Illinois Storage Corridor DE-FE0031892

Steve Whittaker Illinois State Geological Survey/ University of Illinois

U.S. Department of Energy National Energy Technology Laboratory 2021 Carbon Management and Oil and Gas Research Project Review Meeting August 2021

Presentation Outline

- Project Overview
- Environmental Impact Volume
- Risk Assessment
- Site Characterization
- Drilling
- Modeling
- UIC Class VI Permitting
- Carbon Capture Assessment
- Summary

Illinois Storage Corridor CarbonSAFE Phase 3

Illinois Storage Corridor is a region with significant previous CCS-related activity

Project builds upon IBDP, CarbonSAFE Phases I and 2 and many other studies.

2 separate sites will be investigated in different storage complexes Ethanol source: Mt Simon Storage Complex – Storage HUB (0.5 to 1.7 MTPA CO₂)

Coal-fired power source: FEED study for capture +6 million tons CO_2 per year



IILLINOIS

PRAIRIE RESEARCH INSTITUTE

Illinois State Geological Survey



Storage Development



ILLINOIS Illinois State Geological Survey Prairie research institute

Lower Mt Simon Complex

Sim CCS Gateway



Estimates created using the Sequestration of CO_2 Tool (SCO_2T) CarbonSAFE Macon County DE-FE0029381

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Lower Mt Simon Sandstone net thickness (10% porosity cutoff)

LILINOIS 5 Illinois State Geological Survey PRAIRIE RESEARCH INSTITUTE

Static Model Framework

50 x 50 sq mi



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Legacy Well Identification and Evaluation



Risk Level	Description	# of Wells within 15 mi radius
Level 1	High risk	1
Level 2	Medium risk	1
Level 3	Low risk	149



Early One Earth Geocellular model



0.46 M	t/yr for :	5 yr																															
_																			SGG	AS SATL	RATION	FRACTIO	N										
0	0.02	0.04	0.05	80.0	0.1	0.12	0.14	0.16	0.18	0.2	0.22	0.24	0.26	0.28	0.3	0.32	0.34	0.36	0.38	0.4	0.42	0.44	0.46	0.48	0.5	0.52	0.54	0.56	0.58	0.6	0.52	0.64	0.66
	_		_														_INJO1														FC		
																															UMS		
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																															MMS		
	⊢																Δ.														LMS		
																															LMS-A	rkosic	
		_			_																										Argen	ta	

Homogeneous	Homogeneous model based of											
Unit	Porosity, %	Permeability, mD										
Eau Claire	9.7	0.1										
Upper MS	11.1	7.43										
Middle MS	9.4	2.3										
Lower MS	14.3	35										
LMS Arkosic	20.5	84										
Argenta	13.4	0.85										

 CO_2 plume at 5 years:

0.46 Mt/yr: 2000 ft (0.38 mi) in radius, 560 ft in height

2 Mt/yr: 3500 ft (0.66 mi) in radius, 761 ft in height

Evaluation of DAS for plume imaging

Ray tracing



Successive filtering of rays based on reflection and intersecting angles



2D Seismic Surveys

One Earth area



Prairie State Area



~25 miles 2D at each location using Stryde nodal receiver system

Prairie State Storage Site



- Capture FEED study
- 6MTPA CO₂
- Rural Setting
- Lively Grove #1 test well site
 6 miles north
 of plant

Prairie State Characterization



St Peter TDS



Regional Stratigraphic Framework





Lively Grove #1



First Contact: St Peter



Potosi Dolostone (2ry target)

Thickness and porosity range

WellFormationGross
(ft)Net (ft)
Cutoff: 10% Porosity121452888200Eminence15732.5121452888200Potosi280.3322

Æ

Shaglee Unit







CO₂ Capture Assessment

Full-Scale FEED Study For a 816 MWe Capture Plant at the Prairie State Generating Company Using Mitsubishi Heavy Industries of America Technology



	DE-FE0031841 / P	ittsburgh, PA / November 13,	2019
		Kevin C OBrien	
Dire	ctor, Illinois Sustainable Te	chnology Center and Illinois !	State Water Survey
Kiowit	. MITCUDICU	ILLINOIS	PRAIRIE STATE
WRiewit	HEAVY INDUSTRIES AMERICA	Prairie Research Institute	Generating Company

- The PSGC plant was commissioned in 2012 and uses pulverized coal and super critical technology to run at high temperatures and pressures.
- Two 800-megawatt power units produce over 12 million tons of CO₂ annually.
- Capture of this CO₂ will be based on the KM CDR Process[™] CO₂ capture technology from Mitsubishi Heavy Industries (MHI).



- OEE produces ethanol and approximately 450,000 tons/yr of relatively pure CO₂ byproduct.
- An engineering Pre-FEED study for capture at OEE is being conducted with site specific design considerations
- Trimeric and AECOM are leading this effort





Class VI submittals

- Site Characterization data:
- Area of Review (AoR) and Corrective Action Plan:
- Injection Well Construction Plan:
- Plans for Pre-Operational Testing:
- Proposed Injection Well Operations Plan:
- Proposed Monitoring Plan:
- Proposed Mechanical Integrity Testing (MIT) Plan:
- Proposed Injection Well Plugging Plan:
- Post-Injection Site Care, and Site Closure Plan (PISC):
- *Emergency and Remedial Response Plan (ERRP)*:

Accomplishments to Date

- Submitted EIV and are addressing comments
- Pre-drilling site characterization
- Legacy well risk database and identification
- Drilling well: Lively Grove #1
- Submitted permit to Illinois DNR for well at One Earth
- 2D seismic surveys permitted (to start August 16)
- Static models being developed
- Class VI permit writing in progress
- Process documents for capture at One Earth Energy being developed
- Coordinating with FEED study at Prairie State

Synergy Opportunities

- DE-FE0031841 is conducting a FEED study for capture at the Prairie State Generating Station that directly links with the CarbonSAFE Illinois Storage Corridor project
- Work performed under CarbonSAFE projects FE0029831 (Macon County) and FE0031626 (Wabash) are providing contributions to geological and infrastructure knowledge

Project Summary

- Pre-Drilling Site Characterization conducted
- Environmental Impact Volumes in revision
- Lively Grove #1 being drilled for characterization data
- One Earth #1 being permitted
- 2D Seismic surveys permitted and will start in mid-August
- Modeling in early stages
- Risk Assessment iterative
- Capture Assessment at One Earth in progress
- Data being compiled and integrated into Class VI permit templates

Project Team



Appendix

These slides will not be discussed during the presentation, but are mandatory.

Benefit to the Program

- CarbonSAFE Program goals being addressed:
 - Identify & characterize geological storage complexes to store > 50 million tonnes CO₂ within 30 years, and;
 - accelerate deployment of CCUS at commercial scale including understanding of how to safely, efficiently and cost effectively characterize and permit project sites.

• Project benefits.

- Characterization will establish storage resources at 2 specific sites and have broader regional implications
- Provide basis for development of storage hub(s)
- Work will provide leadership for other industrial/energy sources and initiate further development in the region and elsewhere
- Linkage with capture program

Project Overview

Goals and Objectives

- Illinois Storage Corridor Objectives
 - Mature and prove CCS at commercial scale by performing subsurface characterization and related work to enable submission of 2 Class VI permit applications, and gain approval for construction of CO₂ injection wells at 2 sites in different storage complexes.
- CarbonSAFE Phase III program objectives:
 - acquisition, analysis and development of information to characterize a storage complex and demonstrate storage resources for commercial volumes of CO₂.
 - identification of a storage site(s) within the storage complex,
 - preparation and submission of an Underground Injection Control (UIC) Class VI permit to construct

Organization Chart



Gantt Chart

• Provide a simple Gantt chart showing project lifetime in years on the horizontal axis and major tasks along the vertical axis. Use symbols to indicate major and minor milestones. Use shaded lines or the like to indicate duration of each task and the amount of work completed to date.

Gantt Chart

Tal	ble 6. Gantt Chart with Team Responsibilities by Ta	efers to			Bud	lget F	Period	11			Bu	idget	Perio	od 2																	
mil	estones in Table 3.		2020		20	21			20	022			2023	5	Subawardees													Vendors			
#	Task Name	Start	End	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	ISGS	unc	PNNL	BYU	Projeo	Geostock	Hekla	CO2 CRC	Stanford	Trimeric	Texas Tech	IGWS	Industrial Economics	Cornerpost	Van Ness Feldman	
1.0	Project Management and Planning											-																			
1.1	Project Management Plan	10/01/2020	09/30/2023	Α												Х															
1.2	2 Data Management Plan	10/01/2020	09/30/2023													Χ									Χ						
1.3	3 Technology Maturation Plan	10/01/2020	09/30/2022																							1					
1.4	Manage All Project Activities, Objectives, and Milestones	10/01/2020	09/30/2023	В												x															
1.5	5 Knowledge Sharing	10/01/2020	09/30/2023													Χ															
1.6	5 Communications	10/01/2020	09/30/2023													Χ															
2.0	National Environmental Protection Act (NEPA	4)			_	_																									
2.1	Preparation and Submission of an Environmental Information Volume (EIV)	10/01/2020	03/31/2021														X														
2.2	Preparation and Submission of NEPA Documentation	10/01/2020	09/30/2021																	X											
3.0	Risk Assessment																														
3.1	Quantitative Risk Assessment	10/01/2020	09/30/2023													Х	Χ	Χ	Х	Х	X	Х	Χ	Χ	Χ	Χ	Χ	Х	Χ	Х	
3.2	2 NRAP Toolkit Assessment	10/01/2020	03/31/2023													Χ		X						Х							
4.0	Stakeholder Engagement and Public Outreach	<u>.</u>		_	_	_				_			_																		
4.1	Stakeholder Analysis and Engagement Plan	10/01/2020	09/30/2022				С									Χ															
4.2	Conduct Stakeholder Engagement and Public Outreach	07/01/2022	09/30/2023													x															
5.0	Site Characterization																														
5.1	Pre-Drilling Site Assessment	10/01/2020	03/31/2021		D											Χ			X	Х							Χ				
5.2	Obtain Permits for Field-based Characterization Activities	10/01/2020	06/30/2021			Е										x				X	x										
5.3	3 2S and 3D Seismic Surveys	10/01/2020	03/31/2022				F									Χ			X	Χ											
5.4	Analyses of Site Data for Class VI Permit Requirements	10/01/2020	09/30/2022													x	x	x	x	x			x	x		x					
5.5	Policy, Regulatory, Legal, and Permitting Characteristics	10/01/2020	09/30/2022													X												X	x	X	

Gantt Chart (cont.)

Table 6. Gantt Chart with Team Responsibilities by Ta	Budget Period 1									dget	Perio	d 2																	
milestones in Table 3.		2020		20)21			20)22			2023		Subawardees												Vendo	rs		
# Task Name	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	ISGS	UIUC	JNNL	BYU	Projeo	Geostock	Hekla	CO2 CRC	Stanford	Trimeric	Texas Tech	IGWS	Industrial Economics	Cornerpost	Van Ness Feldman		
0 Drilling and Well Testing																													
6.1 Design Well Drilling Program	10/01/2020	06/30/2022													X				Χ	X									
6.2 Drill and Construct Stratigraphic Test Well	07/01/2021	03/31/2022					G												Χ	X									
6.3 Well Testing and Data Collection	10/01/2021	09/30/2022													X	X			Χ	X									
7.0 Storage Site Modeling	0 Storage Site Modeling																												
7.1 Development of Conceptual and Static Model	01/01/2021	09/30/2022			н										Х		Х						Х			Х			
7.2 Development of Dynamic Reservoir Model	04/01/2022	09/30/2022													Χ	Χ	Х					Х	Χ			Χ			
7.3 Development of Geomechanical Model	04/01/2022	09/30/2022													Х	X	Х						Х			Х			
7.4 Model Calibration and Updating	01/01/2021	09/30/2022													Х	X	Χ						Х						
8.0 UIC Class VI Permitting																													
8.1 Pre-Permitting Activities	10/01/2020	06/30/2022													X						Χ					Х	X	Х	Х
8.2 UIC Class VI Permit Application	04/01/2022	09/30/2022								Ι					Χ				X		Χ					X	X	Х	Χ
8.3 Permit Application Revisions	10/01/2022	09/30/2023													X						Χ					Χ	Χ	Х	Х
0 Carbon Capture Assessment																													
9.1 Identification of CO ₂ Sources and Capture Technology	10/01/2020	03/31/2021																						x					
9.2 Conduct Pre-Feasibility Study of Capture System	04/01/2021	09/30/2022																						x					

Bibliography

No peer reviewed publications generated from the project to date.