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UNIVERSITY OF
NORTH DAKOTA



Critical Challenges. Practical Solutions.



Energy & Environmental Research Center (EERC)

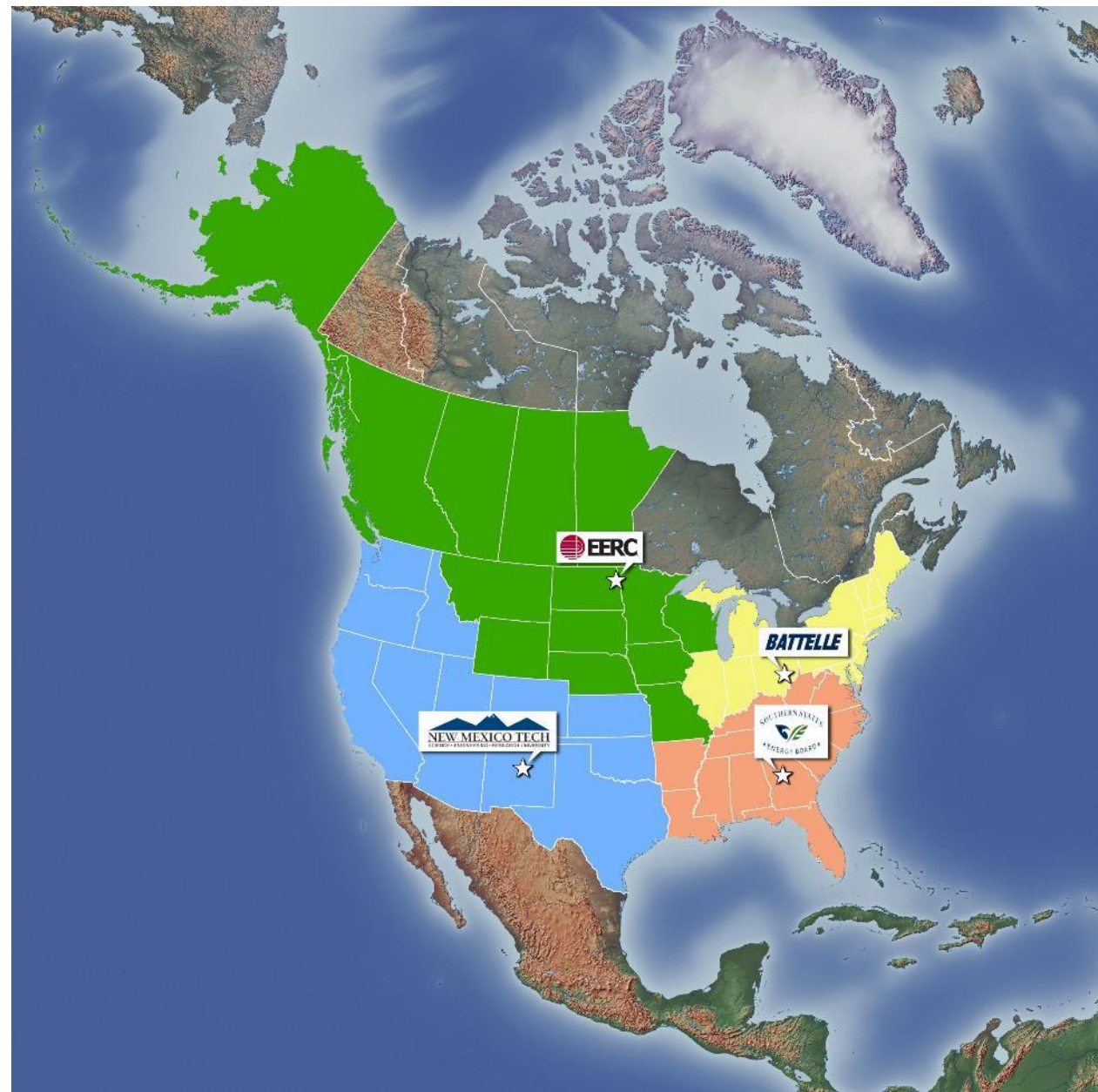
**Plains CO₂ Reduction Partnership Initiative to Accelerate Carbon Capture,
Utilization, and Storage Deployment (FE0031838)**

U.S. Department of Energy
National Energy Technology Laboratory
Carbon Management Project Review Meeting
August 15–19, 2022

Kevin C. Connors
PCOR Partnership Project Manager

REGIONAL CARBON SEQUESTRATION PARTNERSHIP PROGRAM

- Wisconsin, Iowa: Coordinating with Battelle.
- Montana: Coordinating with New Mexico Institute of Technology.
- Missouri: Coordinating with Battelle and the Southern States Energy Board.



PCOR Partnership

- 2003–2005: **Phase I** – Characterization
- 2005–2009: **Phase II** – Field Validation
- 2007–2018: **Phase III** – Demonstration
- 2019–2024: **Initiative** – Deployment

(PCOR region expanded to include AK + all of BC, WY, and MT)

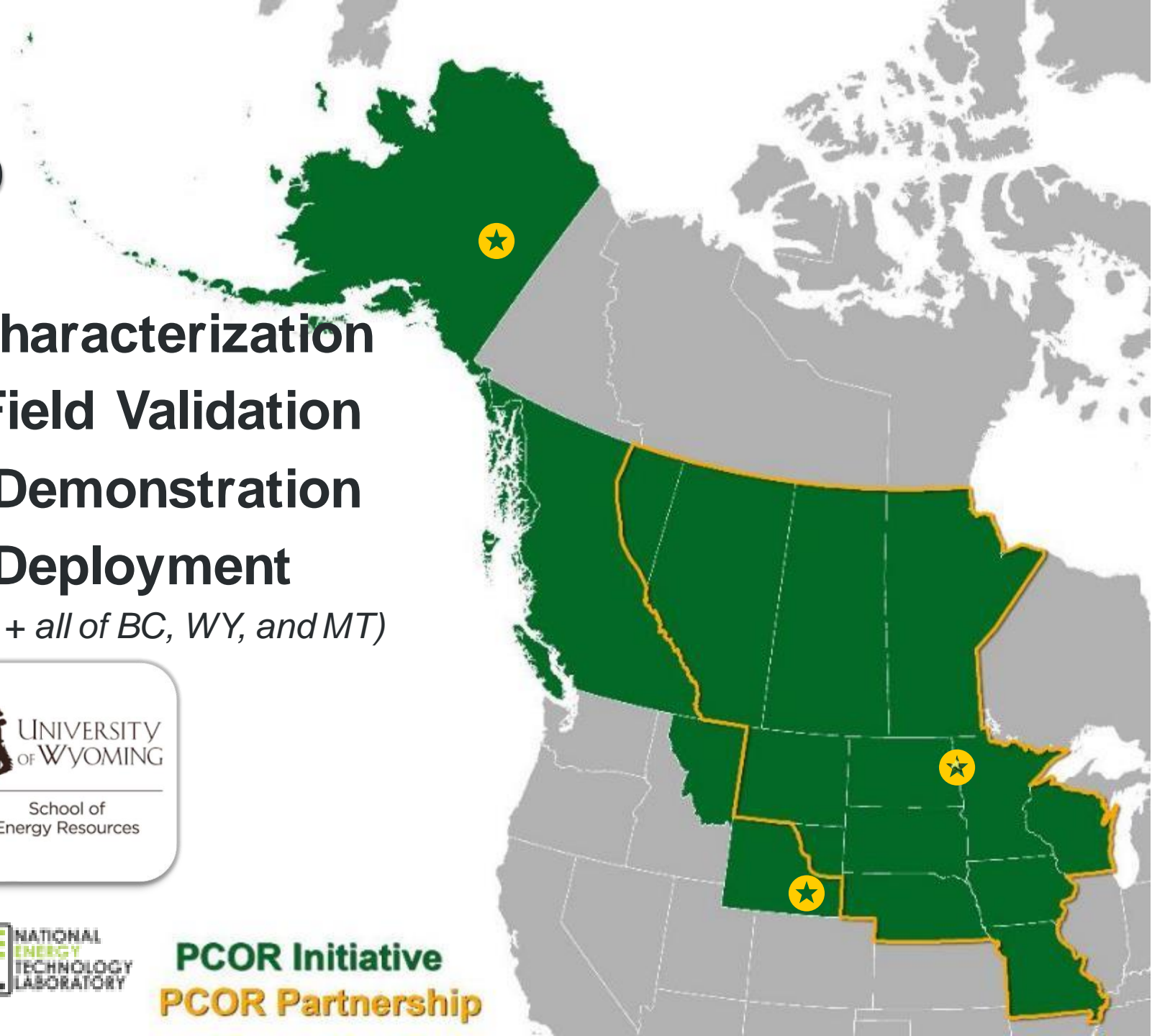
 Institute of Northern Engineering
University of Alaska Fairbanks



School of
Energy Resources



PCOR Initiative
PCOR Partnership



PCOR PARTNERSHIP

The PCOR Partnership Initiative is addressing regional capture, transport, use, and storage challenges facing commercial CCUS deployment. The Initiative is focusing on:

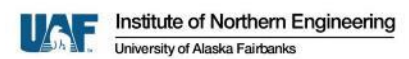
- Strengthening the technical foundation for geologic CO₂ storage and enhanced oil recovery (EOR).
- Advancing capture technology.
- Improving application of monitoring technologies.
- Promoting integration between capture, transportation, use, and storage industries.
- Facilitating regulatory frameworks.
- Providing scientific support to policy makers.

Our Partners inform our priorities





PARTNERSHIP MEMBERS



New Partners – PCOR Partnership Initiative



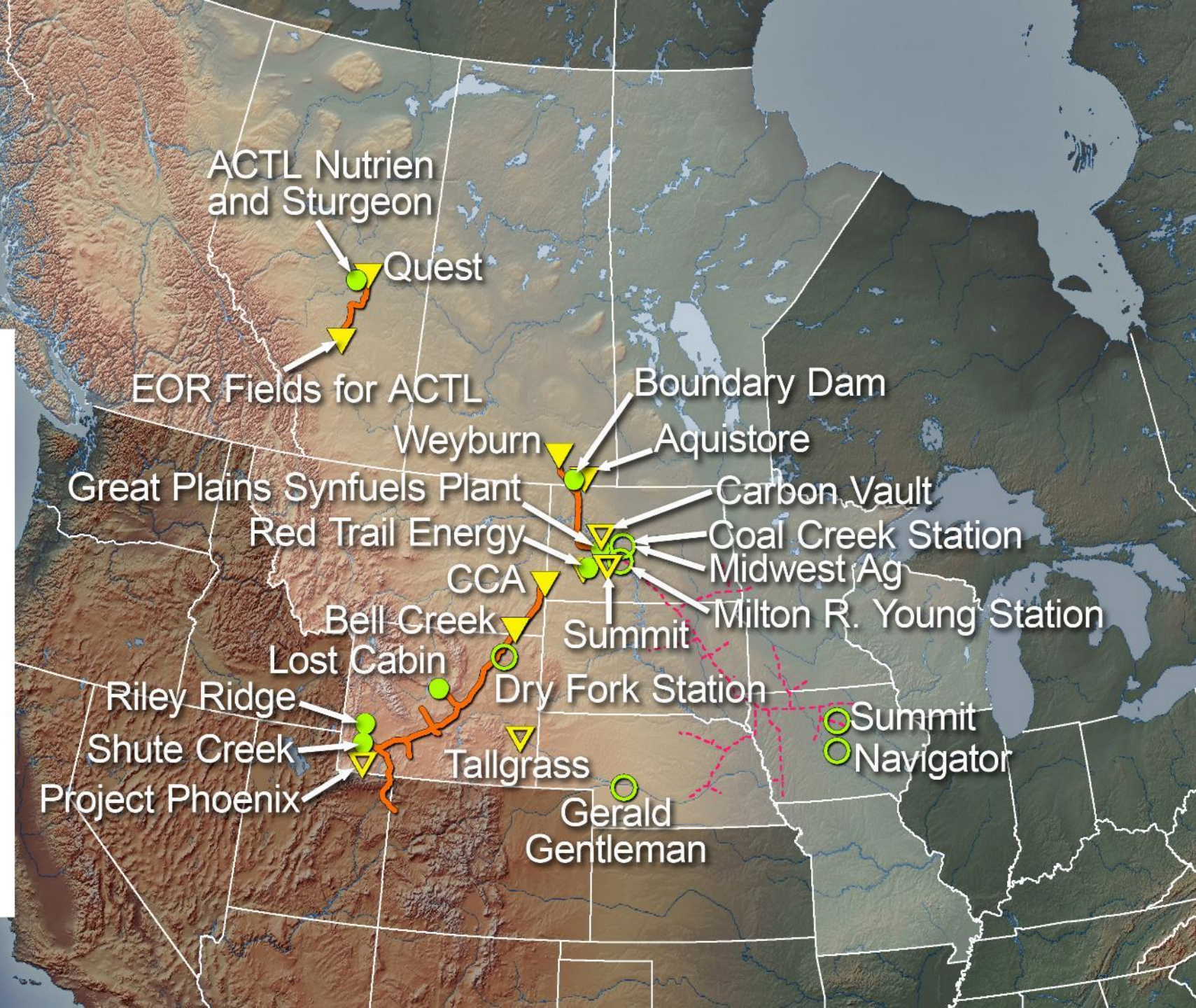
2021 AND 2022 HIGHLIGHTS

- PCOR Partnership annual meetings held in Jackson, WY (106 participants) and Anchorage, AK (129 participants)
- Over 230 members; 55 new since 2019
- 2021 Regulatory Roundup held in Deadwood, SD; 2022 scheduled for September 2022 (expecting record attendance)
- TAB meetings held in Jackson, WY (2021), Houston, TX (2022), and Anchorage, AK (2022)
- Field effort initiated at the Red Trail Energy (RTE) CCS site
- Collaboration with UAF and UW
- New PCOR Partnership public and partner websites
- Several products (deliverables and white papers) published
- Numerous white papers in development



Active and Developing CCUS Projects in the PCOR Partnership Region

- Active Capture
- ▼ Active Injection
- Developing Capture
- ▼ Developing Injection
- CO₂ Pipeline
- - - Proposed CO₂ Pipeline



CO₂ Pressure Plume and Saturation Plume Monitoring



U.S. DEPARTMENT OF
ENERGY



EERC



RTE




- Research Institute of Innovative Technology for the Earth (RITE)
- Red Trail Energy (RTE)
- Energy & Environmental Research Center (EERC)
- Plains CO₂ Reduction (PCOR) Partnership
- U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL)

The Challenge: Monitoring requirements for geologic CO₂ storage projects are substantial.

The Objective: Develop the next generation of cost-efficient long-term monitoring tools and validate them against established methods for monitoring carbon capture and storage (CCS). Develop an approach for more frequent data acquisition and processing while maintaining a reduced surface impact.

Desired result: New monitoring tools that are qualified with CCS regulatory and incentive programs and are available for use by CCS projects that can incorporate them into their monitoring strategies.


PCOR Products



Plains CO₂ Reduction (PCOR) Partnership
Energy & Environmental Research Center (EERC)

TECHNICAL APPROACHES TO STACKED STORAGE

Plains CO₂ Reduction (PCOR) Partnership
Task 2 – Deliverable D2



Plains CO₂ Reduction (PCOR) Partnership
Energy & Environmental Research Center (EERC)

STRATEGIES FOR STORAGE PERMANENCE: WELL INTEGRITY AND LEGACY WELL EVALUATIONS


Plains CO₂ Reduction (PCOR) Partnership Initiative
Task 2 – Deliverable 5



Plains CO₂ Reduction (PCOR) Partnership
Energy & Environmental Research Center (EERC)

MATCHING CAPTURE TECHNOLOGIES WITH POINT SOURCES IN THE PCOR PARTNERSHIP REGION

White Paper



Plains CO₂ Reduction (PCOR) Partnership
Energy & Environmental Research Center (EERC)

CARBON DIOXIDE STORAGE OPTIMIZATION

Plains CO₂ Reduction (PCOR) Partnership
Task 2 – Deliverable D2



CHARACTERIZATION AND MONITORING TECHNOLOGIES FOR GEOLOGIC CARBON STORAGE


Plains CO₂ Reduction (PCOR) Partnership
White Paper

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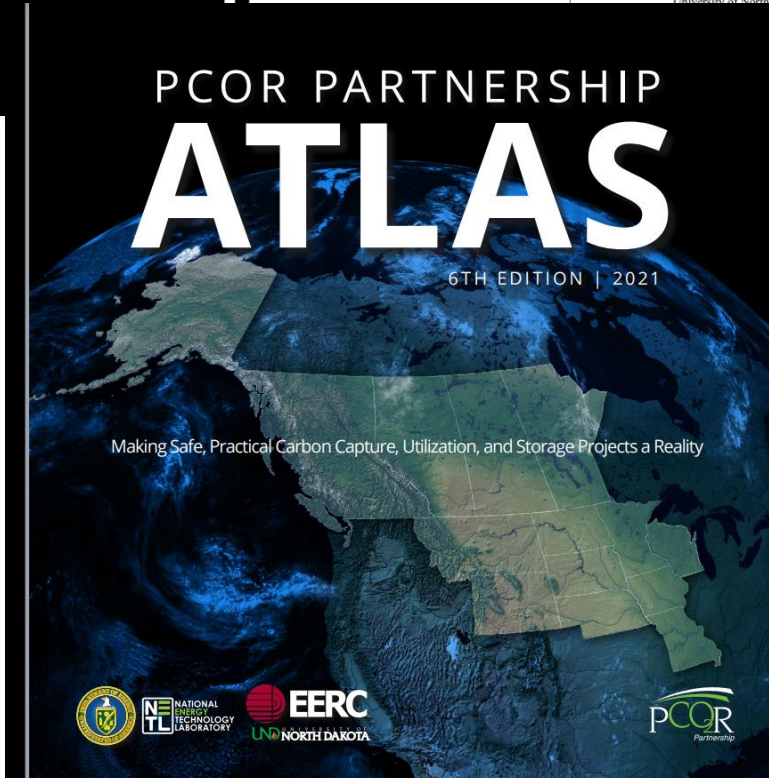
Plains CO₂ Reduction (PCOR) Partnership
Energy & Environmental Research Center (EERC)

CCUS BUSINESS MODELS IN THE PCOR PARTNERSHIP REGION

Plains CO₂ Reduction (PCOR) Partnership Initiative
Task 5 – Deliverable 4

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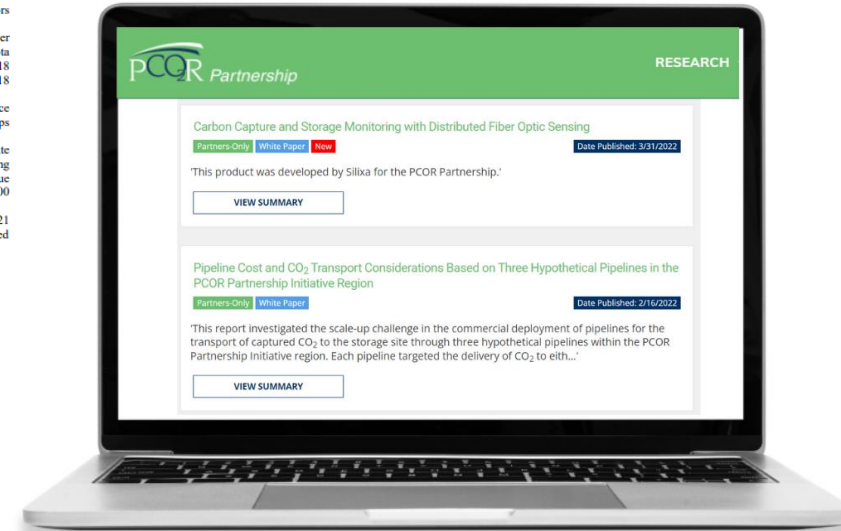

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PCOR PARTNERSHIP ATLAS

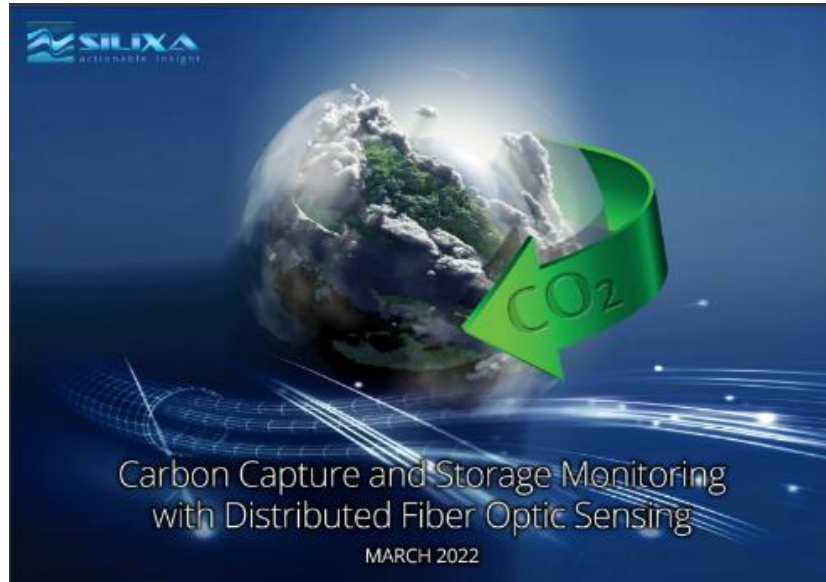
6TH EDITION | 2021

Making Safe, Practical Carbon Capture, Utilization, and Storage Projects a Reality



Available online to all partners at undeerc.org/PCORPartners

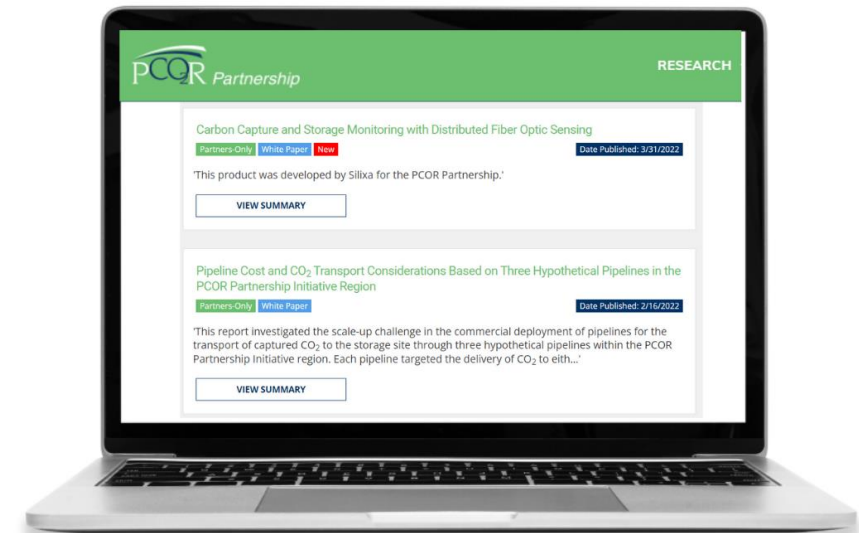
Expanded Partnership Expertise



- Monitoring advancements



- Infrastructure considerations



Available online to all partners at underc.org/PCORPartners



GREENHOUSE GASES

SCIENCE AND TECHNOLOGY



GREENHOUSE GASES SCIENCE AND TECHNOLOGY



Original Research Article

Risk-based area of review estimation in overpressured reservoirs to support injection well storage facility permit requirements for CO₂ storage projects

Matthew E. Burton-Kelly ✉, Nicholas A. Azzolina, Kevin C. Connors, Wesley D. Peck, David V. Nakles, Tao Jiang

First published: 18 June 2021 | <https://doi.org/10.1002/ghg.2098>

PERMITS



A Touchstone Energy® Cooperative

POLICY AND REGULATORY DEVELOPMENTS

- Pore space Law
- Long-term liability
- Class VI primacy
- Regulatory program implementation
- Pathways to permit approval
- Policy/Regulatory Barriers



Regulatory Roundup Meeting August 17–18, 2021



PRODUCTS COMING SOON

- Class VI wellbore construction and design using corrosion resistant alloys
- Class VI injection well pressure transient analysis
- Pore space leasing considerations
- Pressure interference
- Approaches to predicting plume stabilization
- CCUS and grid stability
- CO₂ purity specifications and compatibility with pipeline materials
- Repurposing existing carbon steel pipelines
- CCS Hydrogen Roadmap: Optimal integration of CCS and hydrogen
- Lessons learned from coring, wireline logging, and seismic surveys



Critical Challenges. Practical Solutions.

PCOR PARTNERSHIP

- Building on over 19 years of applied research in CCUS.
- Active region developing commercial CCUS projects.
- Engaged and motivated partners.
- Engaged regulators.
- PCOR is a catalyst for CCUS projects in the region.
- Focused on infrastructure development strategies.
- Ethanol industry in the region accelerating CCUS.
- Expanding CO₂ EOR opportunities in the region.



WHAT'S NEXT?

- Enabling Sustainable Monitoring for CCUS
- Storage optimization and active reservoir management
- Pressure interference study
- Injectivity interference study
- ML-based classifications of aquifer salinity
- Pore space resource competition
- Storage hubs and blue hydrogen
- CO₂-EOR Business Case and Messaging
- Develop strategies to address broad carbon management goals of states/provinces/regions
- Public and industry outreach





PCCOR

Partnership



PCCO₂R

Partnership



Celebrating

20 years of
Partnership



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A wide-angle photograph of a university campus at sunset. The sun is low on the horizon, creating a warm glow. In the foreground, there are trees with yellowing leaves. In the background, there are several large, multi-story brick buildings and a parking lot with many cars.

THANK YOU

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NORTH DAKOTA



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ACKNOWLEDGMENT

This material is based upon work supported by the U.S. Department of Energy National Energy Technology Laboratory under Award No. DE-FE0031838.

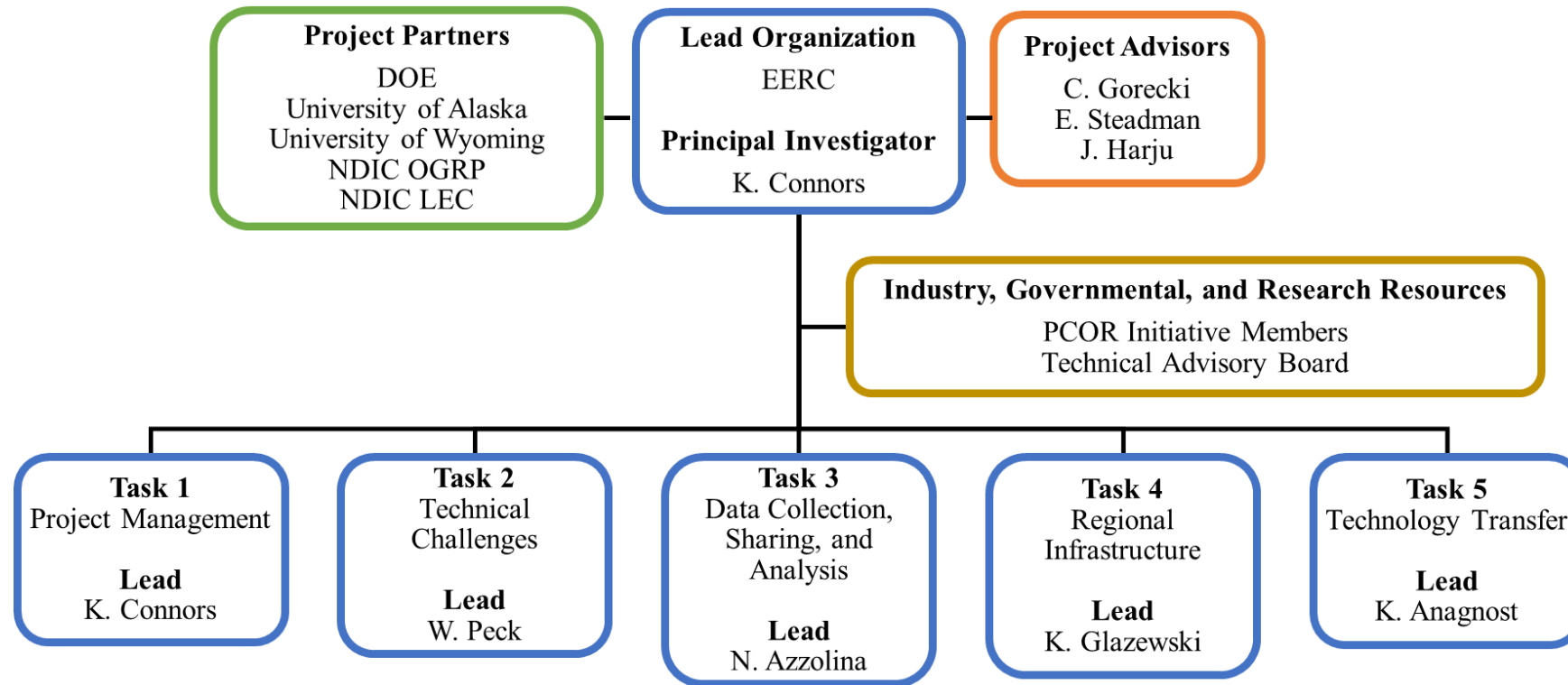
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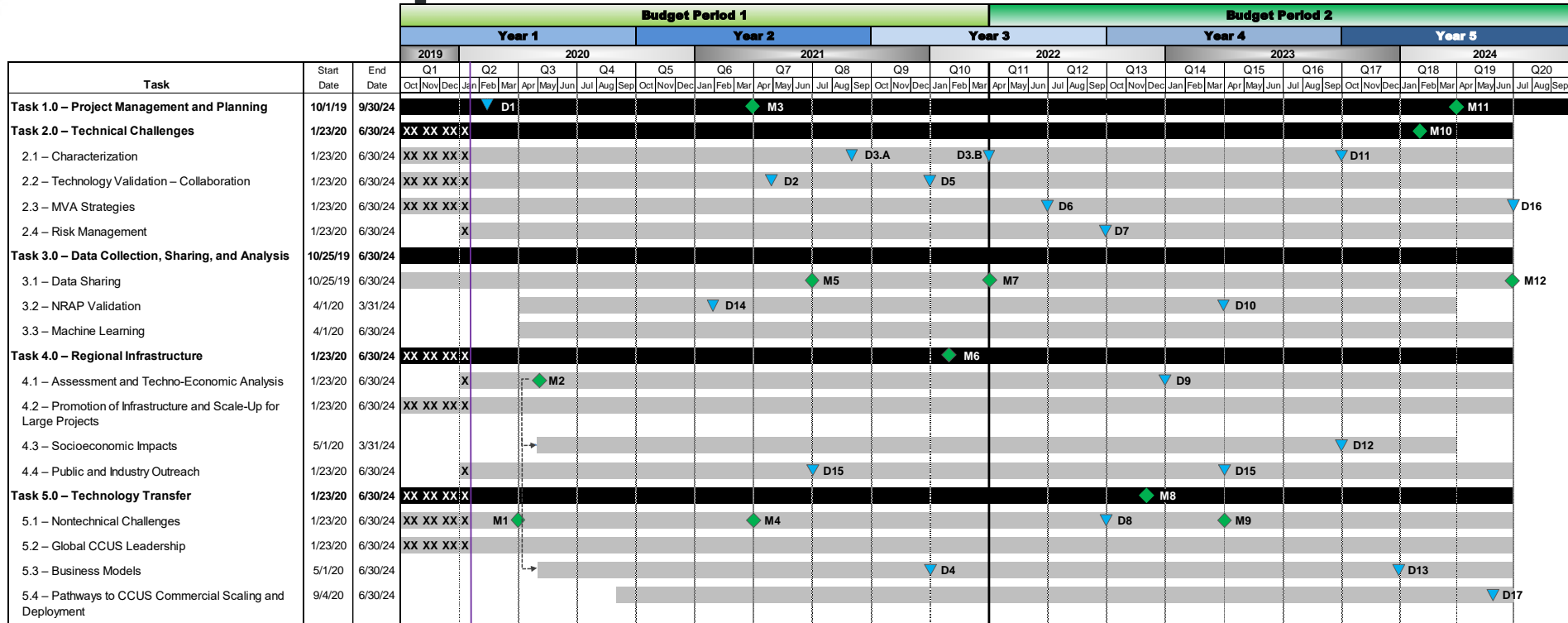
Funding and Project Performance Dates

	BP1 10/1/2019–3/31/2022		BP2 4/1/2022–9/30/2024		Total	
	Federal	Nonfederal	Federal	Nonfederal	Federal	Nonfederal
DOE	\$7,592,000	\$–	\$7,408,000	\$–	\$15,000,000	\$–
NDIC	\$–	\$1,630,424	\$–	\$1,369,576	\$–	\$3,000,000
UW	\$–	\$135,284	\$–	\$242,140	\$–	\$377,424
UAF	\$–	\$133,648	\$–	\$241,802	\$–	\$375,450
Total	\$7,592,000	\$1,899,356	\$7,408,000	\$1,853,518	\$15,000,000	\$3,752,874
Total Cost Share	80%	20%	80%	20%	80%	20%

PCOR Partnership Organization Chart



PCOR Partnership Gantt Chart



Summary Task

Activity Bar

Milestone (M)

Deliverable (D)

Critical Path

Definitization 1/23/2020 |

No Activity Prior to Definitization

No Activity Prior to Definitization

Milestones (M)

- M1 – Regulatory Roundup Scheduled (3/31/20)
- M2 – Initial Techno-Economic Framework Established (4/30/20)
- M3 – Annual Meeting Scheduled (3/31/21)
- M4 – Regulatory Roundup Scheduled (3/31/21)
- M5 – Data Shared with National Lab for NRAP Assessment (6/30/21)
- M6 – GHGT-16 Abstract Submitted (1/31/22)
- M7 – BP1 EDX Submitted (3/31/22)
- M8 – Draft Journal Article Completed (11/30/22)
- M9 – Regulatory Roundup Scheduled (3/31/23)
- M10 – GHGT-17 Abstract Submitted (1/31/24)
- M11 – Annual Meeting Scheduled (3/31/24)
- M12 – BP2 EDX Submitted (6/30/24)

Deliverables (D)

- D1 – Project Management Plan (2/21/20)
- D2 – Topical Report – Storage Optimization (4/30/21)
- D3.A – Topical Report – Stacked Storage Opportunity Assessment (8/31/21)
- D3.B – Topical Report – Stacked Storage Scenario Geomechanical Modeling (3/31/22)
- D4 – Topical Report – Regional Business Model Assessment (12/31/21)
- D5 – Topical Report – Subsurface and Legacy Well Integrity (12/31/21)
- D6 – Topical Report – MVA Strategies (6/30/22)
- D7 – Topical Report – Evaluation of Risk Management (9/30/22)
- D8 – Topical Report – Regional Permitting Guidance (9/30/22)
- D9 – Topical Report – Infrastructure, Scale-Up, and Techno-Economic Assessments (12/31/22)
- D10 – Topical Report – NRAP Testing and Validation (3/31/23)
- D11 – Topical Report – Basement Faulting and Stress State, Induced Seismicity (9/30/23)
- D12 – Topical Report – Regional Socioeconomic Assessments (9/30/23)
- D13 – Topical Report – Updated Regional Business Model Assessment (12/31/23)
- D14 – Topical Report – Risk-Based Area of Review (1/31/24)
- D15 – PCOR Partnership Atlas (6/30/21 and 3/31/23)
- D16 – Enabling Sustainable Monitoring for CCUS (6/30/2024)
- D17 – PCOR Partnership Initiative Road Map (5/31/2024)



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