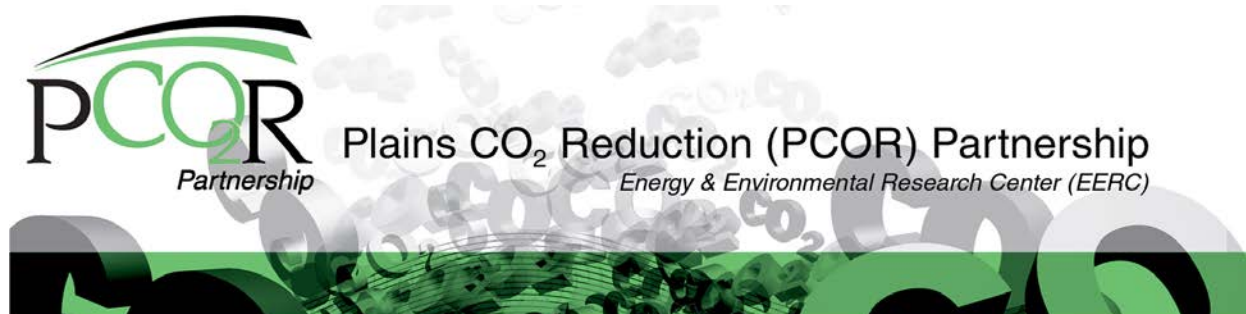




PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT

Research Performance Progress Report (quarterly)

(for the period April 1 – June 30, 2020)

Prepared for:

AAD Document Control

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July 30, 2020

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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 3

 Task 4.0 – Regional Infrastructure 7

 Task 5.0 – Technology Transfer 8

CHANGES/PROBLEMS 9

SPECIAL REPORTING REQUIREMENTS 9

BUDGETARY INFORMATION 10

REGULATORY ROUNDUP WebEx SLIDES.....Appendix A

LIST OF TABLES

1 Project Deliverables 4

2 Milestone Status Report 5



PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT
Quarterly Progress Report
April 1 – June 30, 2020

EXECUTIVE SUMMARY

The Plains CO₂ Reduction (PCOR) Partnership Initiative is one of four projects competitively awarded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) under the Regional Initiative to Accelerate CCUS (carbon capture, utilization, and storage). The PCOR Partnership Initiative is led by the Energy & Environmental Research Center (EERC) with support from the University of Wyoming (UW) and the University of Alaska Fairbanks (UAF) and includes stakeholders from the public and private sectors. The PCOR Partnership Initiative region includes all or part of ten U.S. states and four Canadian provinces.

Contracts with subrecipients UW and UAF were finalized. The project team, including subrecipients, worked on revising the statement of project objectives and budget for the additional funding to be provided by DOE.

Milestone 2 – Initial Techno-Economic Framework Established was completed April 28, 2020. The first Regulatory Roundup WebEx was held June 9, 2020, with 18 external participants. Planning continued for the PCOR Partnership Initiative annual membership meeting. The EERC and DOE NETL identified a set of four NRAP (National Risk Assessment Partnership) tools that will be included in Task 3.0 testing. The CO₂ source database for the PCOR Partnership Initiative region was updated from the previous assessment in 2017 under the PCOR Partnership Program.

The EERC holds an unwavering commitment to the health and well-being of its employees, partners and clients, and the global community. As such, precautionary measures have been implemented in response to COVID-19. Staff continue to carry out project-related activities remotely, and personnel supporting essential on-site laboratory and testing activities are proceeding under firm safety guidelines. Travel has been minimized, and protective measures are being undertaken for those who are required to travel. At this time, work conducted by EERC employees is anticipated to progress with minimal disruption. Challenges posed by economic variability will be met with open discussion between the EERC, the DOE Project Manager, and other partners to identify solutions. The EERC is monitoring developments across the nation and abroad to minimize risks, achieve project goals, and ensure the success of our partners and clients.



PCOR PARTNERSHIP INITIATIVE TO ACCELERATE CCUS DEPLOYMENT
Quarterly Progress Report
April 1 – June 30, 2020

INTRODUCTION

The Plains CO₂ Reduction (PCOR) Partnership Initiative is one of four projects operating under the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Regional Initiative to Accelerate CCUS (carbon capture, utilization, and storage). The PCOR Partnership Initiative is led by the Energy & Environmental Research Center (EERC) with support from the University of Wyoming (UW) and the University of Alaska Fairbanks (UAF) and includes stakeholders from the public and private sectors. The membership, as of June 30, 2020, is 189 members. The PCOR Partnership Initiative region includes all or part of ten states (Alaska, Iowa, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, Wisconsin, and Wyoming) and four Canadian provinces (Alberta, British Columbia, Manitoba, and Saskatchewan).

The goal of the PCOR Partnership Initiative is to identify and address onshore regional storage and transport challenges facing commercial deployment of CCUS in an expanded region, compared to past initiatives. To achieve this goal, the PCOR Partnership Initiative 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 and needs
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. 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 the DOE 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 Initiative region. Potential business case scenarios will be evaluated, taking into account 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 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 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:

- Attended DOE Regional Initiatives – FY2020 Funding Webinar on April 30, 2020. The PCOR Partnership Initiative Principal Investigator (PI) presented an overview of plans for the additional funding to be provided in fiscal year (FY) 2020.
- Sought input from task leaders and subrecipients on statement of project objectives (SOPO) revisions and budget allocations for the DOE FY2020 add-on funding.
- A fully executed subrecipient contract with UW was completed May 15, 2020.
- A fully executed subrecipient contract with UAF was completed June 11, 2020.
- DOE contract modification 002 was received June 24, 2020, removing the exemption of foreign national approval. Acquisition of the required documents from foreign nationals that have been and expect to be working on the project began.
- Continued planning the annual membership meeting. Activities included the following:
 - Selected alternative dates in September 2020 in Jackson, Wyoming, because of the COVID-19 situation and travel restrictions for many companies. Received a contract revision from the hotel for the venue.
 - Sent a revised “save the date” e-mail to partners with new dates of September 21–22, 2020.
 - Discussed the meeting agenda and speakers.
- Engaged in conversations with current and prospective partners regarding their continued involvement in the PCOR Partnership Initiative.

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

- Complete add-on SOPO revisions and budget and submit to DOE.
- Continue annual membership meeting planning, including any updates on meeting dates based on the COVID-19 situation.
- Track 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 Initiative region related to stacked storage opportunities; storage performance; monitoring, verification, and accounting (MVA) technology; and subsurface integrity. The EERC will collaborate with PCOR Partnership Initiative members to identify knowledge gaps and address regional challenges through targeted webinars, workshops, reports, and papers.

Progress on Task 2.0 is as follows:

- Conducted a literature review about the geology of the PCOR Partnership Initiative region that can be used and optimized for potential CO₂ storage.
- Composed and continued to refine an outline of the storage optimization report (D2).

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

- Initiate modeling and simulation efforts required for D2.

Task 3.0 – Data Collection, Sharing, and Analysis

In Task 3.0, the project team will collaborate with other DOE Fossil Energy (FE)-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.

Table 1. Project Deliverables

Deliverable (D) No. and Title	Planned Completion Date	Actual Completion Date	Verification Method	Comments
D1 – Project Management Plan	30 days after contract definitization	2/21/2020	PMP file submitted to DOE Project Manager (PM)	
D2 – Report – Storage Optimization	12/31/2020		Topical report submitted to DOE PM	
D3 – Report – Stacked Storage Opportunity Assessment	6/30/2021		Topical report submitted to DOE PM	
D4 – Report – Regional Business Case Assessment	3/31/2021		Topical report submitted to DOE PM	
D5 – Report – Subsurface and Legacy Well Integrity	12/31/2021		Topical report submitted to DOE PM	
D6 – Report – MVA Strategies	6/30/2022		Topical report submitted to DOE PM	
D7 – Report – Evaluation of Risk Management	9/30/2022		Topical report submitted to DOE PM	
D8 – Report – Regional Permitting Guidance	9/30/2022		Topical report submitted to DOE PM	
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		Topical report submitted to DOE PM	
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	

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		Reported in subsequent quarterly report	
M4 – Regulatory Roundup Scheduled	3/31/2021		Reported in subsequent quarterly report	
M5 – Data Share with National Lab for NRAP Assessment	6/30/2021		Reported in subsequent quarterly report	
M6 – GHGT-16 ¹ Abstract Submitted	1/31/2022		Reported in subsequent quarterly report	
M7 – BP1 EDX ² Submitted	3/31/2022		Reported in subsequent quarterly report	
M8 – Draft Journal Article Completed	11/30/2022		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 16th International Conference on Greenhouse Gas Control Technologies.

² Energy Data eXchange.

Progress on Task 3.0 is as follows:

- Subtask 3.1 – Data Sharing:
 - The project team identified a set of available geologic models (geomodels) in Schlumberger’s Petrel and numerical reservoir simulations in Computer Modelling Group’s compositional simulator, GEM (CMG GEM), and is in the process of cataloging details about each geomodel and simulation output, including file types, file sizes, model domain, reservoir layers, simulation time, injection wells, and CO₂ mass injection target. The catalog will help to identify potential files that could be shared to accelerate CCUS technology development. In addition, the catalog will provide a basis for NRAP tool testing in Subtask 3.2.
- Subtask 3.2 – NRAP Validation:
 - The Task 3.0 lead held a conference call on May 7, 2020, with a representative from DOE NETL to discuss the NRAP suite of tools and how the EERC’s PCOR Partnership Initiative Task 3.2 work products would fit within the broader goals and objectives of NRAP. The EERC and DOE NETL identified the following set of four NRAP tools that will be included in the Task 3.0 testing:

- **Reservoir Reduced-Order Model – Generator (RROM-Gen):** The EERC will use RROM-Gen to translate one or more numerical reservoir simulation output data sets of pressure and gas (CO₂) saturation from CMG GEM into a format that is amenable to analysis within the NRAP suite of tools.
- **Open-Sourced Integrated Assessment Model (Open-IAM):** Using the outputs from RROM-Gen, the EERC will use Open-IAM to explore potential leakage scenarios of brine and CO₂ from the storage reservoir into an overlying thief zone (Aquifer 1) and underground source of drinking water (USDW, Aquifer 2) based on varying numbers of leaky wellbores, wellbore distances from the injection well, and leaky wellbore properties.
- **Designs for Risk Evaluation and Management (DREAM):** Using the outputs from Open-IAM, the EERC will use DREAM to explore potential monitoring schemes built of various configurations of monitoring locations and leak detection parameters.
- **State of Stress Analysis Tool (SOSAT):** The EERC will use SOSAT to explore the risk of induced seismicity and leakage due to unintentional hydraulic fracturing.
- The EERC conducted testing of Open-IAM using CMG GEM simulations for the North Dakota CarbonSAFE (Carbon Storage Assurance and Facility Enterprise) project. The project team is in the process of troubleshooting Open-IAM and is working to compile outputs from a sensitivity analysis for the different input parameters.
- Subtask 3.3 – Machine Learning:
 - The EERC participated in multiple SMART (Science-Informed Machine Learning for Accelerating Real Time Decisions in Subsurface Applications) Initiative meetings.
 - As part of SMART Initiative Task 4, the EERC generated an ensemble of 100 geologic realizations and simulation outputs for a synthetic deep saline formation representing a clastic shelf depositional environment. In addition, the EERC created CO₂ saturation plume maps representing time-lapse seismic surveys and the approximate time-series delineation of the CO₂ plume in the storage reservoir (CO₂ plume maps). Lastly, the EERC is working with Lawrence Livermore National Laboratory (LLNL) to create simulated interferometric synthetic aperture radar (InSAR) maps of pressure buildup in the storage reservoir (pressure buildup maps). The 100 realizations and CO₂ plume maps have been posted to the SMART Initiative Task 4 DOE EDX folder, and the pressure buildup maps are anticipated to be posted during the next quarter. The ensemble of 100 realizations and time-series CO₂ plume and pressure buildup maps provide a one-of-a-kind resource for training and testing ML approaches to forecasting CO₂ and pressure propagation in the subsurface in response to CO₂ injection.
- Completed a literature review on the development of risk-based area of review.

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

- Subtask 3.1: Continue to catalog available geomodels and reservoir simulations that could be shared to accelerate CCUS technology development.
- Subtask 3.2: Continue to participate in the NRAP webinar series to learn about existing and forthcoming NRAP tools. Continue to troubleshoot and test the suite of NRAP tools described above.
- Subtask 3.3: Continue to track SMART Initiative activities to identify opportunities to leverage CO₂ storage project data sets for the validation and testing of ML-based approaches to modeling CO₂ and/or pressure in the subsurface.

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 Initiative region and will be communicated through outreach activities.

Progress on Task 4.0 is as follows:

- Held internal discussions to discuss task activities.
- M2 – Initial Techno-Economic Framework Established was completed April 28, 2020. The EERC developed an initial techno-economic framework for the development of hypothetical CO₂ pipeline networks for deployment in the PCOR Partnership Initiative region by investigating previously completed techno-economic analyses of CO₂ pipelines for CO₂ EOR in the state of North Dakota, which developed various buildout strategies for CO₂ pipelines in the region and estimated the costs for their deployment using normalized cost data, i.e., dollars per diameter-inch-mile, that were available from DOE and a range of commercial sources, in combination with the effort of other researchers who examined the buildout and cost for deploying a CO₂ pipeline network across the PCOR Partnership Initiative region and other regions of the United States. When combined, these past studies of the EERC and others provided the foundation for a techno-economic framework for investigating potential buildout scenarios for a CO₂ transport and distribution infrastructure in the PCOR Partnership Initiative region which can be used to support the regional acceleration of CCUS deployment.
- Updated the CO₂ source database for the PCOR Partnership Initiative region, previously assessed in 2017. During the update, the region evaluated was expanded to include the portions of Montana, Wyoming, and British Columbia not previously included in the PCOR Partnership region plus the state of Alaska. An overall gain of 85 sources and an additional 72 million tonnes of annual CO₂ emissions released were noted compared to the 2017 database compiled under the PCOR Partnership Program.

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

- Develop a preliminary plan for acquiring input data for statewide economic models within the PCOR Partnership Initiative region.

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 Initiative 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 FE program goals.

Progress on Task 5.0 is as follows:

- Held the Regulatory Roundup WebEx on June 9, 2020, to discuss the best format to hold an eventual in-person regulatory roundup meeting. The slides presented are provided in Appendix A. Attendees included the following:
 - Andrew Beaton and Dan Palombi, Alberta Geological Survey
 - Michelle Schwabe, British Columbia Oil and Gas Commission
 - Lon Whitman, Enhanced Oil Recovery Institute (Wyoming)
 - Craig Boomgaard and Wendy Cheung, U.S. Environmental Protection Agency Region 8 – Underground Injection Control Program
 - Jason Toner, Government of Alberta, Resource Development Policy Branch
 - Amy Childers and Lori Wrotenbery, Interstate Oil and Gas Compact Commission
 - Christian Bohm, Manitoba Geological Survey, Government of Manitoba
 - Steve Melzer, Melzer Consulting
 - Gavin Jensen, Ministry of Energy and Resources, Government of Saskatchewan
 - George Hudak, Montana Board of Oil and Gas Conservation
 - Stephen Fried, North Dakota Oil and Gas Division
 - Lynn Helms, North Dakota Industrial Commission Department Mineral Resources Oil and Gas Division
 - Felicia Blanke, Nebraska Oil and Gas Conservation
 - Melinda Yurkowski, Petroleum Geology, Government of Saskatchewan
 - Lily Barkau, Wyoming Water Quality Division
- Had individual Regulatory Roundup follow-up communications with the following individuals:
 - George Hudak, Montana Board of Oil and Gas Conservation
 - Stephen Fried, North Dakota Oil and Gas Division
 - Lily Barkau, Wyoming Water Quality Division

- Named Wayne Rowe as Task 5.0 leader. Mr. Rowe brings nearly four decades of oil and gas industry experience, with the last 12 years developing geologic storage sites to help advance Task 5.0 objectives.
- The PCOR Partnership public website content was updated.

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

- Continue engagement with regulators in the PCOR Partnership Initiative region through individual communications as a follow-up to the Regulatory Roundup.
- Initiate assessment of the status of nontechnical challenges and developments in proposed legislation, regulations, and financial incentives throughout the PCOR Partnership Initiative region.
- Initiate regional business model assessment structured to take advantage of available investment, incentives, loan guarantees, and technology advancements to propel CCUS projects forward in the PCOR Partnership Initiative region.

CHANGES/PROBLEMS

The EERC is operational and open for business. Personnel that are not essential for on-site operations have transitioned to working from home. Essential project, laboratory, and field-based activities are proceeding with the incorporation of the Centers for Disease Control and Prevention (CDC), the state of North Dakota, and the University of North Dakota (UND) guidelines associated with COVID-19, and mitigation measures have been implemented.

In collaboration with project partners, the EERC is continually assessing potential impacts to project activities resulting from COVID-19 and/or the U.S. economic situation.

The situation has impacted planning efforts for the PCOR Partnership Initiative annual meeting. The dates for the annual membership meeting were pushed from June 2020 to September 2020 and continue to be contemplated. The Regulatory Roundup was held as a WebEx rather than as an in-person meeting.

In the event that any potential impacts to reporting, scope of work, schedule, or cost are identified, they will be discussed and addressed in cooperation with the DOE PM.

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 June 30th, 2020**

(\$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	256.5	338.8	338.8	339.0	339.0	338.8	338.8	338.8	338.8	338.8
Nonfederal Share	82.8	82.8	82.8	82.8	82.8	82.8	82.8	82.8	82.8	82.7
Total Planned	339.3	421.6	421.6	421.8	421.8	421.6	421.6	421.6	421.6	421.5
Cumulative Federal	256.5	595.3	934.1	1273.1	1612.1	1950.9	2289.7	2628.5	2967.3	3306.1
Cumulative Nonfederal	82.8	165.6	248.4	331.2	414.0	496.8	579.6	662.4	745.2	827.9
Cumulative Baseline Costs	339.3	760.9	1182.5	1604.3	2026.1	2447.7	2869.3	3290.9	3712.5	4134.0
Actual Incurred Cost										
Federal Share	63.8	81.4	213.9							
Nonfederal Share	0.0	6.5	49.7							
Total Incurred Costs	63.8	87.9	263.6							
Cumulative Federal	63.8	145.2	359.2							
Cumulative Nonfederal	0.0	6.5	56.2							
Cumulative Incurred Costs	63.8	151.7	415.4							
Variance										
Federal Share	192.7	257.4	124.9							
Nonfederal Share	82.8	76.3	33.1							
Total Variance	275.5	333.7	158.0							
Cumulative Federal	192.7	450.1	574.9							
Cumulative Nonfederal	82.8	159.1	192.2							
Cumulative Variance	275.5	609.2	767.1							

[illegible]

APPENDIX A

REGULATORY ROUNDUP WebEx SLIDES



Energy & Environmental Research Center (EERC)

PCOR Partnership Initiative

Introductory Regulatory Roundup
Webinar

June 9, 2020

Kevin Connors
Principal Policy and Regulatory Strategist

INTRODUCTORY REGULATORY ROUNDUP

AGENDA

- Welcome and EERC Introductions
- Purpose
- PCOR Partnership Initiative
- Regulatory Roundup
- Regional Policy and Regulatory Activity Map
- Brief Update from Participants
- Next Steps



Institute of Northern Engineering
University of Alaska Fairbanks



Purpose: *The Introductory Regulatory Roundup Webinar is intended to engage regulators in the PCOR Partnership region, introduce the PCOR Initiative, and determine interest level for participation in future Regulatory Roundup meetings. The PCOR region has expanded under the new initiative and personnel have changed from the historic PCOR region. For the EERC, this is an opportunity for us to learn from the participants and identify challenges facing CCUS deployment.*

OUR VISION

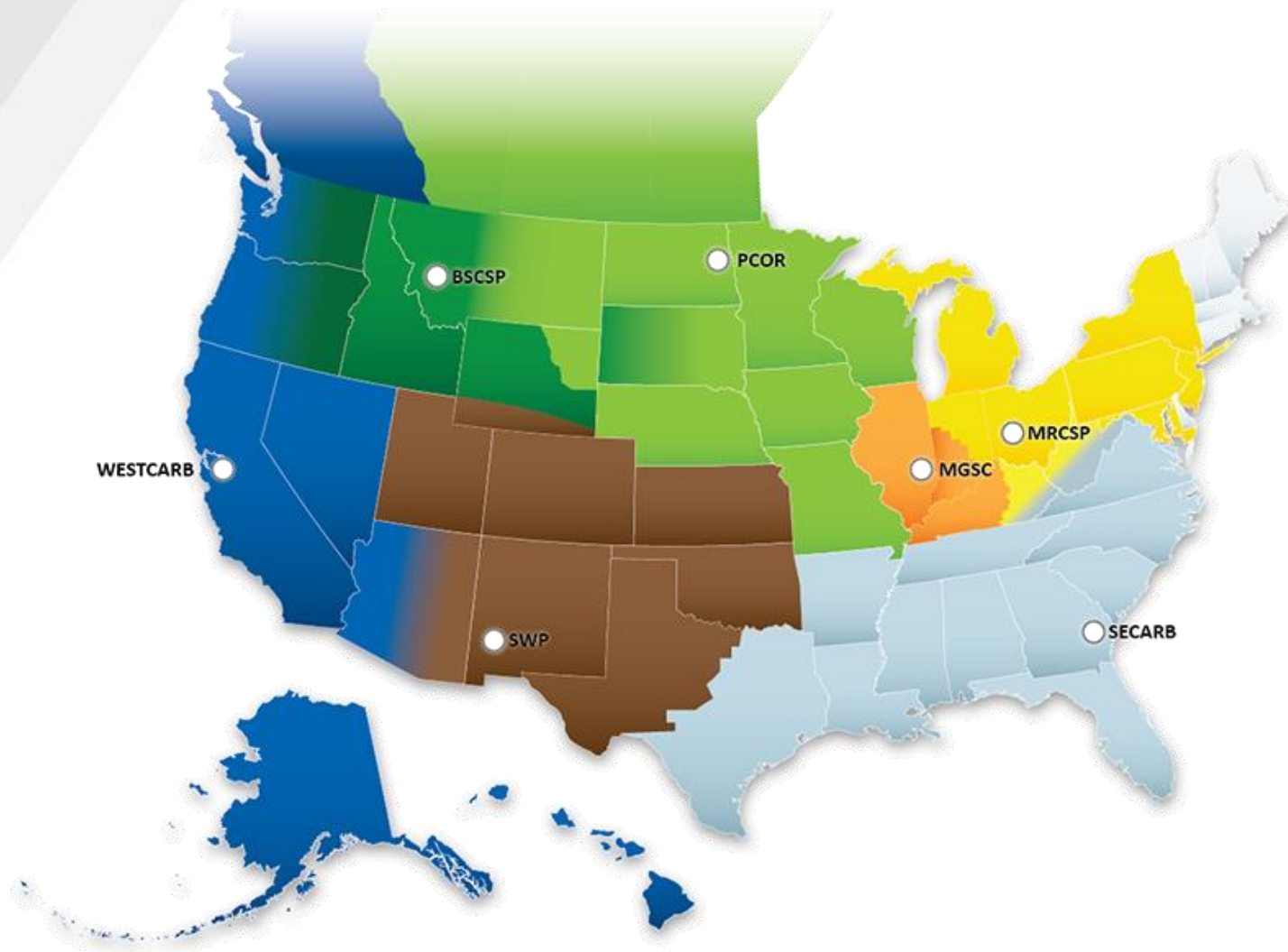
TO LEAD THE WORLD IN **DEVELOPING
SOLUTIONS** TO ENERGY AND
ENVIRONMENTAL CHALLENGES.



CARBON CAPTURE, UTILIZATION, AND STORAGE (CCUS)



REGIONAL CARBON SEQUESTRATION PARTNERSHIP (RCSP) PROGRAM



Characterization Phase

- Characterized regional CO₂ sources and potential storage locations within the U.S.
- Evaluated business cases based on the entire CCUS value chain
- Conducted outreach efforts to raise support for carbon storage within industry and the general public



Validation Phase

- 19 small-scale field projects in various carbon sinks such as: saline aquifers, terrestrial, basalt formations, and coal seams
- Cumulatively injected over 1 MMT of CO₂
- Validated each region's most promising storage opportunities



Development Phase

- 7 large-scale field laboratories located in saline formations and oil and gas fields
- Cumulatively injected over 11.1 MMT of CO₂
- Optimized Monitoring, Verification, and Accounting program (MVA) design and operational parameters



RCSP PROGRAM: NEW INITIATIVE



RCSP Initiative Goal:
Identify and address regional storage and transport challenges facing commercial CCUS deployment.



PLAINS CO₂ REDUCTION (PCOR) PARTNERSHIP

2003–2005 – PCOR Partnership:
Characterization

2005–2008 – PCOR Partnership:
Field Validation

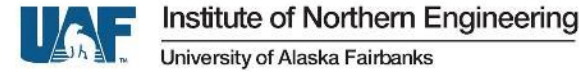
2007–2019 – PCOR Partnership:
Commercial Demonstration

2019–2024 – PCOR Partnership Initiative:
(extended to include AK, all of WY, MT, and BC)
Commercial Deployment



PCOR Initiative
PCOR Partnership





VALUABLE RESULTS



VALUABLE RESULTS MULTIPLIED



NORTH DAKOTA
CarbonSAFE



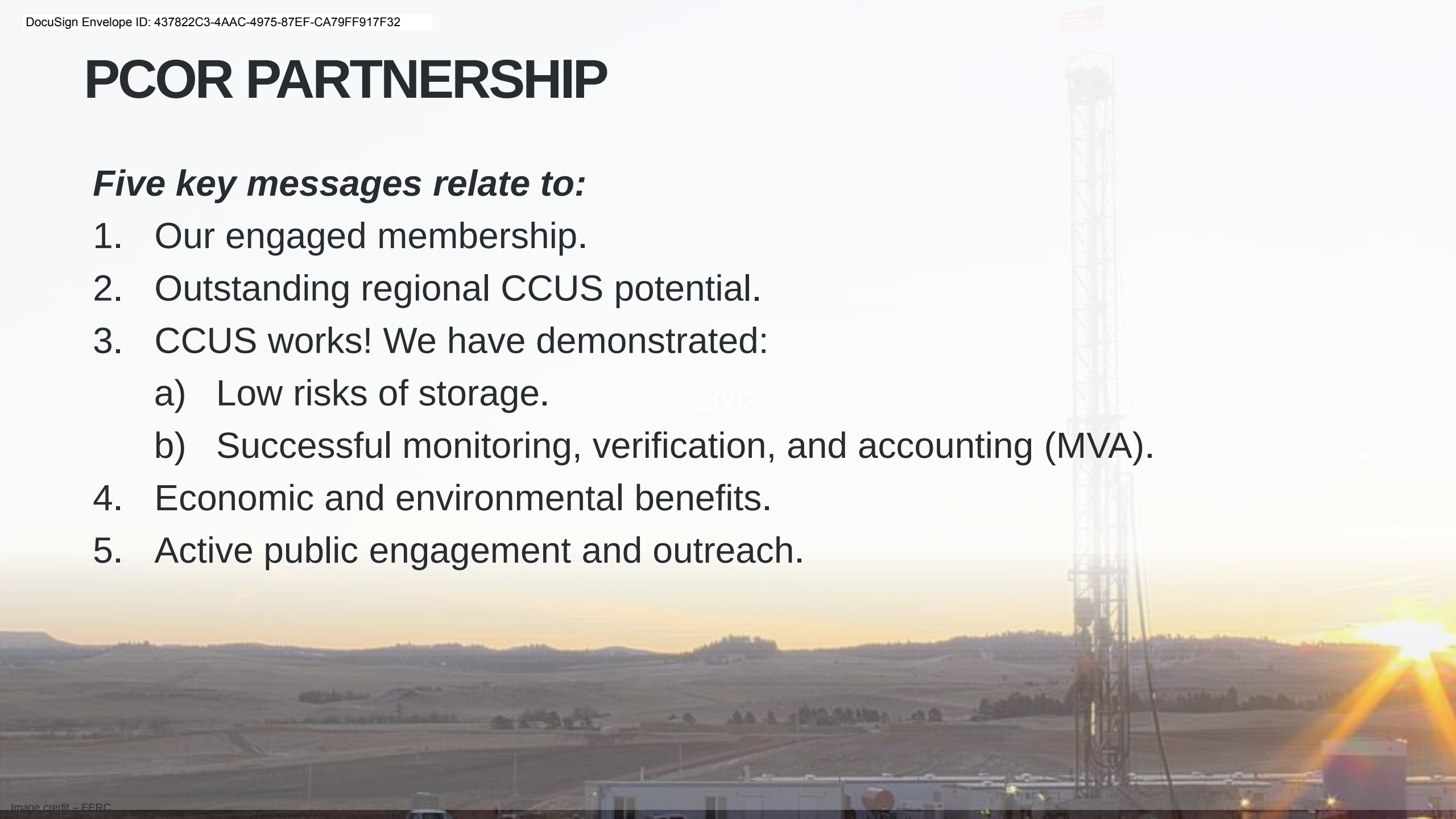
Critical Challenges. Practical Solutions.

PCOR PARTNERSHIP

Five key messages relate to:

1. Our engaged membership.
2. Outstanding regional CCUS potential.
3. CCUS works! We have demonstrated:
 - a) Low risks of storage.
 - b) Successful monitoring, verification, and accounting (MVA).
4. Economic and environmental benefits.
5. Active public engagement and outreach.

2003



PCOR PARTNERSHIP INITIATIVE 2019–2024

Goal:

Identify and address regional storage and transport challenges facing commercial CCUS deployment.

Vision:

Provide the premier regional forum to promote CCUS infrastructure and accelerate CCUS deployment.



Critical Challenges. Practical Solutions.

REGULATORY ROUNDUP

What Is the Regulatory Roundup?

In order to facilitate the exchange of information, ideas, and experiences among regulatory officials, the PCOR Partnership hosts Regulatory Roundup Meetings. The meetings inform regional regulatory officials about the current status and evolving nature of regulations that affect CO₂ capture, compression, transport, injection for CO₂ storage, or CO₂ enhanced oil recovery (EOR). These meetings allow for improved coordination of regulatory strategies and will ultimately enhance opportunities for CO₂ storage and CO₂ EOR in the region.



Regulatory Activities in the Region

A number of states have put laws and regulations for CCS onto the books, including Wyoming, North Dakota, Texas, and Louisiana, to name a few. However, with the publication by EPA of a final rule covering injection wells for geologic storage of CO₂, and the pending publication by EPA of final guidance documents supplementing the EPA final rule, states now have to rewrite their legislation and rules to conform to EPA's rule.

British Columbia is reviewing regulatory framework for CCS. Additional legislation may be considered for clarification purposes.

Alberta has developed regulations for storage, pore space ownership, and long-term stewardship.

Saskatchewan has adapted existing oil and gas regulations for CO₂ storage.

North Dakota has legislation in place that addresses pore space ownership and access, and long-term stewardship. Class VI Primacy was granted in April 2018.

Montana has legislation in place for pore space issues and long-term stewardship. Rule development will begin once primacy for underground injection of CO₂ for storage purposes is received from EPA.

WDEQ filed application for UIC Class VI primacy and EPA has published notice to approve the application. The public comment period is complete with no comments in opposition of the approval.

Numerous states and provinces in the region have commissioned studies to investigate the potential for CCS in their respective jurisdictions. Additionally, many states and provinces are involved in regional initiatives that are contemplating various solutions, including CCS, as a means to manage CO₂ emissions.

No legislation in place or rules adopted or under development.

Past Regulatory Roundup Meetings

- July 22–23, 2015, Deadwood, South Dakota
- June 24–25, 2014, Deadwood, South Dakota
- July 30–31, 2013, Deadwood, South Dakota
- July 31, 2012, Deadwood, South Dakota
- October 17, 2011, Buffalo, New York
- June 29–30, 2011, Bismarck, North Dakota
- November 16, 2010, Tucson, Arizona
- July 21–22, 2010, Deadwood, South Dakota
- June 16–17, 2009, Deadwood, South Dakota

Current Regulations

Mandatory Greenhouse Gas Reporting Rule (MRR)

EPA requires geologic storage projects to comply with the MRR. Subpart RR of the MRR refers to the injection of CO₂ for geologic storage. It covers any well or group of wells that injects CO₂ for long-term geologic storage and all wells permitted as Class VI wells. Such facilities are required to report the following:

- Source(s) of CO₂
- Mass of CO₂ received
- Mass of CO₂ produced (i.e., mixed with produced oil, gas, or other fluids)
- Mass of CO₂ emitted from surface leakage
- Mass of CO₂ equipment leaks and vented CO₂ emissions
- Mass of CO₂ stored in subsurface geologic formations

REGULATORY ROUNDUP

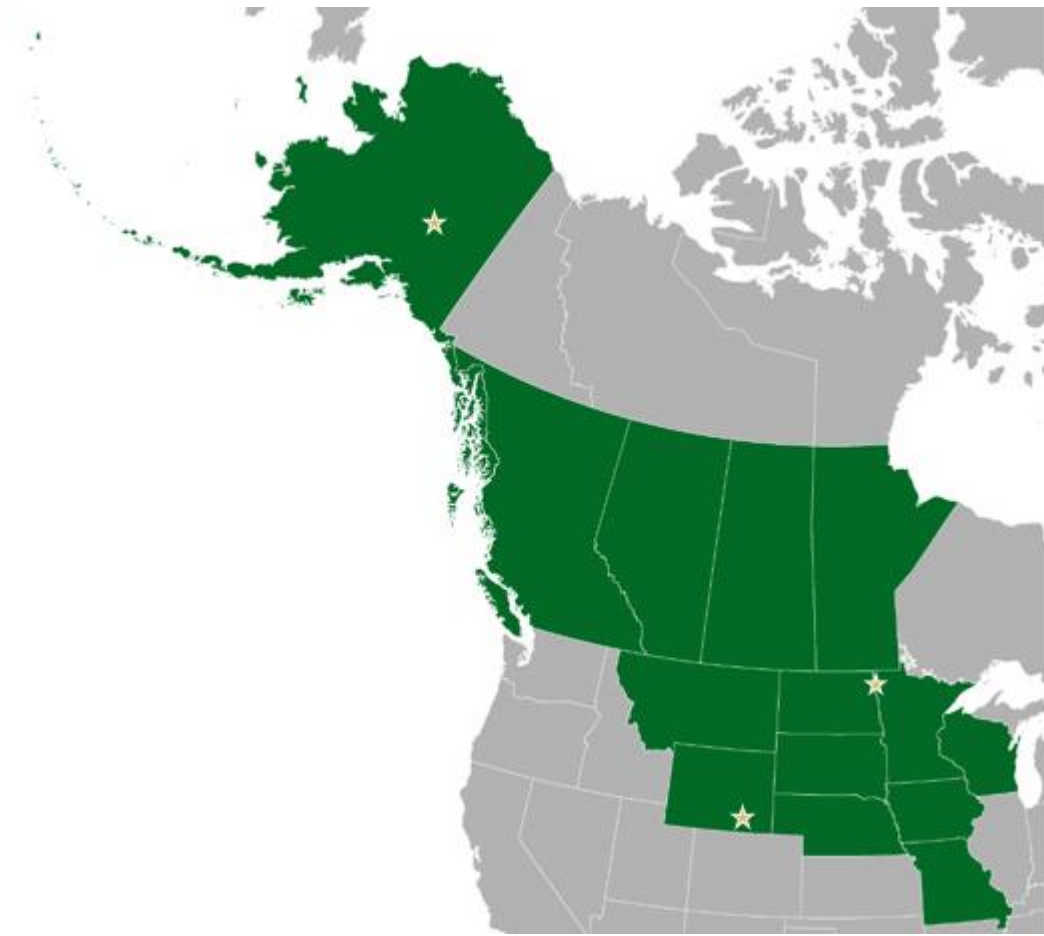
Regulatory Efforts under the PCOR Initiative:

- Engage regulators in the region through a series of regulatory roundup meetings.
- Advance and accelerate the development of regulatory frameworks
 - Permitting requirements and timelines
- Address major regulatory topics
 - Pore space
 - Defining AOR (area of review)
 - Management postinjection site care
- Knowledge transfer between regulatory officials with active CCUS projects and Class VI primacy in place or pending and those with less CCUS development and/or no CCUS-specific regulations in place.
 - Share learnings from the process of seeking Class VI primacy and implementing Class VI regulations at the state level
- The project team will facilitate regional permitting guidance covering Canadian provinces and U.S. states with Class VI primacy as well as states where the federal EPA retains primacy.



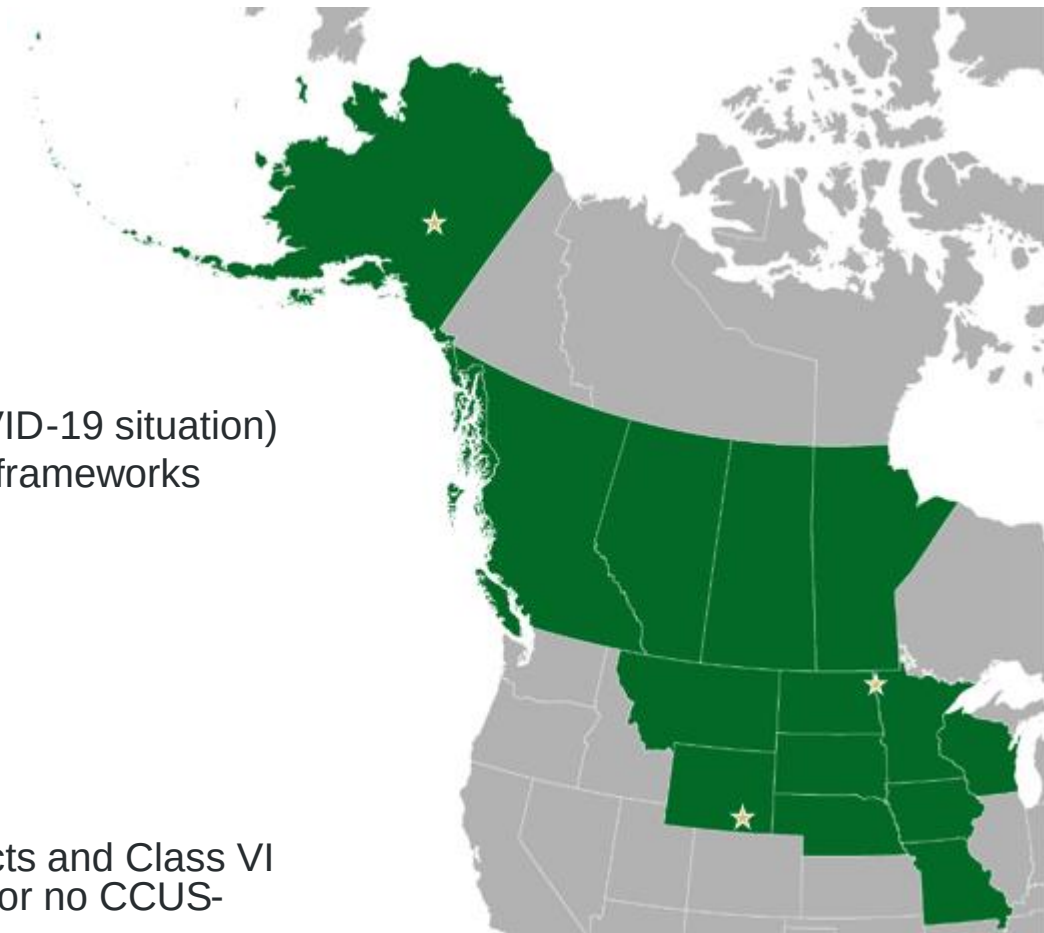
REGIONAL PERSPECTIVE

- Questions
- Participant Update
 - Policy and Regulatory Activities
 - Carbon Capture, Use, and Storage Project Activities



NEXT STEPS

- Continue to communicate with regulators in the region
- Update PCOR region Policy and Regulatory Activity Map
- Schedule regulatory roundup meeting (dependent on and monitoring the COVID-19 situation)
- Work with states and Canadian provinces on documenting current regulatory frameworks
 - Identify permitting timelines
 - Identify policy and regulatory challenges
- Address major regulatory topics
 - Pore space
 - Practical approaches for defining AOR (area of review)
 - Management of future liabilities.
- Facilitate a dialogue regarding the status of CCUS projects
 - Emphasis on knowledge transfer between states with active CCUS projects and Class VI primacy in place or pending and those with less CCUS development and/or no CCUS-specific regulations in place.
 - As an example, both North Dakota, the only state with primacy for Class VI wells, and Wyoming, which has a Class VI primacy application pending, can provide valuable insights to other states by sharing their learnings from the process of seeking Class VI primacy and implementing Class VI regulations at the state level.
- The project team will facilitate regional permitting guidance covering Canadian provinces and U.S. states with Class VI primacy as well as states where the federal EPA retains primacy.





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A wide-angle photograph of a university campus. In the foreground, there are large trees with yellow autumn leaves. In the background, there are several large, multi-story brick buildings, likely university halls or administrative buildings. The sky is clear and blue.

THANK YOU

Critical Challenges. Practical Solutions.



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