CARBON STORAGE IN THE ILLINOIS BASIN REGION: PROJECT EXPERIENCES

SALLIE GREENBERG, PH. D.

ILLINOIS STATE GEOLOGICAL SURVEY

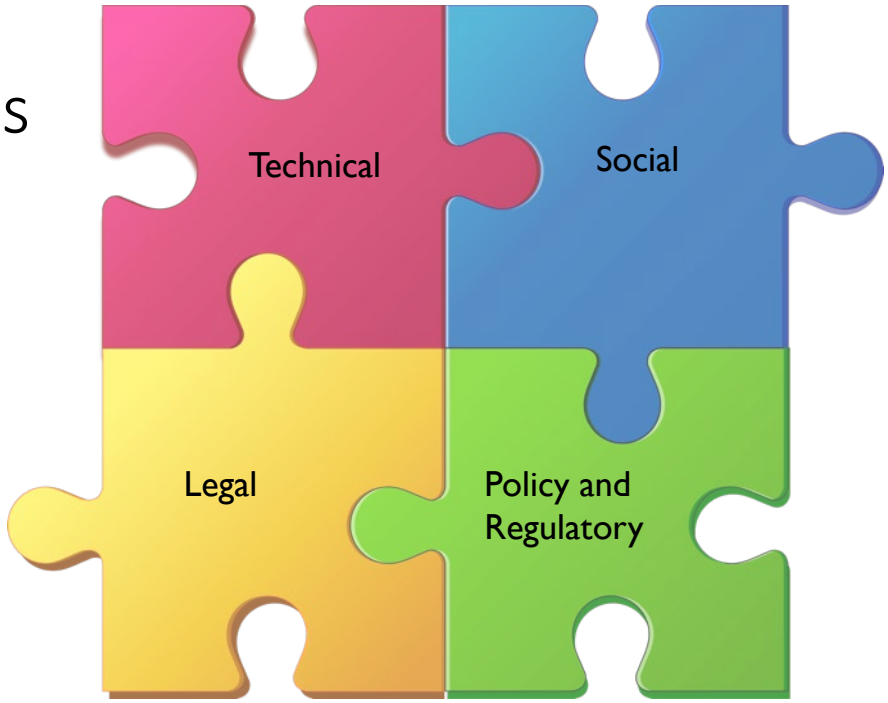
UNIVERSITY OF ILLINOIS

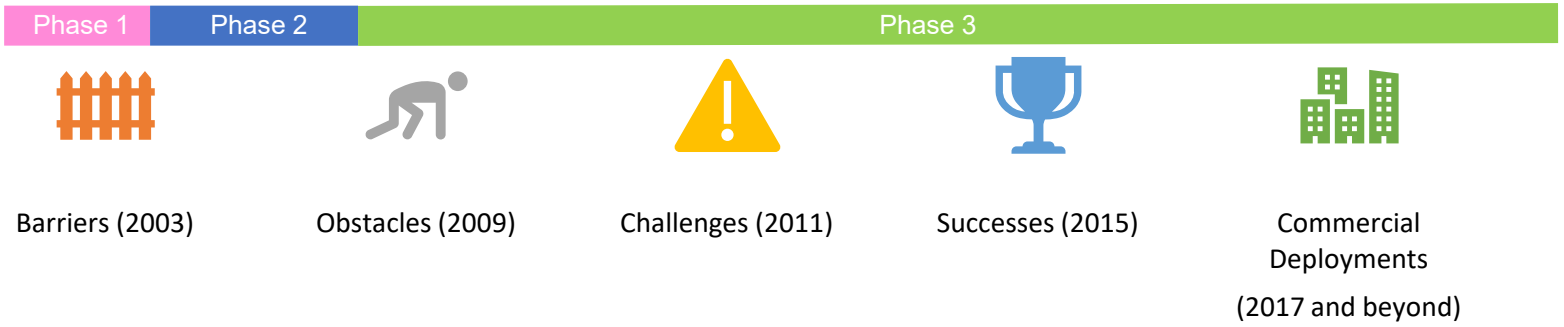
CARBON REMOVAL AND STORAGE WORKSHOP - CARB

2 AUGUST 2021

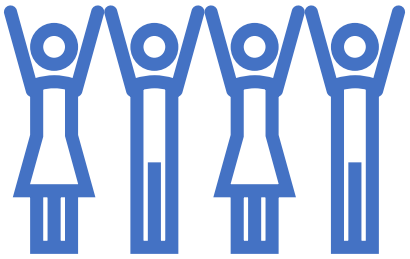
In Decatur and throughout the Illinois Basin, the ISGS has demonstrated Safe and Effective storage.

The pieces Have come together





Accomplishments: Illinois Basin – Decatur Project

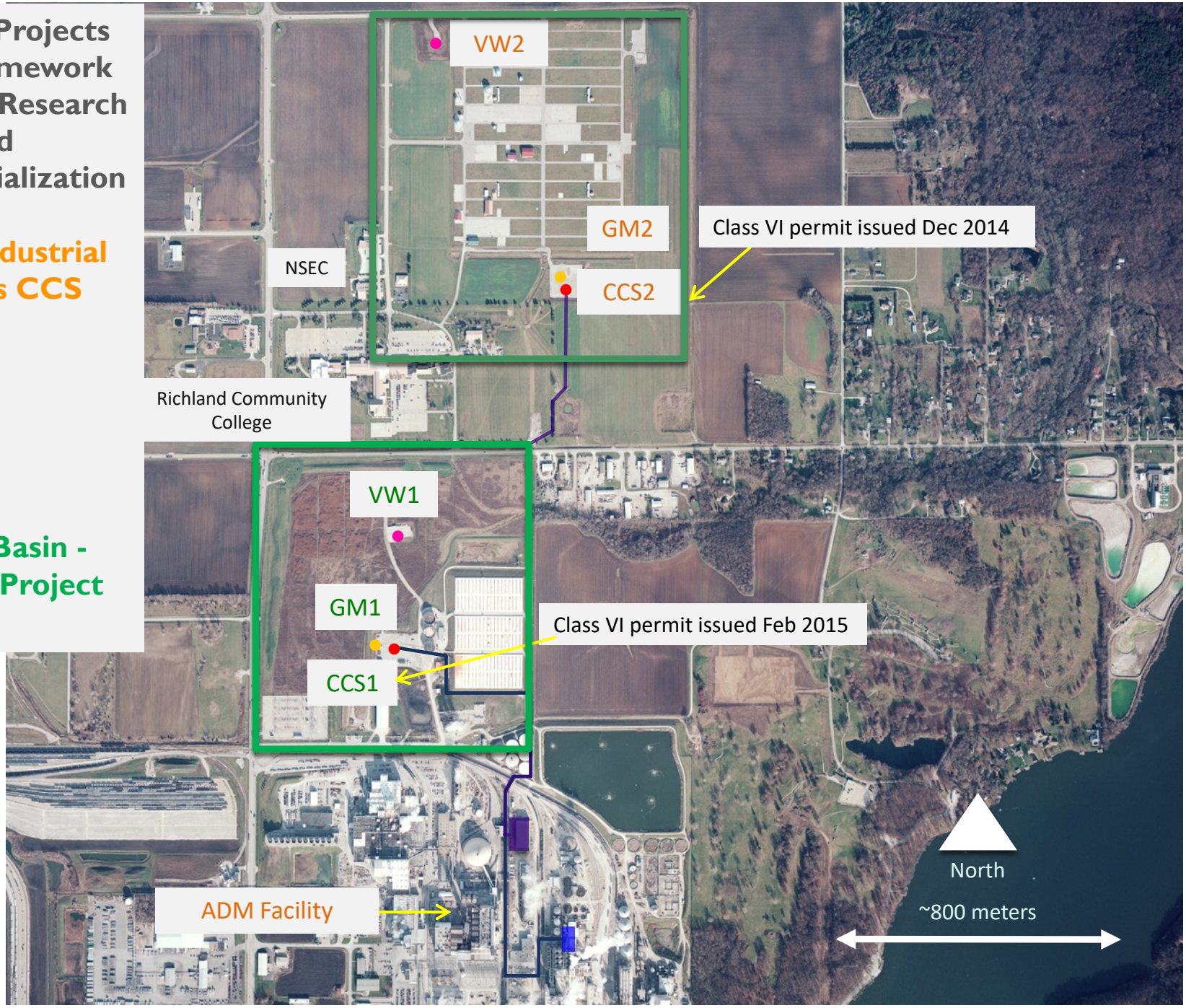


- Captured, transported, stored, and monitored 1 million tonnes of CO_2 from biofuel production in an onshore Saline Reservoir
- Executed FOAK monitoring, verification, and accounting (MVA) program
- Met and exceeded all technical and non-technical challenges
- Successful Class VI permitting
- Conducted microseismic monitoring and interpretation
- Developed International collaborations
- Laid foundations for multiple projects
- Build international, national, and regional capacity
- Stakeholder engagement strategy built trusted relationships
- Created comprehensive data set

Multiple Projects Build Framework for CCUS Research and Commercialization

Illinois Industrial Sources CCS

Illinois Basin - Decatur Project



CCUS PROJECTS IN DECATUR, IL USA

Illinois Basin – Decatur Project

- Large-scale demonstration
- Volume: 1 million tonnes
- Injection period: 3 years
- Injection rate: 1,000 tonnes/d
- Compression capacity: 1,100 tonnes/day

Contribution:

- Geologic and Social Site Characterization
- Reservoir Modeling and Risk Assessment
- MVA Development and Engineering Design
- Stakeholder Engagement

Status:

- Post-injection monitoring ends April 2020
- Conceptual site model and history matching

Illinois Industrial CCS Project

- Industrial-scale demonstration
- Volume: up to 5 million tonnes
- Injection period: 3 years (or longer)
- Injection rate: 3,000 tons/d
- Compression capacity: 2,200 tonnes/day

Contribution:

- Commercial-scale up surface and subsurface
- Intelligent Monitoring
- Class VI permitting

Status:

- Injection Began April 7, 2017
- Optimization of capture process
- ~2,400,000 (as of June 2021)

IBDP Monitoring Program

Comprehensive risk-based program with research, regulatory, and operational objectives

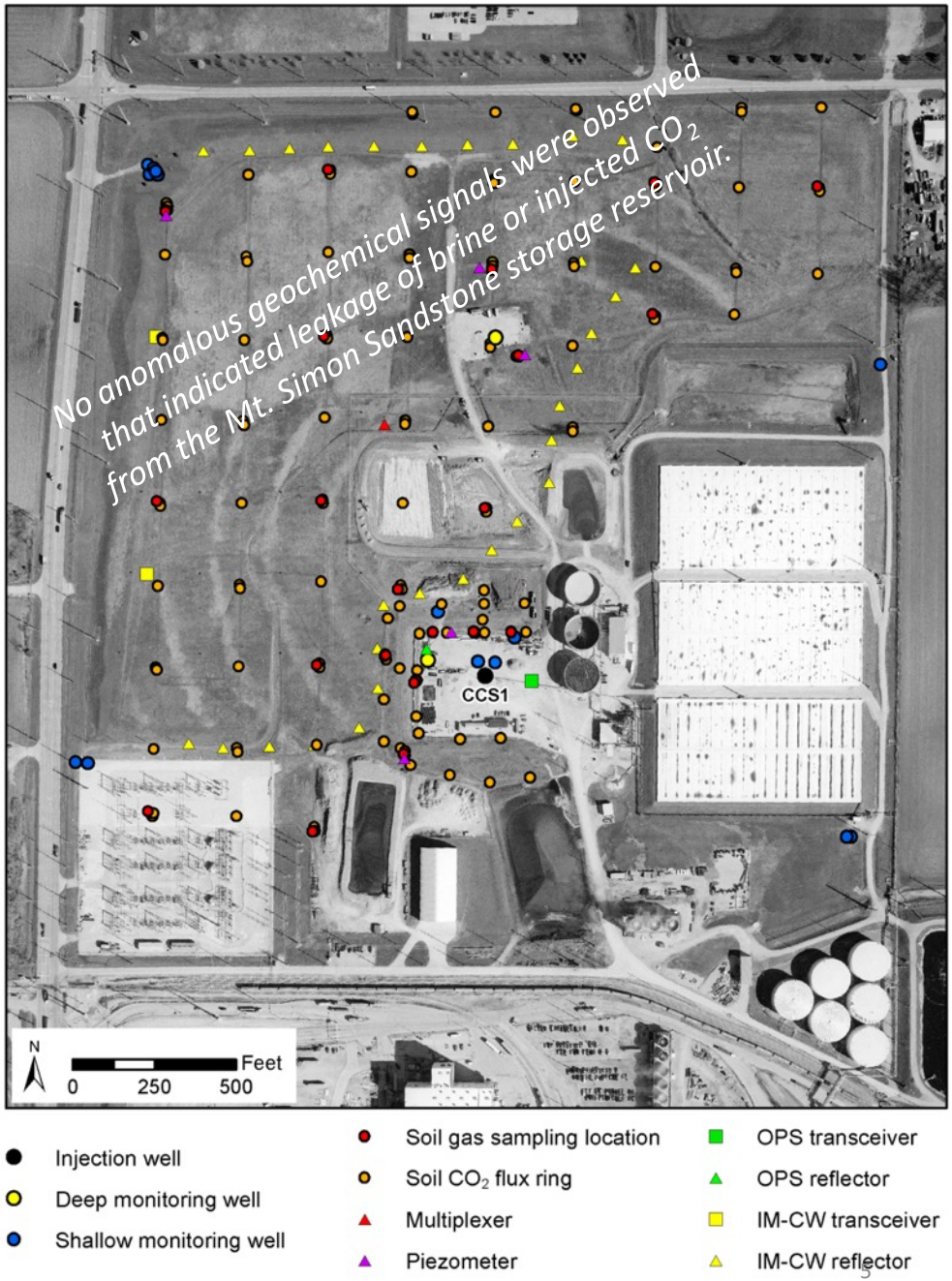
- (20+ techniques); 11+ years
  - 2 years pre-injection (2009-2011)
  - 3 years during injection (2011-2014)
  - 6 years post-injection (2014-2020)

Primary monitoring networks

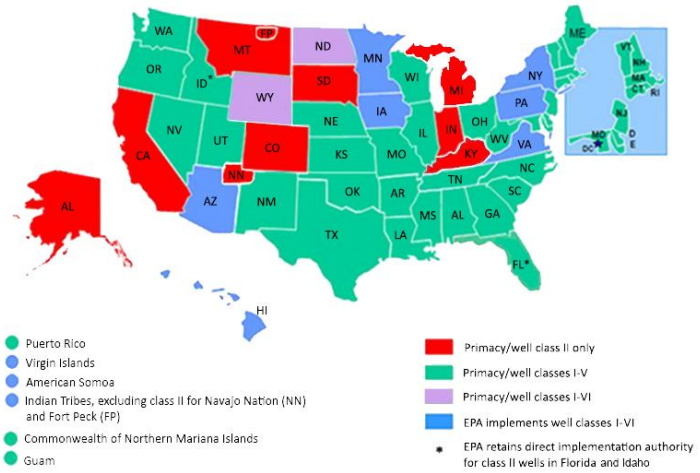
- Microseismic
- Deep groundwater
- Shallow groundwater
- Soil gas

Collected/analyzed

- 1,434 shallow (< 100 m) groundwater samples
- 188 deep (100-2,200 m) groundwater samples
- 755 soil gas samples



Permitting



All Six Class VI permits have been issued in Illinois, only two are in use:

- CCS1 – Archer Daniels Midland (IBDP)
  - Post-injection site care (PISC)
- CCS2 – Archer Daniels Midland (Industrial Sources)
  - Full operations permit, 10-year PISC
- FutureGen 2.0 - 4 permits issued, withdrawn when ARRA funding expired

- Permitting has been rate-limiting step for both Illinois projects
  - Projects tied together for monitoring purposes
  - 3 years to issue permit, 3 years to receive permission to inject
- Key issue: Uncertainty lies between issuance of final permit and authorization to inject – up to 3 years
- Accelerate timing of permitting
  - Better than current 18 months (Illinois longer)
  - Impacts ability to realize 45Q tax credit

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Illinois State Geological Survey
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Decatur by the numbers (IBDP + ICCS):

- 3+ million tonnes CO_2 stored from **biofuels**
- More than **16,000 feet meters** of drilled wells
- More than **800 feet** of collected core
- Near-surface groundwater monitoring efforts have resulted in more than **60,000 analyses**
- For basin-scale modeling, we will use **1,020,000 CPU-hours** of XSEDE supercomputing resources.
- More than **1,700 visitors from 29 countries** have been to IBDP and ICCS
- More than **100 people from at least 10 organizations** have worked together to make these projects a success

Key Learnings

- Geology is critical and will always remain key factor
- Induced seismicity in basement formations is not a given
- Iterative scientific investigation allows for advancement and economy of scale
- Baseline environmental assessments are critical
- Unanticipated results provide insights into improvements that benefit all projects
- Incorporate technology changes into life cycle of project
- Occom's Razor applies to CCUS
- Scientific and engineering timeframe not aligned with policy
- Pilot and demonstration projects provide critical insights
- Policy drivers are necessary to facilitate commercialization
- Regulatory, legal, and social factors are critical and require significant time investment

This work was initially 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)