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL), the North Dakota Industrial Commission Oil and Gas Research Program and Lignite Research Program, and more than 230 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.

A letter proposal was submitted to the DOE project manager on April 26, 2022, requesting \$5 million in FY2022 funding from DOE. The letter proposal included an additional funding request in the amount of \$4 million should additional funding from DOE be available beyond the \$5 million FY2022 funding. The additional funding would allow the PCOR Partnership to enhance the current scope of work beyond the current changes proposed in the statement of project objectives. On July 21, 2022, DOE published a Notice of Intent (NOI) to issue Funding Opportunity Announcement (FOA) No. DE-FOA-0002799. If released, this FOA is expected to make available not less than \$20 million for cost-shared research and development (R&D) projects to support the goals of DOE's Regional Initiative effort. At the time of this quarterly report, there is uncertainty regarding the status of the letter proposal submitted April 26, 2022, requesting funding and the anticipated FOA identified in the NOI issued by DOE on July 21, 2022.

Presentations on the PCOR Partnership were given to seven prospective partners. Nine new members were welcomed to the PCOR Partnership, bringing the membership to 239 as of September 30, 2022: DarkVision Technologies Inc.; White Rock Oil & Gas; Devon Energy; RITE (Research Institute of Innovative Technology for the Earth); Tallgrass Energy Partners; TERRACOH, Inc.; GLJ Ltd.; Alaska Asia Clean Energy Corporation; and Alaska Department of Natural Resources.

Two deliverables (D7 and D8) were submitted this quarter, in the form of three reports:

- D7 – PCOR Partnership Storage Project Risk Management: Integrating Guidance Documents, Regulatory Requirements, Financial Incentives, and Best Practices

- D8a – Regulatory Frameworks and Permitting Considerations for Geologic Storage of Carbon Dioxide in the PCOR Partnership Region
- D8b – Project Development and Permitting Strategies from the First Wave of Geologic CO₂ Storage Projects in North Dakota

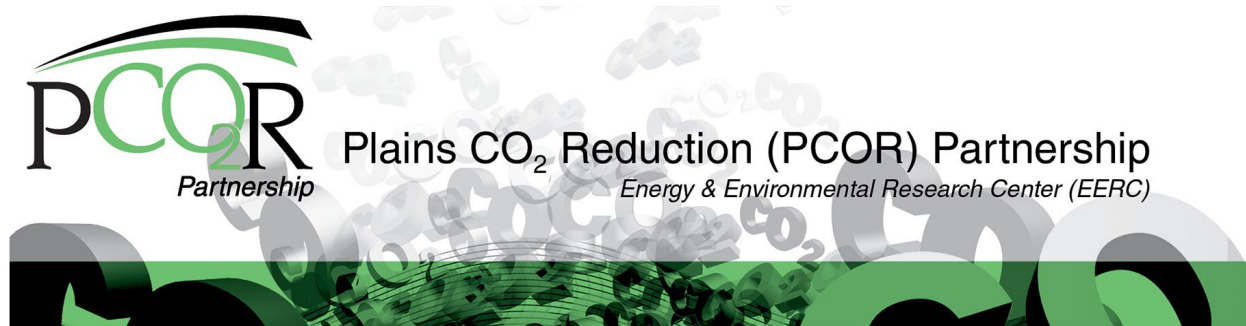
The EERC prepared and hosted the 2022 Regulatory Roundup in Deadwood, South Dakota. On September 13 and 14, 2022, 25 participants, including regulators representing nine different states (North Dakota, Wyoming, Alaska, Nebraska, Colorado, Utah, Texas, Louisiana, and Kansas) were in attendance.

Four products (three presentations and one poster) along with the required papers were prepared for the 16th International Conference on Greenhouse Gas Control Technologies (GHGT-16). The EERC will present at GHGT-16 in Lyon, France, in October 2022.

Activities continued related to the field effort at the Red Trail Energy CCS (carbon capture and storage) site. The SASSA (scalable, automated, sparse seismic array) method is currently being used to record baseline seismic data from a surface orbital vibrator. The geophysics team started software development for data analysis and processing of SASSA seismic data acquired in April through September 2022. The EERC team procured a 6C seismic station for recording waveform data to complement the SASSA processing effort. An electronic vibe (eVibe) was rented for both active and static sourcing operations. This eVibe will be installed semipermanently on a concrete platform in a shed for continuous on-demand operations as an additional source for the SASSA method. Eight NETL seismometers with recording boxes have been made available for monitoring potential induced seismic activity. The technical seismometers' characteristics will allow the PCOR Partnership to complement SASSA monitoring of the CO₂ plume. They will be deployed at locations with SASSA sensors in October 2022.

Several presentations were given and posters presented to a variety of audiences. One outreach activity included participation in Grand Forks STEMKAMP, held August 19, 2022. The camp was geared toward military families and was hosted by the local public school district through a grant from the U.S. Department of Defense and Goshen Education Consulting. The EERC had a PCOR Partnership outreach booth at the camp for “family day,” providing the opportunity for students and families to learn about CCS topics and the PCOR Partnership.

Numerous white papers continue to be under development by the EERC team as well as the subrecipient teams at UW and UAF. Topics include geomechanical evaluations; CCUS and grid reliability, including a case study by Jackson Walker, LLP; a high-level road map that will summarize the near-term, midterm, and long-term opportunities for hydrogen with CCS; CO₂ specifications for pipeline transport; operational lessons learned from stratigraphic well drilling in Wyoming; pore space-leasing considerations on federal lands; Wyoming geologic storage formation outlines; and technical and legal considerations for pore space leasing in general.



PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT

Quarterly Progress Report

July 1 – September 30, 2022

INTRODUCTION

The Plains CO₂ Reduction (PCOR) Partnership, funded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL), the North Dakota Industrial Commission Oil and Gas Research Program and Lignite Research Program, and more than 230 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 an expanded region, compared to 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 5-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, CO₂ 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 data sets and technologies will be analyzed and evaluated to highlight current challenges limiting commercial

adoption of CCUS as well as to identify potential solutions. The project team will support DOE's National Risk Assessment Partnership (NRAP) and machine learning (ML) initiatives by drawing on data sets 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 membership meetings, regulatory roundup meetings, Technical Advisory Board (TAB) 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 in order 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 progress meetings with subrecipients UAF and UW.
- Prepared and presented “Plains CO₂ Reduction Partnership Initiative to Accelerate Carbon Capture, Utilization, and Storage Deployment (FE0031838)” at the 2022 Carbon Management Project Review Meeting held August 15–19, 2022, in Pittsburgh, Pennsylvania.
- A letter proposal was submitted to the DOE PM on April 26, 2022, requesting \$5 million in FY2022 funding from DOE. The letter proposal included an additional funding request in the amount of \$4 million should additional funding from DOE be available beyond the \$5 million FY2022 funding. The additional funding would allow the PCOR Partnership to enhance the current scope of work beyond the current changes proposed in the statement of project objectives. On July 21, 2022, DOE published a Notice of Intent (NOI) to issue Funding Opportunity Announcement (FOA) No. DE-FOA-0002799. If released, this FOA is expected to make available not less than \$20 million for cost-shared research and development (R&D) projects to support the goals of DOE's Regional Initiative effort. At the time of this quarterly report, there is uncertainty regarding the status of the letter proposal submitted April 26, 2022, requesting funding and the anticipated FOA identified in the NOI issued by DOE on July 21, 2022.

- Began planning discussions for the 2023 Annual Membership Meeting.
- Attended the North Dakota Lignite Energy Council 2022 Annual Meeting on September 28–29, 2022, in Bismarck, North Dakota.
- EERC staff, including members of the project team, participated in a multiday event during the week of July 25–29, 2022. This in-person-only event was held at the EERC facility in Grand Forks, North Dakota, and comprised training on EERC functions related to research management and execution, team meetings, and team building.
- Engaged in conversations with current and prospective partners regarding their continued involvement in the PCOR Partnership:
 - Made contact with 22 prospective partners.
 - Gave presentations on the PCOR Partnership to seven prospective partners.
 - Welcomed nine new members:
 - DarkVision Technologies Inc.
 - White Rock Oil & Gas
 - Devon Energy
 - RITE (Research Institute of Innovative Technology for the Earth)
 - Tallgrass Energy Partners
 - TERRACOH, Inc.
 - GLJ Ltd.
 - Alaska Asia Clean Energy Corporation
 - Alaska Department of Natural Resources (DNR)
 - Received seven requests for information on how to join via the PCOR Partnership public website.
 - The PCOR Partnership currently has 239 members.

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

- Begin planning the next PCOR Partnership Invitational with UAF and UW.
- Continue tracking progress on project deliverables (D) and milestones (M) (see Tables 1 and 2).

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; monitoring, verification, and accounting (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

Deliverable 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. Full report due 11/1/2021 as discussed with DOE PM.
D3.B – Report – Stacked Storage Scenario Geomechanical Modeling	3/31/2022	3/31/2022	Topical report submitted to DOE PM	Created as 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 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	12/31/2022		Topical report submitted to DOE PM	
D10 – Report – NRAP Testing and Validation	3/31/2023	12/17/2021 (Part 1)	Topical report submitted to DOE PM	To be provided in two parts.
D11 – Report – Basement Faulting and Stress State, Induced Seismicity	9/30/2023		Topical report submitted to DOE PM	
D12 – Report – Regional Socioeconomic Assessments	9/30/2023		Topical report submitted to DOE PM	
D13 – Report – Updated Regional Business Case Assessment	12/31/2023		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 3/31/2023	6/30/2021	Atlas submitted to DOE PM	Moved from 3/31/2021.
D16 – Enabling Sustainable Monitoring for CCUS	6/30/2024		Topical report submitted to DOE PM	
D17 – PCOR Partnership Initiative Road Map	5/31/2024		Topical report submitted to DOE PM	

Table 2. Milestone Status Report

Milestone 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		Reported in subsequent quarterly report	
M10 – GHGT-17 Abstract Submitted	1/31/2024		Reported in subsequent quarterly report	
M11 – Annual Meeting Scheduled	3/31/2024		Reported in subsequent quarterly report	
M12 – BP2 EDX Submitted	6/30/2024		Reported in subsequent quarterly report	

¹ Energy Data eXchange.² 16th International Conference on Greenhouse Gas Control Technologies.

Progress on Task 2.0 is as follows:

- Prepared and submitted D7 – PCOR Partnership Storage Project Risk Management: Integrating Guidance Documents, Regulatory Requirements, Financial Incentives, and Best Practices to DOE on September 30, 2022.
- Worked on white papers on approaches to geomechanical evaluations.
- Continued collaboration for the field effort at the Red Trail Energy (RTE) CCS (carbon capture and storage) site. Activities included the following:
 - The SASSA (scalable, automated, sparse seismic array) method is currently being used to record baseline seismic data from a surface orbital vibrator (SOV). The geophysics team started software development for data analysis and processing of SASSA seismic data acquired in April through September 2022. The EERC team procured a 6C seismic station for recording waveform data to complement the SASSA processing effort.

- In addition to the SASSA deployment effort in early June 2022, the team collected drone imagery to support ongoing field efforts related to locating feasible equipment deployment locations for the NETL seismometers and preliminary planning for potential artificial reflector installation. The EERC team has performed geomechanical studies to understand the extent of surface deformation related to pressure change from injection operations. This surface deformation study will inform the deployment of artificial reflectors for higher-resolution measurements with InSAR (interferometric synthetic aperture radar).
- The EERC team rented an electronic vibe (eVibe) for both active and static sourcing operations. A 3000-m seismic reflection line was collected along a W–E transect through the injection area for monitoring plume extents. This eVibe will be installed semipermanently on a concrete platform in a shed for continuous on-demand operations as an additional source for the SASSA (scalable, automated, sparse seismic array) method.
- Eight NETL seismometers with recording boxes have been made available for the effort. The NETL seismometers will be used for monitoring potential induced seismic activity. The technical seismometers' characteristics will allow the PCOR Partnership to complement SASSA monitoring of the CO₂ plume. They will be deployed at locations with SASSA sensors in October 2022.
- Weekly meetings began with contractor SkyGeo to review InSAR data for historical analysis and modeling to inform decision making for artificial reflector installation.
- Received comments for consideration on June 30, 2022, from the DOE PM on a white paper entitled “Pressure Interference Evaluation to Support Storage Resource Planning in the Plains CO₂ Reduction (PCOR) Partnership Region” that was submitted to the DOE PM on June 2, 2022. The team revised the document based on the comments and submitted the revision August 18, 2022.
- UW continued work on draft documents to advance PCOR Partnership knowledge in topics under Task 2.0, including formation outlines and operational lessons learned from stratigraphic test wells.
- UW submitted a deliverable to the EERC on September 30, 2022: formation outlines for Minnelusa, Hulett, and Lakota Formations and associated seals. These reports included updated CO₂ storage estimates for formations in the Powder River Basin.
- UW continues to work on a deliverable entitled “Formation Outlines for Storage Reservoirs and Seals in the Rock Springs Uplift.” UW is using the workflow used for estimating storage capacity in the Powder River Basin for storage reservoirs at the Rock Springs Uplift. The existing drafts of formation outlines for the Rock Springs Uplift will be updated with new storage estimates.

- UW has incorporated comments from the EERC and continues to refine the “Stacked Storage Potential in the Powder River Basin and the Rock Springs Uplift” deliverable. It is expected this report will be submitted to the EERC by October 31, 2022.

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

- Undertake additional RTE field activities: install SASSA sensors and collect baseline data using SOVs and InSAR data analysis. Meet weekly with contractor SkyGeo to review InSAR data for historical analysis and modeling to inform decision making for artificial reflector installation.
- Continue work on white papers.

Task 3.0 – Data Collection, Sharing, and Analysis

In Task 3.0, the project team will collaborate with other DOE Fossil Energy Carbon Management (FECM)-funded researchers to improve understanding of CO₂ 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:

- Subtask 3.1 – Data Sharing
 - Continued to identify and catalog data sets that will be generated through the PCOR Partnership and available for upload to the EDX for M12 – BP2 EDX Submitted.
- Subtask 3.2 – NRAP Validation
 - Continued testing of NRAP-Open-IAM. The project team is comparing the results from NRAP-Open-IAM against the results for an identical storage complex and overburden stratigraphy in the Analytical Solution for Leakage in Multilayered Aquifers (ASLMA) FORTRAN-based semianalytical model.
- Subtask 3.3 – Machine Learning
 - Continued to explore the use of ML-based predictive modeling techniques to use geophysical well logs to classify aquifers located throughout the PCOR Partnership region into three groups based on their estimated total dissolved solids (TDS) concentrations: i) confidently less than 10,000 mg/L TDS, ii) confidently greater than 10,000 mg/L TDS, or iii) uncertain classification – not (i) or (ii). Collaborating with UW on this effort.
 - Analyzing the results of numerical reservoir simulations to quantify the impacts to injectivity at Storage Site A when a second Storage Site B is located 10 to 25 miles away, both sites are injecting 0.5 to 4 MtCO₂/year, and different injection constraints are applied to the simulations.

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

- Continue to explore the use of ML-based predictive modeling techniques to use geophysical well logs to classify aquifers located throughout 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 CO₂ 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:

- Continued work and reviews on multiple white papers, several of which are expected to be completed in the next quarter. White paper topics include the following:
 - CCUS and grid reliability of the PCOR regional electric grid – received external industry partner reviewer comments on the white paper. Comments were substantial and how to address comments is under consideration.
 - PCOR Partnership hydrogen CCUS road map.
 - Pipeline specifications for carbon capture transportation.
 - Step rate test.
 - Well testing for CO₂ storage sites.
- Began technical work on D9 related to infrastructure buildout scenarios. The team is currently evaluating relationships between potential CCUS facility and geologic storage locations to identify build-out scenarios for more in-depth analysis.
- Continued shipping copies of the PCOR Partnership Atlas, 6th Edition (D15) to the partnership, including new members.
- Stress Engineering Services, Inc., is working as a subcontractor to provide the PCOR Partnership membership with a basic guideline on considerations for selecting corrosion-resistant alloy material for use in CO₂ storage and utilization applications. The guidelines were provided to the EERC on May 24, 2022, for review. A white paper associated with the guidelines is in preparation by Stress Engineering Services, Inc.
- Continued development of secondary education content and beta-testing material.
- GHGT-16 products below were finalized, along with the required associated paper by the same title:

- PCOR Partnership: Breaking Down the Barriers in CCUS (oral presentation, scheduled for delivery October 25, 2022, Session 6G – Regulatory Experiences USA).
 - Risk-Based Area of Review Estimation in Overpressured Reservoirs to Support Injection Well Storage Facility Permit Requirements for CO₂ Storage Projects (oral presentation, scheduled for delivery October 27, 2022, Session 11F – Risk Management for CO₂ Storage)
 - Stacked Carbon Dioxide Storage: Technical and Geomechanical Considerations (oral presentation, scheduled for delivery October 26, 2022, Session 8B – Site Characterisation)
 - Demonstration of Novel Monitoring Techniques for a North Dakota Carbon Capture and Storage Project, scheduled for delivery October 26, 2022 (E-Poster Session Station C – Demonstration Projects CCS; content includes activities under a complementary project)
- Prepared for and participated in Grand Forks STEMKAMP, held August 19, 2022. The camp was geared toward military families and was hosted by the local public school district through a grant from the U.S. Department of Defense and Goshen Education Consulting. The EERC had a PCOR Partnership outreach booth at the camp for “family day,” providing the opportunity for students and families to learn about CCS topics and the PCOR Partnership.
 - Held internal meetings to discuss outreach strategy and preparation of an outreach plan.
 - UAF and EERC personnel have started work on a techno-economic assessment for CCS in and around the Alaska Cook Inlet coupled with electricity generation of different capacities. This techno-economic assessment will inform a UAF deliverable entitled “A Road Map for Deploying Commercial CCUS in Alaska.”
 - UAF is waiting on approvals of foreign national students to get them involved with a deliverable to the EERC entitled “Efficacy of Corrosion Inhibitors at Various CO₂ Concentrations and Implications for CO₂ EOR Development on the North Slope.”
 - UW has begun work on a deliverable, “Infrastructure, Scale-Up, and Techno-Economic Assessments” (UW D9, due October 31, 2022):
 - Develop supply curves of CCUS and a map that will include potential coal power plants with CO₂ capture facilities, CO₂ pipelines, and CO₂ storage fields. The supply curves and the map will provide information about whether there is a need to expand existing pipelines, where and how to expand them, and where and how to develop new pipelines. This work will contribute to EERC D9.
 - UW is working on a deliverable entitled “Social License for Wyoming’s Energy Future.” This deliverable will be based on the results of a PCOR Partnership-sponsored

survey and Q-study that will assess Wyoming residents' opinions about energy topics, including CCS/CCUS. The survey format has been finalized by the UW School of Energy Resources, with input from the EERC. The survey was distributed to Wyoming residents by the Wyoming Survey and Analysis Center (WySAC), and all responses were collected by the end of August 2022. Now that the survey is complete, a Q-study will be conducted that will include interviews with stakeholders. The results of both the survey and the Q-study will be analyzed and summarized in this deliverable.

- UW is working to complete a “Hydrogen Production with CCS Opportunities” deliverable. A draft will be provided to the EERC by November 15, 2022.
- UW submitted a draft deliverable, “Federal Land Challenges for CCS,” on September 30, 2022. The EERC will review and provide UW with comments and suggestions.

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

- Continue to ship the PCOR Partnership Atlas (D15) to new PCOR Partnership members.
- Identify infrastructure build-out scenarios for D9 and perform a techno-economic analysis of those scenarios.
- Continue development of secondary education content and beta-testing material.
- Complete white papers on the Jackson Walker, LLP, CCUS and grid stability study and well testing for CO₂ storage sites, and provide to DOE and PCOR Partnership members.

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:

- Prepared and submitted D8 to DOE on September 30, 2022. As discussed with the PM, this deliverable was divided into two separate but related reports:
 - D8a – Regulatory Frameworks and Permitting Considerations for Geologic Storage of Carbon Dioxide in the PCOR Partnership Region
 - D8b – Project Development and Permitting Strategies From the First Wave of Geologic CO₂ Storage Projects in North Dakota

- Prepared and hosted the 2022 Regulatory Roundup in Deadwood, South Dakota, on September 13–14, 2022:
 - July 14, 2022, regulators in the PCOR Partnership area and beyond received a save-the-date eblast with links to register and reserve a room in the block.
 - The draft agenda was released in an eblast on August 3, 2022.
 - An eblast containing meeting format and speaker guidelines was sent August 17, 2022.
 - 25 participants attended, representing nine different states (North Dakota, Wyoming, Alaska, Nebraska, Colorado, Utah, Texas, Louisiana, and Kansas).
- Completed M8 – Draft Journal Article Completed this quarter with the submission of two draft journal articles:
 - A draft manuscript entitled “Pressure Interference Evaluation to Support CO₂ Storage Resource Development Planning in the Williston Basin, North Dakota, USA” was submitted to *Greenhouse Gases: Science and Technology* in September 2022.
 - A draft manuscript entitled “Impacts of Local Grid Refinement (LGR), Capillary Pressure, and Relative Permeability on Early Injection Well Behavior During Simulation of Large-Domain Dedicated Carbon Dioxide Storage” was submitted to *International Journal of Greenhouse Gas Control* in October 2022.
- Continued efforts to populate both the public website (undeerc.org/pcor) and the partners-only website (undeerc.org/pcorpartners) with new and updated information.
- Continued development of several white papers, focusing on the following topics: pore space-leasing considerations, capillary entry pressure, step rate testing, stabilized plumes, and other lessons learned through PCOR Partnership efforts.
- Continued work on a regulatory crosswalk between U.S. Environmental Protection Agency (EPA) Underground Injection Control (UIC) for CO₂ geologic sequestration, the North Dakota Administrative Code for Geologic Storage of Carbon Dioxide, and CARB (California Air Resources Board) to help streamline necessary data acquisition for storage facility-permitting efforts.
- Presented “Perspectives from Recently Permitted Onshore CCS Projects” at the 2022 Carbon Management Project Review Meeting held August 15–19, 2022, in Pittsburgh, Pennsylvania.
- Attended the Midwest Regional Carbon Initiative (MRCI) 2022 Partners and Stakeholders Meeting on September 27–28, 2022, in Columbus, Ohio.
- A member of the UAF team was asked by the Alaska DNR to serve as the host and lead facilitator for the newly constituted CCUS Alaska State Workgroup, the purpose of which is to accelerate commercial carbon capture, use, and sequestration in Alaska.

- The work group kickoff meeting was held July 21, 2022, with 59 corporate, state, university, and nongovernmental organization/public attendees. Four subgroups were formed: regulatory framework, road map to commercial CCUS, government funding opportunities, and public outreach.
- The first CCUS regulatory framework work group meeting was held August 10, 2022, with approximately 50 participants.
- A series of four meetings were held in August to inform DNR regarding the state of Alaska’s proposed regulatory framework. Alaska DNR is taking the lead on these topics which include state property rights and leasing, amalgamation of property rights, long-term liability, fiscal terms, and Class VI primacy. During the full-day symposium on August 30, participants discussed and documented their preferences. The result will be a white paper authored by Alaska DNR and shared with the Alaska Governor’s office. Carbon legislation, to be proposed by the Governor and authored by the Department of Law, is expected to be one of four legislative priorities in the January 2023 session.
- UW continued work on draft documents to advance PCOR Partnership knowledge in topics under Task 5.0.

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

- Continue updating the PCOR Partnership public and partner websites.
- Complete white papers on the topics of Class VI wellbore construction and design; lessons learned from coring programs, wireline logging, and seismic surveys; pore space leasing considerations; and stabilized plume evaluations.
- An invitation-only webinar entitled “Risk-Based Area of Review (AOR) Delineation for CO₂ Storage Projects” will be presented on October 11, 2022, with 32 regulatory representatives registered for the presentation.
- Plan to solicit feedback via an e-survey to attendees from the Regulatory Roundup and the Risk-Based AOR webinar to aid in future regulator-focused meetings.
- Send out registration information to partners and other interested parties for a PCOR Partnership webinar scheduled for November 16, 2022, featuring the former North Dakota tax commissioner discussing recent changes to the Internal Revenue Code, Section 45Q, and registration information.

CHANGES/PROBLEMS

No changes or problems at this time.

SPECIAL REPORTING REQUIREMENTS

None.

BUDGETARY INFORMATION

ENERGY & ENVIRONMENTAL RESEARCH CENTER
PLAINS CO₂ REDUCTION PARTNERSHIP INITIATIVE TO ACCELERATE CARBON CAPTURE, UTILIZATION, AND STORAGE
DEPLOYMENT
DE-FE0031838
Project-to-Date Financial Report at September 30th, 2022

(\$K)	Q4 Oct - Dec 2019	Q1 Jan - Mar 2020	Q2 Apr - Jun 2020	Q3 Jul - Sep 2020	Q4 Oct - Dec 2020	Q1 Jan - Mar 2021	Q2 Apr - Jun 2021	Q3 Jul - Sep 2021	Q4 Oct - Dec 2021	Q1 Jan - Mar 2022
Baseline Cost Plan										
Federal Share	63.8	81.4	213.9	239.7	296.8	376.4	1230.8	1402.3	814.6	1388.5
Nonfederal Share	0.0	6.5	49.7	40.6	83.0	81.9	179.0	82.8	488.5	495.0
Total Planned	63.8	87.9	263.6	280.3	379.8	458.3	1409.8	1485.1	1303.1	1883.5
Cumulative Federal	63.8	145.2	359.1	598.8	895.6	1272.0	2502.8	3905.1	4719.7	6108.2
Cumulative Nonfederal	0.0	6.5	56.2	96.8	179.8	261.7	440.7	523.5	1012.0	1507.0
Cumulative Baseline Costs	63.8	151.7	415.3	695.6	1075.4	1533.7	2943.5	4428.6	5731.7	7615.2
Actual Incurred Cost										
Federal Share	63.8	81.4	213.9	239.6	296.8	376.4	1230.8	1402.3	814.6	1388.5
Nonfederal Share	0.0	6.5	49.7	40.6	83.0	81.9	179.1	82.8	488.4	495.0
Total Incurred Costs	63.8	87.9	263.6	280.2	379.8	458.3	1409.9	1485.1	1303.1	1883.5
Cumulative Federal	63.8	145.2	359.2	598.8	895.6	1272.0	2502.8	3905.1	4719.7	6108.2
Cumulative Nonfederal	0.0	6.5	56.2	96.7	179.8	261.6	440.7	523.5	1011.9	1506.9
Cumulative Incurred Costs	63.8	151.7	415.4	695.5	1075.3	1533.6	2943.5	4428.6	5731.7	7615.2
Variance										
Federal Share	0.0	(0.0)	(0.0)	0.1	0.0	(0.0)	(0.0)	0.0	(0.0)	0.0
Nonfederal Share	0.0	0.0	0.0	0.0	(0.0)	0.0	(0.1)	0.0	0.1	(0.0)
Total Variance	0.0	(0.0)	(0.0)	0.1	0.0	0.0	(0.1)	0.0	0.0	0.0
Cumulative Federal	0.0	(0.0)	(0.1)	0.0	0.0	0.0	(0.0)	0.0	(0.0)	(0.0)
Cumulative Nonfederal	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.1
Cumulative Variance	0.0	(0.0)	(0.1)	0.1	0.1	0.1	(0.0)	0.0	0.0	0.0

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Project-to-Date Financial Report at September 30th, 2022

(\$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
Baseline Cost Plan										
Federal Share	889.2	889.2	889.2	889.2	889.2	889.2	889.2	889.2	889.1	889.1
Nonfederal Share	224.6	224.6	224.6	224.6	224.6	224.6	224.6	224.6	224.6	224.5
Total Planned	1113.8	1113.8	1113.8	1113.8	1113.8	1113.8	1113.8	1113.8	1113.7	1113.6
Cumulative Federal	6997.4	7886.6	8775.8	9665.0	10554.2	11443.4	12332.6	13221.8	14110.9	15000.0
Cumulative Nonfederal	1731.6	1956.2	2180.8	2405.4	2630.0	2854.6	3079.2	3303.8	3528.4	3752.9
Cumulative Baseline Costs	8729.0	9842.8	10956.6	12070.4	13184.2	14298.0	15411.8	16525.6	17639.3	18752.9
Actual Incurred Cost										
Federal Share	1823.3	1157.3								
Nonfederal Share	335.8	195.6								
Total Incurred Costs	2159.1	1352.9								
Cumulative Federal	7931.5	9088.9								
Cumulative Nonfederal	1842.7	2038.3								
Cumulative Incurred Costs	9774.2	11127.1								
Variance										
Federal Share	(934.1)	(268.1)								
Nonfederal Share	(111.2)	29.0								
Total Variance	(1045.3)	(239.1)								
Cumulative Federal	(934.1)	(1202.3)								
Cumulative Nonfederal	(111.1)	(82.1)								
Cumulative Variance	(1045.2)	(1284.3)								