

Tri-State CCS Hub

WV-GO – February 2025

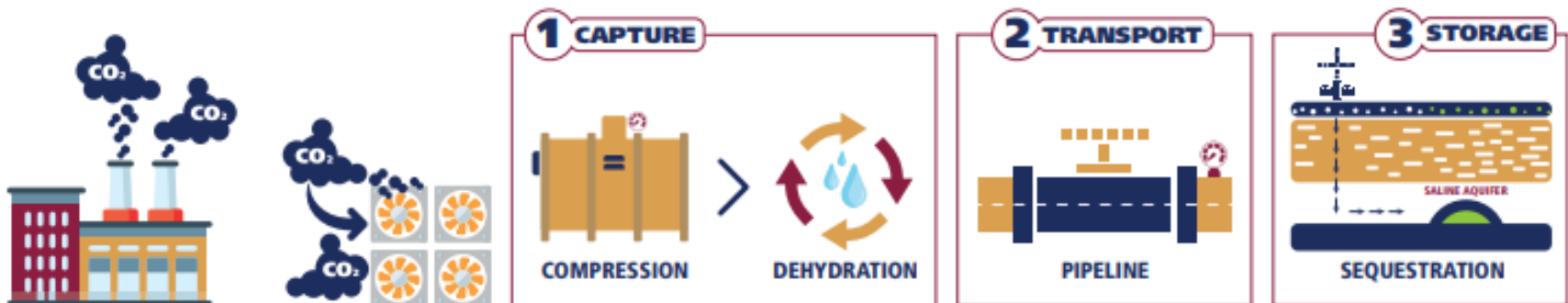
Ryan Choquette



Carbon Capture and Storage (CCS) 101

How CCS Works

- ▶ CCS captures CO₂ emissions produced by manufacturers and industrial facilities before they enter the atmosphere
- ▶ Captured CO₂ is liquified, transported and permanently stored deep underground beneath a thick layer of impermeable cap rock
- ▶ CO₂ then naturally mineralizes and dissolves over time



Small Above-ground Footprint

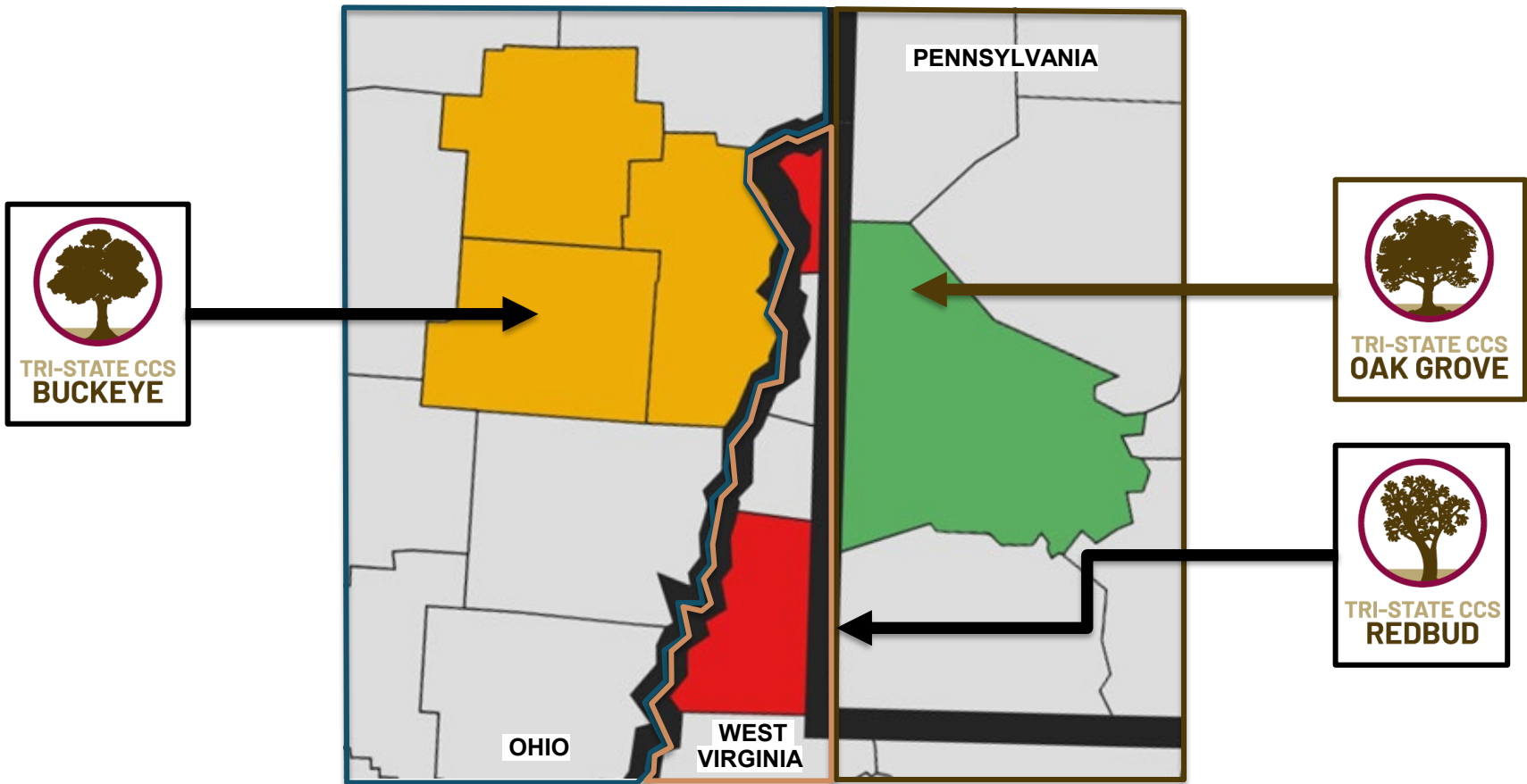
- ▶ CCS facilities are comprised of :
 - Several above-ground injection and monitoring wells that take up less than an acre
 - Pore space deep underground
 - Small pipeline network that connects the storage field to the CO₂ sources



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Video

Project Footprint



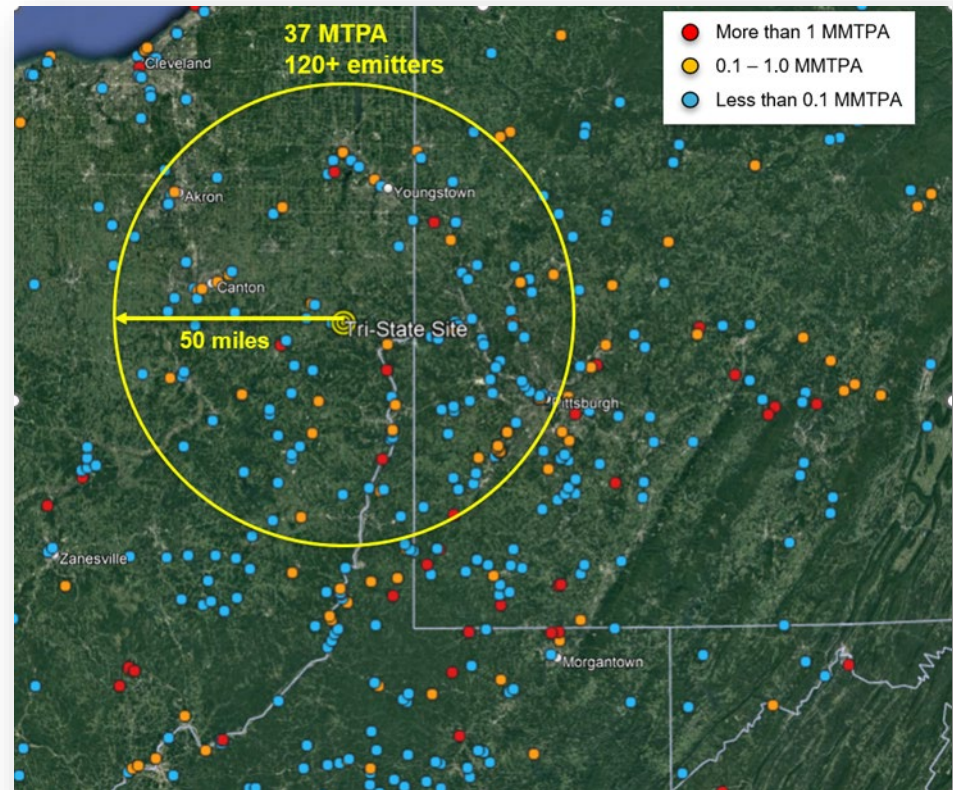
28 well locations under option

Target Capacity of 5+ MMTPA

Pore space and pipeline contracts continue past Class VI submission

Addressable Market

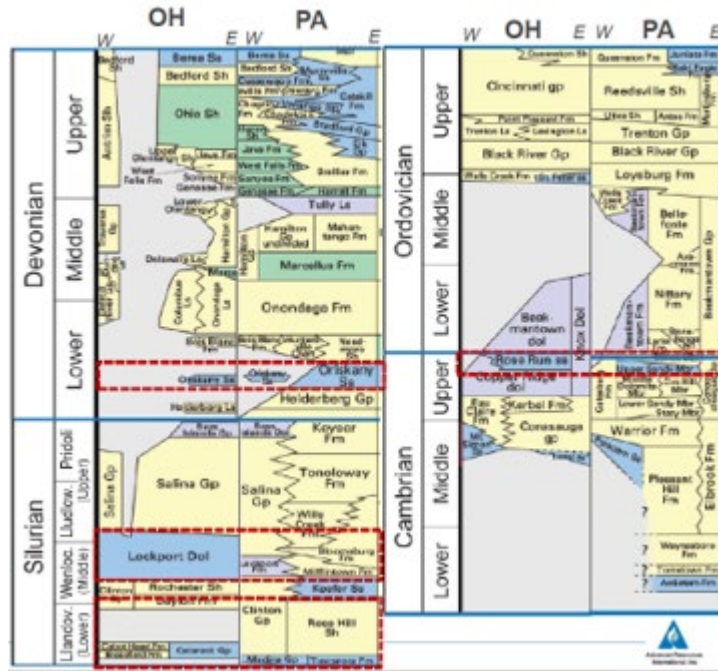
- ▶ Demand for CO₂ storage solution
- ▶ Over 120 facilities within 50 miles of the project area emitting over 37 Mmtpa, approximately 20 Mmtpa have shown support



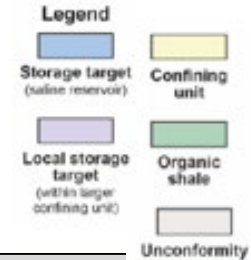
Target Formations

▶ Target Reservoirs

- Oriskany Sandstone:
 - 3,000 - 8,000 ft depth
- Lockport Dolomite:
 - 4,000 - 9,000 ft depth
- Clinton / Medina / Tuscarora Sandstone:
 - 4,500 - >10,000 ft depth
- Rose Run Sandstone:
 - 7,000 - >15,000 ft depth



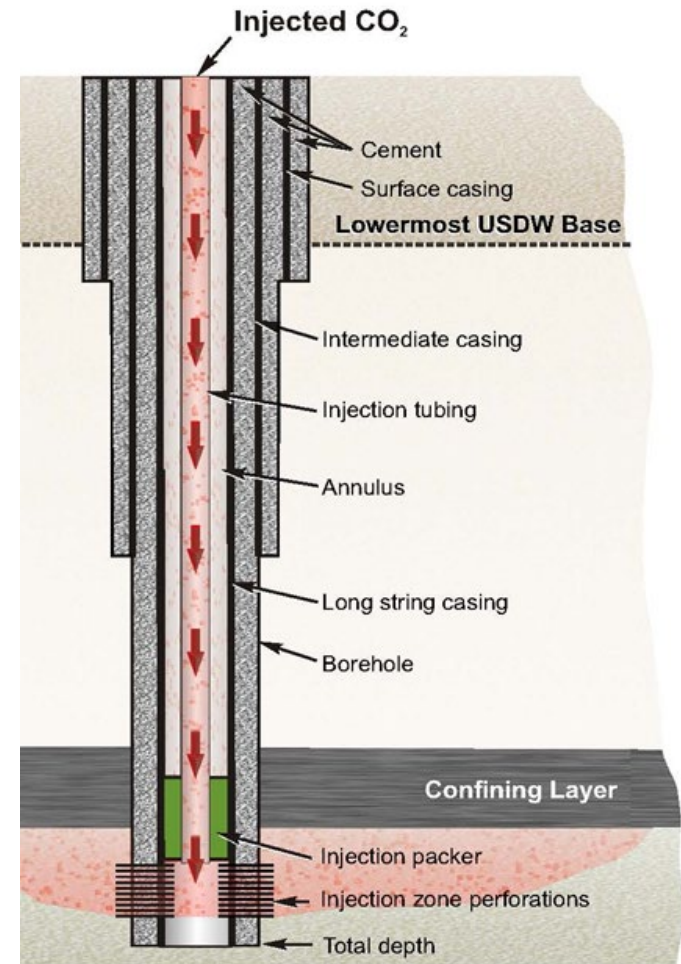
Devonian	Onondaga Fm.	CCS System 1
	Oriskany Sandstone	
	Helderberg LS	
	Devonian Und.	
Silurian	Bass Islands DOL	CCS System 2
	Lockport Dolomite	
	Rochester SH	
	Silurian Undifferentiated	
Ord.	Clinton-Medina	CCS System 3
	Queenston	CCS System 4
Ordovician Und.		
Cambrian	Beekmantown DOL	CCS System 4
	Rose Run Sandstone	
	Copper Ridge Und.	



Attribute	Oriskany	Lockport	Clinton	Beekmantown	Rose Run	Copper Ridge
Mean Formation Depth (ft., elev.) ¹	-4044	-5430	-6051	-9141	-9707	-9857
Gross Reservoir Thickness, mean (ft.) ¹	18	368	142	568	27	337
Average Total Porosity (%) ¹	4	3	5	3	3	3
Average Permeability (mD) ¹	6.1	2.8	2.3	0.2	0.1	0.2
Estimated TDS Estimate Range (ppm) ²	229,432	266,708	281,777	351,247	363,428	365,901
Lithology	Sandstone	Dolomite	Sandstone	Dolomite	Sandstone	Dolomite
Depositional Environment	Clastic Shallow Shelf	Reef	Shallow marine	Peritidal Shelf	Peritidal Shelf	Peritidal Shelf

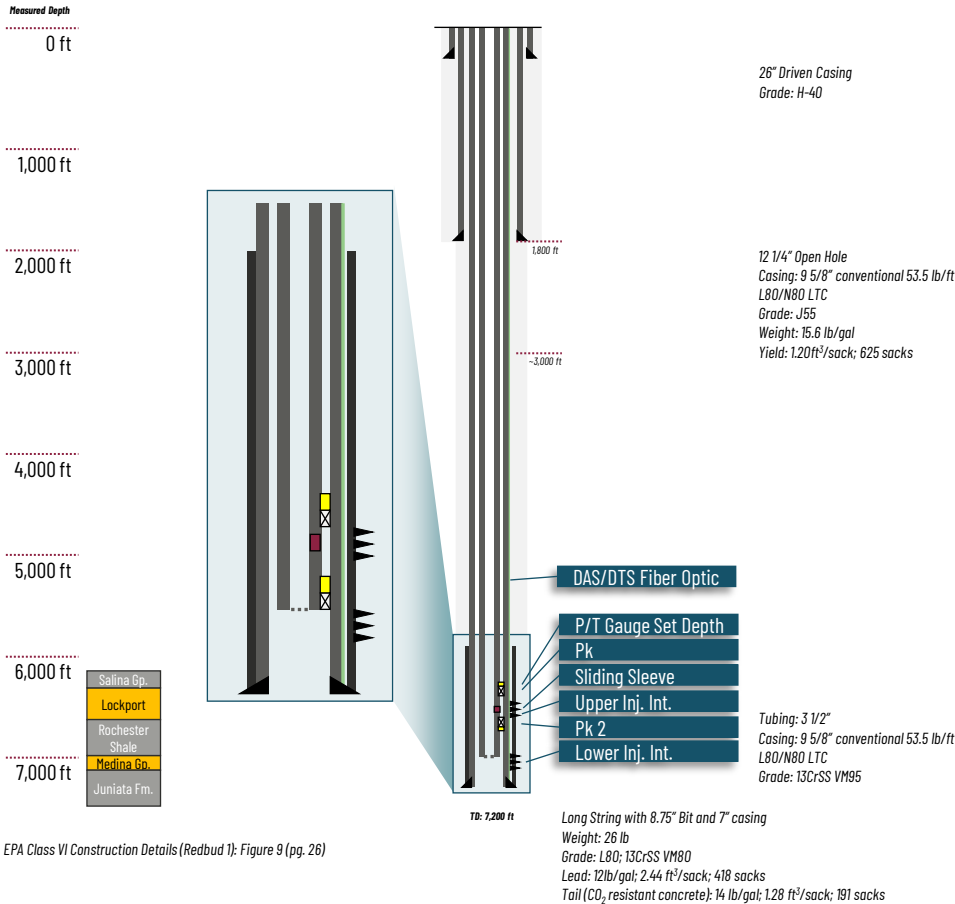
Class VI Requirements

- ▶ Robust well construction – triple-layer casing and cement
- ▶ Chrome casing and CO₂ cement in injection zone
- ▶ 2+ year timeframe for permitting approvals
- ▶ Reservoir modeling, seismic testing, mine/oil/gas coordination
- ▶ Financial assurance tied to each well for monitoring and closure, mitigation actions
- ▶ Plugging or monitoring of existing penetrations
- ▶ Emergency response planning
- ▶ 90% of formation fracture pressure maximum



Redbud I

Injection Well Design Schematic | Un-sleeved & Sleeved



EPA Class VI Construction Details (Redbud 1); Figure 9 (pg. 26)

Source: Company-provided data and EPA Class VI Application.
Note: DAS = Distributed acoustic sensing.

Design Overview

- COMSOL Multiphysics software was used to conduct nodal analysis to determine feasibility of CO₂ injection through 3.5 inch OD tubing
- Analysis assumes Max surface injection pressure of ~3,900 psia and max wellhead injection pressure of 1,773 psia in the LIC
- Analysis calculated max injection rates of 40 Mt/yr into the LIC and 100 Mt/yr into the MIC
- Injection wells will be continuously monitored for injection pressure, rate, volume, temperature of the CO₂ stream, and tubing-long string casing annulus pressure and fluid volume
- Casing stresses and loadings were modeled using Blade Energy Partners StrinGnosis software
- Two packers will be used to isolate the tubing annulus and to isolate the injection intervals. The LIC sliding sleeve will selectively function in the open or closed position to accommodate variable injection rates and maintain mandated injection pressures

Casing String	Casing Depth (Ft)	Borehole Diameter (in.)	Casing Outside Diameter (in.)	Casing Material (weight/grade /connection)	Coupling Outside Diameter (in.)
Conductor	150	n.a.	16.0	65 lb/ft, H-40, STC	n.a.
Surface	1,800	12.25	9.625	40 lb/ft, J-55, STC	10.625
	0 - 6,130	8.75	7.0	26 lb/ft, L-80, VAM 21	7.565
Long String	6,130 - 7,200	8.75	7.0	26 lb/ft, 13VM80, VAM 21	7.565
	0 - 6,931	n.a.	3.5	9.2 lb/ft, 13CRSS-VM95, VAM TOP	3.908

EPA Class VI Construction Details (Redbud 1); Table 6 (pg. 15)

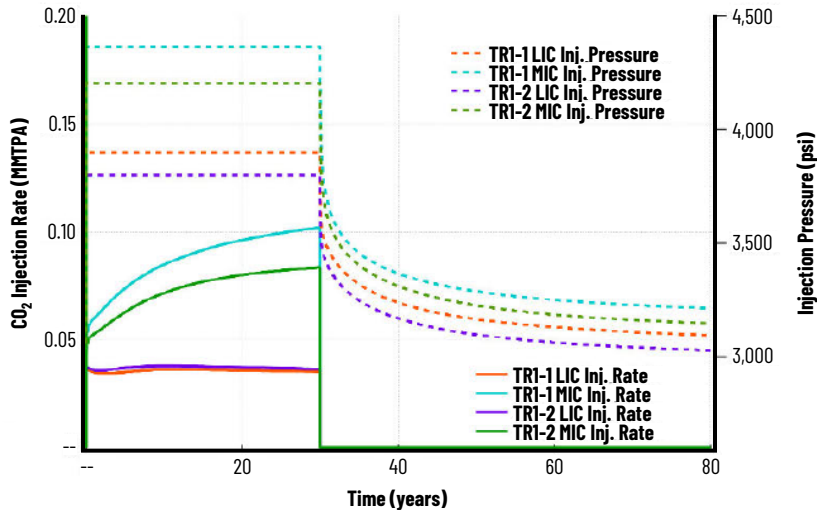
Redbud I

Pressure & Injection Rate Highlights

- Individual well injection rate of 0.5 MMTPA was modified in the model to accommodate max injection pressures for each zone:
 - TRI-1 average injection rate of 140 Mt/y with a max injection pressure of 3,900 psia
 - TRI-2 average injection rate of 120 MT/y with a max injection pressure of 3,800 psia

Modeled Injection Pressure & Rate | 2 Wells LOP

EPA Class VI AOR CA Plan (Redbud I): Figure 21 (pg. 39)



Source: Company-provided data and EPA Class VI application.
 Note: LIC = Lockport Dolomite Group.
 MIC = Medina Group.
 MMTPA = Million metric tons per annum.
 SSTVD = Sub-sea true vertical depth.

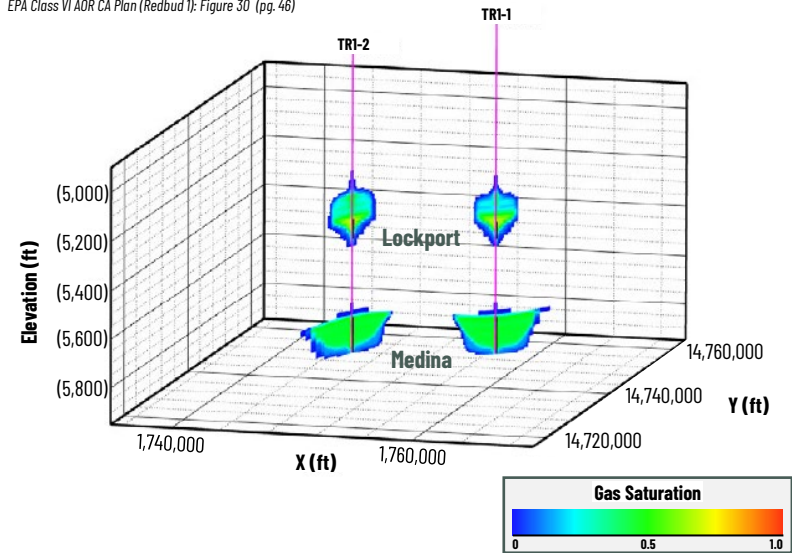


Injection Unit | Lockport Gp.

Injection Pressure Details	TRI-1	TRI-2
Fracture gradient (psi/ft)	0.7	0.7
Maximum injection pressure (90% of fracture pressure, psi)		
Upper interval (Lockport)	3,900	3,800
Lower Interval (Medina)	4,366	4,205
Elevation at Max Injection Pressure (ft SSTVD)		
Upper interval (Lockport Gp.)	(5,311)	(5,184)
Lower Interval (Medina Gp.)	(5,704)	(5,587)

Modeled CO₂ Plume | After 80 Years

EPA Class VI AOR CA Plan (Redbud I): Figure 30 (pg. 46)



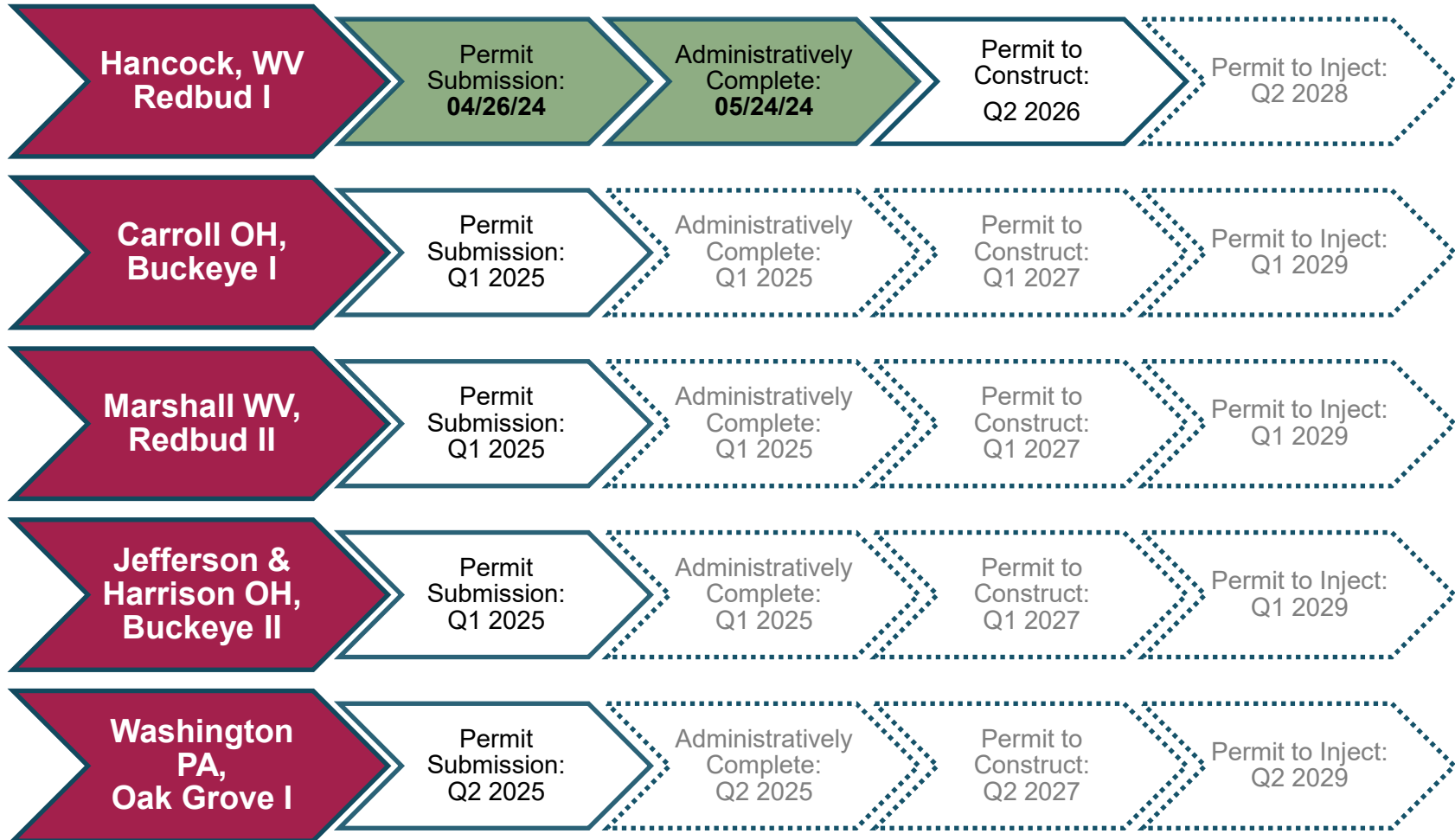
Project Timeline

PRE- DEVELOPMENT (Ongoing Geologic Study)	DEVELOPMENT	CONSTRUCTION	OPERATION	LONG-TERM STORAGE
3-5 years	1 year	2-4 years	30+ years	Indefinite

- ▶ **Goal:**
 - Operational Project in 2030
- ▶ **Current priorities:**
 - Continue geologic study and evaluations
 - Submit remaining Class VI applications
 - Finalize offtake contracts with emitters
 - Public education and stakeholder engagement
 - Coordination with oil, gas and mining interests
 - Obtain pore space rights with landowners

Class VI EPA Permitting Schedule

In progress



Community Engagement

- ▶ Project website: <https://tristateccs.com/>
- ▶ Stakeholder outreach
 - Met with OH/PA/WV legislators, emergency management directors, economic development/chambers of commerce
 - Coordination with industry groups
 - Informational meetings with landowners
- ▶ Local representative
- ▶ Local offices opened in each state
 - Cadiz, OH
 - Weirton, WV
 - Burgettstown, PA
- Presentations across the region
 - GO-WV (West Virginia oil and gas association)
 - OOGA (Ohio oil and gas association)
 - Ohio Valley Energy Association
 - Ohio Chamber's Energy Symposium
 - Appalachian Hydrogen and Carbon Capture
 - WV Governor's Energy Summit



Economic Benefits for Region

OHIO	Number of Well Sites	Construction Spending	Construction Employment	Operation Spending	Operation Employment
	12	\$585M	1,080 jobs; \$218M in salaries	\$11.6M annually	27 jobs; \$2M in salaries
WEST VIRGINIA	Number of Well Sites	Construction Spending	Construction Employment	Operation Spending	Operation Employment
	7	\$250M	372 jobs; \$75M in salaries	\$6.3M annually	14 jobs; \$1M in salaries
PENN-SYLVANIA	Number of Well Sites	Construction Spending	Construction Employment	Operation Spending	Operation Employment
	3	\$145M	265 jobs; \$60M in salaries	\$3.1M annually	8 jobs; \$0.8M in salaries

More Information

Website: <https://TriStateCCS.com/>

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A New Project in
the Tri-State.