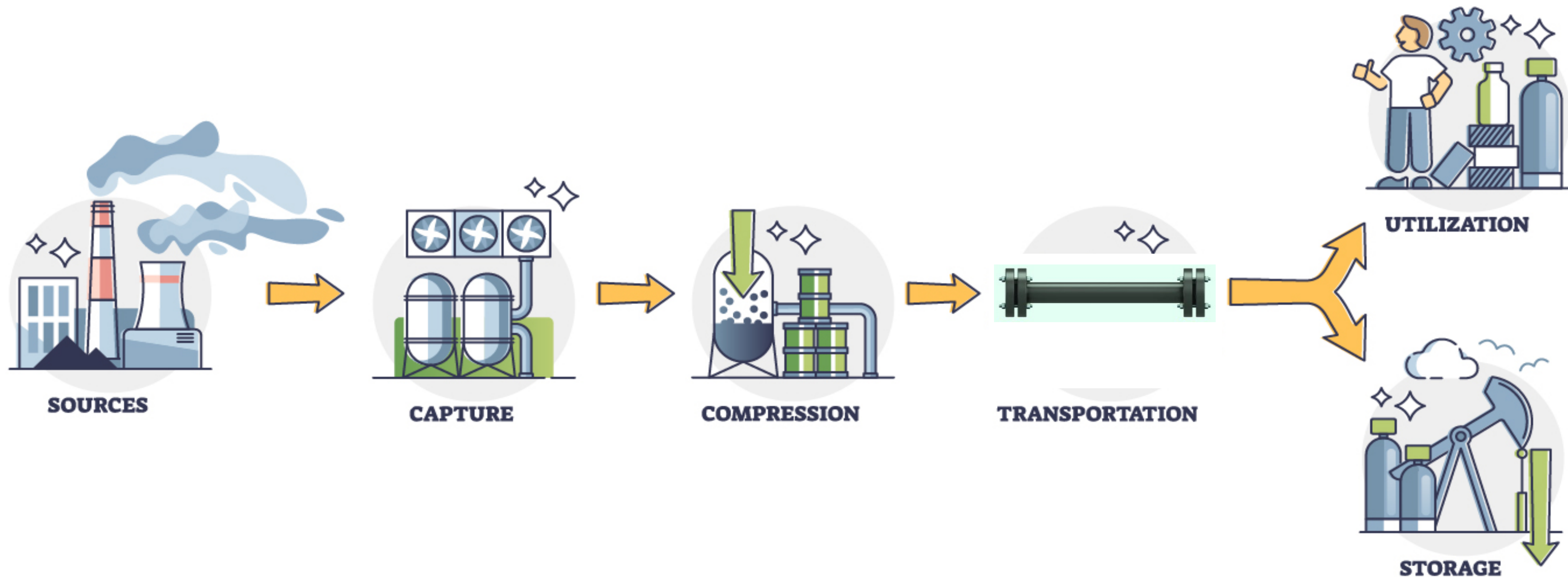
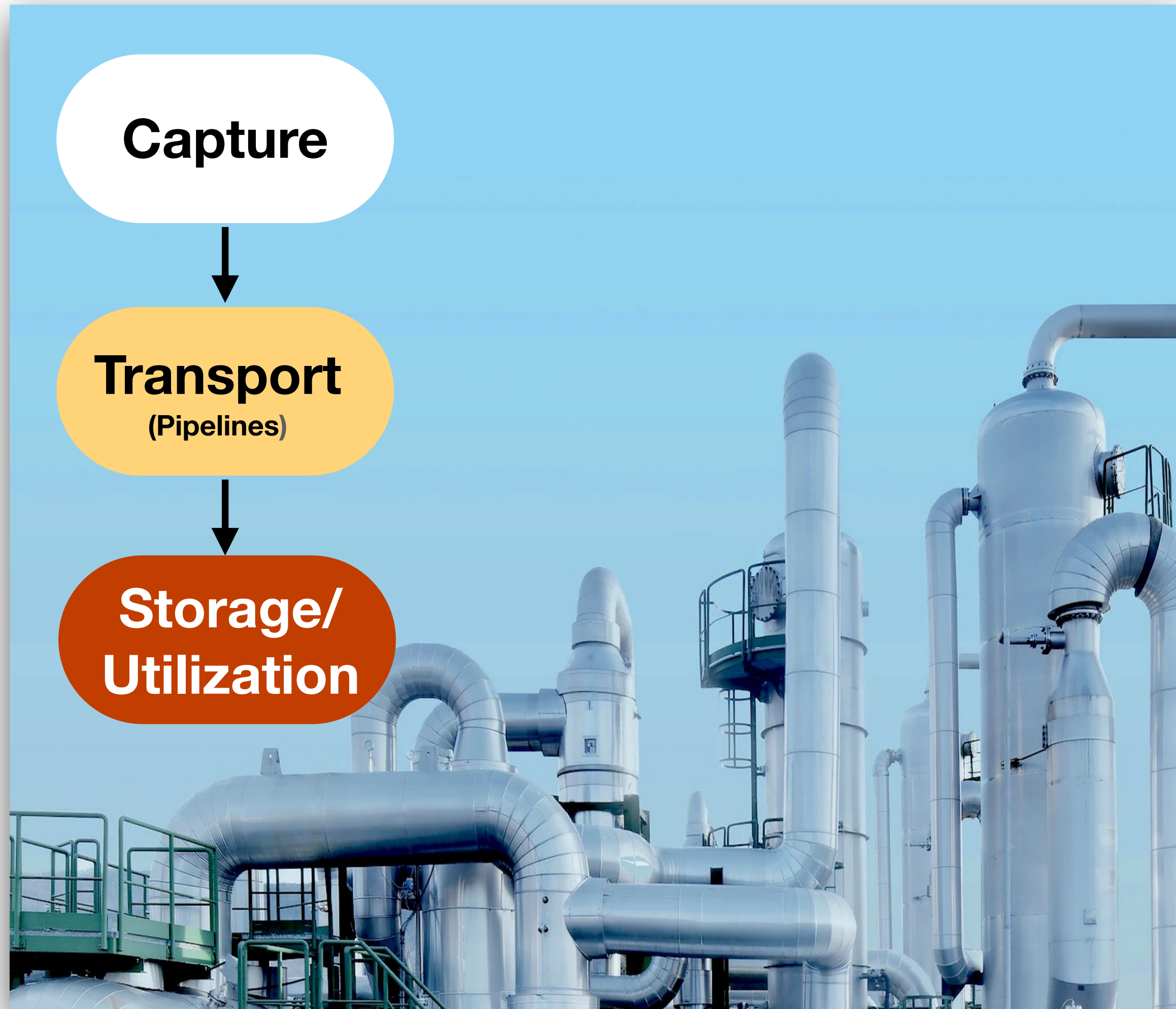


# Coalition to Stop CO<sub>2</sub> Pipelines

# Carbon Capture and Storage



# What is CCS?



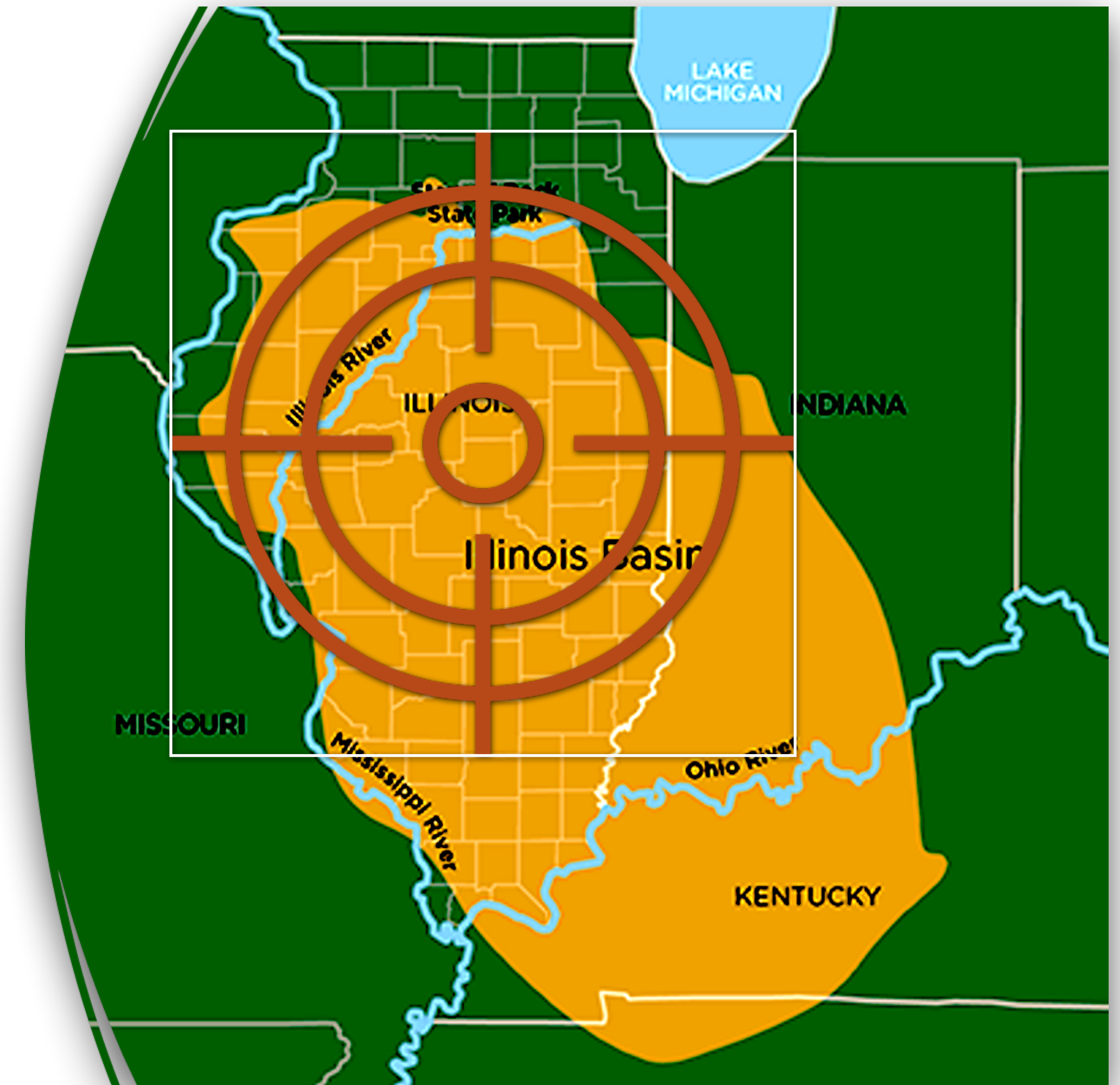
CCS is the process of capturing and storing carbon dioxide before it is released into the atmosphere

Once the CO<sub>2</sub> has been captured from an industrial or power plant, it is compressed into a liquid state and transported via pipeline to a location where it will be injected deep underground in geological formations

Historically, CCS has predominantly been used for enhanced oil recovery (EOR) to extract crude oil from reservoirs that had been previously tapped out using standard drilling methods

# Why CCS now? Why Illinois?

- Carbon capture for sequestration was not a profitable enterprise, until the Inflation Reduction Act (IRA). In part due to requests from Joe Manchin, the IRA has increased the value of the 45Q tax credit by **70%**.
- Illinois' Mt. Simon Sandstone Reservoir and shale caprock make it a primary state industry is targeting for storage
- Prairie State Energy Campus and gas electric generating plants view CCS as a potential lifeline for continuing to operate these facilities
- Corn growers and Illinois Farm Bureau see CCS as an opportunity to continue to make ethanol with an eye toward using ethanol in sustainable aviation fuel



# But CCS has been a failure ...

- FutureGen (IL) CCS plan **Canceled** (2015)
- Summit (TX) **Canceled** (2017)
- Kemper (Miss) **Canceled** 2017
- American Elec. Power (W VA) **Withdrawn** (2011)
- Antelope Valley (ND) **Withdrawn** (2012)
- Southern Company (AL) **Withdrawn** (2010)
- Petra Nova (TX) “**Shuttered**” 2020) (CO<sub>2</sub> used for EOR)
- Canada’s Boundary Dam project is operational, but it is operating at far less the capacity than planned, and has **doubled the price of electricity!**



*The Petra Nova carbon capture facility in Texas*

# Key Concerns with CCS ...

1. It has not been an effective at reducing carbon emissions to date and there are not adequate performance standards at the Federal level to ensure CCS is an effective climate strategy
2. CCS could extend the life of heavily polluting facilities and prolong the pollution burden on EJ communities
3. Requires an immense amount of water, especially at power plants
4. **CCS investments could divert critical resources away from renewables**



*The Petra Nova carbon capture facility in Texas*

# Guardrails for carbon capture

## **Climate Protections & Performance Standards:**

- Capture efficiency rate (90%) to ensure CCS projects are effective climate strategies
- Lifecycle analysis to take into account “upstream” and “downstream” emissions to ensure CCS projects do not create more CO<sub>2</sub> than they are attempting to sequester
- Alternatives analysis

**Co-Pollutant Air Pollution Protections:** Capture facilities are not allowed to increase dangerous air pollution emissions like sulfur dioxide, particulate matter, ozone

**Water Protections:** Require an analysis of impacts to water quantity and quality, and limits on water usage in times of water shortage.

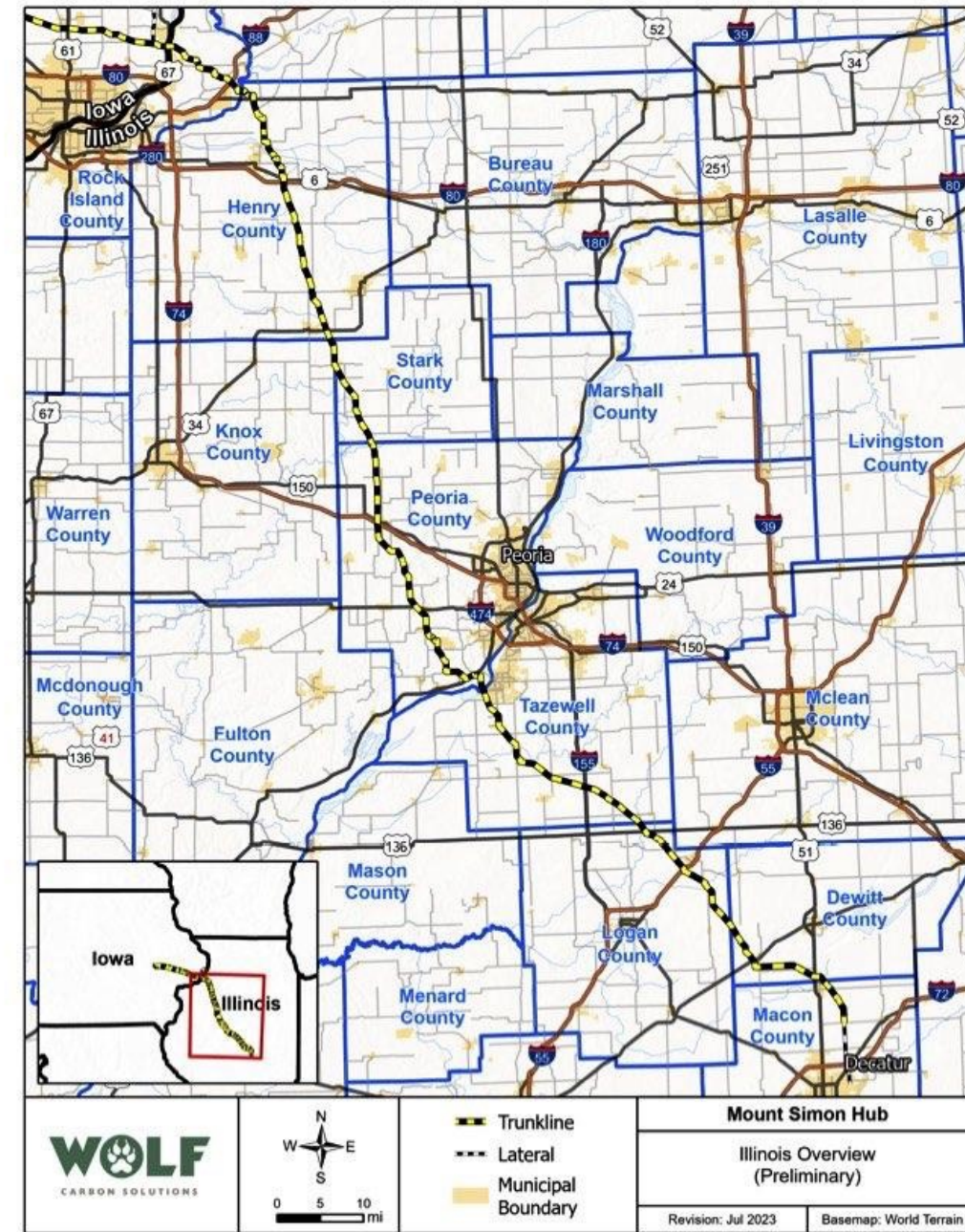
**Robust public engagement:** Important, particularly for environmental justice communities most likely to be affected



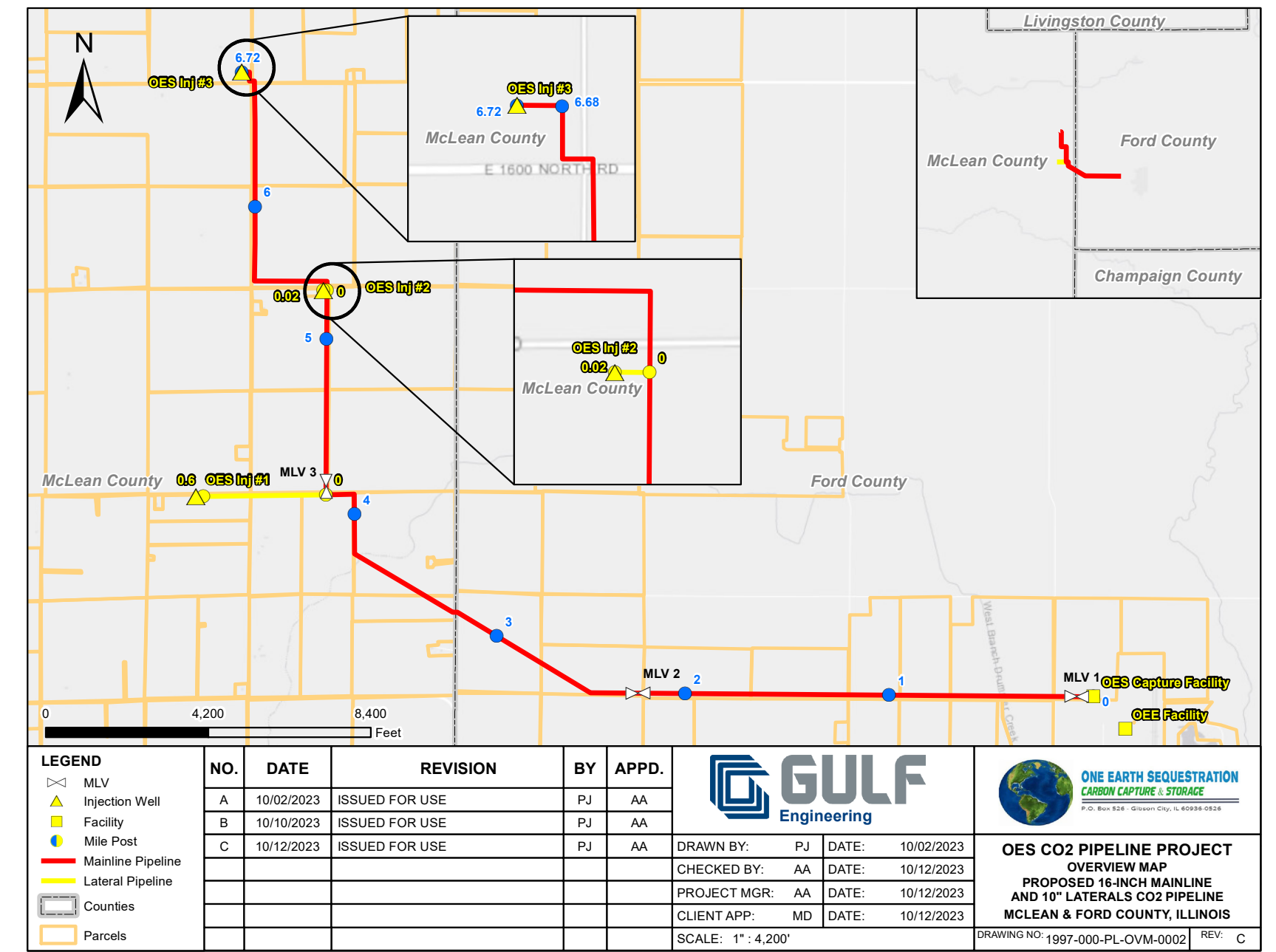
# Carbon Transport via Pipeline



**Navigator CO<sub>2</sub> Ventures**  
ICC Docket #23-0161



**Wolf Carbon Solutions**  
ICC Docket #23-0475



**One Earth Sequestration LLC**  
ICC Docket #23-0708

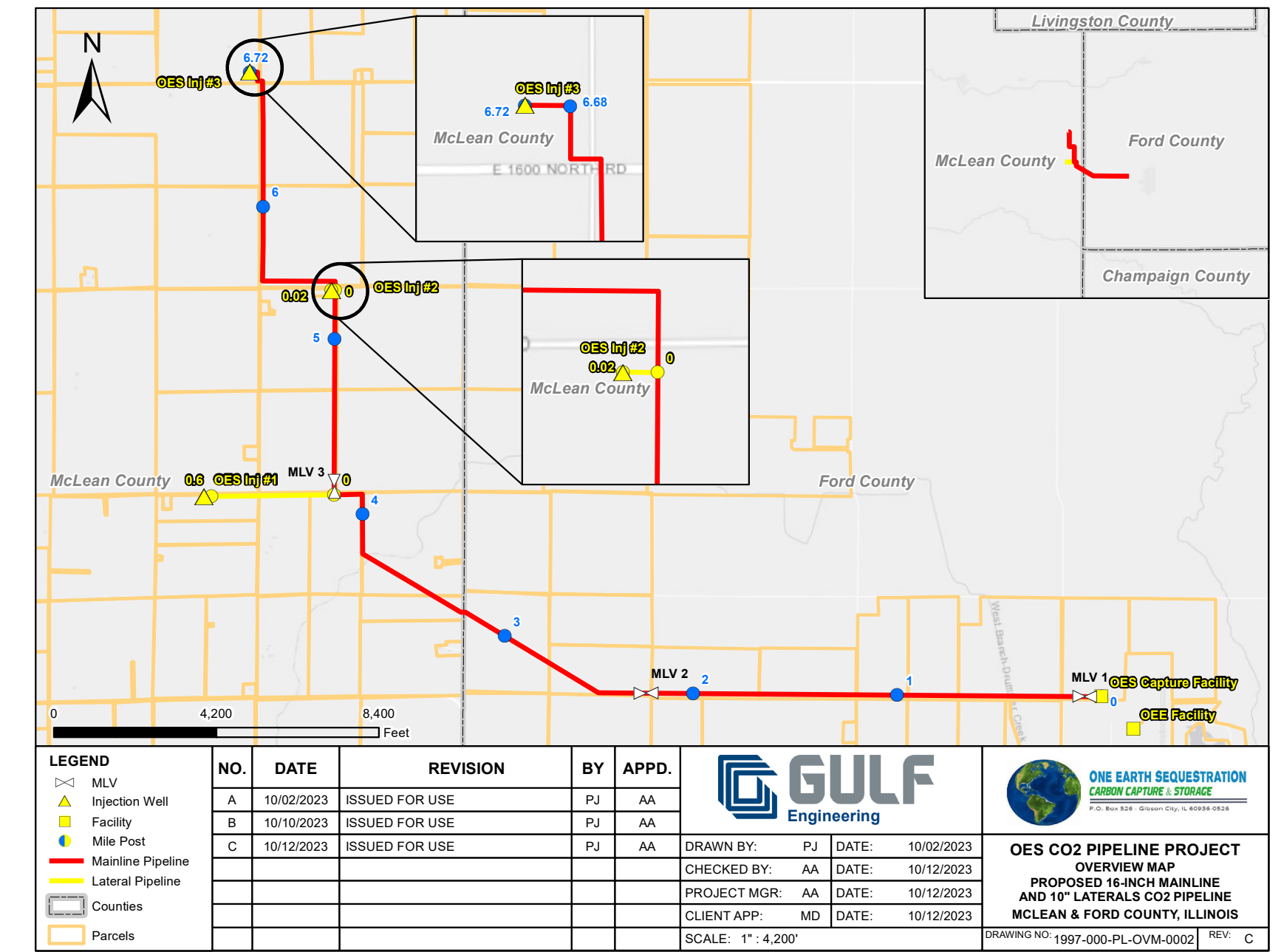
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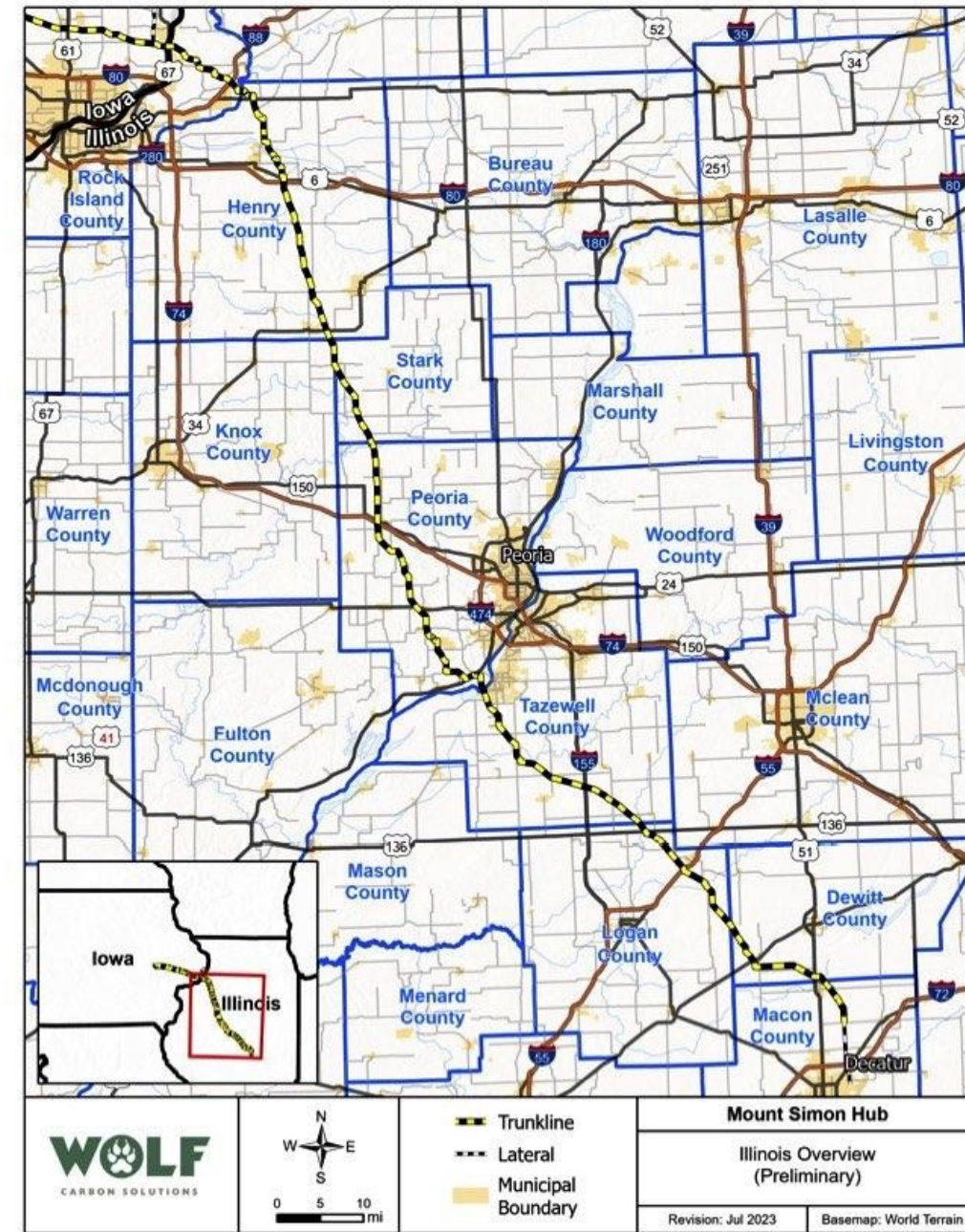
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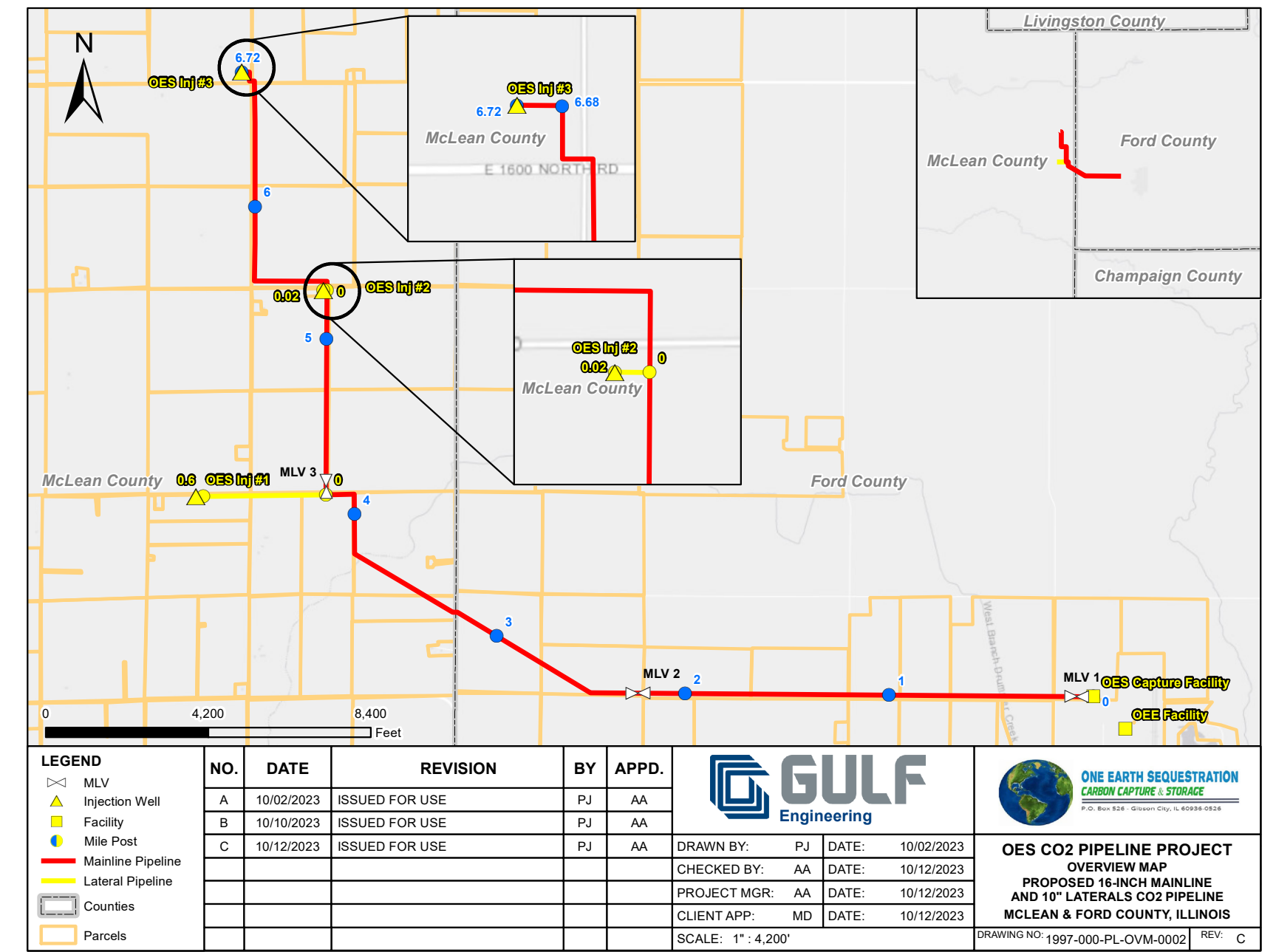
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**Navigator CO2 Ventures**  
ICC Docket #23-0161



**Wolf Carbon Solutions**  
ICC Docket #23-0475



**One Earth Sequestration LLC**  
ICC Docket #23-0708

MIDWEST ALLIANCE FOR CLEAN  
**HYDROGEN**

# Why be concerned? What is CO<sub>2</sub>?

**“It’s in the air we breathe.”**

*Wolf Carbon Solutions*

**“It’s is the same thing that puts  
the fizz in your soda.”**

*Navigator CO<sub>2</sub> Ventures*



[www.dnvgl.com/spadeadam](http://www.dnvgl.com/spadeadam)

Dense Phase CO2  
8" NB Pipe Rupture

# Satartia Mississippi, February 2020



Gassing of Satartia. Ziegert, Dan.  
Huffington Post. August 26, 2021

# Denbury CO<sub>2</sub> pipeline rupture



A 24-inch CO<sub>2</sub> pipeline ruptured in Yazoo County, MS, in February, 2020

- Pipeline weld stressed by soil movement after days of heavy rain
- Explosion created a 40-foot deep crater
- The CO<sub>2</sub> plume released that lasted four hours and traveled 1.25+ miles to Satartia

CO<sub>2</sub> displaces oxygen and hugs the ground:

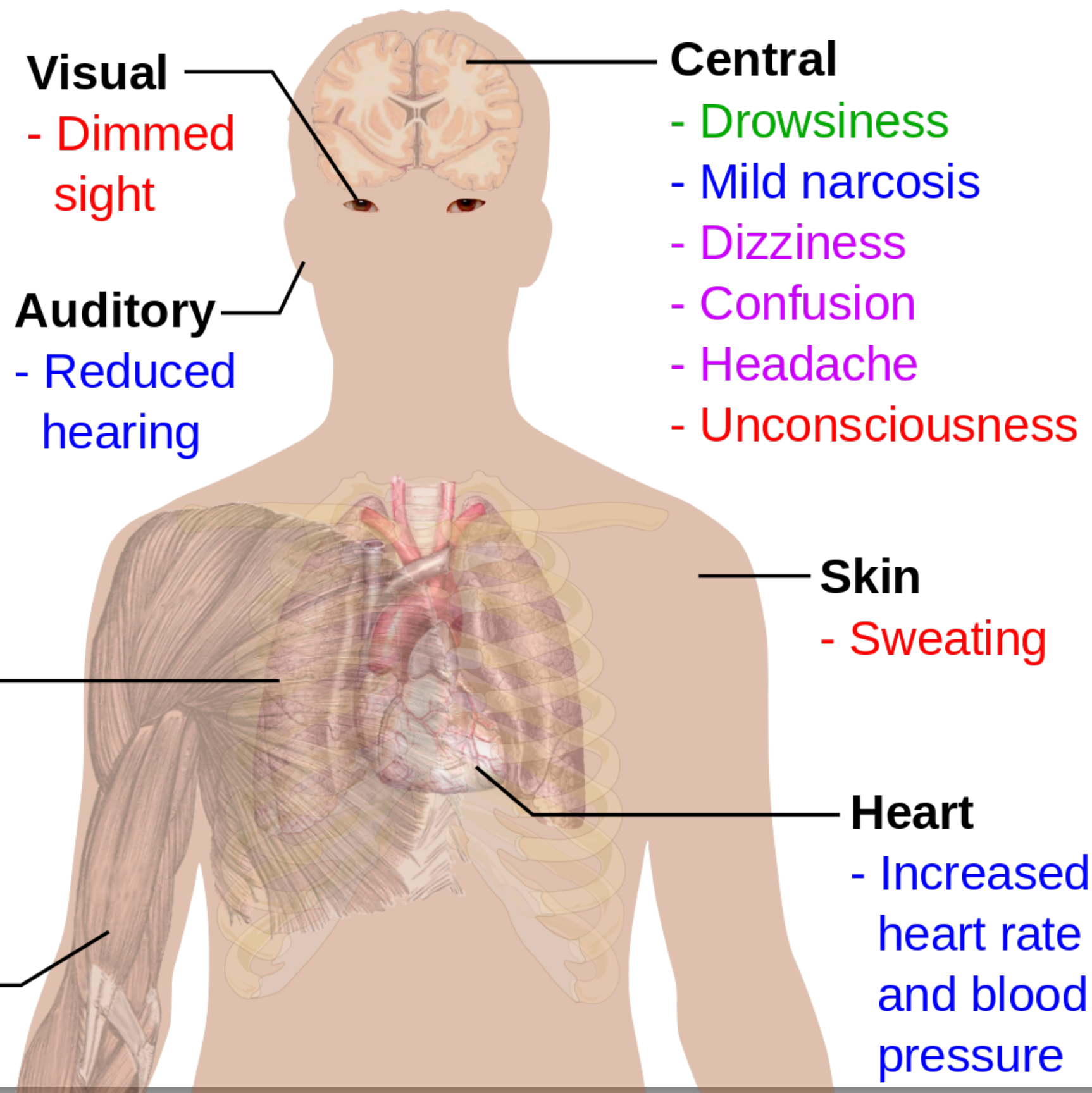
- People in its path became intoxicated, and then convulsed
- Over 200 people evacuated by first responders (cars wouldn't run)
- 45 were hospitalized and many have long-term health effects

# State needs to set criteria for routing

Main symptoms of

## Carbon dioxide toxicity

Volume % in air	
■	- 1%
■	- 3%
■	- 5%
■	- 8%



## Short-term exposure limit

0.04% ambient air

2% breathing rate increased

3% = 30,000 ppm

NIOSH: not to exceed 15 minutes

## Immediate danger to life and health

4% = 40,000 ppm

5 % breathing rapid and distressed

Can cause confusion and impair ability to get to safe location

## Leads to death

7 -10% loss of consciousness

10% convulsions, coma, and death within minutes

# Rulemaking to improve safety

## PHMSA Announces New Safety Measures to Protect Americans From Carbon Dioxide Pipeline Failures After Satartia, MS Leak

Thursday, May 26, 2022

PHMSA 05-22

**WASHINGTON** - The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) today announced it is taking steps to implement new measures to strengthen its safety oversight of carbon dioxide (CO<sub>2</sub>) pipelines around the country and protect communities from dangerous pipeline failures. The new measures, as well as an enforcement action taken today are a result of PHMSA's investigation into a CO<sub>2</sub> pipeline failure in Satartia, Mississippi in 2020 that resulted in local evacuations and caused almost 50 people to seek medical attention.

To strengthen CO<sub>2</sub> pipeline safety, PHMSA is undertaking the following:

- initiating a new rulemaking to update standards for CO<sub>2</sub> pipelines, including requirements related to emergency preparedness, and response;
- issuing a [Notice of Probable Violation, Proposed Civil Penalty, and Proposed Compliance Order](#) (NOPV) to Denbury Gulf Coast Pipeline, LLC for multiple probable violations of Federal pipeline safety regulations (PSRs). The proposed civil penalties amount to \$3,866,734.
- completing a [failure investigation report](#) for the 2020 pipeline failure in Satartia, Mississippi;
- issuing an updated nationwide [advisory bulletin](#) to all pipeline operators underscoring the need to plan for and mitigate risks related to land-movements and geohazards that pose risks to pipeline integrity like the 2020 incident in Satartia, Mississippi; and
- [conducting research solicitations](#) to strengthen pipeline safety of CO<sub>2</sub> pipelines.

# Pipeline developers moving forward now



U.S. Department  
of Transportation  
**Pipeline and  
Hazardous Materials  
Safety Administration**

## PHMSA does NOT:

- Regulate pipelines that transport CO<sub>2</sub> as liquid or gas.
- Have design standards in place to mitigate running ductile fractures.
- Require odorants to detect CO<sub>2</sub>.
- Have standards to limit maximum concentrations of impurities, including water.
- Currently regulate routing or siting.

PHMSA is also conducting research to improve modeling for emergency response and to establish safe setbacks



# State needs to set criteria for routing



- The technology exists to determine the hazard zones around CO<sub>2</sub> pipelines for a variety of settings (urban, suburban, and rural settings)
- The State of Illinois should establish standards for modeling needed by first responders and in route permitting
- Standard setting will require the participation of health experts, pipeline engineers, and meteorologists, computer modelers, and first responders
- Standard setting should be transparent and allow public input

# Farmland / community impacts

Public safety

Farm impacts:

- Soil mixing
- Compaction
- Tile severance
- Crop production loss
- Land use restrictions

**Eminent domain**

Loss of tax base

Funding emergency services

Long-term liability



# National buildout to achieve net zero

E- B+ utilizes the same trunk network, but with some additional parallel pipes in some corridors



## E- B+ scenario

1,361 million tCO<sub>2</sub>/y  
111,000 km pipelines  
Capital in service: \$220B

### CO2 point source type

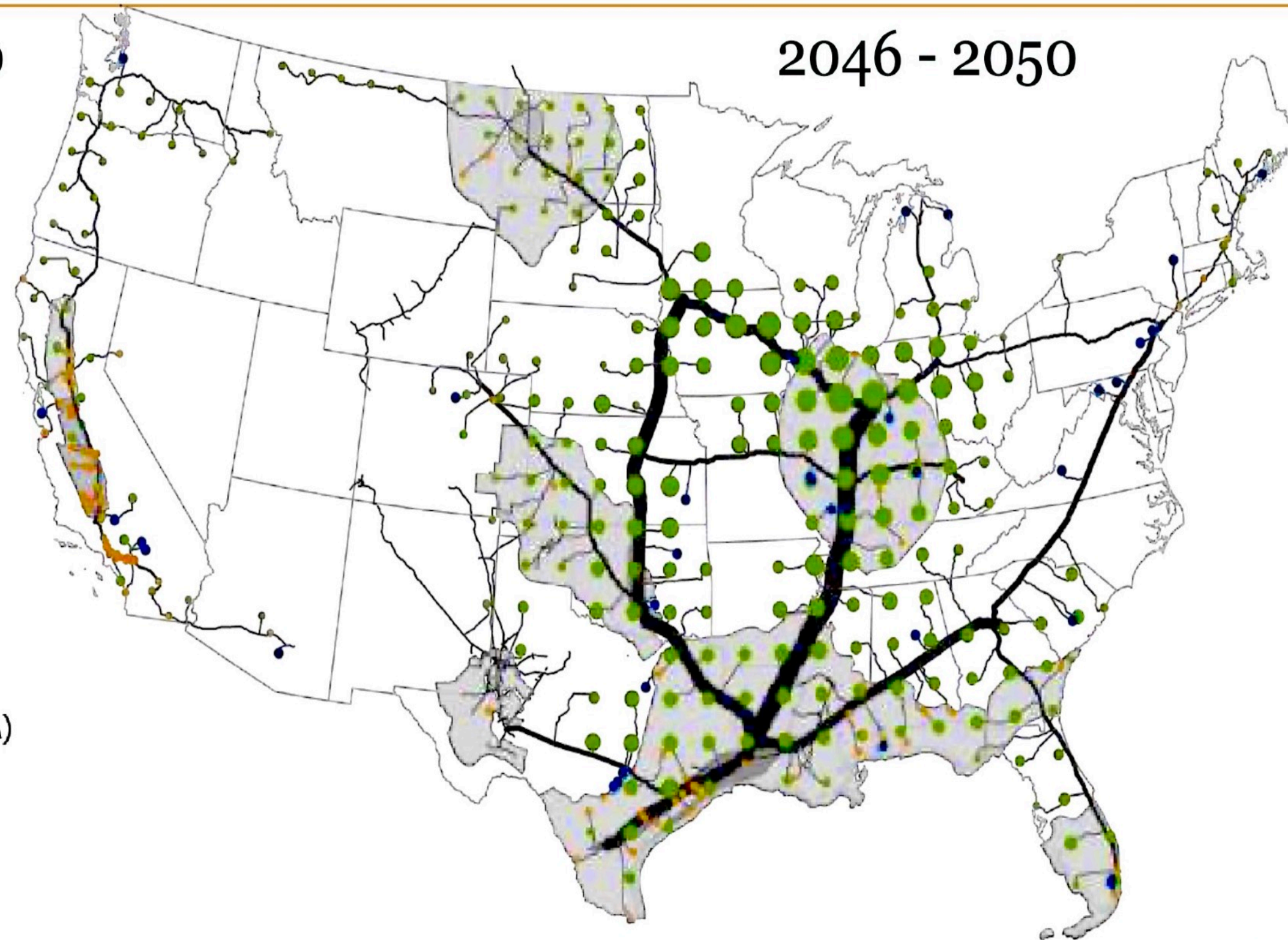
- CO2 point sources
- BECCS - power and fuels
- Cement w/ ccs
- Natural gas power ccs oxyfuel

### CO2 captured (MMTPA)

- 0.0006449
- 7.9144
- 15.8282
- 23.7419

### Trunk lines (capacity in MMTPA)

- 5
- 166.667
- 328.333
- 490



2046 - 2050



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- Today - Only 5,300 miles of short-run CO<sub>2</sub> pipelines
- Potential buildout of over 65,000 miles of new CO<sub>2</sub> pipelines
- DOE suggests there could be as many as **96,000 miles**, if **pipelines** are 24" to 30" vs. 48" in diameter
- Major hubs in Illinois

# Guardrails for CO<sub>2</sub> pipelines

Create moratorium on CO<sub>2</sub> pipelines until PHMSA completes its rule-making

Conduct analysis of geohazards

Fund emergency preparedness:

- Grants for equipment
- Training

Limit the use of eminent domain

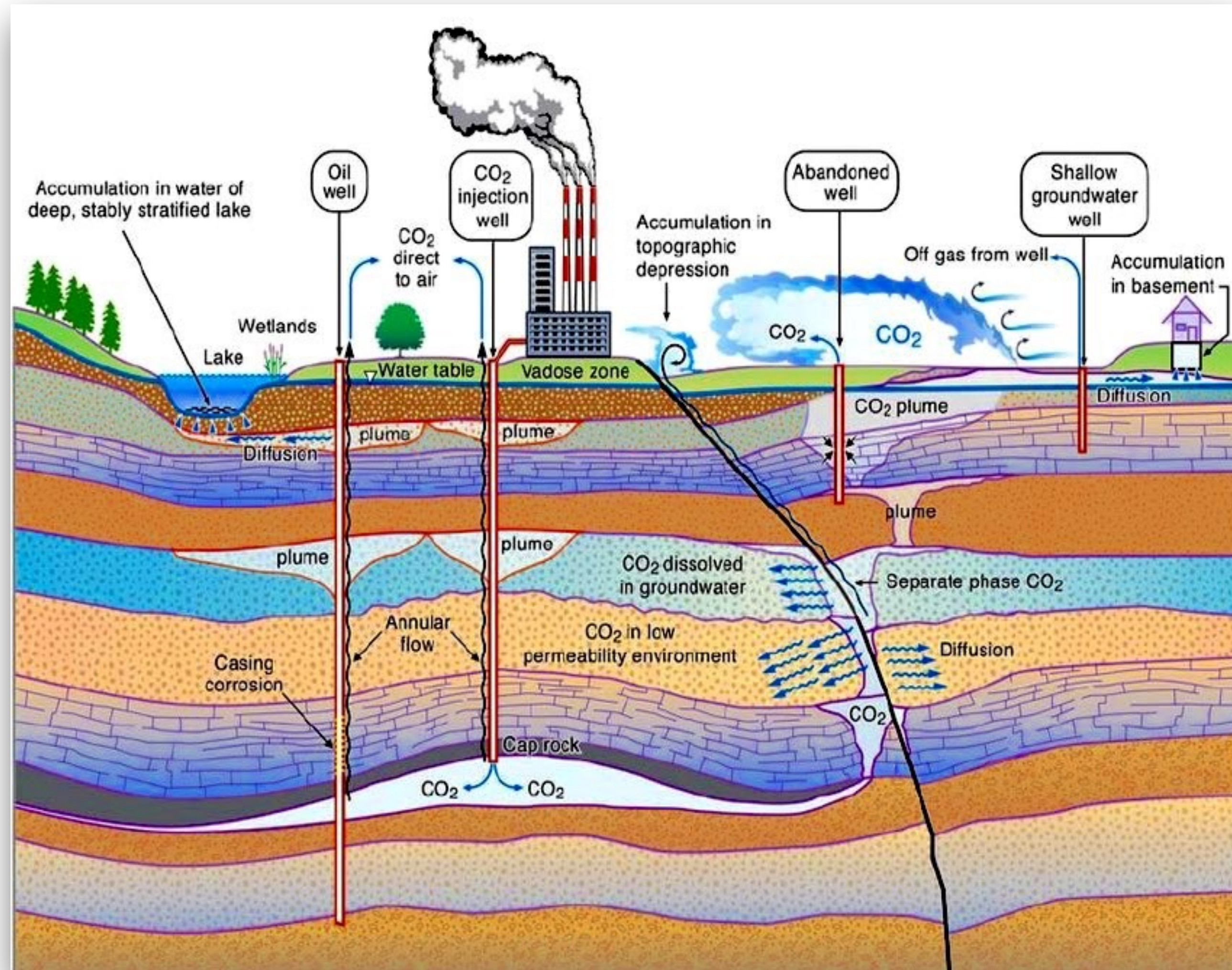
Establish safe setbacks:

- Require most precise modeling
- Create thresholds of acceptable exposure levels that protect people and allow self rescue or rescue

Require robust public engagement BEFORE a developer files its application to the ICC



# Key concerns over carbon sequestration



Sequestered CO<sub>2</sub> can leak:

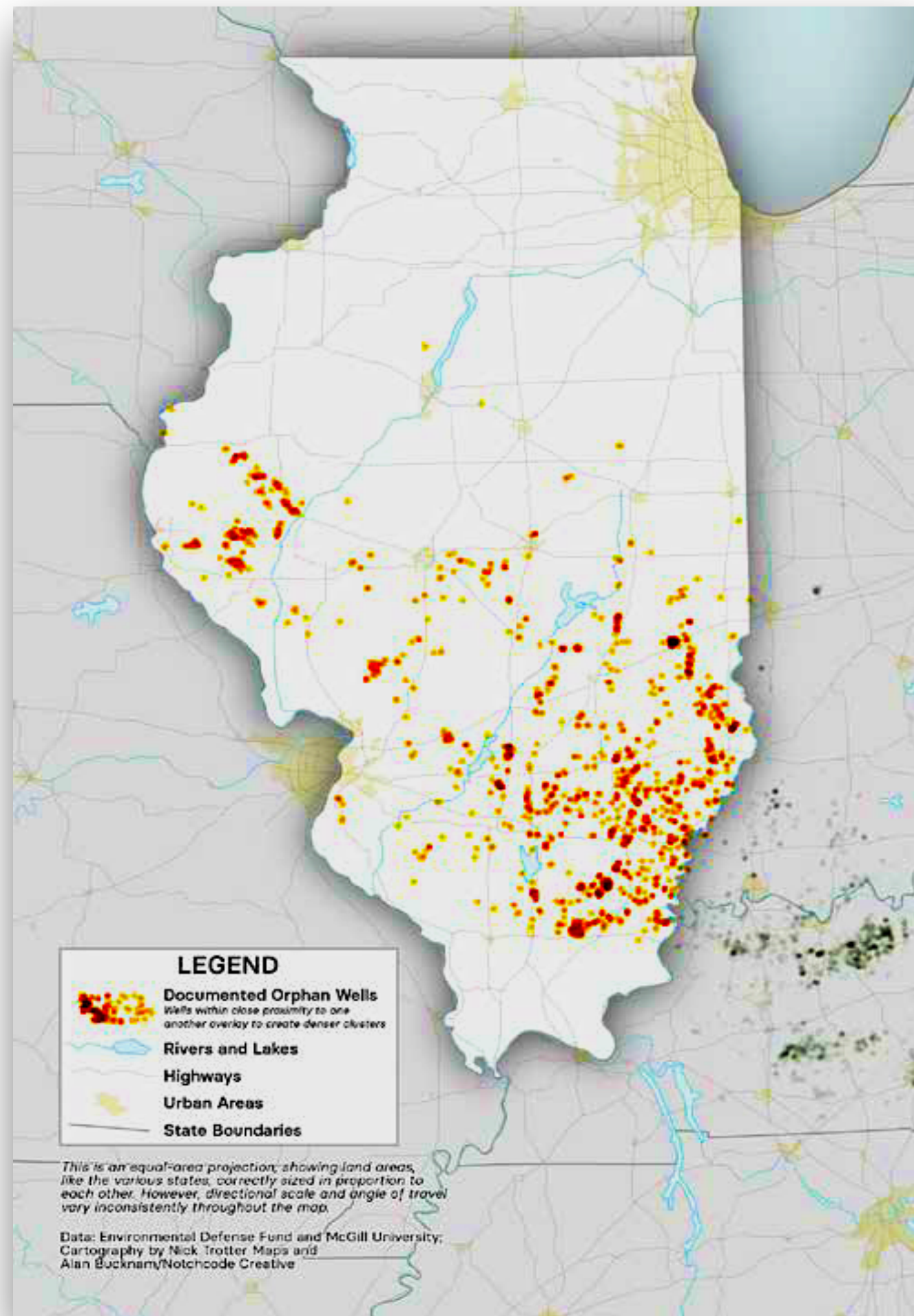
- Supercritical CO<sub>2</sub> is more buoyant than surrounding liquids
- It can escape along injection or abandoned wells or through fractures in the cap rock, or seal

Leaking CO<sub>2</sub> can:

- Contaminate aquifers
- Stunt crop growth
- Release CO<sub>2</sub> back into the atmosphere

It can take up to 1,000 years for CO<sub>2</sub> stored in a saline aquifer to become fully inert

# Abandoned wells source of leaking



There are thousands of oil & gas wells across central and southern Illinois. This map shows only “orphaned wells” - unplugged wells - which total over 4,000. DNR counts more than 32,000 oil & gas wells; DNR doesn’t know where all of them are.

- Even “plugged wells” are at risk - carbonic acid can erode cement.
- Old wells can provide a pathway for CO<sub>2</sub> to escape containment and rise to the surface.
- An old well released CO<sub>2</sub> near a Wyoming school in 2016, requiring evacuation & school shutdown for months.

## “Wyoming School Shuttered by Gas Leak Ready to Reopen”

By Cooper McKim | May 26, 2017

“Midwest School shut its doors after staff and students smelled gas-like odors which came from an abandoned well that led to levels of CO<sub>2</sub> that were 20 times higher than recommended.” ...CO<sub>2</sub> was finding its way out of the well through small cracks underground then rising up into the school.

# Geology proposed for storage is leaking

## CO<sub>2</sub> leaking, ADM, Decatur

- CO<sub>2</sub> stored over 6,000 feet underground has moved 1,000 feet toward the surface since 2013. Could put pressure on the cap rock
- Source: Alex Kolker, PhD, oceanographer, geologist, and climate scientist

## Underground natural gas Storage fields in the Mt. Simon Saline Aquifer:

- Ancona gas field (Livingston County): documented leaks
- Troy Grove (La Salle County) gas field: documented leaks
- Manlove gas field (Champaign County): documented leaks that contaminated residents' water; replacement water required.



## *Methane leak permeates rural farmland*

ANCONA, Ill. (WCIA) — Government agencies tasked with safeguarding the environment allowed methane — the same highly-flammable, invisible element that warms homes, ignites stovetops and fuels the power grid — to leak into the sky, bubble in streams and water

# CCS Projects in Illinois

## **Navigator CO2 Ventures, ICC Docket #23-0161**

**Capture** (ethanol) - **STATUS UNKNOWN**

Big River Resources, Henry County

**Pipeline** - **CANCELLED October 20, 2023**

Adams, Brown, Christian, Fulton, Hancock, Henry, Knox, McDonough, Montgomery, Morgan, Pike, Sangamon, and Schuyler Counties

**Carbon Storage**

**IN PROCESS**

Christian County (applied for 6 Class VI wells)

**STATUS UNKNOWN**

Montgomery County (no permits applied for,)

## **Wolf CO2 Pipeline, ICC Docket #23-0475**

**Carbon Capture** (ethanol)

BioUrja, Peoria County (EJ) - negotiating

**Pipeline**

Dewitt, Henry, Knox, Logan, Macon, Peoria, Rock Island, Stark, and Tazewell Counties

**Carbon Storage, ADM, Macon County**

Maroa (applied for 3 Class VI Wells)

Decatur Campus (applied for 4 Class VI Wells)

**One Earth CCS, ICC Docket #23-078** (ethanol)

McLean County (applied for 3 Class VI Wells)

**Marquis CCS** (ethanol, on site)

Putnam County (applied for 1 Class VI Well)

**CWLP CCS** (coal)

Sangamon County (pilot carbon capture in process)

Likely to require pipeline to sequester off-site at full capacity)

**Prairie State Energy Campus CCS** (coal)

St. Clair County and/or off site. Plans in process

**Emberclear** (natural gas / blue hydrogen)

Sangamon County. Plans in process

**Navigator CO2 Ventures, Carbon Storage** (ethanol?)

Securing lease agreements: Logan, McLean, Tazewell, Dewitt Co.

Pipeline location / routing not disclosed (planned a Phase II)

Applied for 3 Class VI Wells, McLean and Logan County

Applied for 2 Class VI Wells, DeWitt County

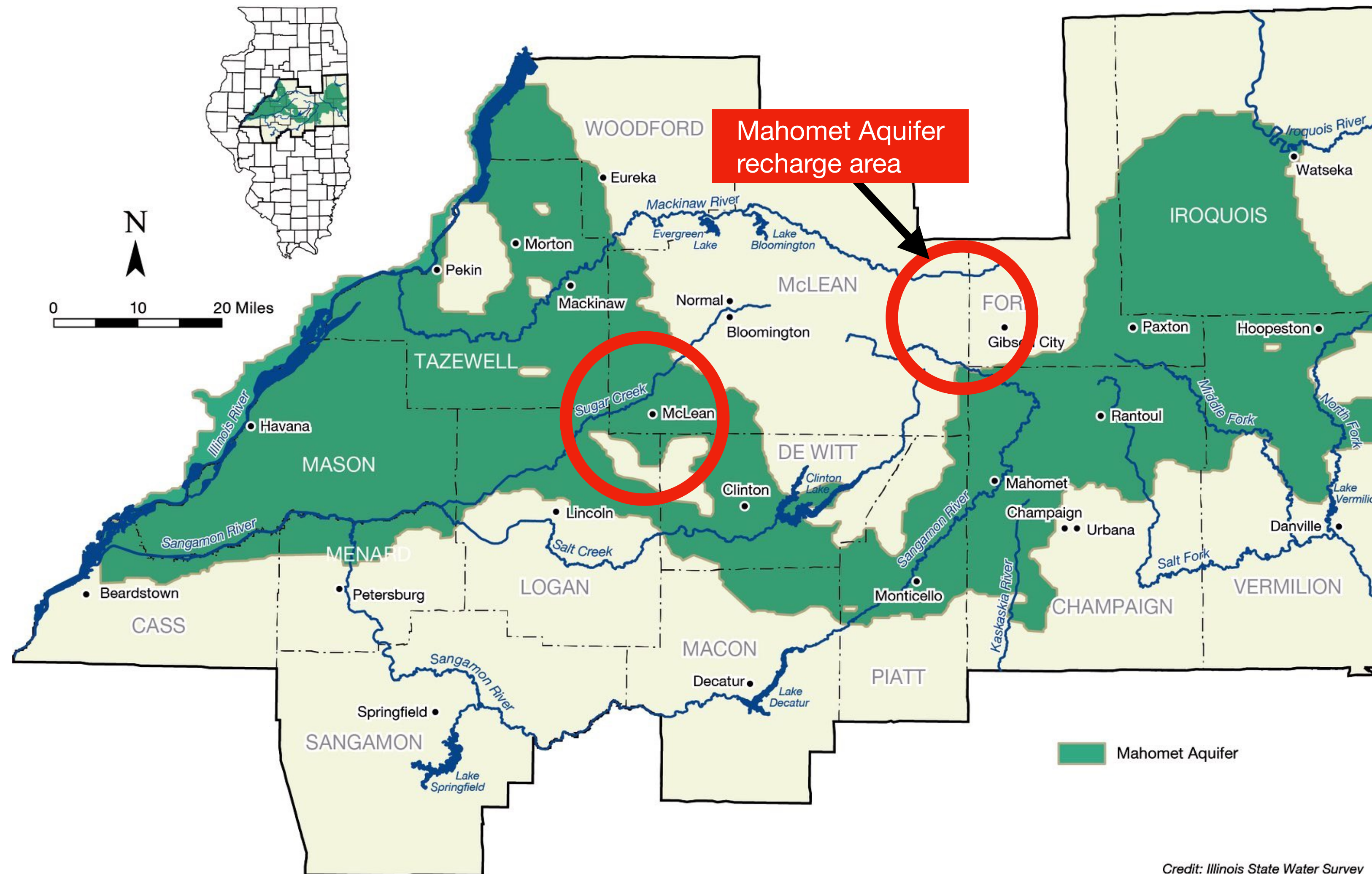
**Wolf Carbon Solutions / ADM, Carbon Storage** (ethanol?)

Securing lease agreements: Livingston and Piatt Counties

Pipeline location / routing not disclosed



# Stored under the Mahomet Aquifer



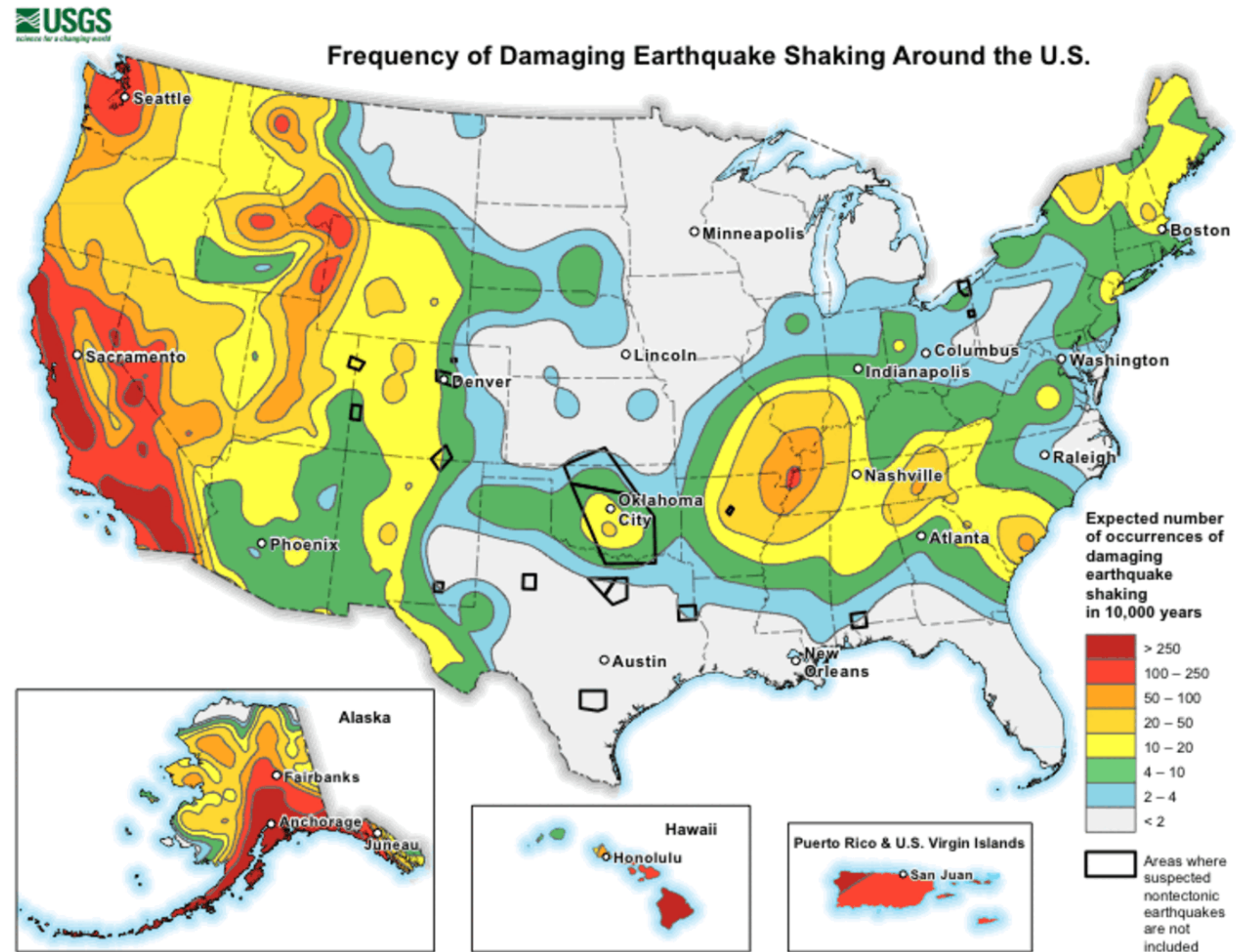
Credit: Illinois State Water Survey

# Earthquakes: natural and induced

Illinois has two active seismic areas: the New Madrid Seismic Zone and the Wabash Valley Seismic zone, both of which can produce significant earthquakes

Injection of CO<sub>2</sub> also can trigger earthquakes large enough to break the caprock or seal

Earthquakes could rupture wells or open fractures, creating pathways for CO<sub>2</sub> to escape confinement



# Liability: current laws not clear

## Some key unanswered questions:

- Who owns “pore space” into which carbon dioxide is injected?
- Who owns the carbon dioxide after its been injected
- Who should is responsible for ensuring carbon dioxide stays deep underground or addressing a leak or well blow-out if one occurs?

A sign in Mammoth Lakes California warning of the danger of high levels of Carbon Dioxide in the Horseshoe Lake area. 170 acres of trees have been killed by the high levels of carbon dioxide.

Credit: [California Dreamin](#) / Alamy Stock Photo



# Guardrails for carbon storage

Designate surface owner of the estate as owner of the pore space, **and** limiting the number of properties that must be acquired through assembly of pore space

Require existing US EPA Class VI Well regulations to be the threshold for a permit. Stronger for monitoring (100 years)

Ensure the confining zone:

- Is not in an active seismic zone, fault area
- Does not intersect with an potable/usable water aquifer or an aquifer connected to such an aquifer; and
- Does not contain any faults, fractures, abandoned or operating wells, mine shafts, quarries, or other features that could serve as escape paths for CO<sub>2</sub>

Ensure liability for CO<sub>2</sub> releases and post closure care remain with the developer / operator

Require robust public involvement



# Next Steps:

Draft a moratorium on CO<sub>2</sub> pipelines and sequestration that is tied to:

- Completion of PHMSA rule making
- Adoption of comprehensive, protective, CCS bill

Continue negotiations with industry and other stakeholders on comprehensive CCS bill (initiated in May, 2023)

Submit both the moratorium and the CCS bill to the legislative review bureau in January, 2024

**Pass BOTH bills!**



# Coalition to Stop CO<sub>2</sub> Pipelines

## Carbon Capture and Storage

