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Energy & Environmental Research Center (EERC)

PERSPECTIVES FROM RECENTLY PERMITTED ONSHORE CCS PROJECTS

U.S. Department of Energy Carbon Management Project Review Meeting

> Pittsburgh, Pennsylvania Wednesday, August 17, 2022

John Hamling Assistant Vice President for Strategic Partnerships

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FIRST WAVE OF INCENTIVE-**DRIVEN CCS PROJECTS IN NORTH DAKOTA**



GREAT PLAINS CO. SEQUESTRATION PROJECT

FACILITY | Lignite coal gasification plant capable of gasifying 6 MMtpa TONNAGE 1.0 to 2.7 MMtpa of CO.

INJECTOR DESIGN | Up to six injection wells into a single storage reservoir

REGULATORY STATUS NDIC| March 2022: Class VI permit submitted

OTHER | Within the anticipated CO₂ plume boundary area, 56% of the land surface is reclaimed mining land, creating unique conditions for near-surface and geophysical oring techniques



RED TRAIL ENERGY

FACILITY 64-million-gallon dry mill ethanol production plant

TONNAGE 180,000 tpa of CO,

REGULATORY STATUS

March 2022: Permit to inject approved

SUMMIT CARBON SOLUTIONS

FACILITY 32 ethanol plants and other facilities in five states

TONNAGE 8.0 million tonnes per annum (MMtpa) of CO₂, initial pipeline capacity of 12.0 MMtpa, expansion capabilities to handle up to 20.0 MMtpa

INJECTOR DESIGN | Multiple injection wells into stacked storage reservoi

PROJECT STATUS | Site characterization and design under way to inform Class VI permits and incen OTHER | Largest proposed CCS project to date, one of the first CO, storage hub

COAL CREEK STATION

FACILITY | 1100-MW two-unit minemouth lignite coal-fired powe generation facilities TONNAGE About 9 MMtpa of CO, anticipated

PROJECT STATUS CO₂ capture pre-FEED study completed on on of the 550-MW units, FEED study under way. OTHER Largest coal-fired power plant in North Dakota



MIDWEST AGENERGY

- FACILITY | Blue Flint 70-million-gallon dry mill ethanol production plant TONNAGE About 200,000 tpa of CO.
- INIECTOR DESIGN | One CO, injector into single

PROJECT TUNDRA



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EERC. UN NORTH DAKOTA **()** ENERGY

CO₂ Point Sources

- Ethanol Production
- Coal-Fired Power Generation
- Gasification
- Fertilizer Production
- Natural Gas Processing
- Natural Gas Power Generation
- Industrial Processes

Capture/Storage Models

- Source/Sink-Matched
- Source Aggregation and Storage Hub
- Capture Hub with Distributed Storage
- Hybrid storage with Enhanced Oil Recovery, Minerals Recovery and/or other Utilization



STORAGE FACILITY PROJECT BOUNDARIES North Dakota UIC Class VI

- **CO₂ Plume** Simulated boundary at end of injection.
- **Stabilized Plume** Simulated boundary at postinjection stabilization.
- **Storage Facility Area** Boundary + Buffer [Pore Space Lease and Amalgamation Area]
- Hearing Notification Area ½ mile from the storage facility area boundary (mineral estate and surface estate).
- Area of Review (AOR) Not shown; calculated with simulation.
- Evaluation Area 1 mile from the storage facility area boundary (default minimum AOR).









Storage facility expansion to accommodate additional CO₂

- Expand storage facility area → More capacity
- More wells \rightarrow Storage efficiency \rightarrow More capacity
- Stacked storage \rightarrow More capacity
- Active reservoir management \rightarrow Storage efficiency \rightarrow More capacity

STACKED STORAGE



Conceptual Scenario

Complex geology, lower capacity, and moderate development cost

Simple geology, great capacity, and low development cost

Moderate geology, moderate capacity, and high development cost

Great capacity, simple geology, and high development cost

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ACTIVE RESERVOIR MANAGEMENT

Active Reservoir Management

- Mitigate pressure interference between neighboring CCS projects.
- Improved storage efficiency / increase capacity of a permitted CO₂ storage site.
- Reduce stress on sealing formation.
- Geosteer injected fluids (injection and extraction of brine).
- Divert pressure from potential leakage pathways.
- Improve injectivity, capacity, and storage efficiency.
- Reduce area of review (AOR).
- Accelerated pressure dissipation after injection.

Brine Treatment

- Alternate source of water.
- Reduced disposal volumes.
- Salable products for beneficial use.





Illustration modified from Lawrence Livermore National Laboratory <u>https://str.llnl.gov/Dec10/aines.html</u>

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