



EERC

EERC Technology... Putting Research into Practice

Williston Basin Coal Seam Injection Test Plains CO₂ Reduction (PCOR) Partnership

Regional Carbon Sequestration Partnership Annual Peer Review Meeting

**Pittsburgh, Pennsylvania
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Lignite Field Validation Test Burke County, North Dakota



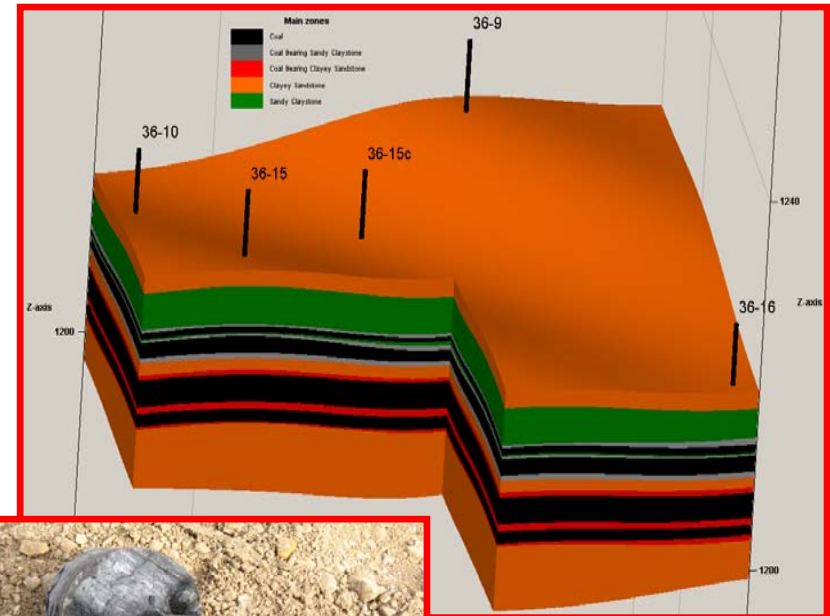
Goal and Objectives

Goal

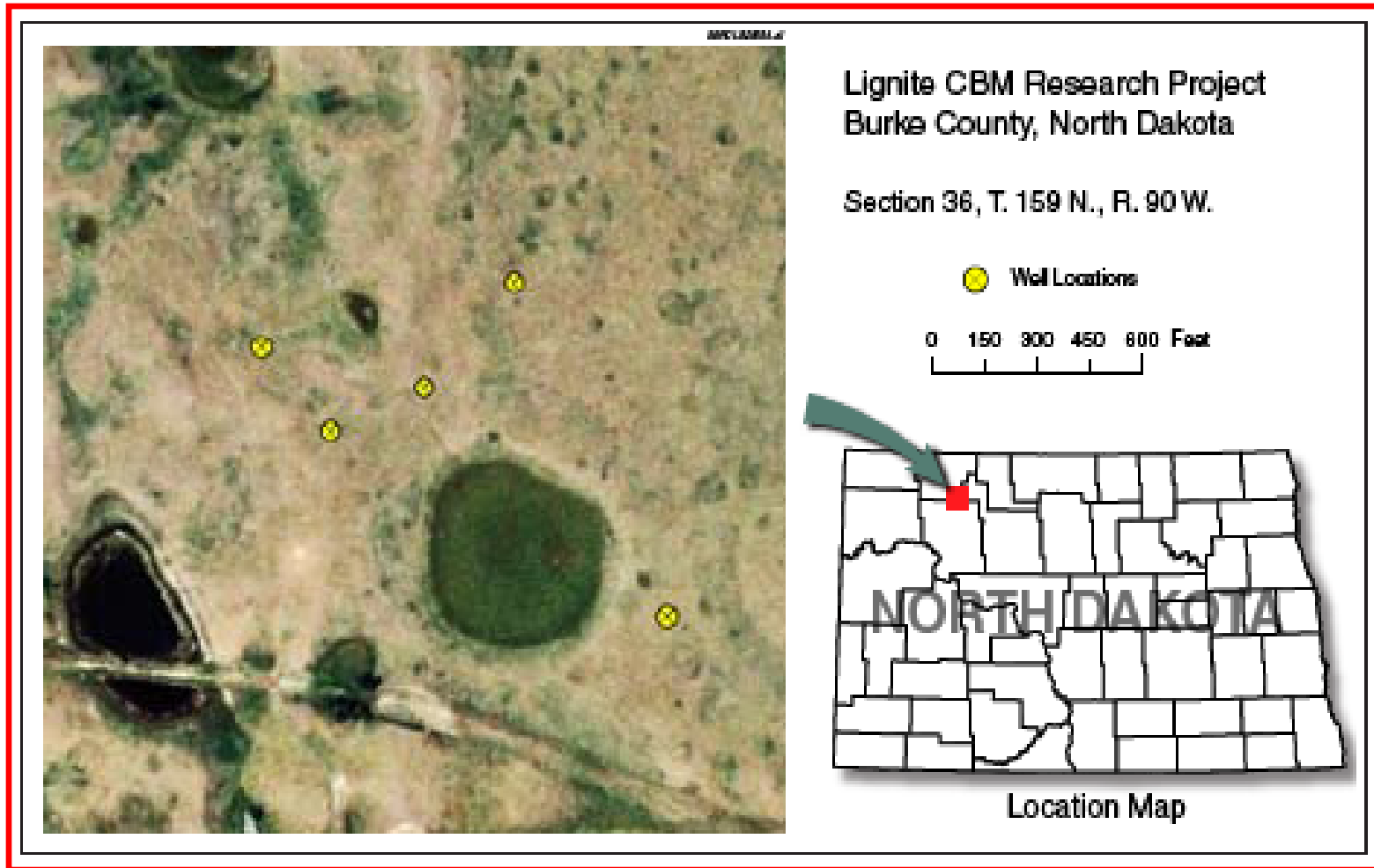
- Determine the feasibility of simultaneous CO₂ sequestration and natural gas production from a lignite coal seam.

Objectives

- Determine the potential for coalbed methane (CBM) production from the lignite seam.
- Inject CO₂ into lignite coal seam and monitor CO₂ fate in the reservoir.
- Determine the potential for production enhancement by CO₂ injection.
- Develop Regional Technology Implementation Plan for CO₂ sequestration in lignite coal.



Site Location



Why Burke County?

- Robust lease activity in Williston Basin
 - Needed a state section of land



Why Lignite?

- Extensive tests have not been conducted on lignite.
 - Glaciated section of the state



Public Involvement

- Two public meetings in Burke County
 - One prior to drilling in the summer of 2007
 - One prior to summer field activities in spring of 2008
- Two lignite test fact sheets



Field-Based Characterization Activities

Conducted during well-drilling operations.

- Geophysical logging suite
- Core and cuttings collection and description



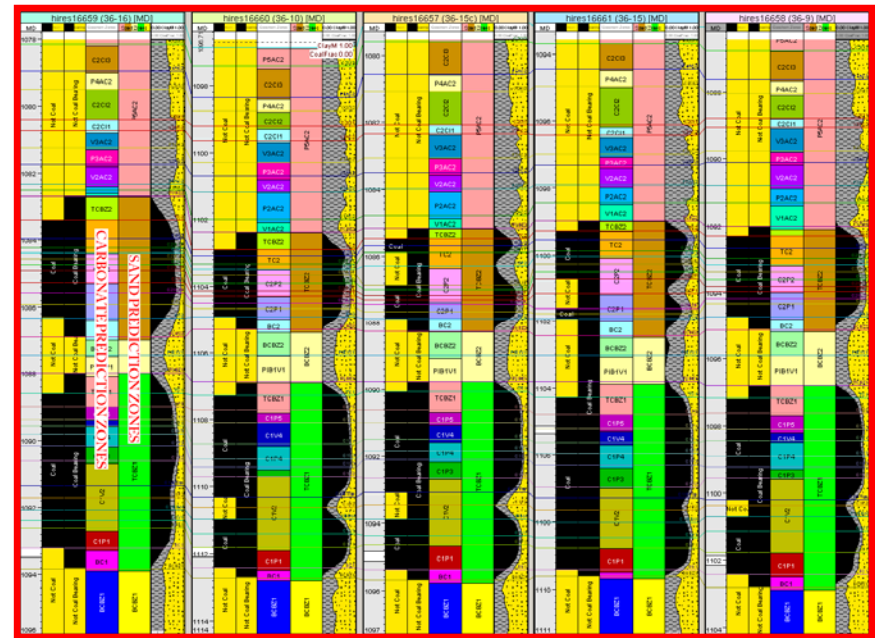
Formation Logging Activities

- Schlumberger Platform Express Log Suite
 - Measurements
 - Porosity
 - Resistivity
 - Natural radiation (sand/shale)
 - Bore hole diameter
- Sonic
 - Used for
 - Pore pressure prediction
 - Determination of density
 - Estimation of rock elastic constants
 - Bulk compressibility estimation



Log Processing and Analysis

- Geophysical logs
 - Schlumberger Platform Express
 - Schlumberger Sonic
 - Developed cleat system may not be present.
 - Stress field likely consistent with maximum principal stress due to overburden.
 - Stress orientation from northeast to southwest.
 - Data used to create model to predict injection rates and performance.
 - Significant damage zone exists around well bore.



Core Evaluation Activities

Lab studies on the recently collected core are being conducted by TerraTek, Inc., the EERC, and NETL.

- Gas content
- Gas specific gravity
- CH₄ and CO₂ isotherms
- Diffusion coefficient
- Gas desorption time
- Coal ash and moisture contents
- Coal density and compressibility
- Rock porosity and permeability



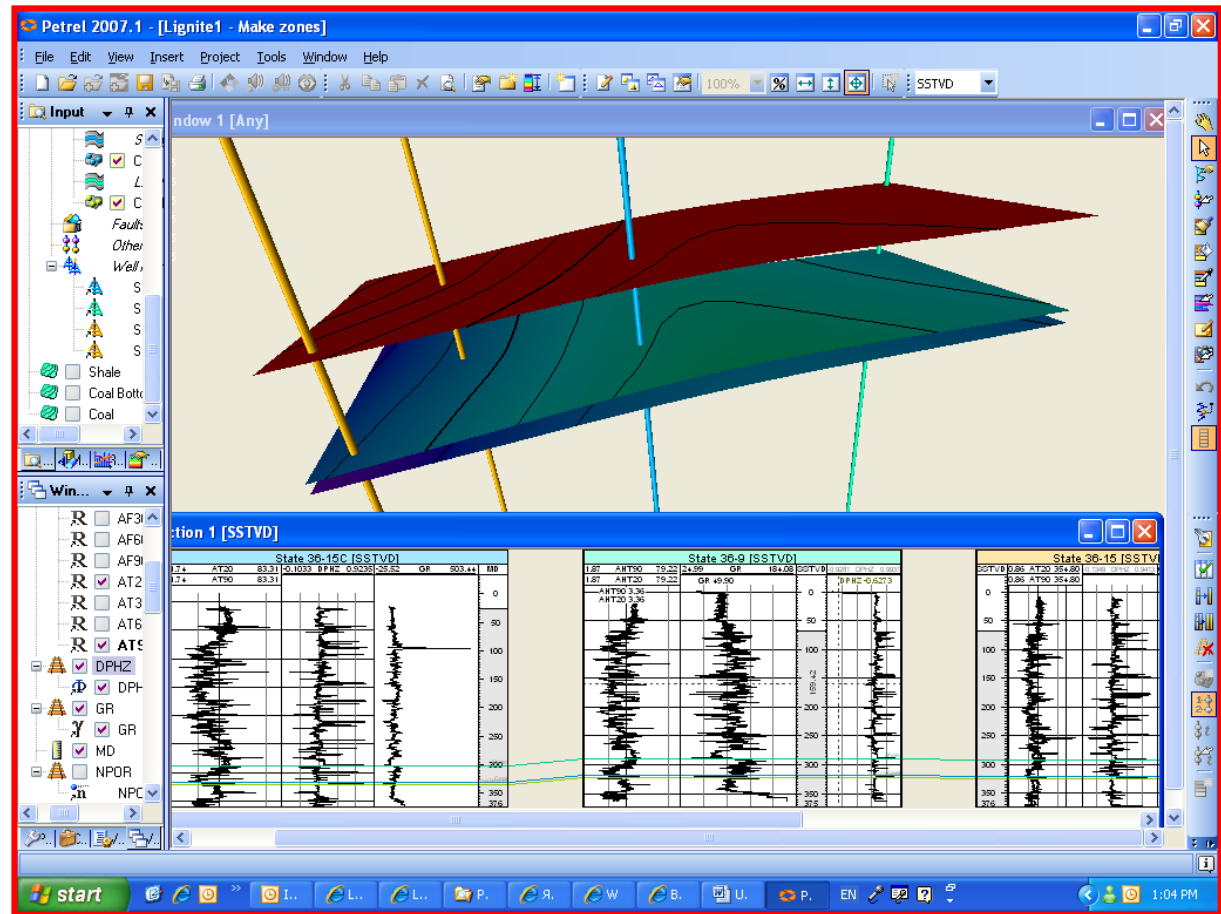
Core Evaluation Activities

- Laboratory analysis on collected core performed by TerraTek, NETL, and EERC labs
 - General conclusions
 - Lignite has somewhat lower sorptive capacity to methane than other coals.
 - Lignite has a much higher sorptive capacity for carbon dioxide.
 - Permeability strongly depends on both stress state and presence of CO₂.



Geological Modeling Activities

- Geophysical logs have been used to model:
 - Stratigraphy.
 - Structure.
 - Petrophysical properties.



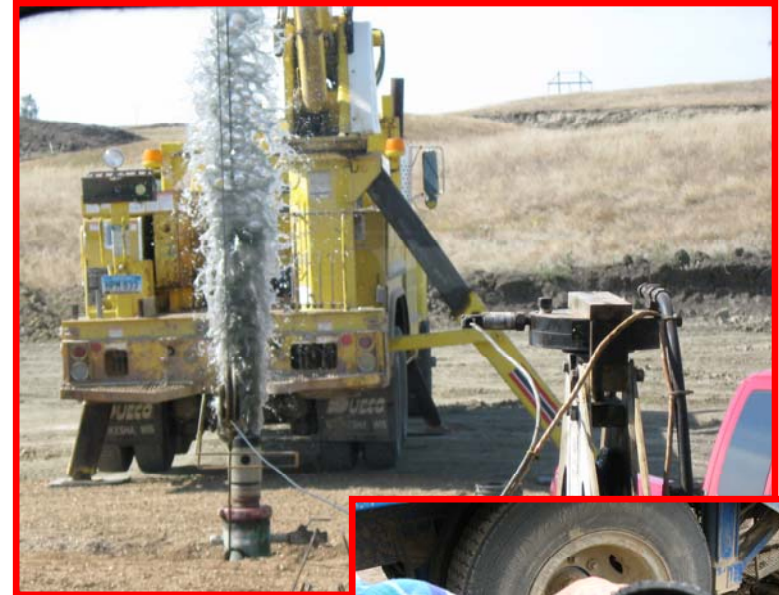
Well Development

- Cased and cemented through coal zone
- Perforated target coal seam
- Performed various well stimulation activities



Well Testing and Stimulation Activities

- Stimulation techniques
 - Swabbing
 - Sonic hammer
 - Acid treatment
 - Best results to date.
 - Nitrogen injection tests
 - Results suggest reservoir may be underpressured.
 - Provides understanding of permeability and skin damage.
 - Seal is good.



Permitting Activities

- Well spacing exemption from 160 acre spacing to 5 in a quarter-section.
- Submitted UIC permit application.
 - Aquifer exemption required for coal seam injection
 - Waiting for EPA approval
- Class II injection well.



Anticipated MMV Activities

- Pressure, temperature, pH, and conductivity monitoring
- Microseismic monitoring with simultaneous tilt measurements
- Tracer study
- Time-lapse crosswell seismic surveys



Path Forward

- Continue well development
- Instrument wells
- Receive permit approval
- Begin CO₂ injection
- Implement measurement, mitigation, and verification (MMV) program
- Revise models based on new data
- Develop Regional Technology Implementation Plan

*Thanks!
Please Keep in Touch!!*

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