ILLINOIS INDUSTRIAL CARBON CAPTURE AND STORAGE PROJECT

Project Overview, Lessons, & Future Plans

2012 NETL CO_2 Capture Technology Meeting

July 9-12, 2012

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Acknowledgements

- The Industrial Carbon Capture and Storage (ICCS) project is administered by the U.S. Department of Energy's Office of Fossil Energy and managed by the National Energy Technology Laboratory (award number DE-FE-0001547) and by a cost share agreement with the Archer Daniels Midland Company, University of Illinois through the Illinois State Geological Survey, Schlumberger Carbon Services, and Richland Community College. This ICCS project received DOE funding from the American Recovery and Reinvestment Act of 2009 ($141.4 million).
- The Midwest Geological Sequestration Consortium is funded by the U.S. Department of Energy through the National Energy Technology Laboratory via the Regional Carbon Sequestration Partnership Program (contract number DE-FC26-05NT42588) and by a cost share agreement with the Illinois Department of Commerce and Economic Opportunity, Office of Coal Development through the Illinois Clean Coal Institute.
- The Midwest Geological Sequestration Consortium (MGSC) is a collaboration led by the geological surveys of Illinois, Indiana, and Kentucky

ADM Company Profile

Core Purpose

Connecting the harvest to the home and transforming crops into products that serve vital needs for food and energy.

Financials

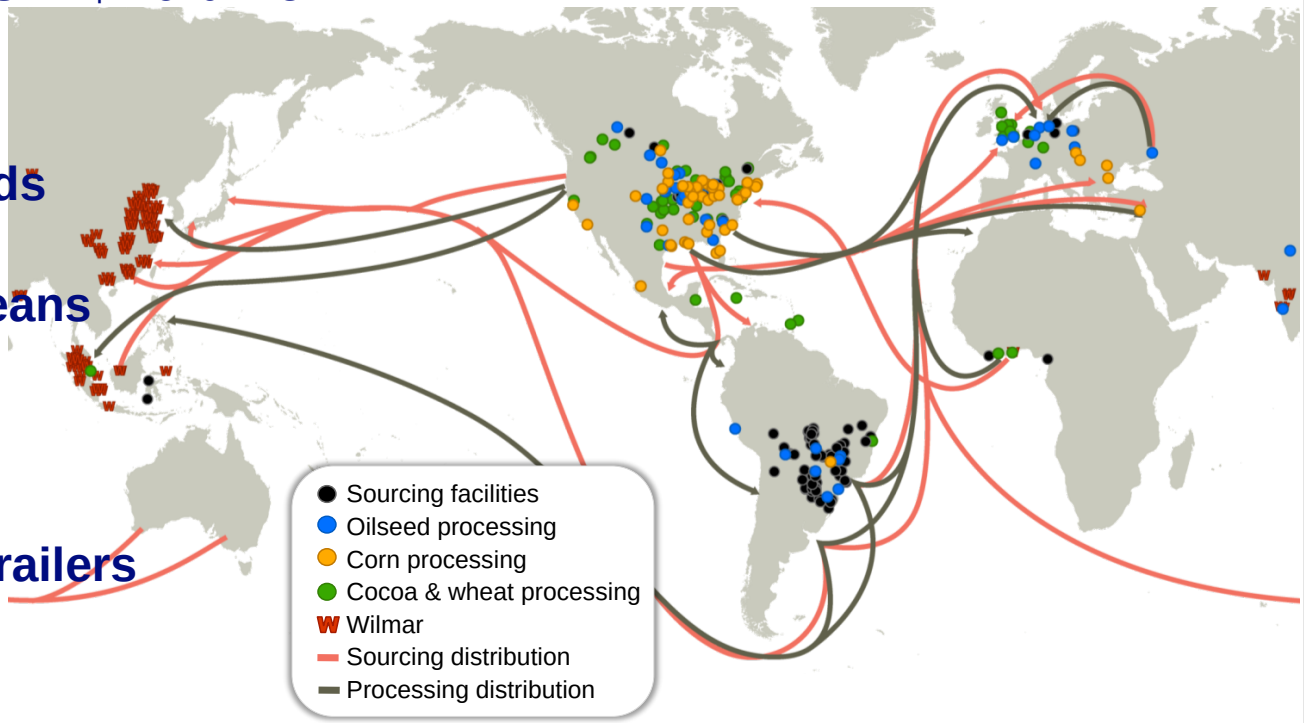
- **FY 2011 Net Sales: $80 billion**
- **FY 2011 Net Earnings: $2.0 billion**

Processing

- **66,000 MT of corn**
- **100,000 MT of oilseeds**
- **28,000 MT of wheat**
- **3,000 MT of cocoa beans**

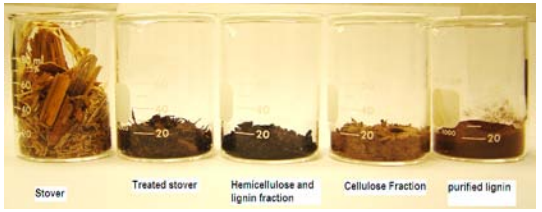
Logistics

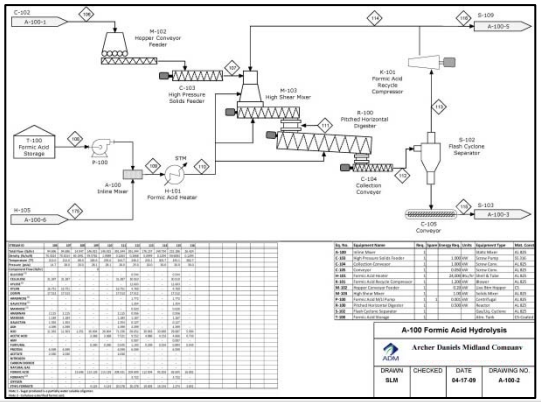
- **26,100 Rail cars**
- **1,700 Barges**
- **700 Trucks – 1,500 Trailers**
- **8 Oceangoing Ships**



ADM Research Initiatives

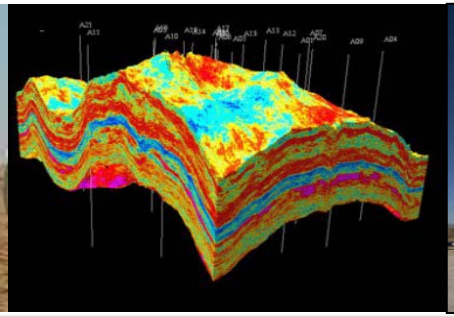
- Biomass Conversion to Fuel Additives
- Integrated Biorefinery: Ethanol & Ethyl Acrylate
- Carbon Capture and Storage
- Membrane Solvent-Extraction: Ethanol
- HTL, Catalytic Pyrolysis, & Hydrogen Research
- Chemical Platform Development: PG/EG
- And Many More…..





Focus of Today's Presentation

- **Provide an Overview and Comparison of the CCS projects underway in Decatur, Illinois**
  - **Illinois Industrial Carbon Capture and Storage Project (IL-ICCS)**
  - **Illinois Basin Decatur Project (IBDP)**
- **Features, Activities, & Impacts of IL-ICCS**
- **Review Lessoned Learned**
- **Future Plans for the Facility & Site**


Illinois Basin Decatur Project (IBDP)

Program Objective

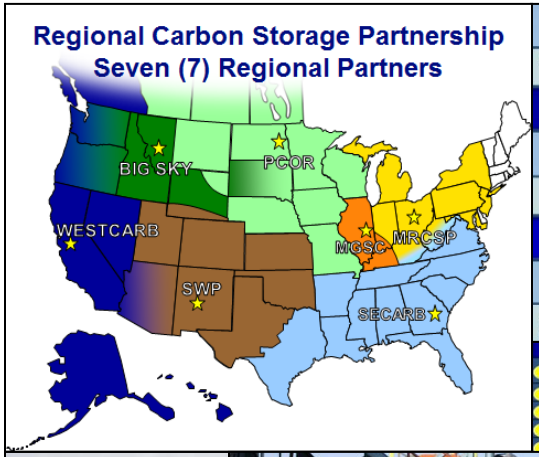
Large scale geologic test to inject 1.0 million tons of CO_2 over a three year period (1,000 MT/day).

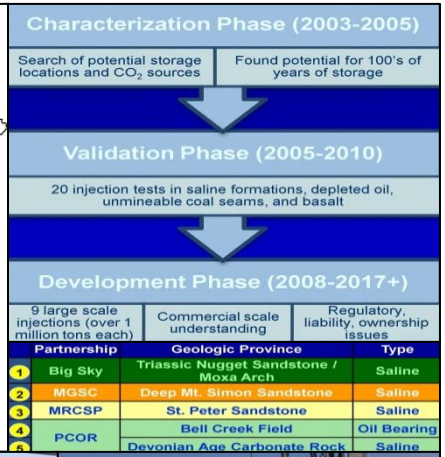
Project Team Members

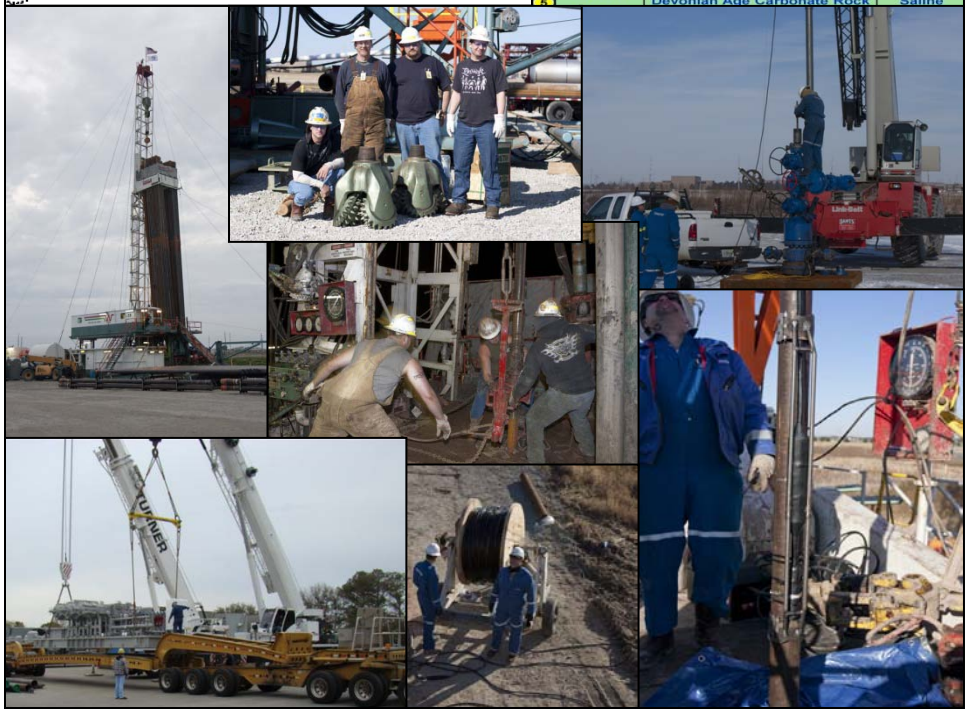
Knowledge Base

- **Site Geological Characterization**
- **Risk Assessment & Reservoir Modeling**
- **Engineering Design & MVA**

Breaking ground for anthropogenic CO_2 storage in a saline reservoir using cutting-edge storage technology







Illinois Industrial CCS Project (IL-ICCS)

Program Objectives

- Target & Demonstrate Advanced CCS Technologies at Industrial Scale Facilities
- Inject and Store One Million Tons of CO_2 Annually (3,000 tons/day)

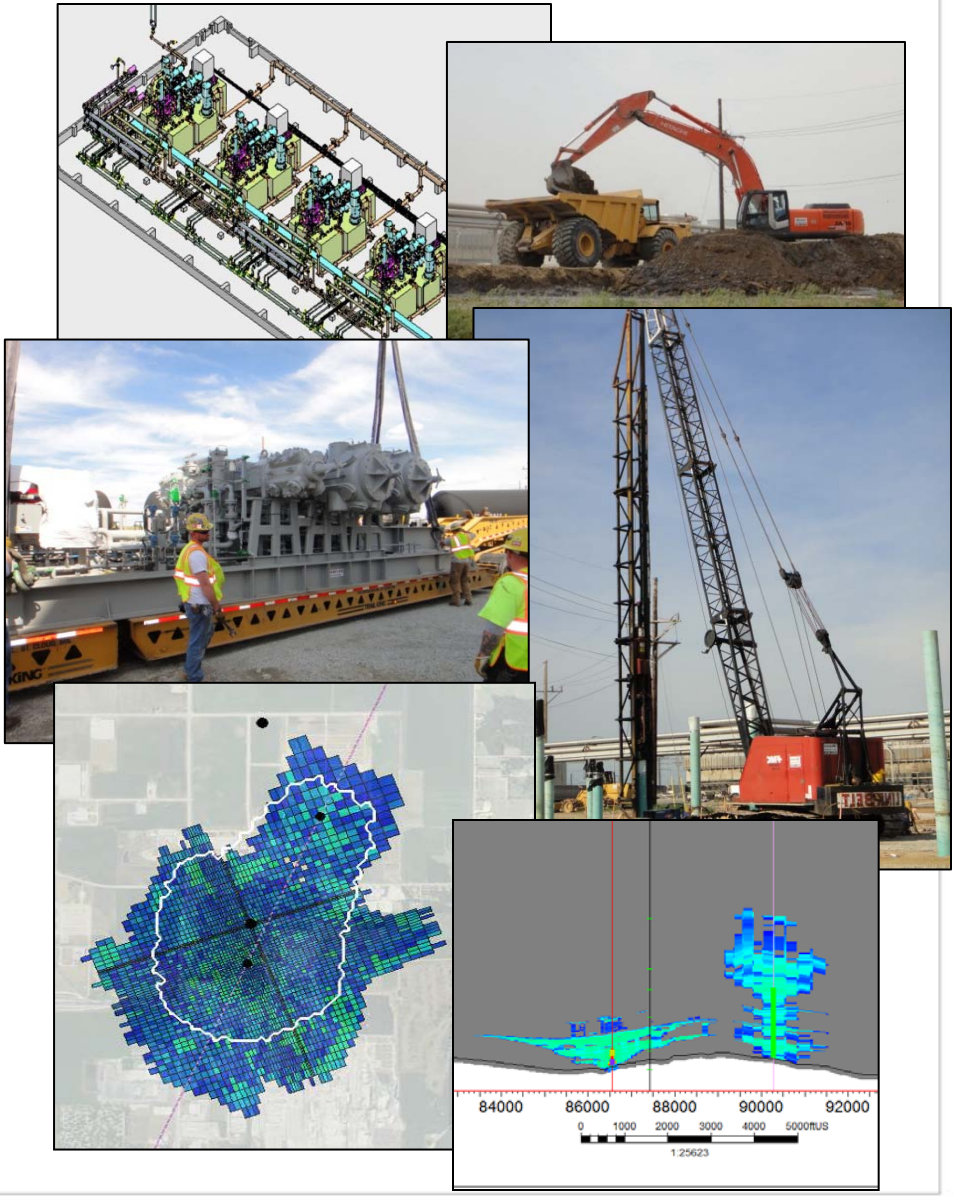
Project Team Members

ADM, Schlumberger Carbon Services, Richland Community College, NETL

Knowledge Base

- Site Geological Characterization
- Risk Assessment & Reservoir Modeling
- Engineering Design & MVA
- Education and Public Outreach

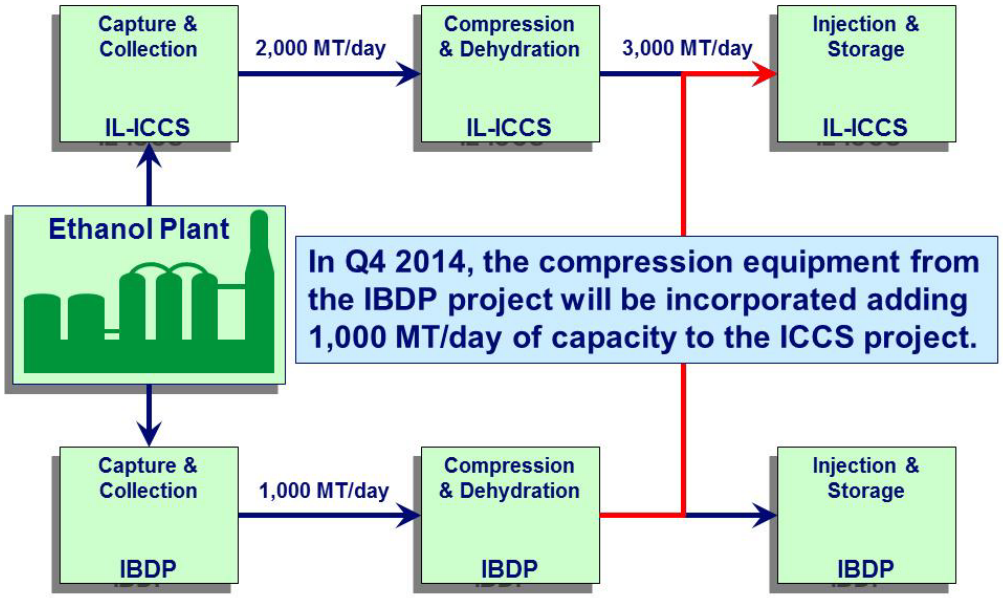
Study the interaction between the CO_2 plumes from two injection wells within the same formation.



Project Objectives

Project Objectives

- Design, construct, and operate a new CO_2 collection, compression, and dehydration facility capable of delivering up to 2,000 metric tons of CO_2 per day to the injection site.
- Integrate the new facility with an existing 1,000 metric tons of CO_2 per day compression and dehydration facility to achieve a total CO_2 injection capacity of 3,000 metric tons per day or one million tons annually.
- Implement deep subsurface and near-surface MVA of the stored CO_2.
- Develop and conduct an integrated community outreach, training, and education initiative.



Project Team Members

Archer Daniels Midland Company

- Project Leader
- Overall Project Execution
- Facility Owner and Operator
- Design & Construction of Surface Facilities
- UIC Class VI Permit Holder

Schlumberger Carbon Services

- Seismic Acquisition & Data Processing
- Reservoir Modeling
- Design & Construction of Storage Facility
- Subsurface Operations
- Deep MVA CO_2 Monitoring

Illinois State Geological Survey

- Site Characterization
- MVA Development
- USDW Monitoring
- Near-Surface CO_2 Monitoring
- Outreach and Communication

Richland Community College

- National Sequestration Education Center
- Community Outreach & CCUS Training
- New Associate Degree Programs in CCUS

Leveraging Knowledge and Experience

Project Schedule

Site Characterization

Design and Engineering

MVA & UIC VI Permit

Construction

Compression & Transmission

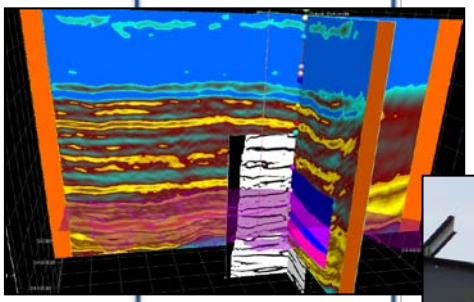
Well Construction

100 Mw Substation

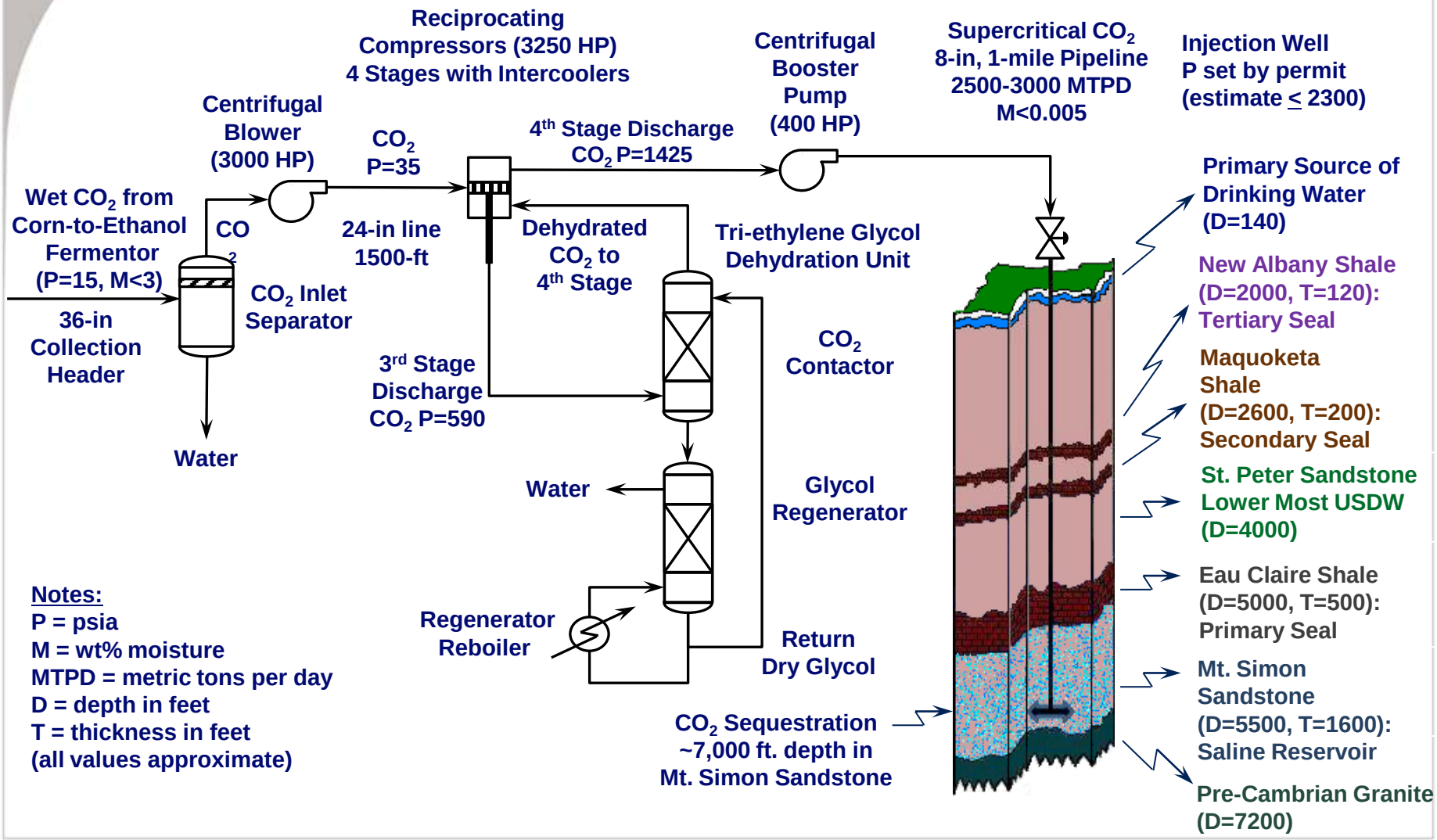
Commissioning & Operation

2011 2012 2013 2014 2015

EPA United States Environmental Protection Agency



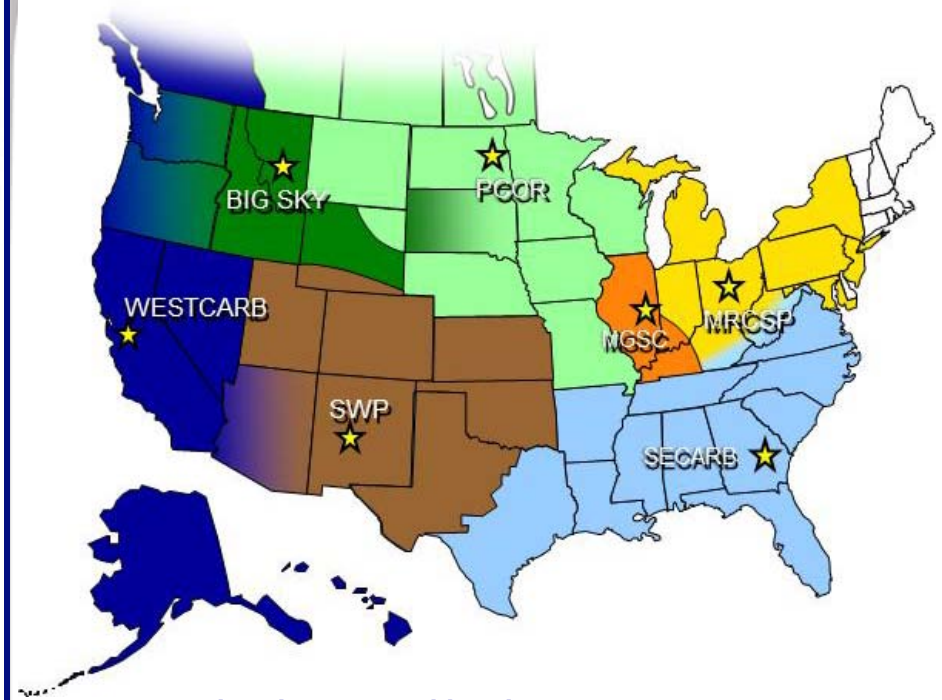
Project Process Flow Diagram



Notes:
P = psia
M = wt% moisture
MTPD = metric tons per day
D = depth in feet
T = thickness in feet
(all values approximate)

Site Selection
Regional Carbon Sequestration Partnerships

IL-ICCS project site selection benefitted from the information developed through the Regional Carbon Sequestration Partnership



- **Engage regional, state, and local governments**
- **Determine regional sequestration benefits**
- **Baseline region for sources and sinks**
- **Establish monitoring and verification protocols**
- **Address regulatory, environmental, and outreach issues**
- **Validate sequestration technology and infrastructure**

Characterization Phase (2003-2005)

Search of potential storage locations and CO_2 sources	Found potential for 100's of years of storage

Validation Phase (2005-2010)

20 injection tests in saline formations, depleted oil, unmineable coal seams, and basalt

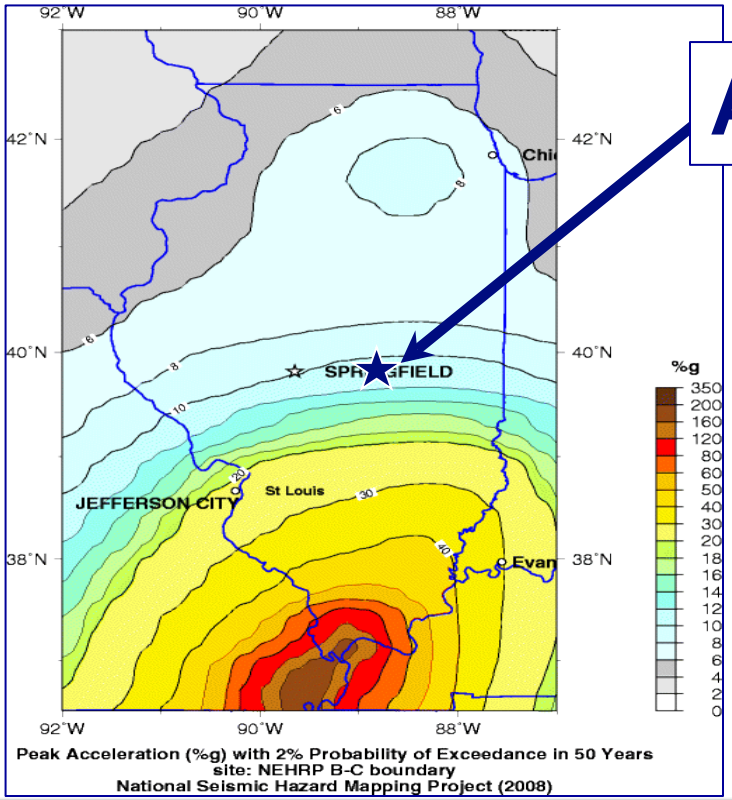
Development Phase (2008-2017+)

9 large scale injections (over 1 million tons each)	Commercial scale understanding	Regulatory, liability, ownership issues

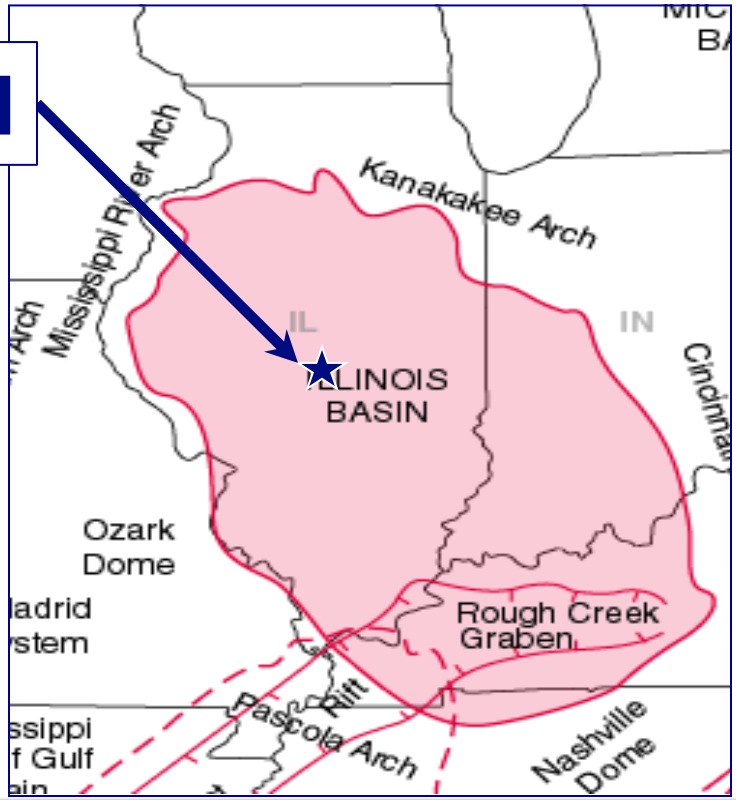
Site Selection
Regional Geologic Characterization

- Cratonic basin
- 60,000 square mile area
- Structurally complex to the south with faulting and seismicity

- ADM Decatur facility is located near the center of this geologic formation
- Estimated CO_2 storage capacity between 27 to 109 billion metric tons



ADM



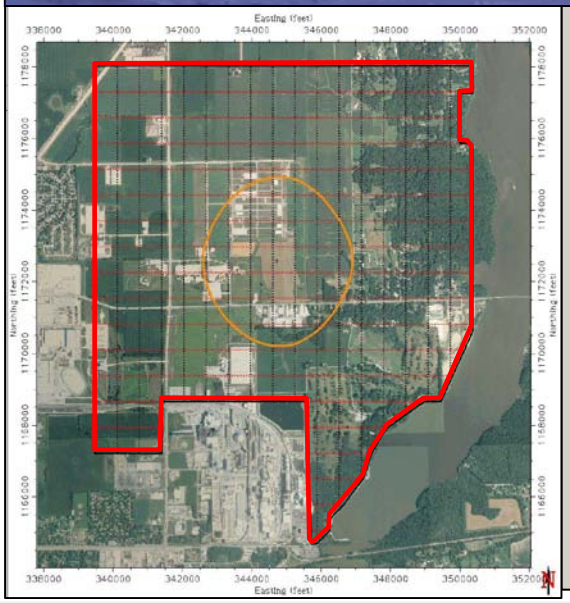
Site Characterization

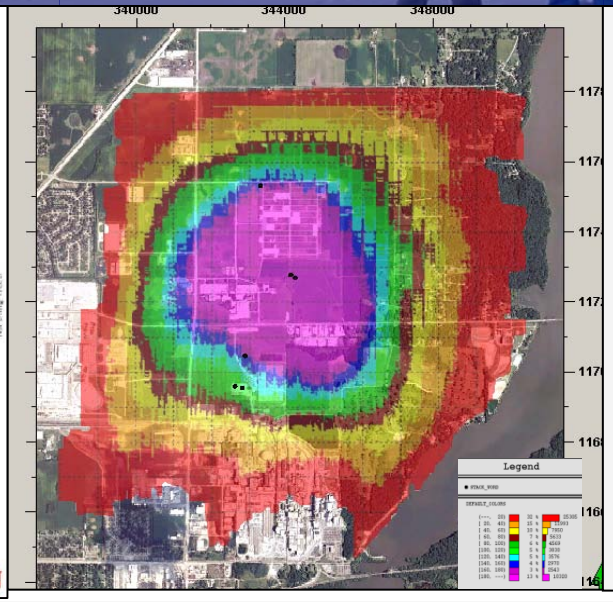
Seismic Acquisition

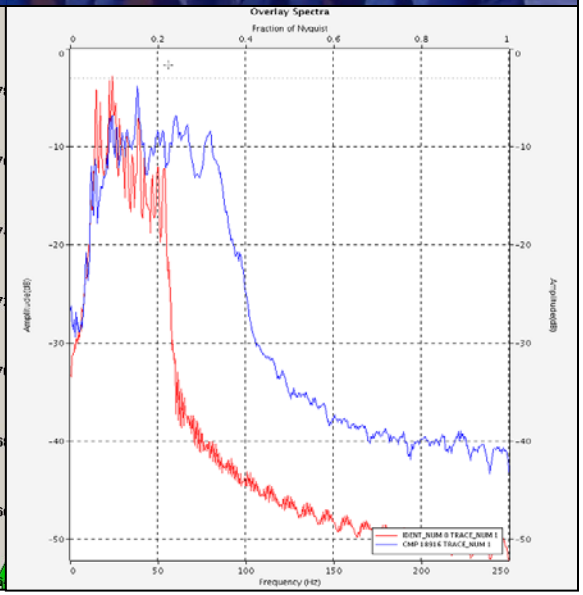
- Receiver lines spaced 640 ft. (N-S lines)
- 18,090 point receivers
- Source lines spaced 720 ft. (E-W lines)
- 2,018 shot points

- Fold coverage is maximized over injection well location
- 40’-by-40’ bin size (horizontal resolution)

- Q-Land Technology with improved signal-to-noise ratio
- More desirable for acquiring seismic data within industrial settings





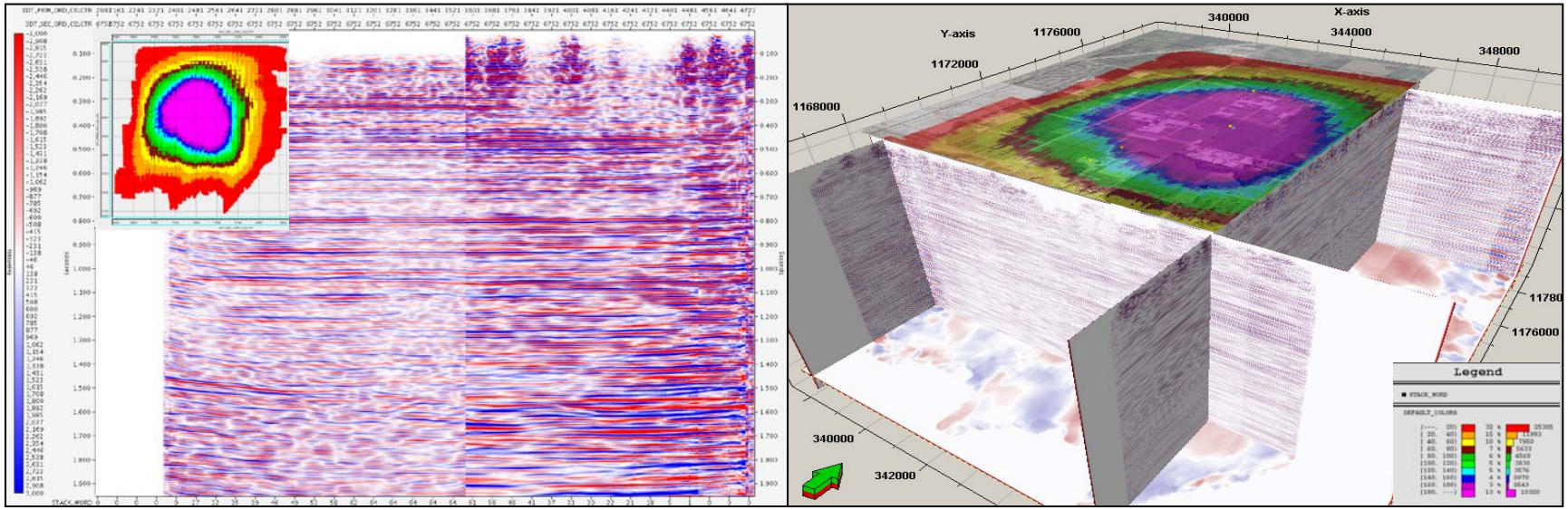


Site Characterization

Seismic Processing & Geocellular Model Development

- Both projects seismic data sets were merged prior to processing
- Improved resolution and clarity
- Petrophysical properties extrapolated from CCS #1 logs
- Extended coverage over both sites
- Large model dimensions (30-by-30 miles) used to minimize boundary effects
- Yielding more usable data within AoR.

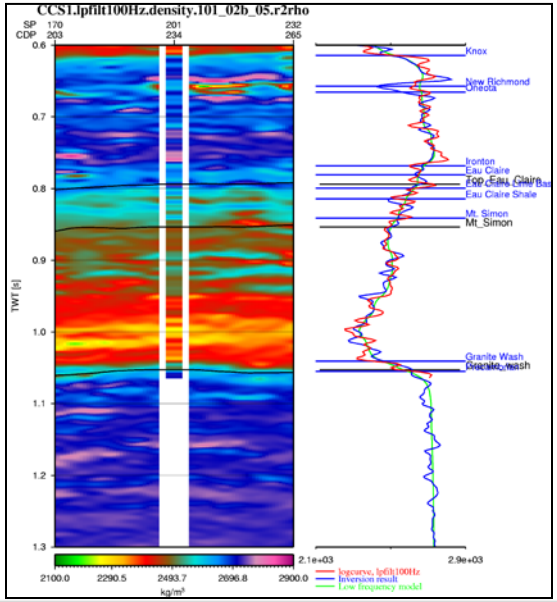
Legacy Data Merged Data

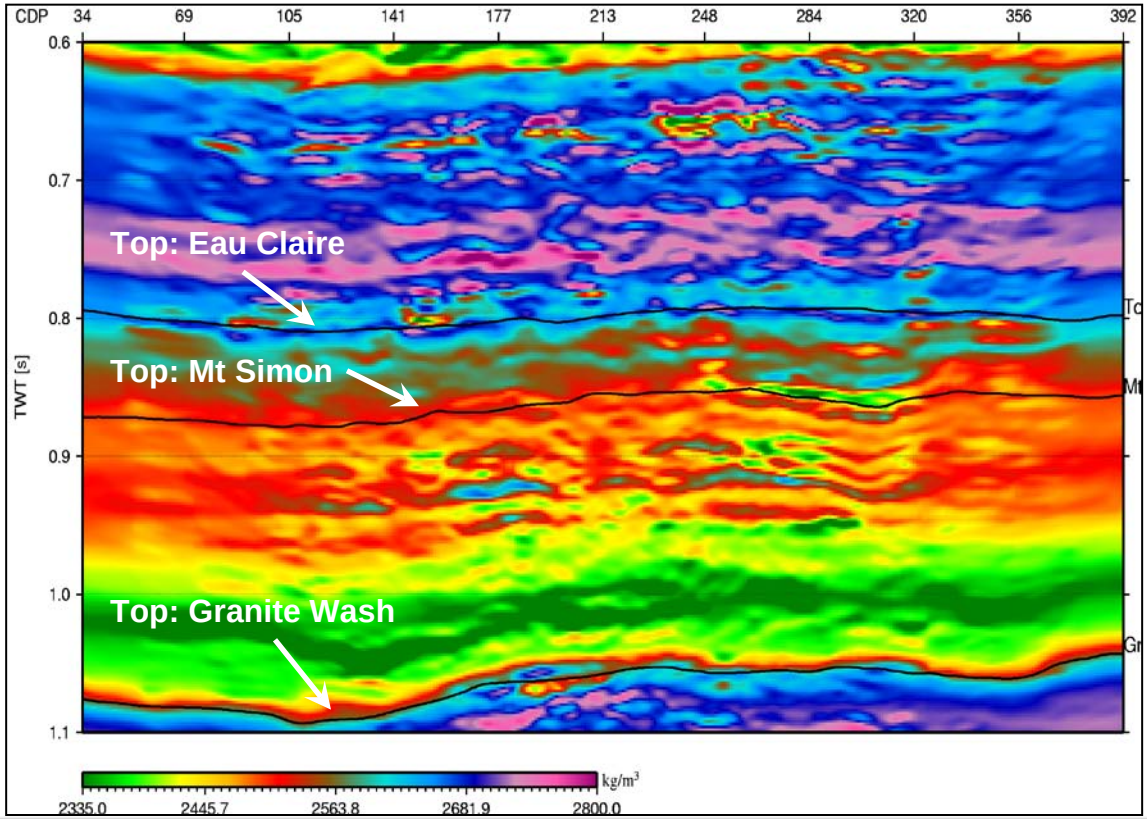


Site Characterization

Seismic Inversion: Formation Density

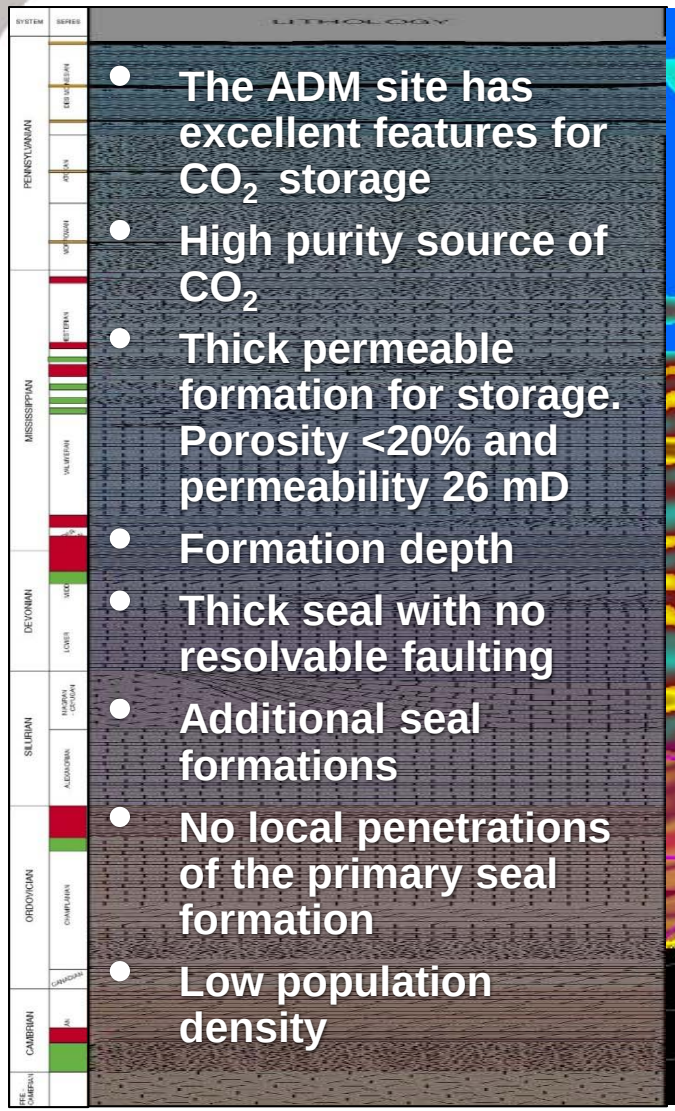
- Synthetic wavelet constructed from correlation to wellbore log data
- Seismic data inverted to generate petrophysical properties
- 2D Line 101 inverted to generate image of formation density
- Enhances detailed features and allows interpretation of depositional bodies



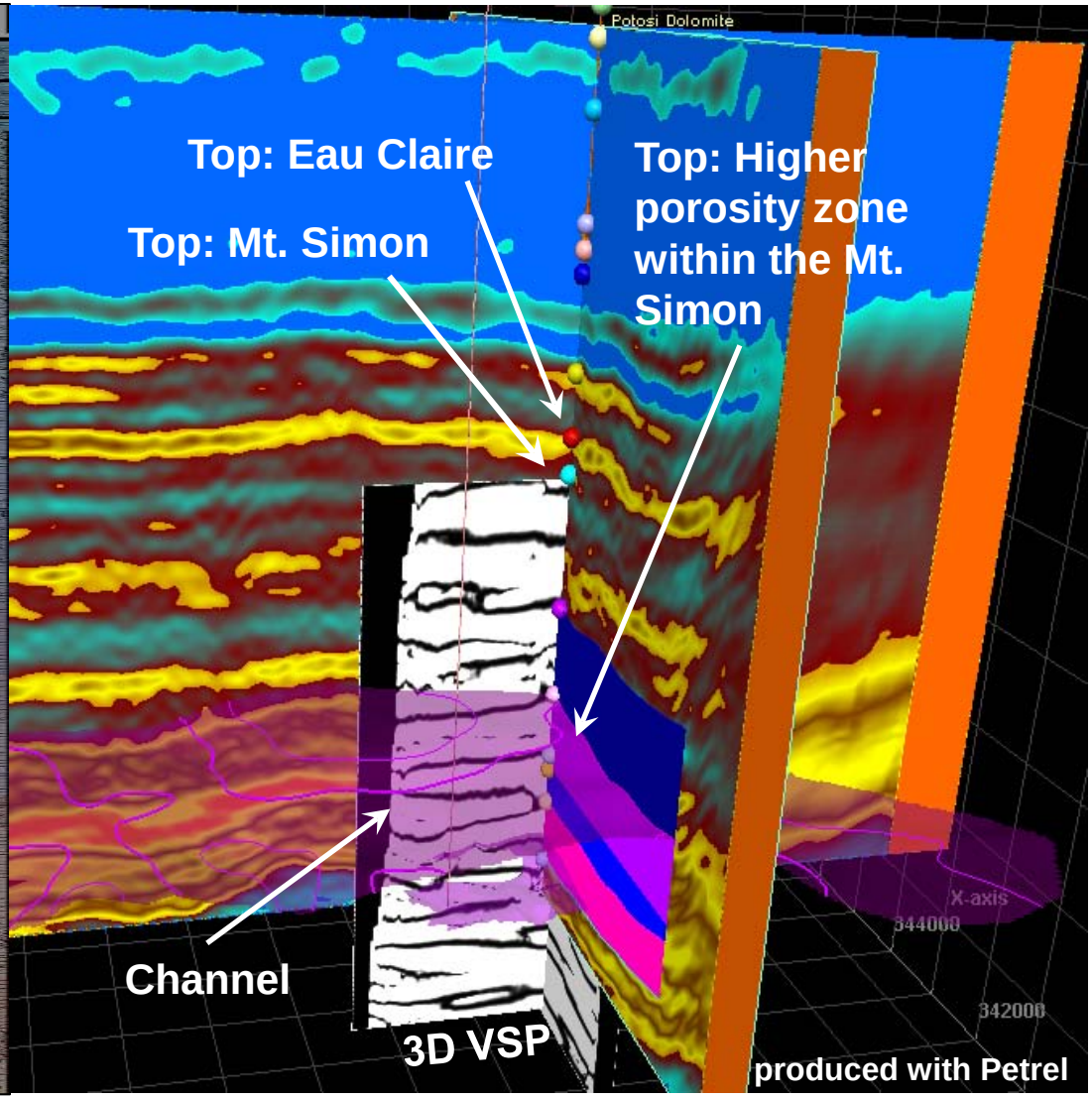


Site Characterization

Evaluation of the Decatur Site



- The ADM site has excellent features for CO_2 storage
- High purity source of CO_2
- Thick permeable formation for storage. Porosity <20% and permeability 26 mD
- Formation depth
- Thick seal with no resolvable faulting
- Additional seal formations
- No local penetrations of the primary seal formation
- Low population density



Site Characterization

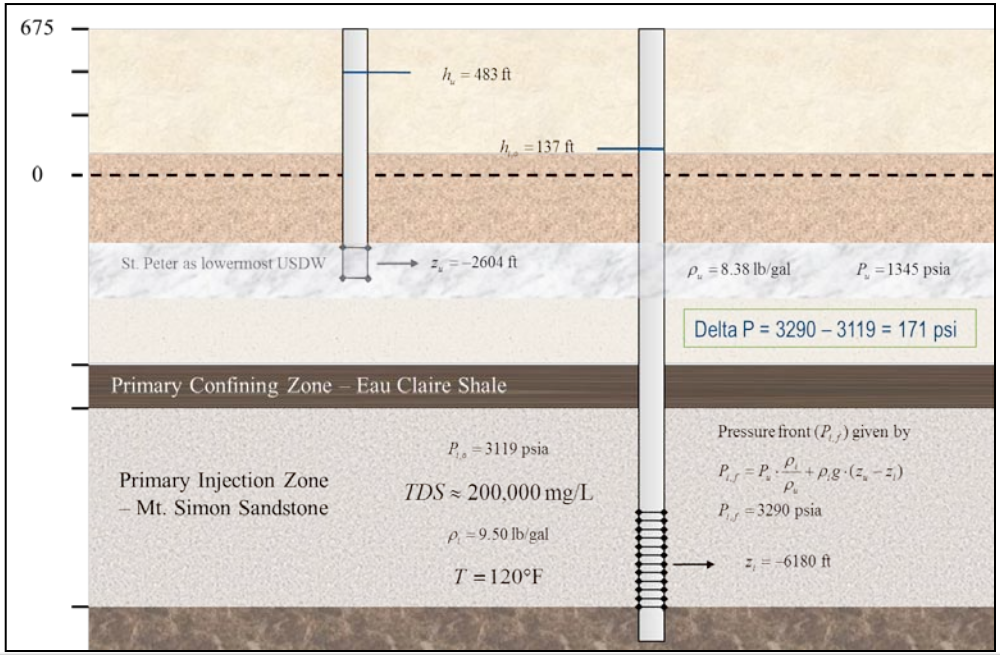
AoR - Maximum Extent of the Plume or Pressure Front

- **The delineation of the AoR is based on the Maximum Extent of the Separate-phase Plume or Pressure-front (MESPOP) methodology, as detailed in the relevant US EPA guidance document (USEPA, 2011).**
- **The pressure front is defined by the differential pressure needed to allow fluid from the injection zone to flow through a hypothetical open conduit into the overlying lowermost USDW (St. Peter Sandstone)**
- **Site specific data used to determine the MESPOP and was calculated to be 171 psi.**

USEPA Pressure Front Delineation Equation

$$P_{i,f} = P_u \cdot \frac{\rho_i}{\rho_u} + \rho_i g \cdot (z_u - z_i)$$

Illustration of pressure front delineation calculation based using the St. Peter Sandstone is as the lowermost USDW.

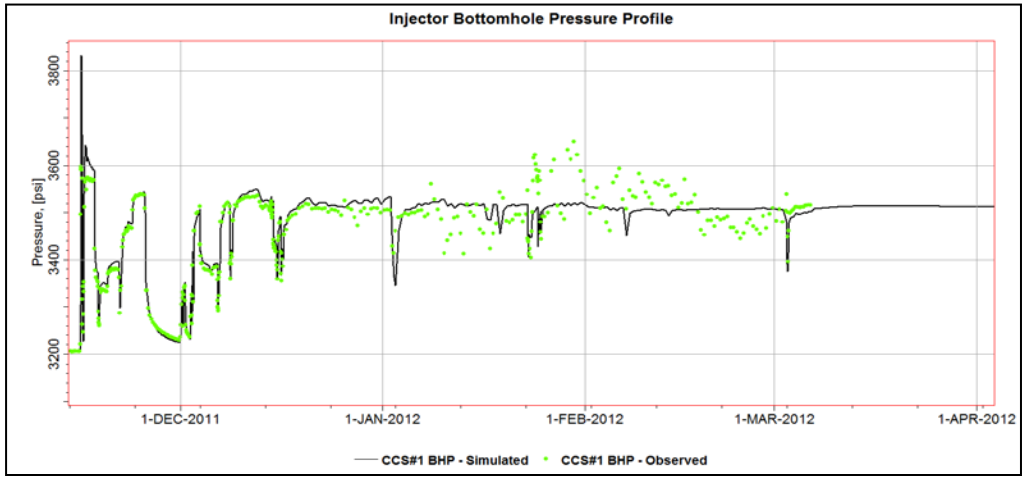


Site Characterization

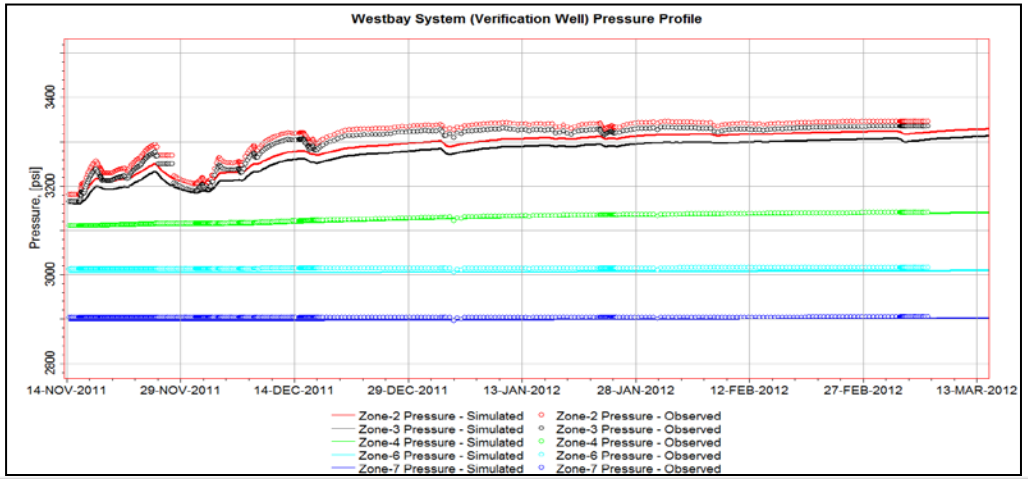
Updating the Site Model – Matching Operational History

- The site model was calibrated using data obtained during the first four (4) months of the IBDP injection period.
- The IBDP injection rate was input into the simulation to calculate the bottom hole pressures and pressures at five different zones at the verification well.
- Reservoir permeability and skin were the main parameters impacting the injection pressure calibration and were used as fitting parameters.
- Once the injection bottom hole pressure was calibrated, simulated pressures at five different zones at the verification well were fine-tuned calibrating the kv/kh ratio of the tight sections and compressibility of the reservoir rock

History Matched Injection Bottom Hole Pressure (BHP) for CCS#1.



History Matched Pressures at Verification Well for CCS#1

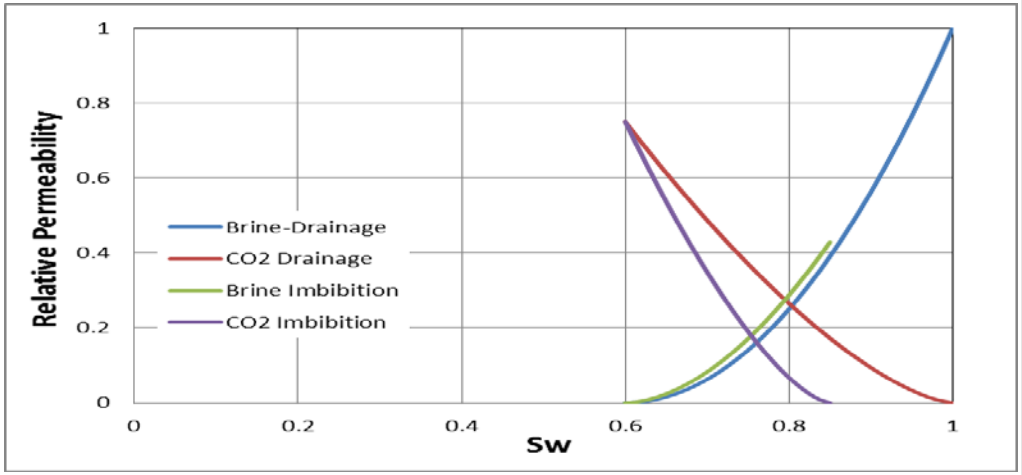


Site Characterization

Updating the Site Model – Matching Operational History

- **RST Well Logs helped us estimate the location, saturation, and thickness of the CO_2 column around the injection and verification wells.**
- **This information helped us fine tune the end points of relative permeability curves which dominate the CO_2 and brine flow in the reservoir.**
- **Using the calibrated model, a predictive simulation was run to evaluate plume development and pressure perturbation during the course of the injection.**
- **The project's planned injection schedule was used for the 50 year simulation.**

Calibrated Reservoir Unit Relative Permeability Curves



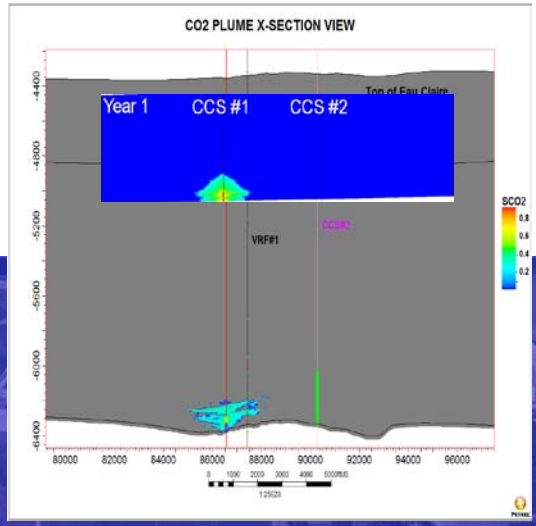
Injection Schedule for IBDP (CCS#1) and IL-ICCS (CCS#2) Projects

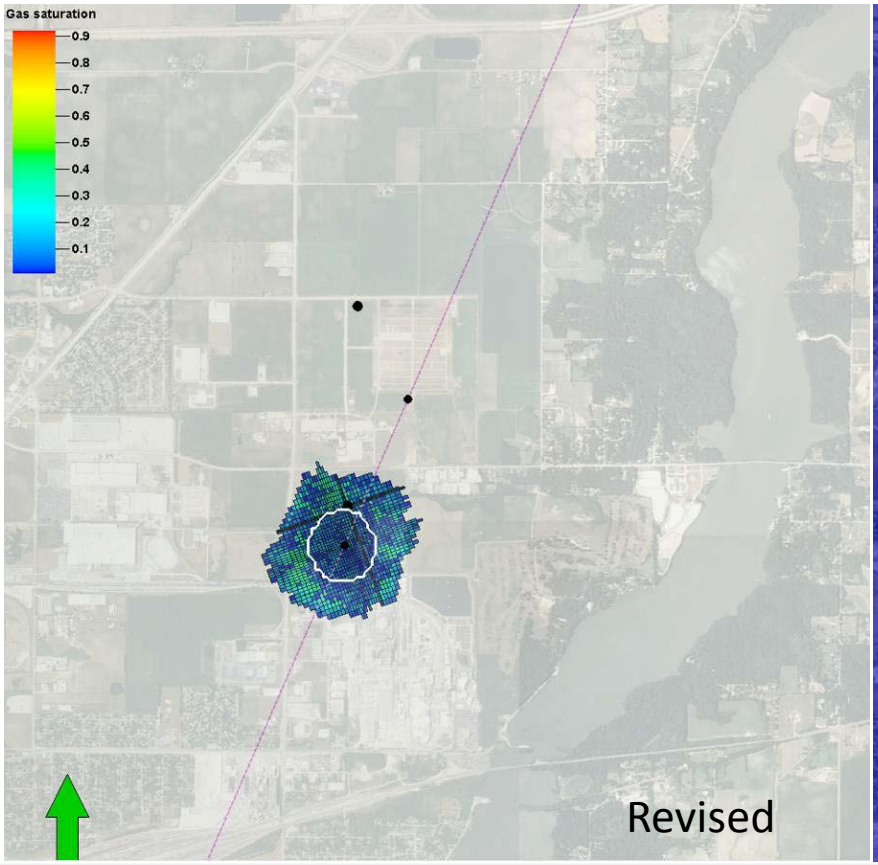
YEAR	IBDP (MT/D)	IBDP (MT/YR)	ICCS (MT/D)	ICCS (MT/YR)
1	1,000	333,333		
2	1,000	333,333		
3	1,000	333,333	2,000	730,000
4			3,000	1,000,000
5			3,000	1,000,000
6			3,000	1,000,000
7			3,000	1,000,000
Total		**1,000,000**		**4,750,000**

Site Characterization

Modeling Plume Extent & Pressure Front Comparison

January 2013 (Year 1.0)

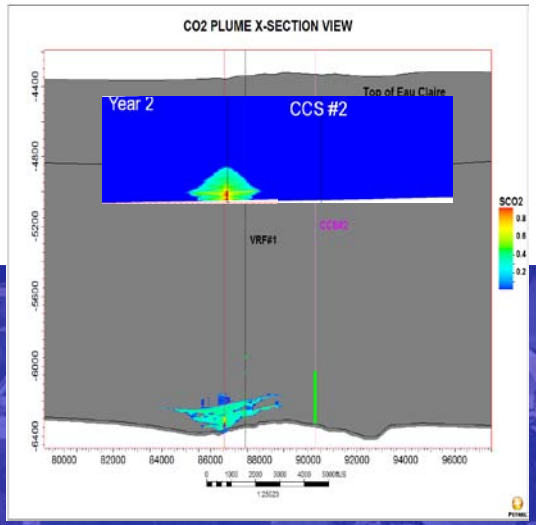


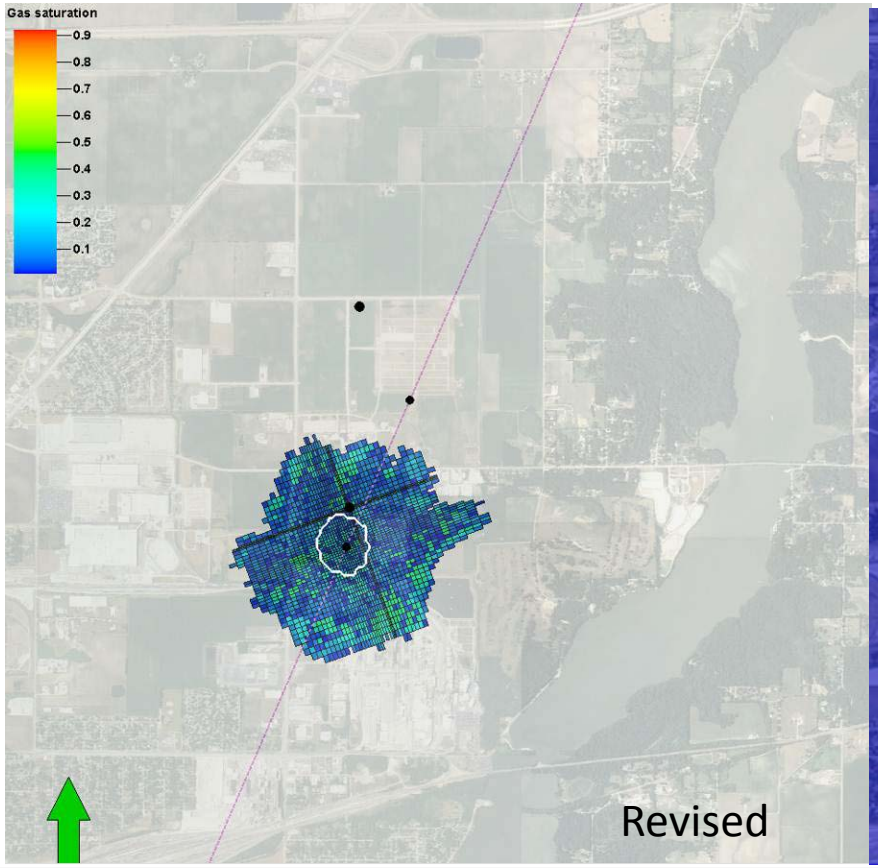


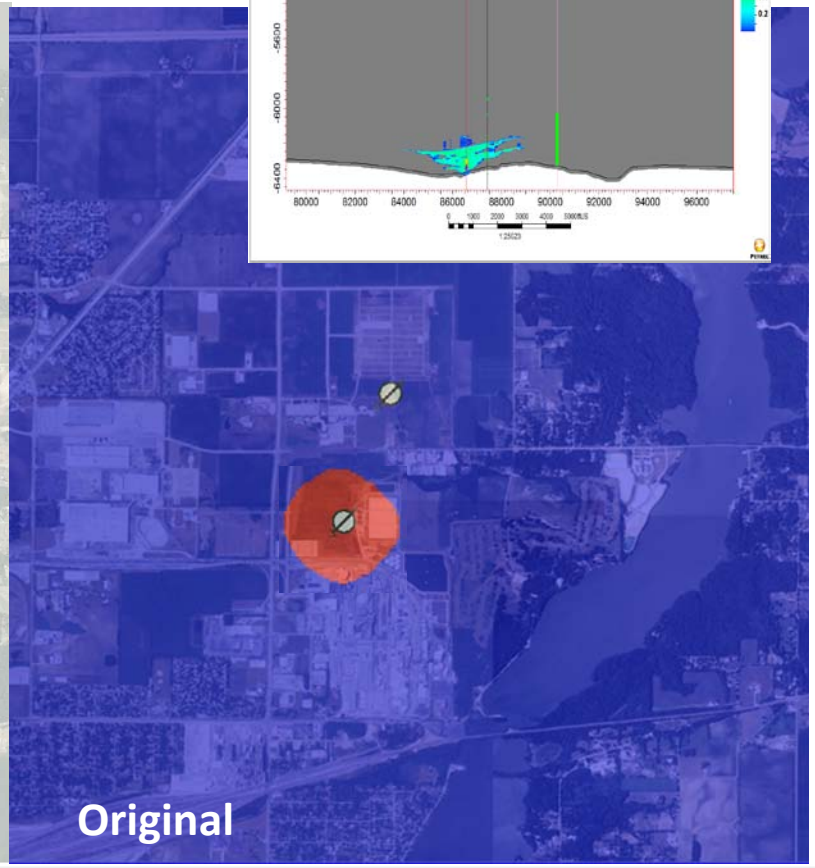
Site Characterization

Modeling Plume Extent & Pressure Front Comparison

January 2014 (Year 2.0)



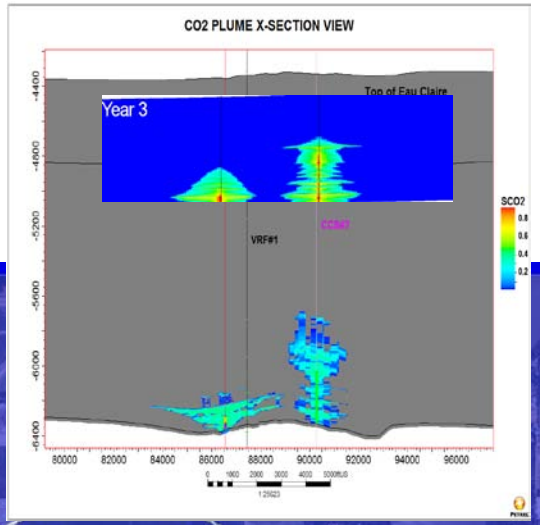


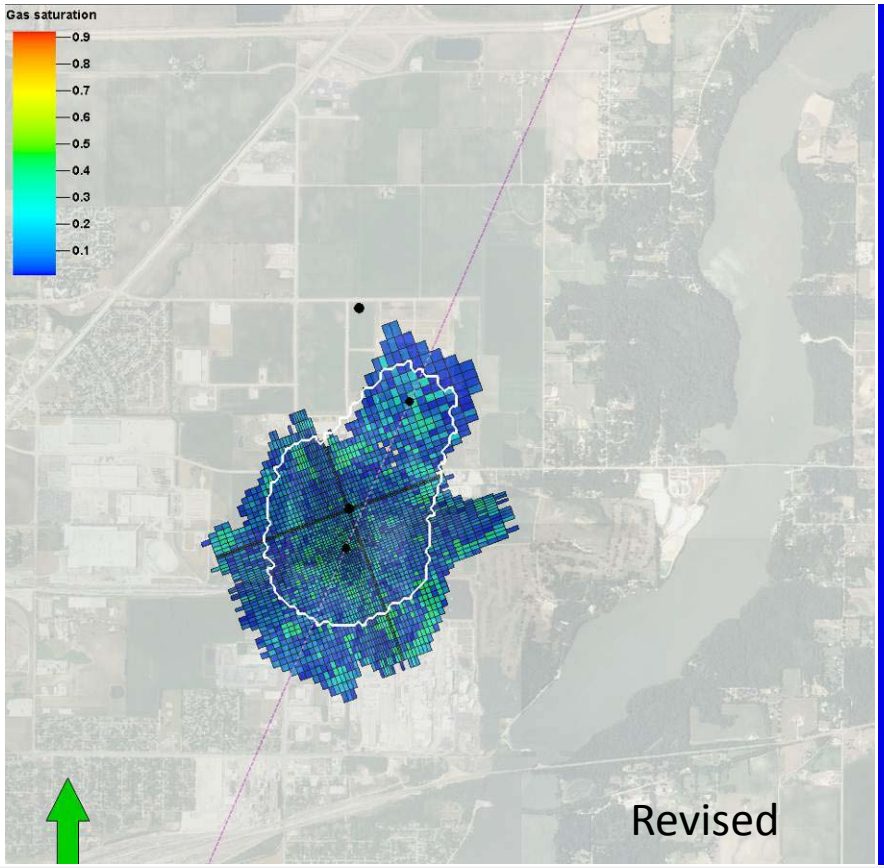


Site Characterization

Modeling Plume Extent & Pressure Front Comparison

January 2015 (Year 3.0)

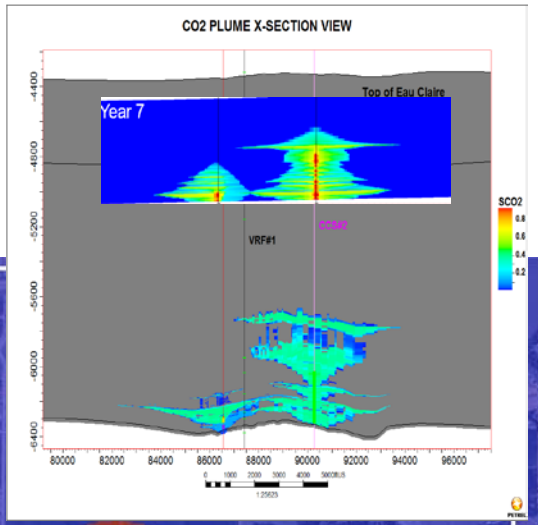


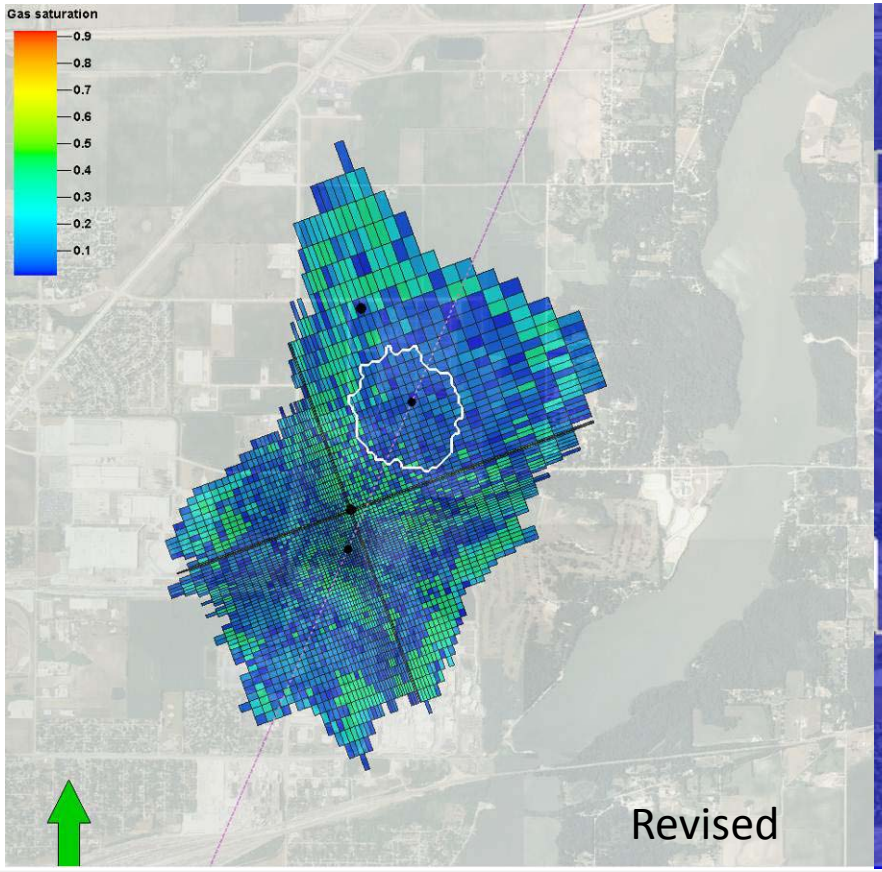


Site Characterization

Modeling Plume Extent & Pressure Front Comparison

January 2019 (Year 7.0)

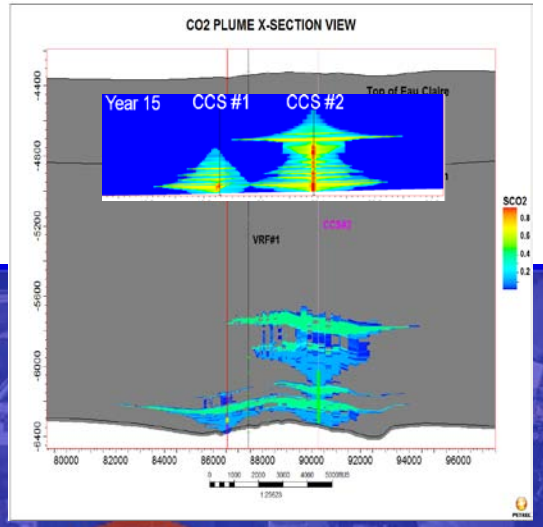


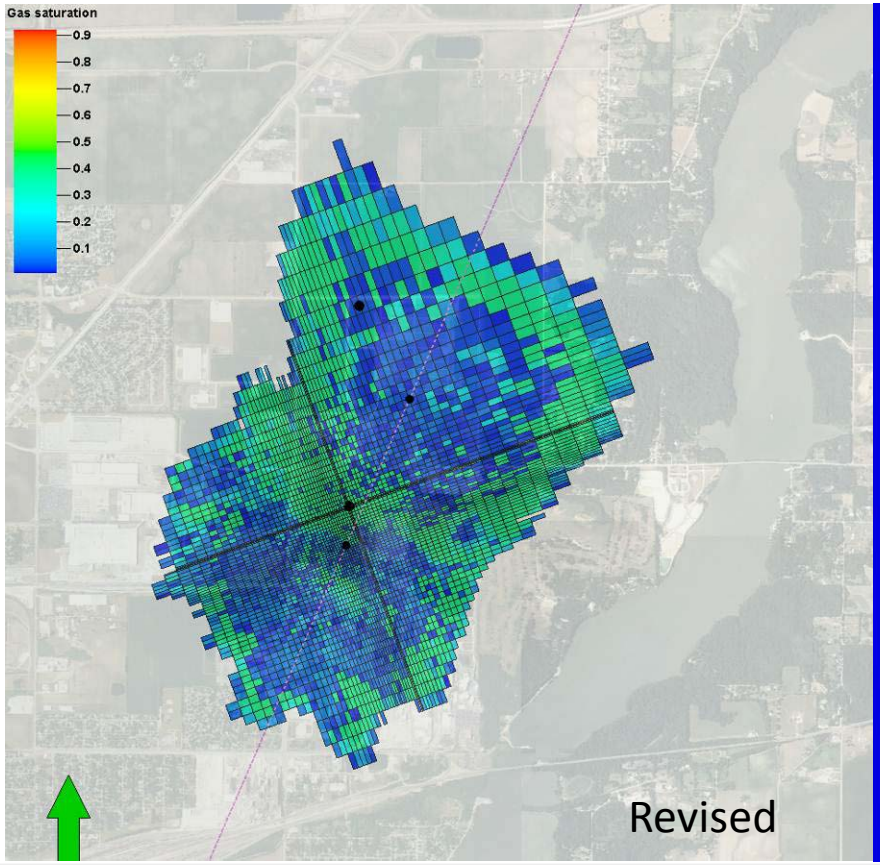


Site Characterization

Modeling Plume Extent & Pressure Front Comparison

January 2030 (Year 18.0)

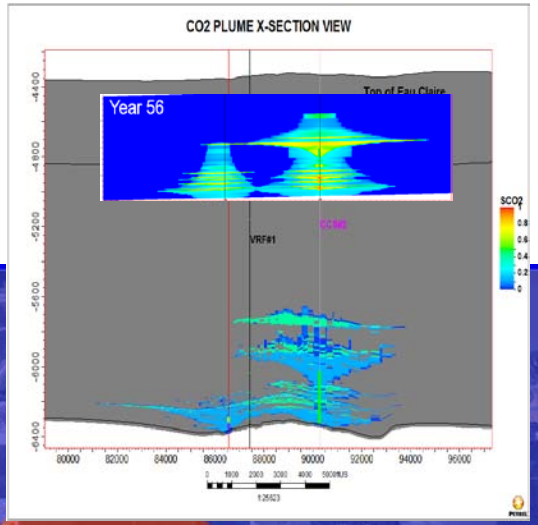


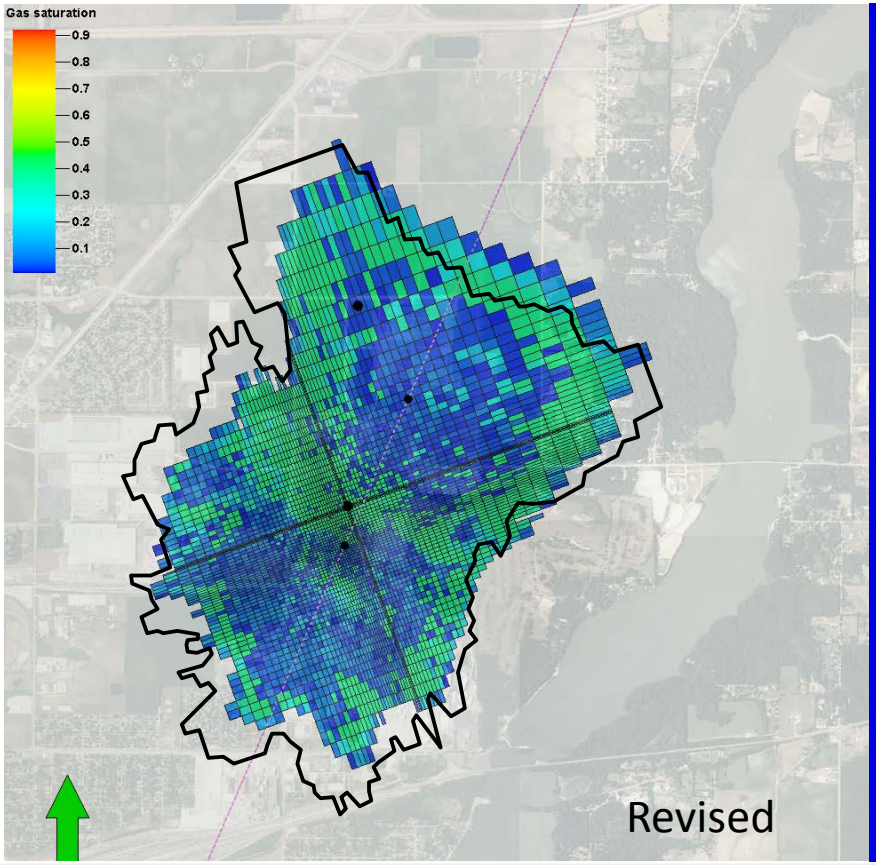


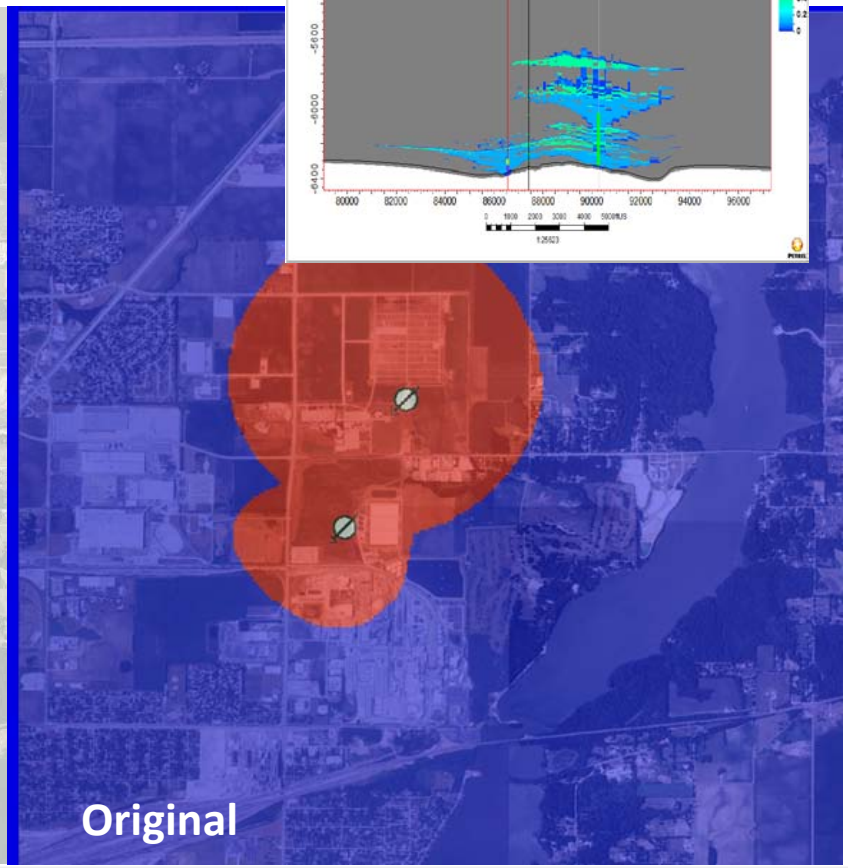
Site Characterization

Modeling Plume Extent & Pressure Front Comparison

January 2062 (Year 50.0)





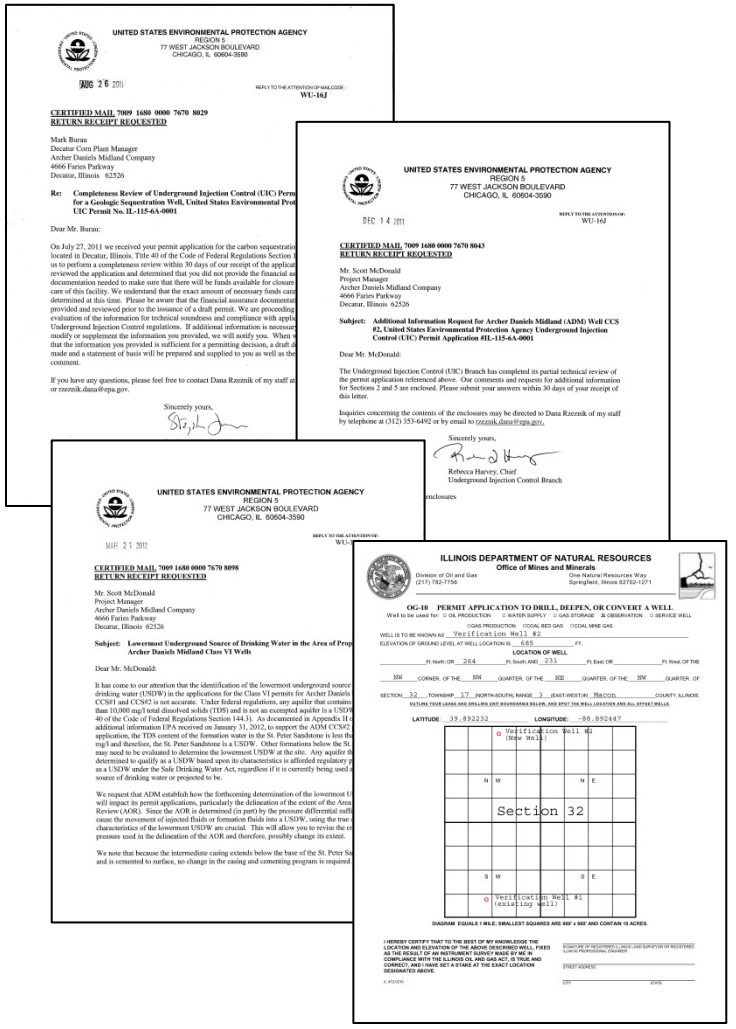


Site Permitting

USEPA: UIC Class VI Permit

1st UIC Class VI Permit Application Reviewed by the USEPA

- **UIC Class VI permit application submitted on July 25, 2011.**
- **US EPA Region V issued a notice of completeness on August 26, 2011.**
- **EPA issued an information request on December 21, 2012.**
- **The project team sent a response on January 25, 2012.**
- **The EPA issued a determination that stated the St. Peter Sandstone formation was the lower most USDW.**
- **The project team submitted revised permit application using new USDW on May 31, 2012.**
- **OG-7 application for construction of monitoring well submitted and issued on June 8, 2012.**



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

AUG 26 2011

REPLY TO THE ATTENTION OF MAIL CODE:
WU-16J

CERTIFIED MAIL 7009 1680 0000 7670 8029
RETURN RECEIPT REQUESTED

Mark Burau
Decatur Corn Plant Manager
Archer Daniels Midland Company
4666 Faries Parkway
Decatur, Illinois 62526

Re: Completeness Review of Underground Injection Control (UIC) Perm
for a Geologic Sequestration Well, United States Environmental Prot
UIC Permit No. IL-115-6A-0001

Dear Mr. Burau:

On July 27, 2011 we received your permit application for the carbon sequestrati
located in Decatur, Illinois. Title 40 of the Code of Federal Regulations Section
us to perform a completeness review within 30 days of our receipt of the applicati
reviewed the application and determined that you did not provide the financial as
documentation needed to make sure that there will be funds available for closure
care of this facility. We understand that the exact amount of necessary funds can
determined at this time. Please be aware that the financial assurance documenta
provided and reviewed prior to the issuance of a draft permit. We are proceeding
evaluation of the information for technical soundness and compliance with applic
Underground Injection Control regulations. If additional information is necessar
modify or supplement the information you provided, we will notify you. When
that the information you provided is sufficient for a permitting decision, a draft d
made and a statement of basis will be prepared and supplied to you as well as the
comment.

If you have any questions, please feel free to contact Dana Rzeznik of my staff a
or rzeznik.dana@epa.gov.

Sincerely yours,

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

DEC 14 2011

REPLY TO THE ATTENTION OF:
WU-16J

CERTIFIED MAIL 7009 1680 0000 7670 8043
RETURN RECEIPT REQUESTED

Mr. Scott McDonald
Project Manager
Archer Daniels Midland Company
4666 Faries Parkway
Decatur, Illinois 62526

Subject: Additional Information Request for Archer Daniels Midland (ADM) Well CCS
#2, United States Environmental Protection Agency Underground Injection
Control (UIC) Permit Application #IL-115-6A-0001

Dear Mr. McDonald:

The Underground Injection Control (UIC) Branch has completed its partial technical review of the permit application referenced above. Our comments and requests for additional information for Sections 2 and 5 are enclosed. Please submit your answers within 30 days of your receipt of this letter.

Inquiries concerning the contents of the enclosures may be directed to Dana Rzeznik of my staff by telephone at (312) 353-6492 or by email to rzeznik.dana@epa.gov.

Sincerely yours,

Rebecca Harvey, Chief
Underground Injection Control Branch

Enclosures

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAR 21 2012

REPLY TO THE ATTENTION OF:
WU-16J

CERTIFIED MAIL 7009 1680 0000 7670 8098
RETURN RECEIPT REQUESTED

Mr. Scott McDonald
Project Manager
Archer Daniels Midland Company
4666 Faries Parkway
Decatur, Illinois 62526

Subject: Lowermost Underground Source of Drinking Water in the Area of Prop
Archer Daniels Midland Class VI Wells

Dear Mr. McDonald:

It has come to our attention that the identification of the lowermost underground source
drinking water (USDW) in the applications for the Class VI permits for Archer Daniels
CCS#1 and CCS#2 is not accurate. Under federal regulations, any aquifer that contains
than 10,000 mg/l total dissolved solids (TDS) and is not an exempted aquifer is a USDW
40 of the Code of Federal Regulations Section 144.3). As documented in Appendix H o
additional information EPA received on January 31, 2012, to support the ADM CCS#2
application, the TDS content of the formation water in the St. Peter Sandstone is less tha
mg/l and therefore, the St. Peter Sandstone is a USDW. Other formations below the St.
may need to be evaluated to determine the lowermost USDW at the site. Any aquifer th
determined to qualify as a USDW based upon its characteristics is afforded regulatory p
as a USDW under the Safe Drinking Water Act, regardless if it is currently being used a
source of drinking water or projected to be.

We request that ADM establish how the forthcoming determination of the lowermost U
will impact its permit applications, particularly the delineation of the extent of the Area
Review (AOR). Since the AOR is determined (in part) by the pressure differential suffi
cause the movement of injected fluids or formation fluids into a USDW, using the true
characteristics of the lowermost USDW are crucial. This will allow you to revise the ex
pressure used in the delineation of the AOR and therefore, possibly change its extent.

We note that because the intermediate casing extends below the base of the St. Peter Sa
and is cemented to surface, no change in the casing and cementing program is required.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES
Office of Mines and Minerals
Division of Oil and Gas
(217) 782-7756
One Natural Resources Way
Springfield, Illinois 62702-1271

OG-10 PERMIT APPLICATION TO DRILL, DEEPEN, OR CONVERT A WELL

Well to be used for: ☐ OIL PRODUCTION ☐ WATER SUPPLY ☐ GAS STORAGE ☒ OBSERVATION ☐ SERVICE WELL
☐ CBM PRODUCTION ☐ COAL BED GAS ☐ COAL MINE GAS

WELL IS TO BE KNOWN AS Verification Well #2
ELEVATION OF GROUND LEVEL AT WELL LOCATION IS 685 FT.

LOCATION OF WELL
Ft. North; OR 264 Ft. South; AND 231 Ft. East; OR Ft. West; OF THE
NW CORNER; OF THE NW QUARTER; OF THE NE QUARTER; OF THE NW QUARTER; OF
SECTION 32 TOWNSHIP 17 NORTH-SOUTH; RANGE 3 (EAST-WEST) IN Macon COUNTY, ILLINOIS.
OUTLINE YOUR LEASE AND DRILLING UNIT BOUNDARIES BELOW, AND SPOT THE WELL LOCATION AND ALL OFFSET WELLS.

LATITUDE 39.892232 LONGITUDE -88.892447

Verification Well #2 (New Well)
Section 32
Verification Well #1 (existing well)

DIAGRAM EQUALS 1 MILE; SMALLEST SQUARES ARE 660' x 660' AND CONTAIN 10 ACRES.

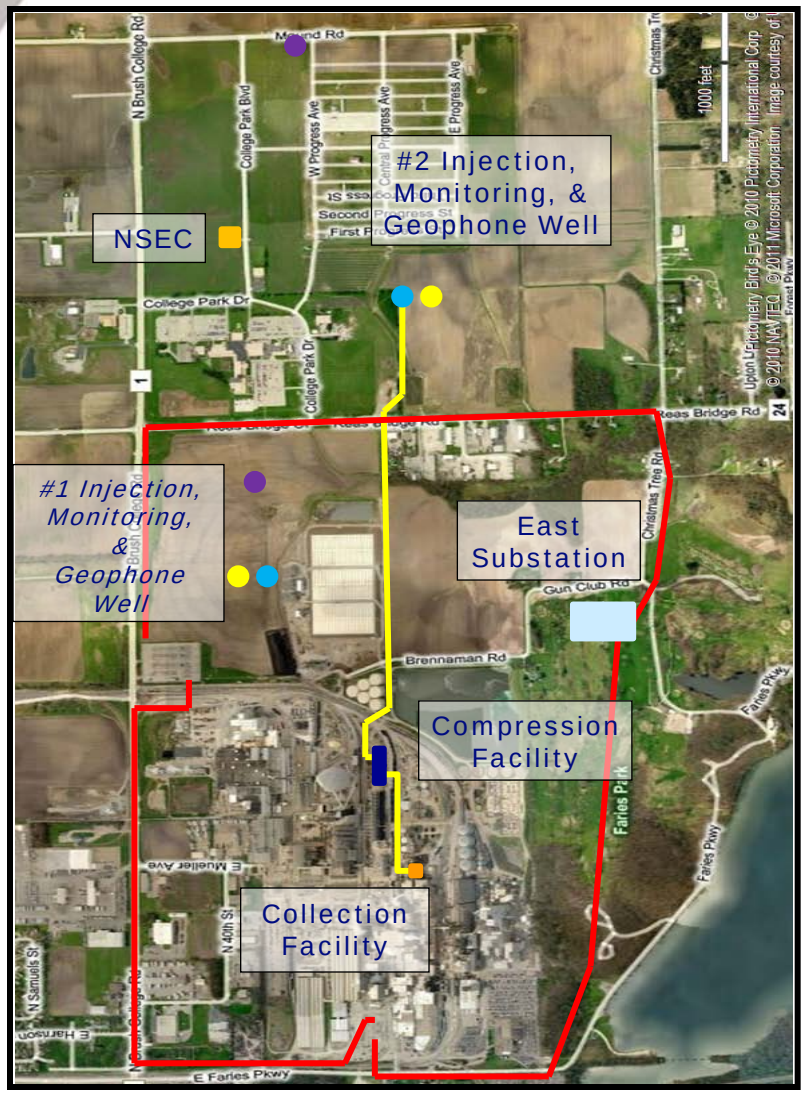
I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE THE LOCATION AND ELEVATION OF THE ABOVE DESCRIBED WELL, FIXED AS THE RESULT OF AN INSTRUMENT SURVEY MADE BY ME IN ACCORDANCE WITH THE ILLINOIS OIL AND GAS ACT, IS TRUE AND CORRECT, AND I HAVE SET A STAKE AT THE EXACT LOCATION DESIGNATED ABOVE.

SIGNATURE OF REGISTERED LAND SURVEYOR OR REGISTERED ILLINOIS PROFESSIONAL ENGINEER

STREET ADDRESS

CITY STATE

Engineering Design & Construction
Major Capital Elements



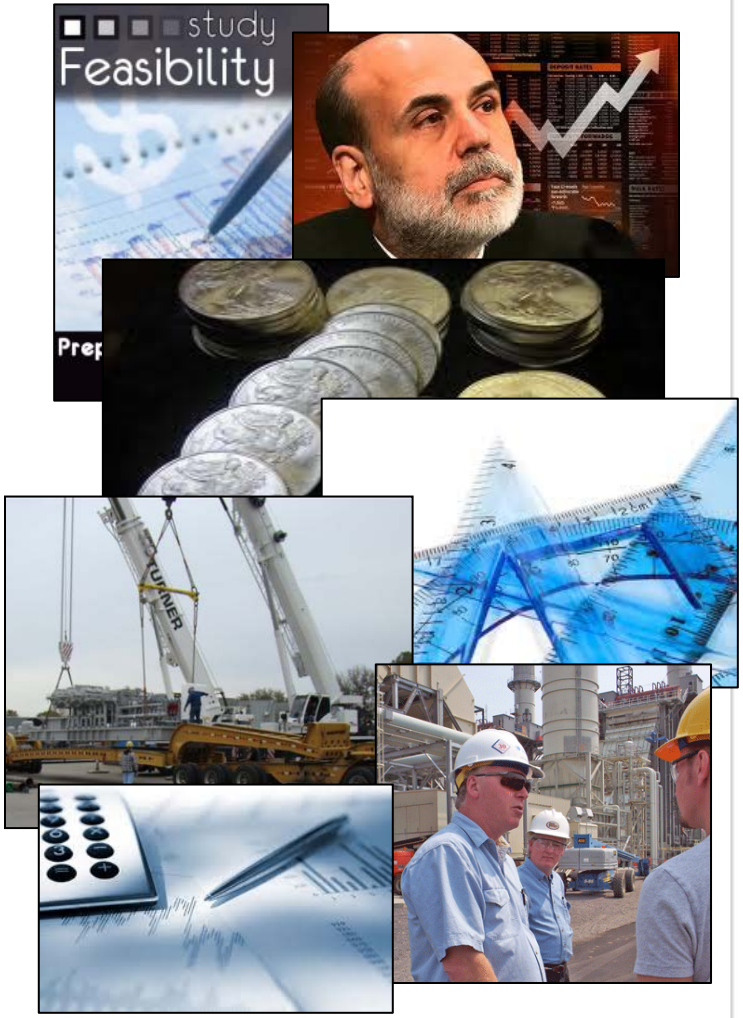
- Collection, Compression, and Transmission Facility
- Electrical Substation & Distribution System
- Storage Site and Monitoring Facility
- National Sequestration Education Center (NSEC)

Engineering Design & Construction
Capital Project Approach Plan

ADM has a stage-gate project plan that is divided into six stages:

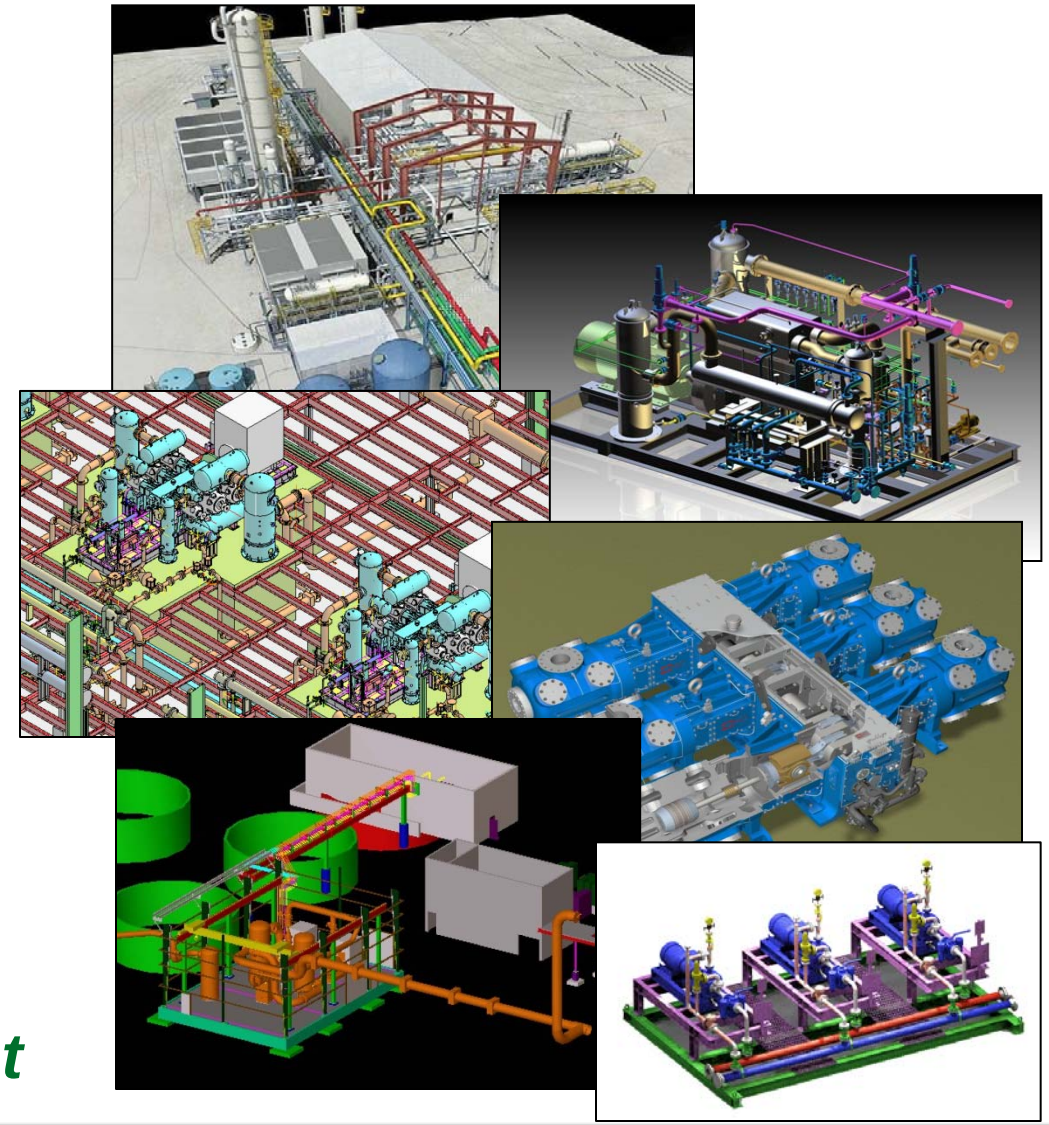
- **Concept and Feasibility Stage**
- **Assessment Stage**
- **Development and Design Stage**
- **Construction Stage**
- **Start up and Commissioning Stage**
- **Final Audit and Closing Stage**

Reduce Capital and Technical Risk



Engineering Design & Construction
Modular Design & 3D Computer Aided Design

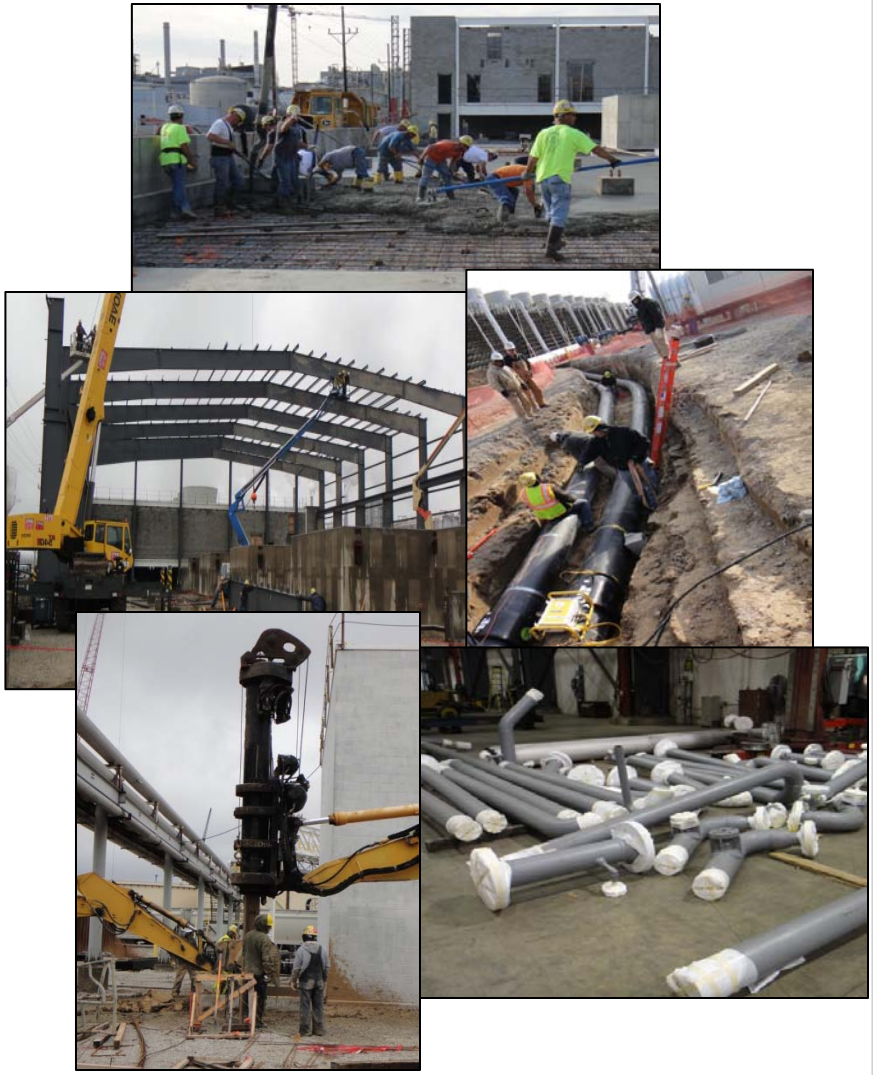
- Major equipment designed as modular components on self contained skids using 3D CAD
- Combined modules into single model which allowed integration of the mechanical, structure, civil, & electrical design elements
- 3D model allowed rapid evaluation of changes to the mechanical and structural design elements
- All construction drawings were created from the 3D model allowing for precise shop fabrication of 80% of the mechanical, structural & electrical components.



Reducing Capital Cost

Engineering Design & Construction Planning

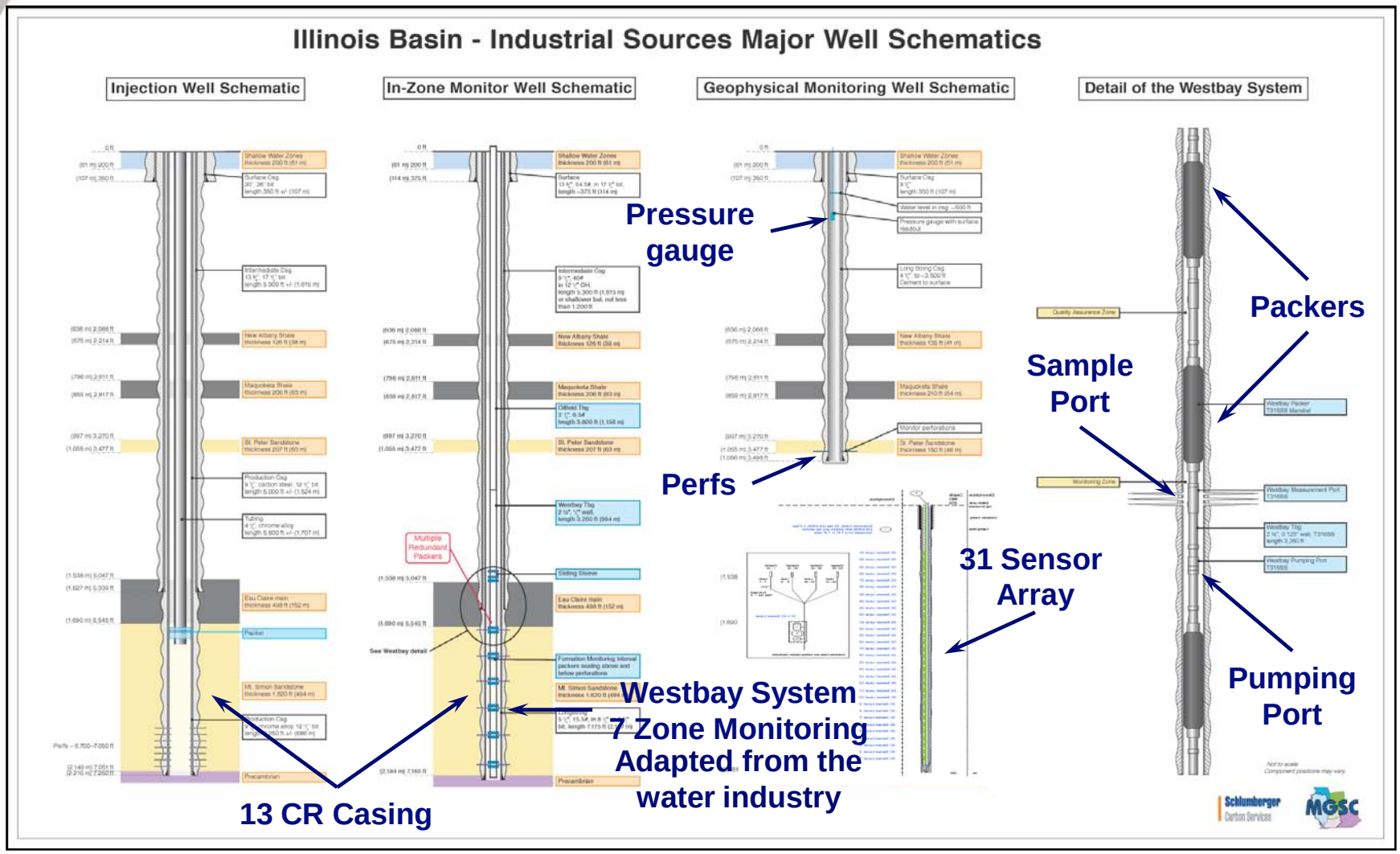
- Designed enclosures with a coordinated/staged construction schedule
- Minimized craft interference and accelerated building erection
- Staggered craft work schedule minimized interference
- The enclosure also facilitate construction during winter or periods of inclement weather
- Refurbished existing equipment and a structures to minimize project footprint and costs
- 24 month construction schedule



Reducing Installation Time

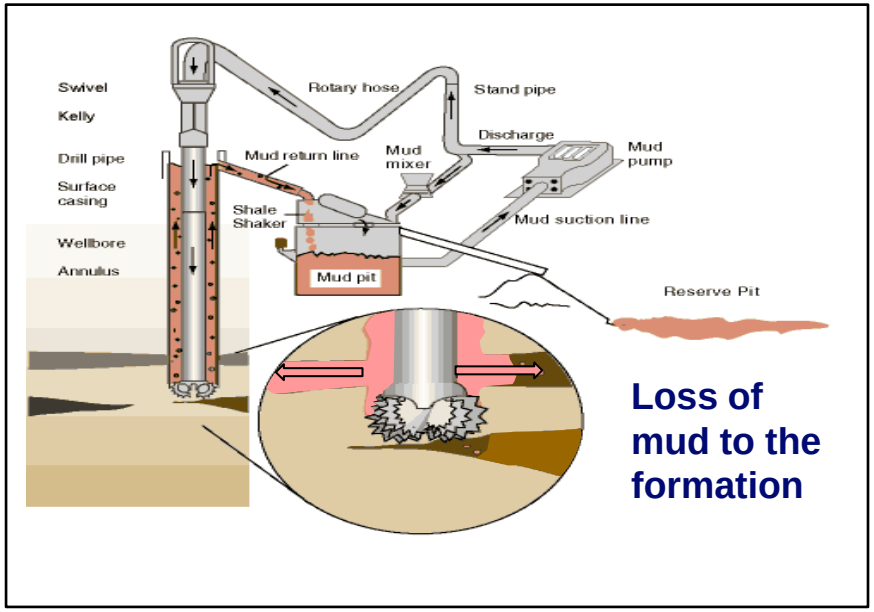
Engineering Design & Planning
Storage Site: Major Well Schematics

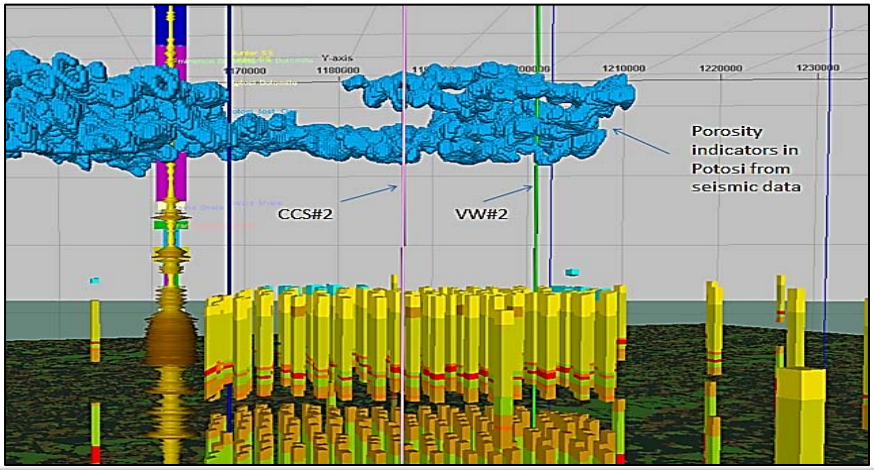
Built to Meet Class VI Standards



Well Construction Management
Storage Site - Lost Circulation Event

- CCS #1 LCM event in the Knox zone conventional LCM were not effective for this zone – Set cement plugs
- MW #1 – bypassed LCM and set cement plugs. 70% cost reduction vs. CCS #1
- Using of 3D seismic and modeling techniques to predict location and severity of lost returns.
- Developed drilling protocol to maximize drill time during LC event (drill thru the formation) and set cement plug.



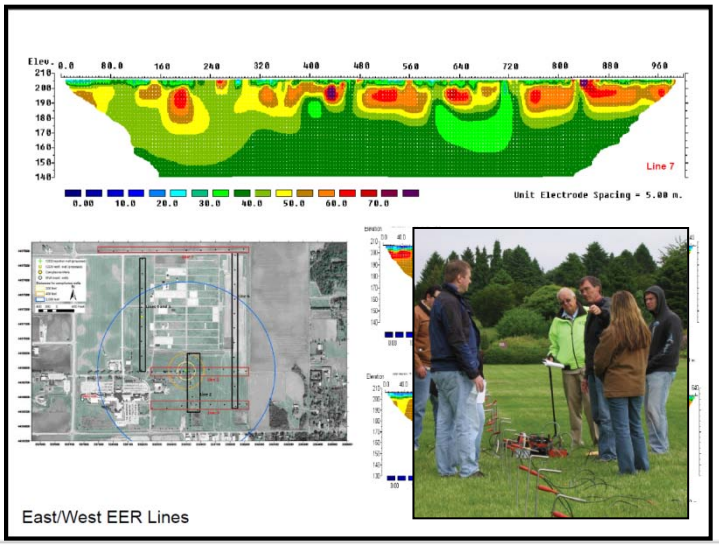


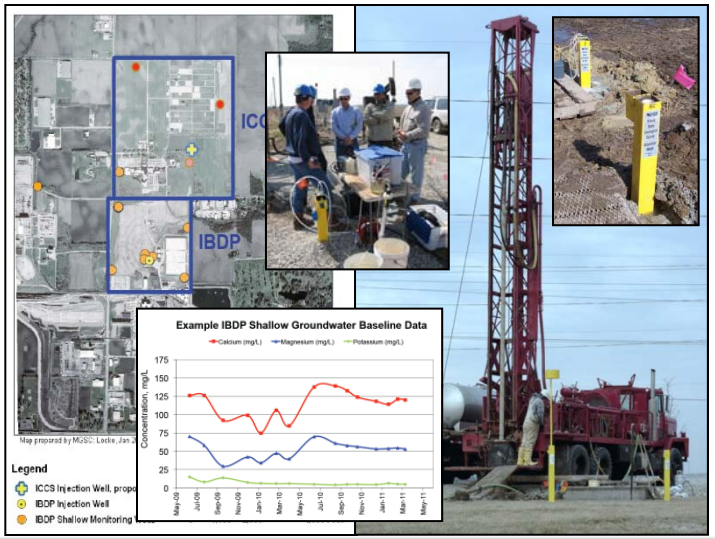
Environmental Monitoring (MVA)
Conceptual Framework

Near Surface		Deep Subsurface	
Soil and Vadose Zone	Ground Water	Above Seal	Injection Zone
Aerial Imagery Soil CO_2 Flux	Geochemical Sampling P/T Monitoring	Geophysical Surveys Seismic Monitoring P Monitoring	Geophysical Surveys Geochemical sampling P/T Monitoring

Environmental Monitoring
Near Surface Monitoring

- Near infrared aerial imagery will be used to evaluate plant stress
- Soil resistivity characterized shallow depths for identification of optimum GWM locations
- GWM for baseline conditions and operational surveillance
- Surface soil CO_2 flux monitoring





Environmental Monitoring
Deep Subsurface Monitoring

- CCS#2 T/P monitoring
- Distributed Temp Sensor
- VM#2 Westbay system
- Multi-level sampling ports reservoir fluid collection and T/P monitoring
- GM#2 has 31 sensor array
- Pressure sensor to monitor above the seal
- Allow offset or walkaway Vertical Seismic Profile (VSP)
- Well logging (RST)

Outreach and Education
Building on Current Regional CCS Activities

- Trusted Information Source
- Local, Regional, National, and International Events
  - Decatur Public Events
  - AAPG Short Courses
  - IEA GHG Summer School 2011
- Providing Information
  - Invited presentations
  - Technical presentations
  - Model presentations
  - Teacher workshops
  - Coordination with STEM.
- Education Development
  - STELA Learning Environment
  - Undergraduate CCUS course

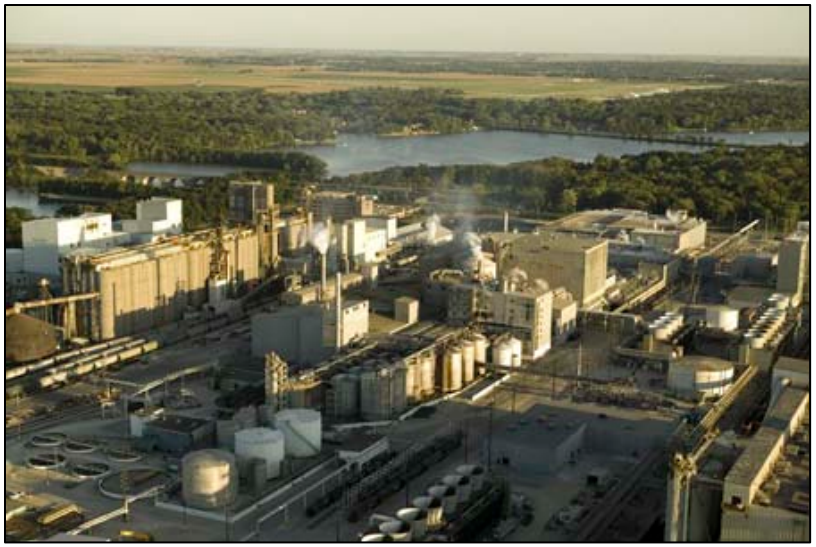
Working with local programs to leverage funding.

National Sequestration Education Center

- Innovative Educational Spaces
- Academic Curricula
- Community & Industry Workshops
- Workforce Training Activities
- Visitor Center
- K-12, Community & Regional Outreach
- Sequestration Training & Learning Array (STELA)

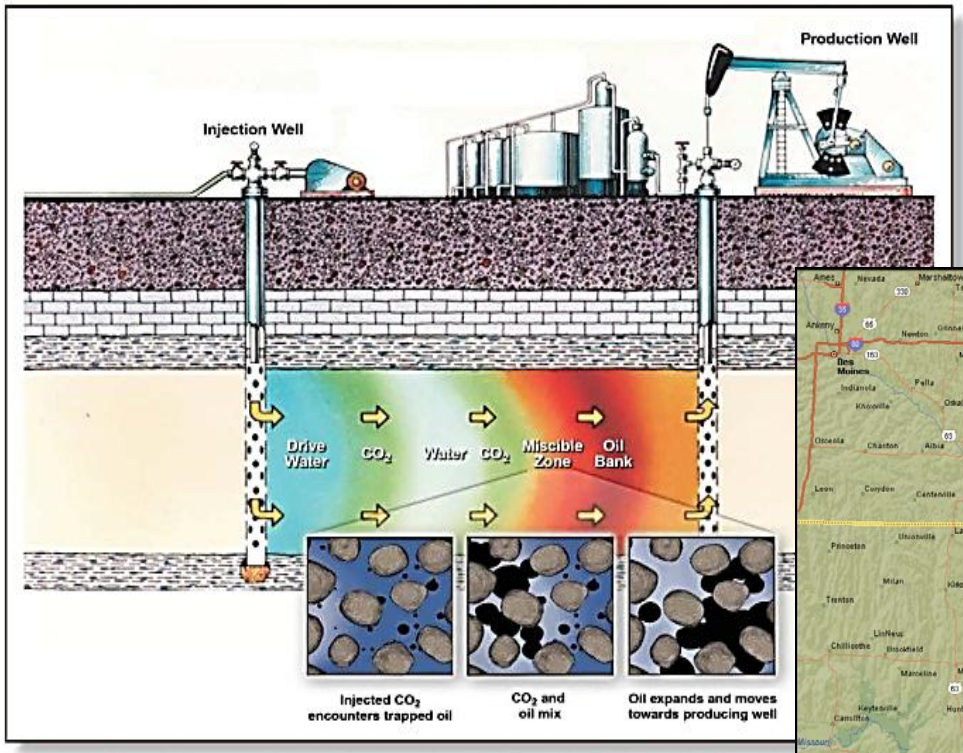
Project Groundbreaking Ceremony: August 24, 2011

Environmental and Cost Benefits
GHG Reduction & Fuel LCA



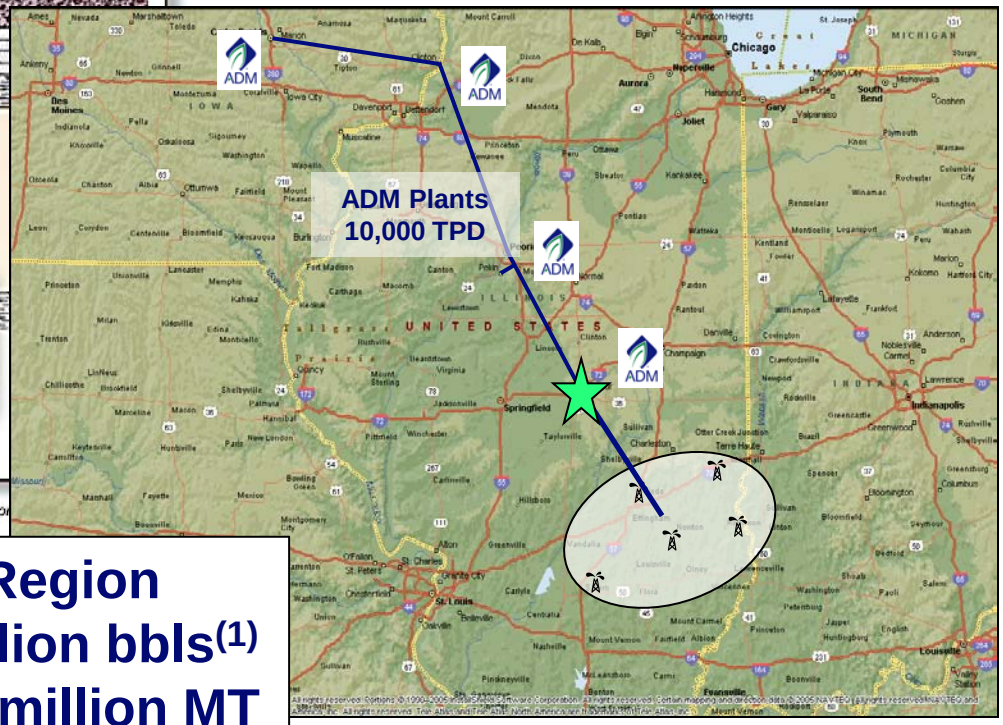
- Reduction in site's CO_2 emissions.
- Process has a GHG reduction efficiency of 94% based on using Midwest electricity grid average.
- Reduction of the carbon footprint of fuel ethanol.
- The operational expense is significantly lower than other forms of CO_2 capture.
- 15 billion gallons annually, represents about 40 million metric tons of CO_2.

Future Commercial Potential
Enhanced Oil Recovery



Cross-section illustrating how carbon dioxide and water can be used to flush residual oil from a subsurface rock fo

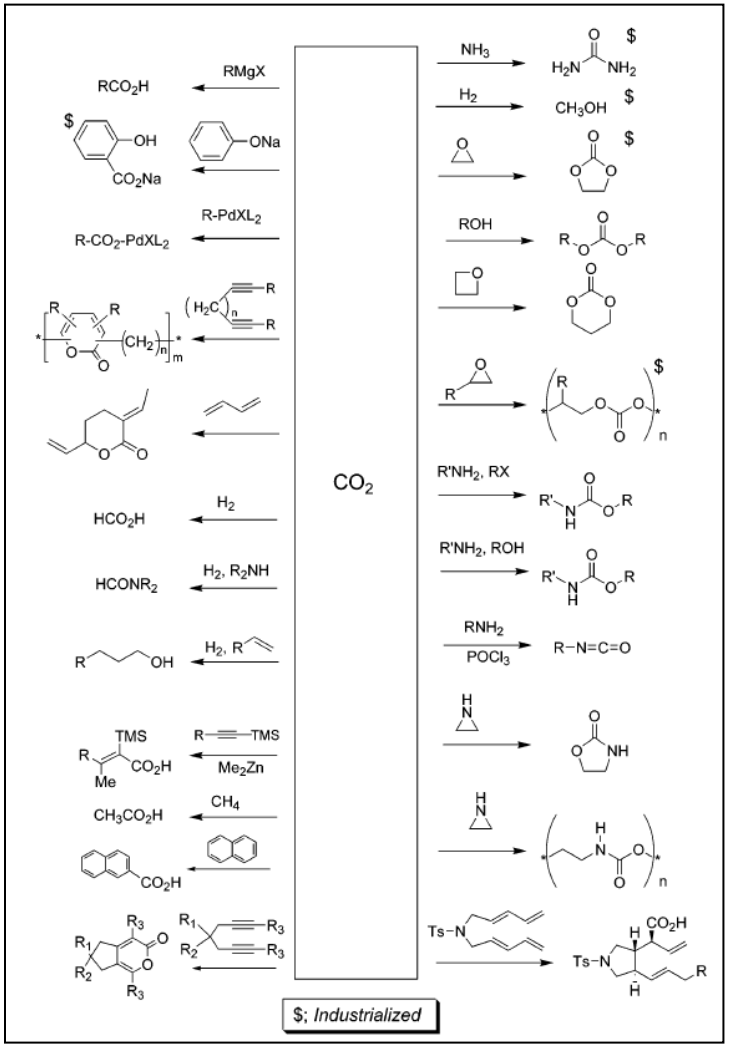
(1) BASIN ORIENTED STRATEGIES FOR CO2 ENHANCED OIL RECOVERY: ILLINOIS AND MICHIGAN BASIN OF ILLINOIS, INDIANA, KENTUCKY AND MICHIGAN; Advanced Resources International, February 2006



- **Illinois Basin - Oil Producing Region**
- **Est. Recoverable Oil = 700 million bbls(1)**
- **Est. CO_2 Requirements = 150 million MT**

Future Commercial Potential

- **Product Development**
  - CO_2 Liquids
  - Carbonates
  - Fertilizer
- **Process Development**
  - SC Extraction
  - Solvent Applications
- **Carbon Management**
  - Storage
  - Trading & Risk Management



Transformation of Carbon Dioxide, Sakakura, Choi, & Yasuda, 2007

Thank You!

Industrial Carbon Capture and Storage Project:

- U.S. Department of Energy Award No. DE-FE-0001547
- Administered by the DOE's Office of Fossil Energy
- Managed by the National Energy Technology Laboratory
- DOE cost share from American Recovery and Reinvestment Act of 2009

Cost Share Agreements:

- Archer Daniels Midland Company
- University of Illinois through the Illinois State Geological Survey
- Schlumberger Carbon Services
- Richland Community College

Project Team Members Contacts:

- Dr. Sai Gollakota (NETL-DoE) Sai.Gollakota@NETL.DOE.GOV
- Dr. Robert Finley, (ISGS) finley@isgs.illinois.edu
- Eric Berlin, (Schlumberger Carbon Services) berlin1@slb.com
- Dr. Douglas Brauer (RCC) dbrauer@richland.edu