

Illinois Basin Decatur Project & ADM Industrial CCS Demonstration

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U.S. DEPARTMENT OF
ENERGY

National Energy
Technology Laboratory

Successful CCS Demonstrations Providing Foundation for Future Commercial Projects

Location

Archer Daniels Midland Company, Decatur, Illinois

Regional Carbon Sequestration Partnership: Midwest Geological Sequestration Consortium

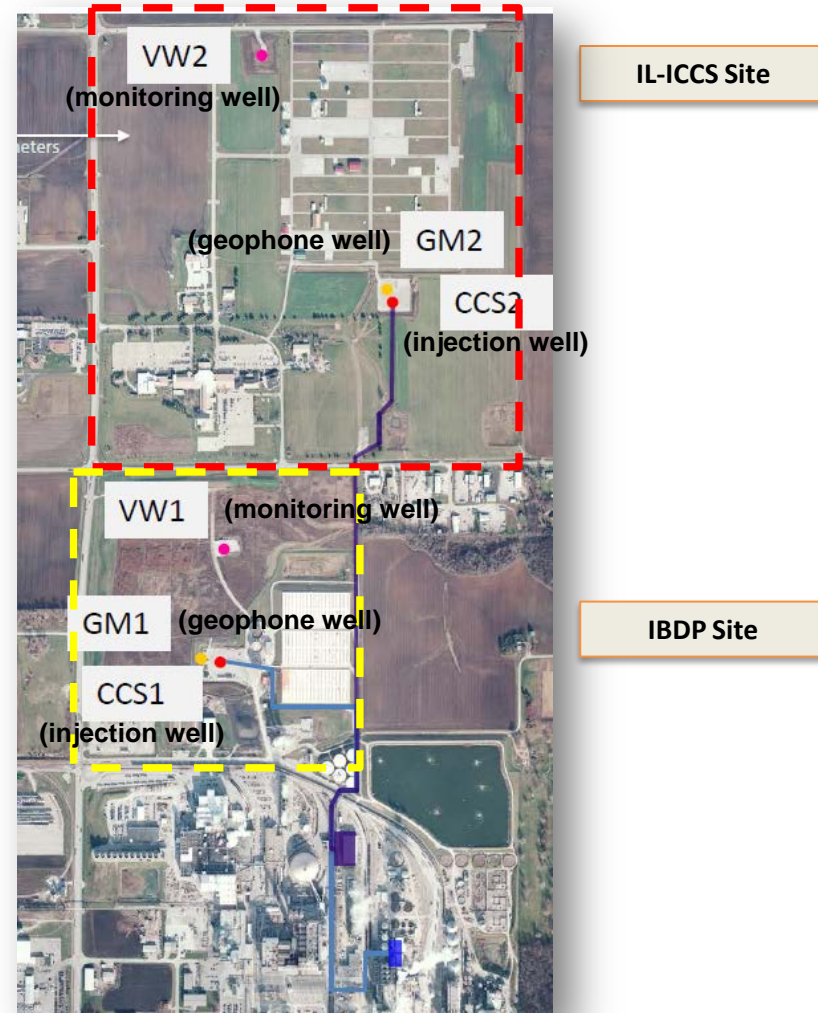
Illinois Basin – Decatur Project (IBDP)

*(Large-scale 3-year field test completed 2011-2014;
post-injection monitoring in progress)*

Industrial Carbon Capture and Storage

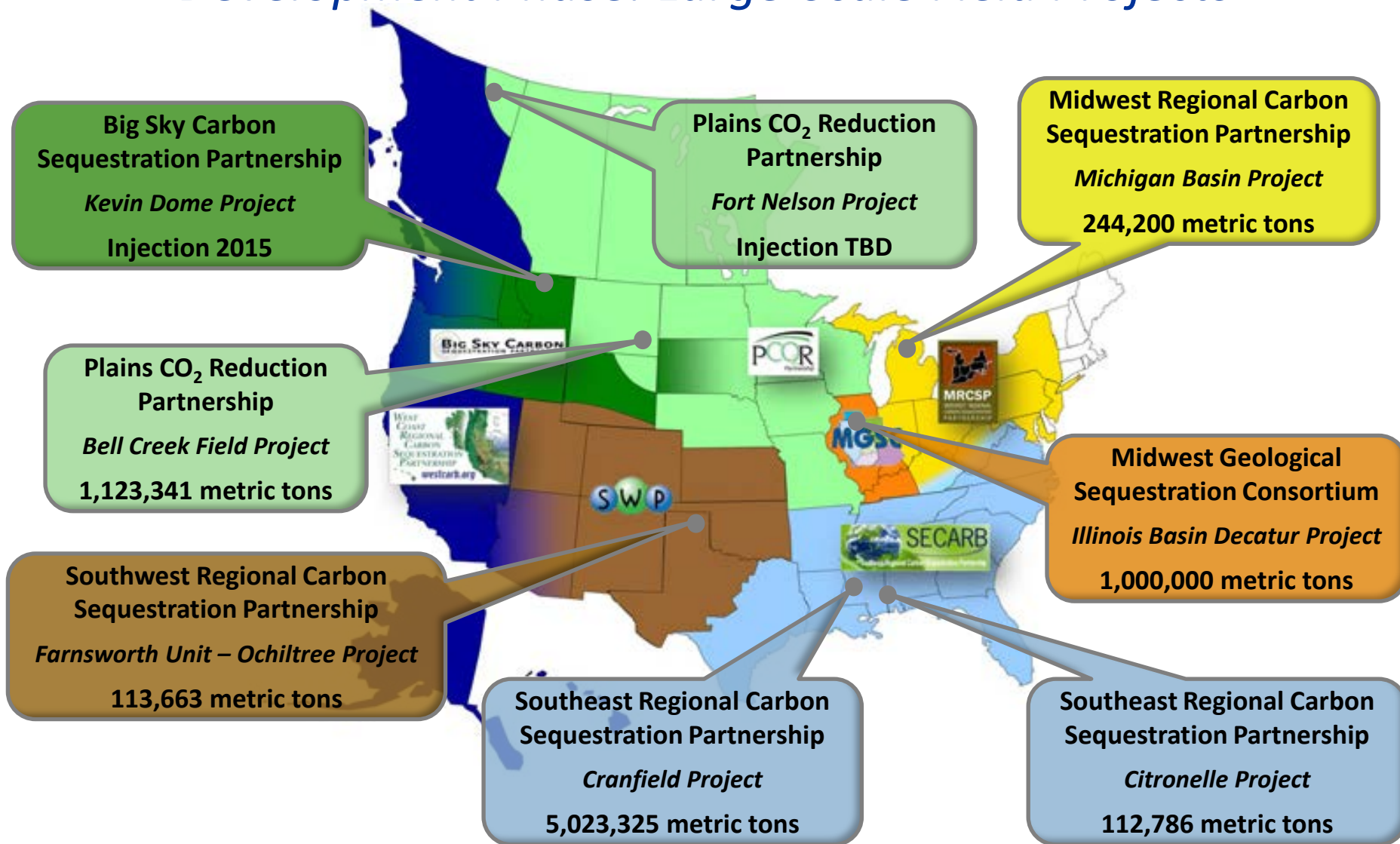
Illinois Industrial Carbon Capture and Storage (IL- ICCS) Project – 2009 Recovery Act Project

*(Commercial-scale demonstration with EPA's first
Class VI injection well operating permit, storage to
begin June 2015)*



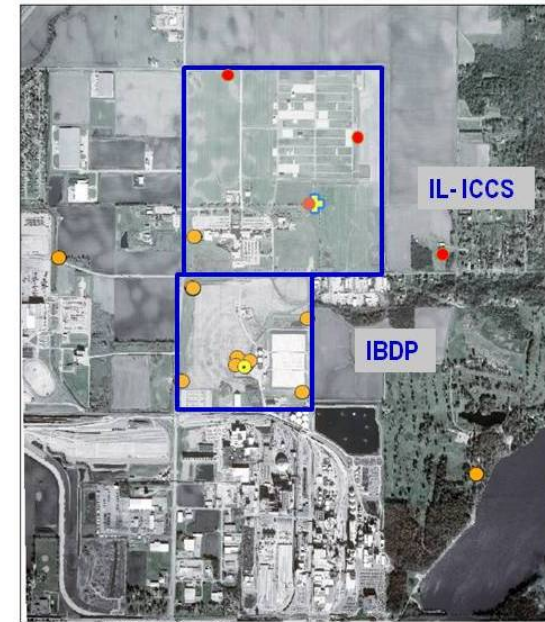
Regional Carbon Sequestration Partnerships

Development Phase: Large-Scale Field Projects



Illinois Basin Decatur Project

- Led by Illinois State Geological Survey under Midwest Geological Sequestration Consortium (MGSC)
- Target storage: 1 million metric tons CO₂ in three years
- Injection depth: 7000 ft below surface into Mt. Simon Sandstone saline reservoir
- CO₂ injection commenced Nov 2011
- 1,000,000 metric ton injection completed November 26, 2014
- Schlumberger Carbon Services uses real-time data acquisition and control system to monitor CO₂ injection operations
- Post-injection UIC Class VI permit effective February 12, 2015



Legend

- ICCS Injection Well, proposed
- IBDP Injection Well
- IBDP Shallow Monitoring Wells

0 1,000 2,000 4,000 Feet



Site map & wellhead - Courtesy of ISGS

Major CCS Demonstration Projects

Project Locations & Cost Share

FutureGen 2.0

Large-scale Testing of Oxy-Combustion w/ CO₂ Capture and Sequestration in Saline Formation
Project: ~\$1.78B – Total; ~\$1.05B – DOE
SALINE – ~1 MM TPY; 2018 start

CCPI

ICCS Area 1

Summit TX Clean Energy

Commercial Demo of Adv. IGCC w/ Full Carbon Capture; EOR in Permian Basin
~\$3.15B – Total; \$450M – DOE
EOR – ~1.65 MMTPY; late 2018 start

HECA

Commercial Demo of Advanced IGCC w/ Full Carbon Capture
~\$5B – Total; \$408M – DOE
EOR – ~2.6 MM TPY; mid-2020 start

Petra Nova

W.A. Parish Generating Station
Post Combustion CO₂ Capture
\$1B – Total; \$167M – DOE
EOR – ~1.4 MM TPY; early 2017 start

Air Products and Chemicals, Inc.

CO₂ Capture from Steam Methane Reformers
EOR in Eastern TX Oilfields
\$431M – Total; \$284M – DOE
EOR – ~0.93 MM TPY; started December 2012; 1.6 MMT stored as of December 2014

Archer Daniels Midland

CO₂ Capture from Ethanol Plant
CO₂ Stored in Saline Reservoir
\$208M – Total; \$141M – DOE
SALINE – ~0.9 MM TPY; June 2015 start

Southern Company

Kemper County IGCC Project
Transport Gasifier w/ Carbon Capture
~\$5.104 – Total; \$270M – DOE
EOR – ~3.0 MM TPY; mid-2016 start

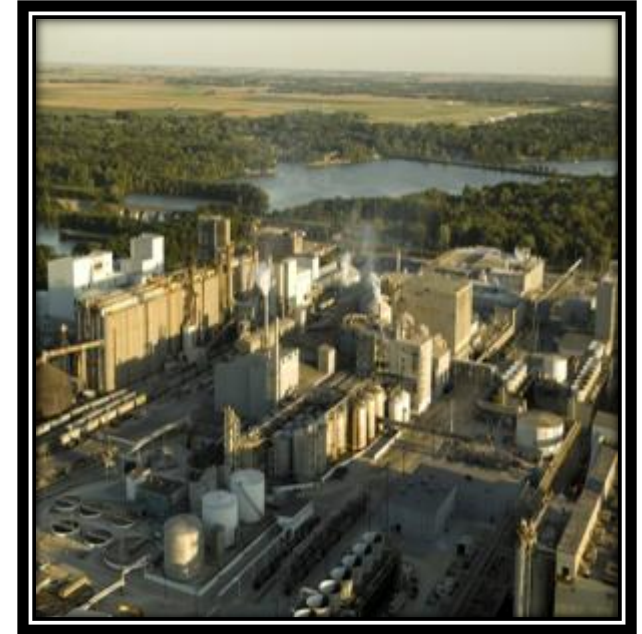
Leucadia Energy

CO₂ Capture from Methanol Plant
EOR in Eastern TX Oilfields
\$436M – Total; \$261M – DOE
EOR – ~4.5 MM TPY; late 2018 start

Archer Daniels Midland Company ICCS Area 1

CO₂ Capture from Biofuel Plant

- Decatur, IL
- CO₂ (>99% purity) is a by-product from production of fuel-grade ethanol via anaerobic fermentation
- Up to 90% CO₂ capture, dehydration (via tri-ethylene glycol) & compression
- ~900,000 tonnes CO₂ /year
- Sequestration in Mt. Simon Sandstone saline fm.
- Total Project: \$208 MM; DOE Share: \$141 MM (68%)



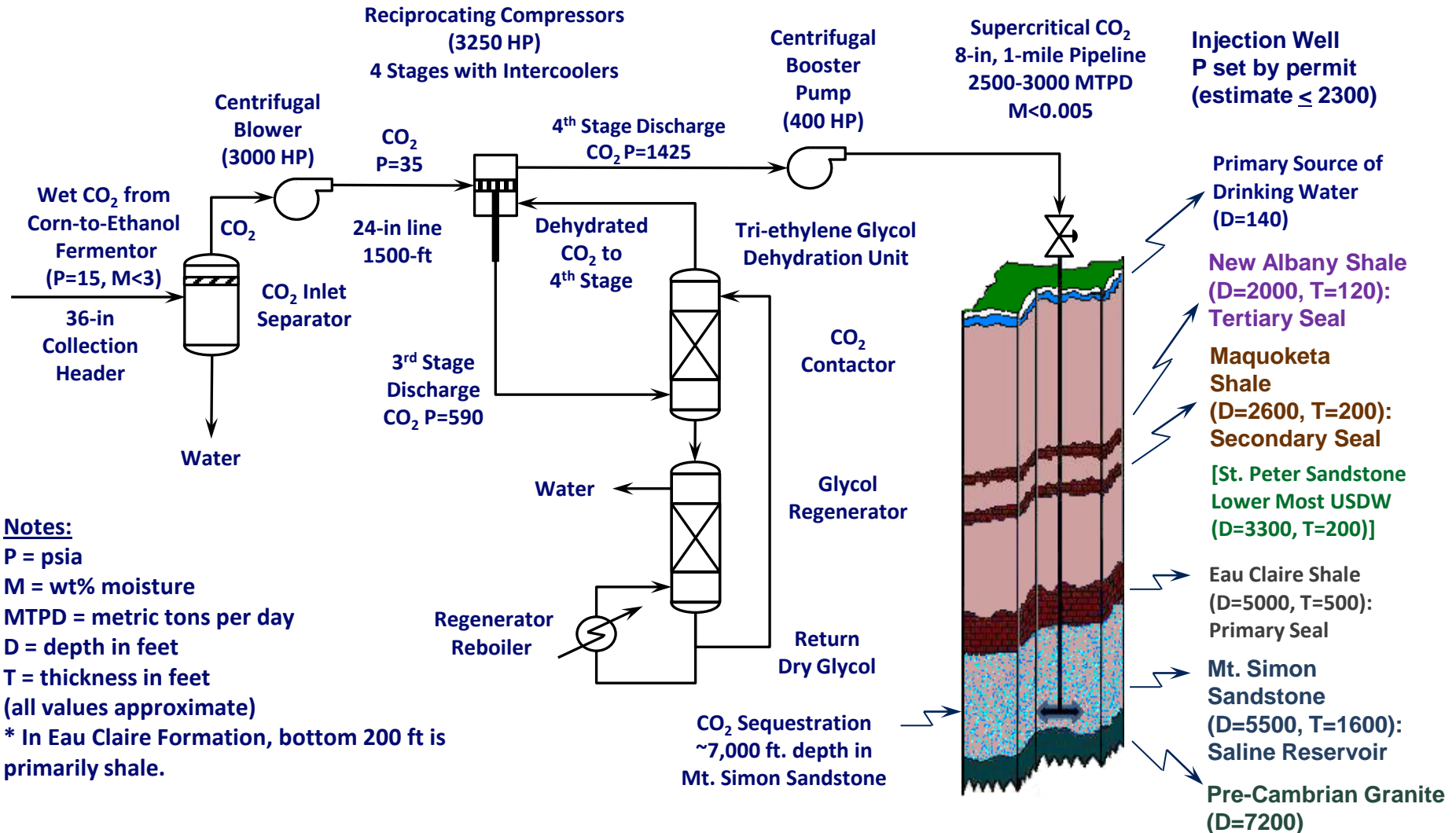
Key Dates

- Phase 2 Awarded: June 15, 2010
- FEED Completed: April 2011
- NEPA FONSI: April 2011
- Construction started: May 2011
- UIC Class VI Injection Well Permit: Sept 2014;
UIC Class VI Operating Permit: June 2015
- Sequestration start: June 2015

Status

- Construction >85% complete
- Two monitoring wells drilled: Nov 2012
- New Hans substation energized: Nov 2014
- Commissioning compression and dehydration underway since July 2013
- Final UIC Class VI permit issued Sept 2014

Simplified Flow Diagram



Blower and Compression Facilities

(Sept. 2014: Courtesy of ADM)



3000 HP blower system



Blower suction and discharge piping



3250-hp 4-stage reciprocating compressor & associated equipment



Four compressor train

Blower & Compression Facilities

(Sept. 2014: Courtesy of ADM)



Piping and auxiliaries in the compressor building



Compressor inter-stage piping



3000 TPD dehydration - triethylene glycol contactor & regenerator system



Blower motor control center

CO₂ Pipeline

(Sept. 2014: Courtesy of ADM)



24" CO2 pipeline from blower to compressor



8" high pressure transmission Line



Pressure testing of compressor piping



Commissioning-Energizing the switchgear

Deep Monitoring Well

(Sept. 2014: Courtesy of ADM)



Drilling the deep monitoring well



**Core samples: Top-Eau Claire
Shale-caprock seal; Bottom: Mt.
Simon Sandstone-saline reservoir**



Deep monitoring well

Hans Electrical Substation

(Sept. 2014: Courtesy of ADM)



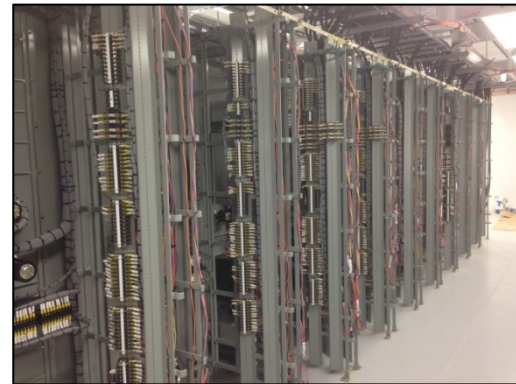
34.5 kV Buss and insulator installation



138 kV transmission line from the Hans & 34.5 kV capacitor banks



138 kV Major equipment and control building



Interconnecting wiring on the control cabinets in the 34.5 kV control building

Class VI Injection Well Drilling

(Feb. 2015: Courtesy of ADM)



Environmental Monitoring Planned Framework

Near Surface

Soil and Vadose Zone

Ground
Water

Aerial Imagery

Soil CO₂ Flux

Geochemical
Sampling
P/T
Monitoring

Deep Subsurface

Above
Seal

Injection
Zone

Geophysical
Surveys
Seismic
Monitoring
P Monitoring

Geophysical
Surveys
Geochemical
sampling
P/T Monitoring

Project Monitoring Photos *(Sept. 2014)*



**Shallow Groundwater
Sampling**



**Soil Gas and CO₂ Flux
Networks**

National Sequestration Education Center

Public Education and Community Outreach

- Conducting an integrated communication, outreach, training, and education initiative to engage local communities to understand CCUS, Illinois ICCS project, and related environmental benefits.
- National Sequestration Education Center (NSEC) at Richland Community College (Decatur, IL) – A new education/training facility:
 - 15,000 sq. ft. center - classrooms, training and laboratory facilities
 - Opened September 2012
- AAS degree in Engineering Technology with a Sequestration Specialty
- AS degree with a Sequestration Concentration (university transfer degree)



For Additional Information

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