

# Carbon Capture and Sequestration

# 95 years of innovation

Our mission is to translate scientific discovery and technology advances into societal benefits.

Nonprofit, charitable trust formed in 1925

## Research & Development

We're solving our customers' greatest challenges today while funding internal research to address tomorrow's threats.

## Philanthropy & STEM

We reinvest our profits into science, technology, and charitable causes, including high-quality STEM education programs for millions of students across the U.S.

## Laboratory Management

Delivering scientific discovery and inspiring innovation with the management role in nine national laboratories.

## National Security

Mission-critical solutions in the air, on the ground, underwater and in cyberspace.

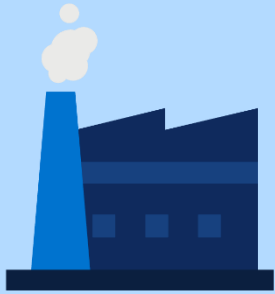
## Health

Innovating to accelerate discoveries that augment human health and performance, improving survivability, resilience and recovery.

## Environment & Infrastructure

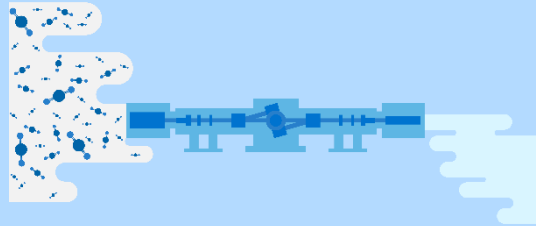
Safeguarding assets, building dynamic research networks, and providing solutions to complex environmental challenges.

# CCS: What does it mean?



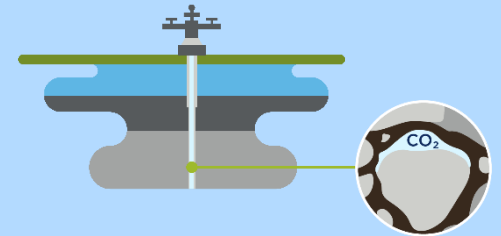
## CARBON

- Carbon dioxide (CO<sub>2</sub>) is a byproduct of industrial processes, including cement, steel, ammonia, hydrogen and combusive power generation



## CAPTURE

- CO<sub>2</sub> is purified, dried, and compressed
- Transport via pipeline or other means if necessary



## SEQUESTRATION

- The compressed CO<sub>2</sub> is pumped >2500 ft/750 m below surface.
- The CO<sub>2</sub> is trapped in porous rock which has a “ceiling” of non-permeable rock to prevent leakage

# Finding Deep Saline CO<sub>2</sub> Storage Sites

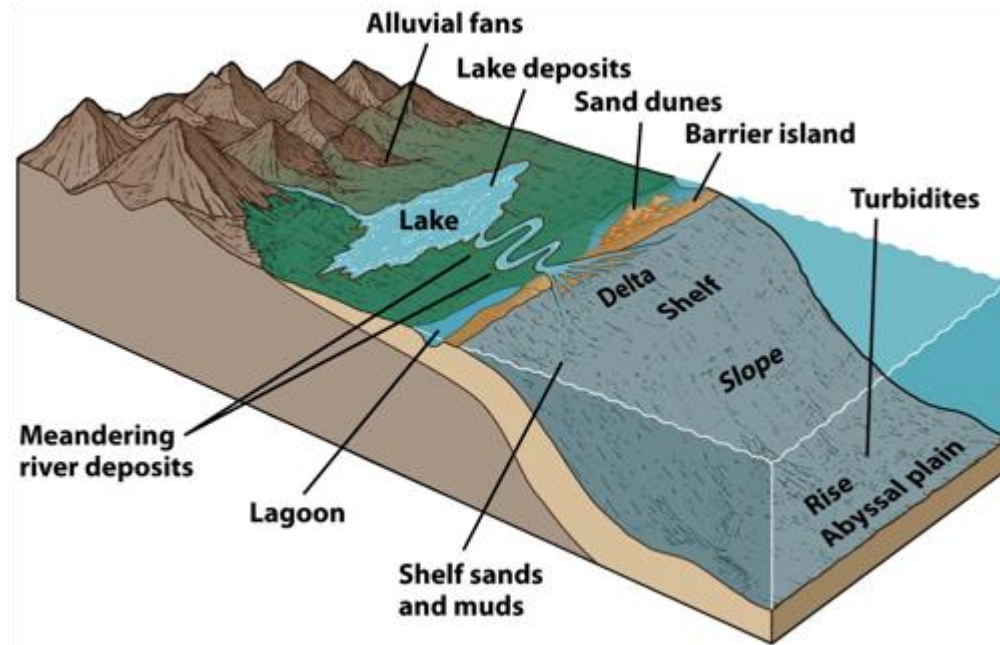


Figure 5-13  
Earth System History, Third Edition  
© 2009 W.H. Freeman and Company



# Coarse Data Tells Us There is Plenty



Potential  
100 MT  
site

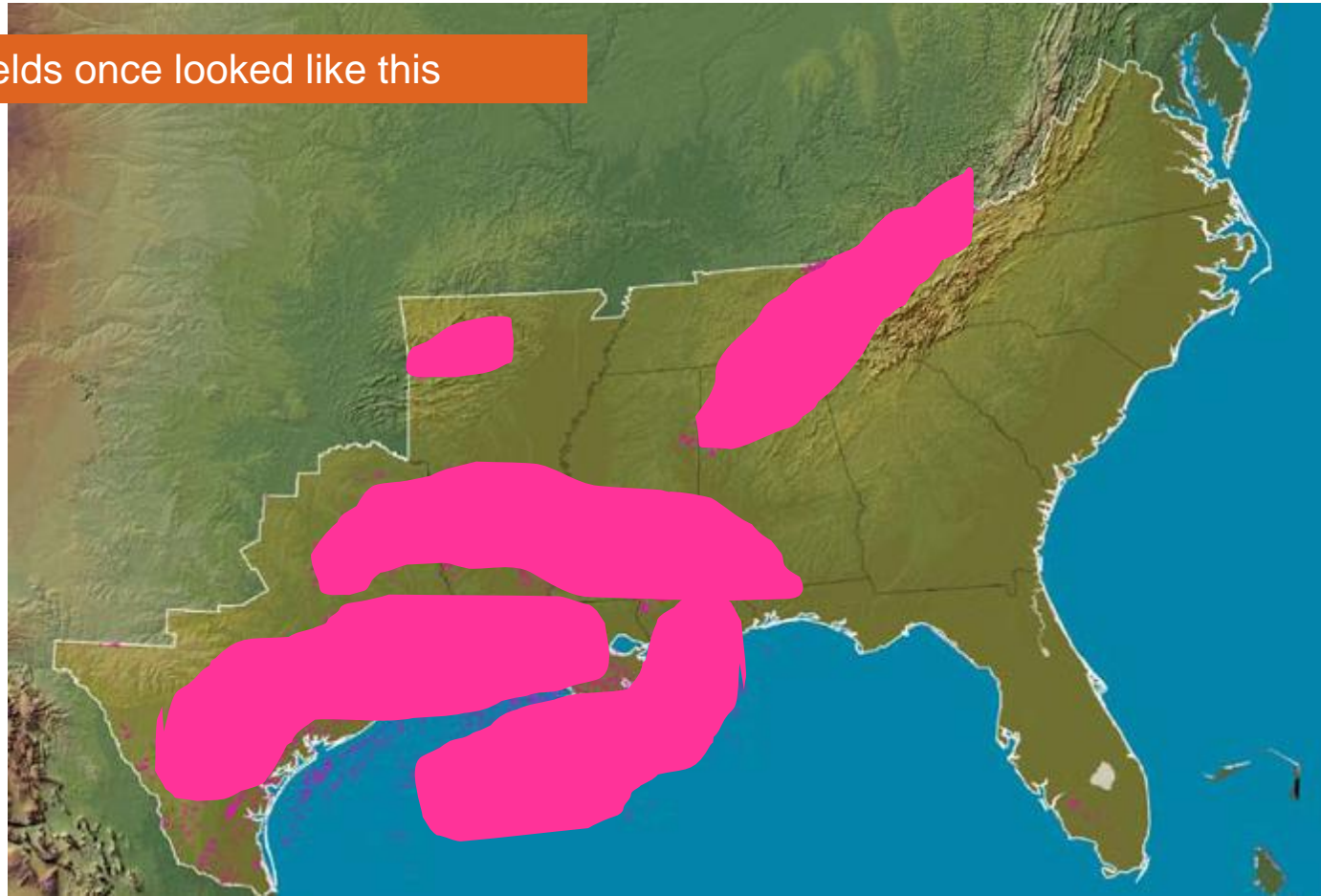


300 ft

10 miles

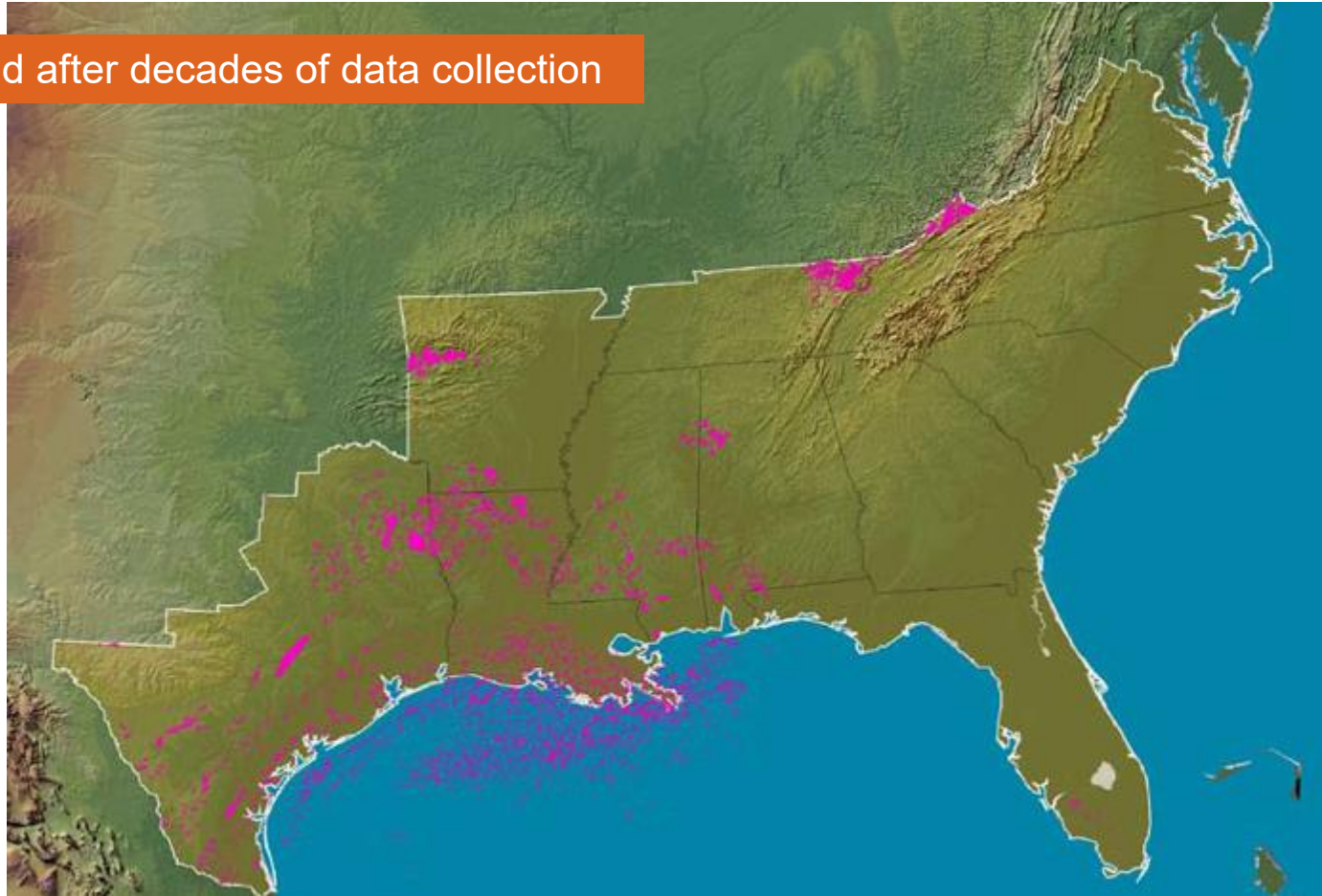
# Oilfield Analogy

Potential oil & gas fields once looked like this

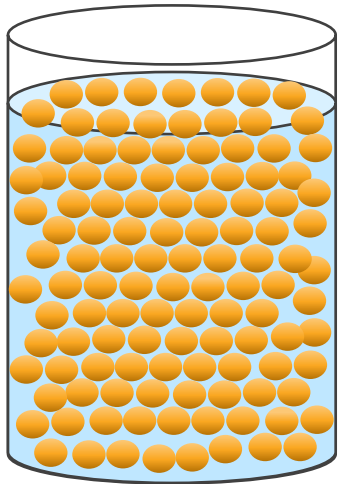


# Oilfield Analogy

Here's what was found after decades of data collection

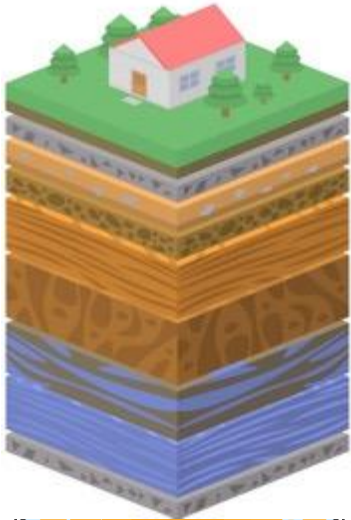


# Finding Deep Saline CO<sub>2</sub> Storage Sites



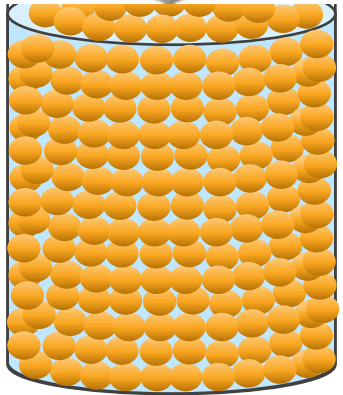
40%

60%



20%

80%



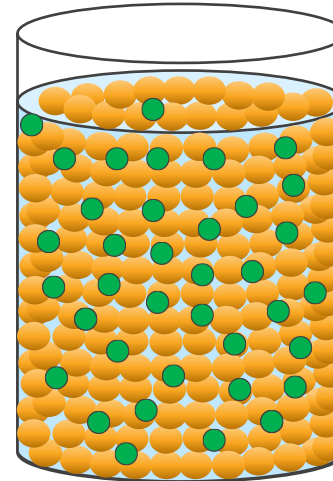


# Commercial Site Requirements

Capacity - amount of CO<sub>2</sub> that can be stored  
(drives acreage of pore space needed \$\$\$)

Injectivity

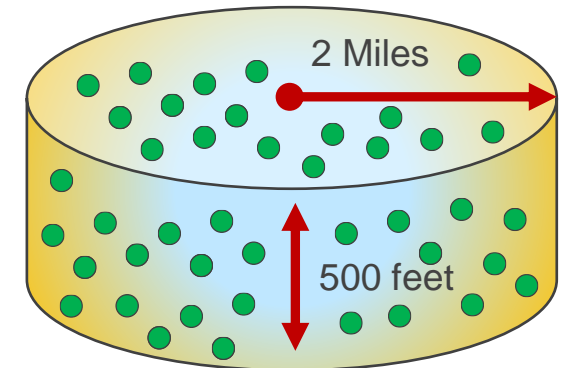
Containment



Sand 80%

Water 15%

CO<sub>2</sub> 5%



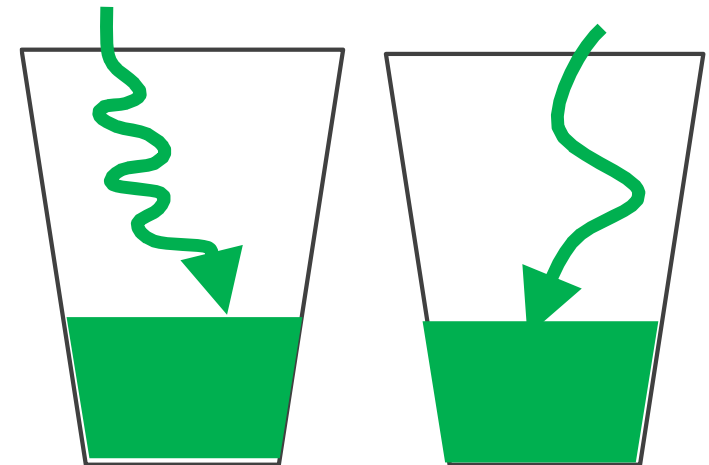
Volume = ~13 square miles x 500 feet x 5%

# Commercial Site Requirements

Capacity

Injectivity - the ease that CO<sub>2</sub> can be injected  
(drives the # of wells needed \$\$\$)

Containment

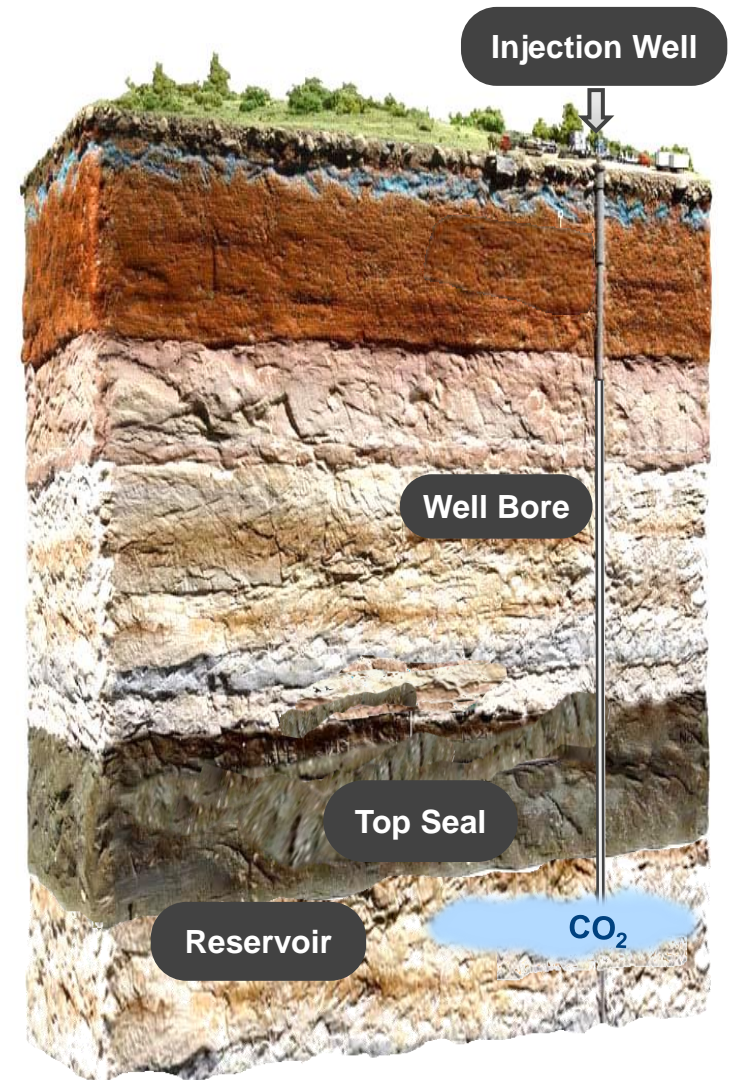


# Commercial Site Requirements

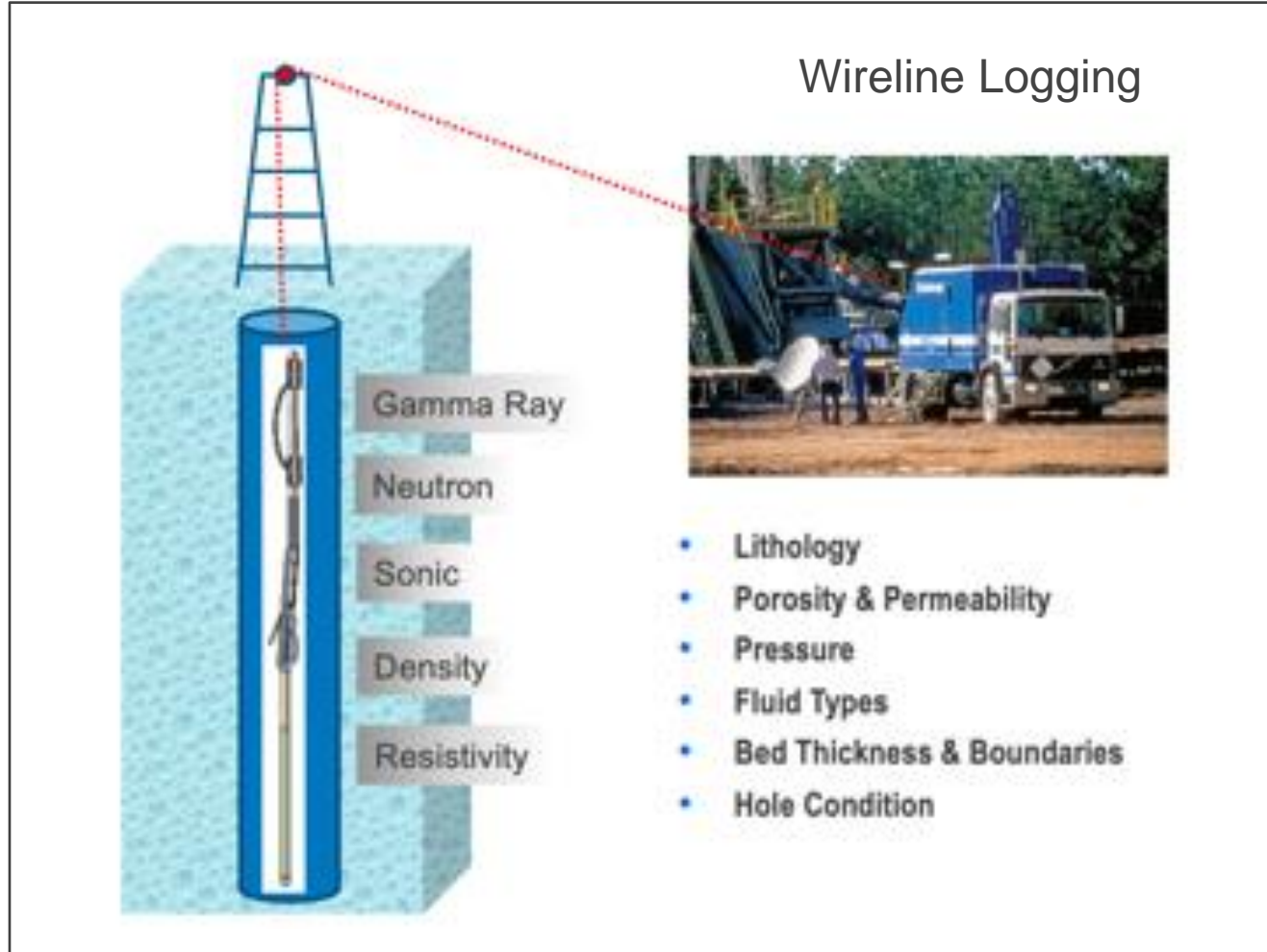
Capacity

Injectivity

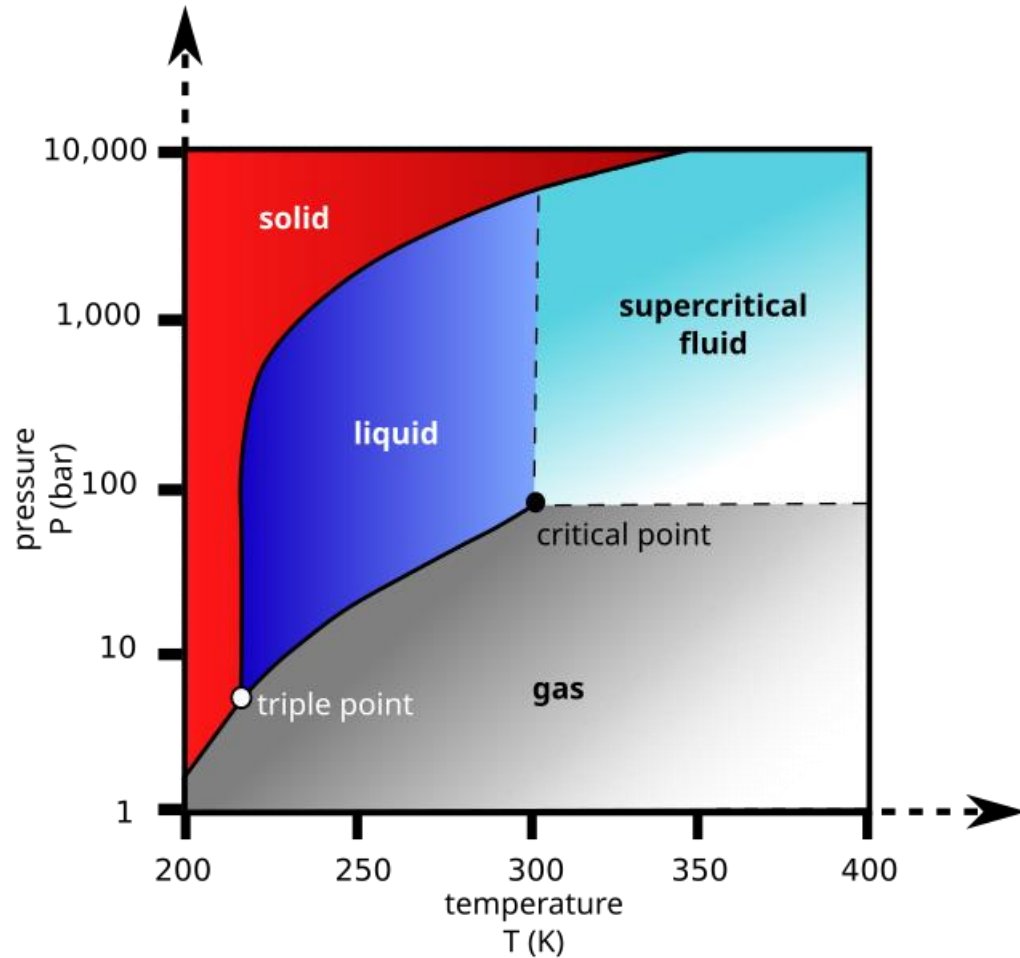
Containment



# Data Collection

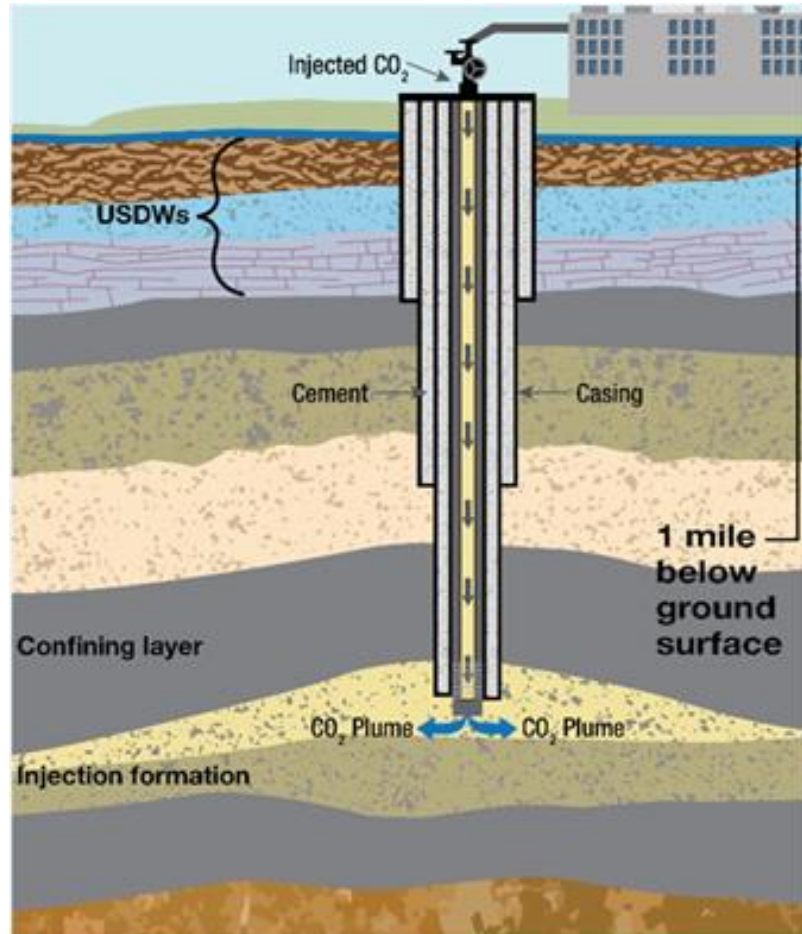


# Carbon Dioxide and Class VI



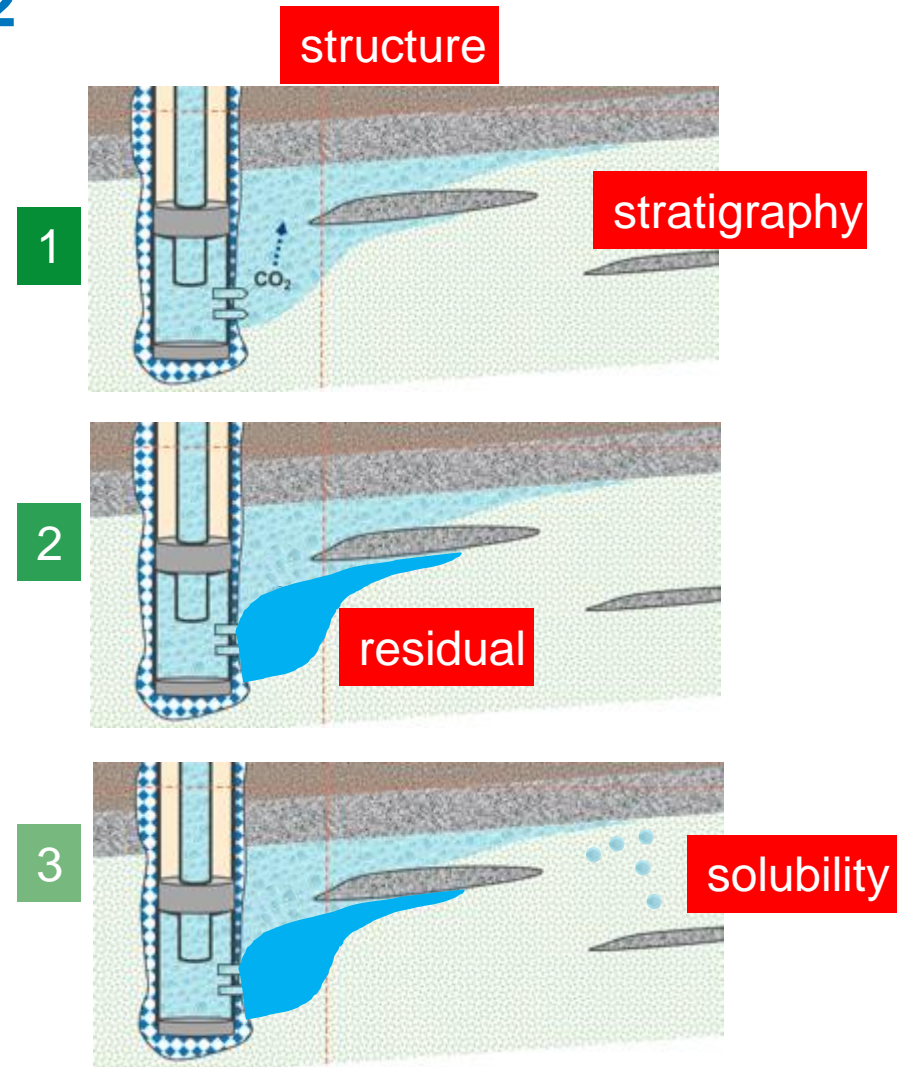
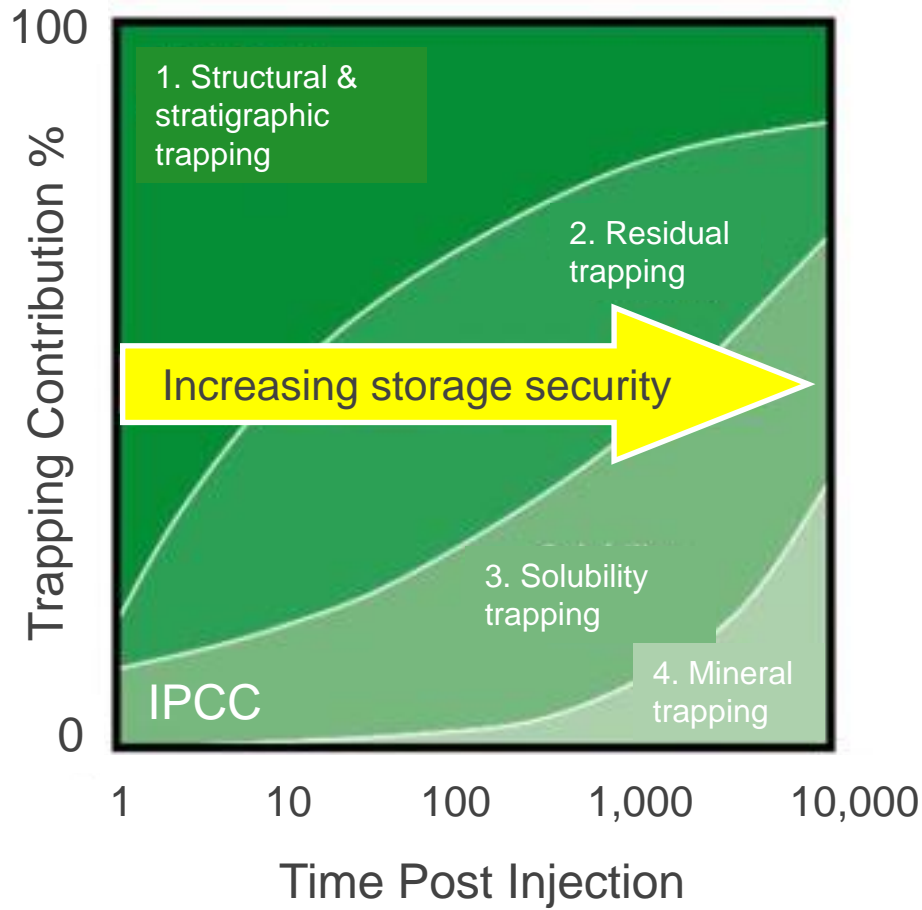
- Relative buoyancy
- Subsurface mobility
- Corrosivity in the presence of water
- Large injection volumes

# Injection well – requirements/considerations

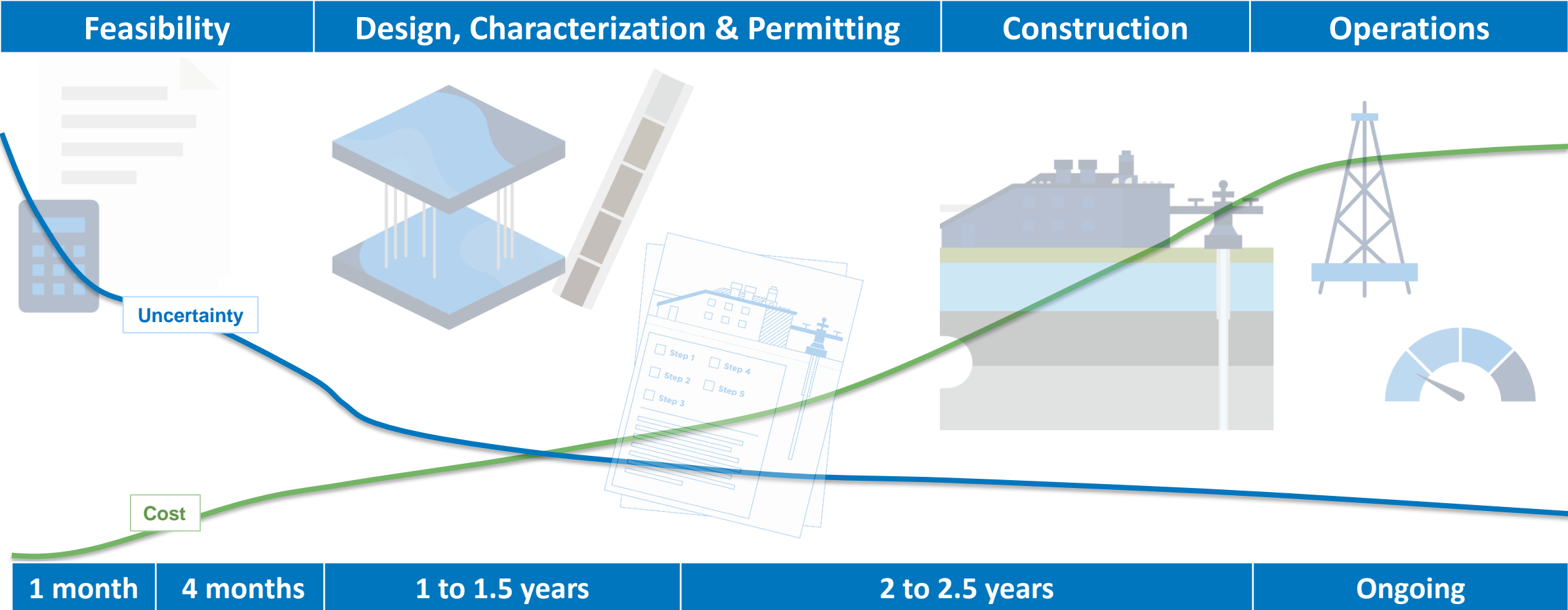


- Prevention of any CO<sub>2</sub> from leaking outside of the injection zone.
- Designed for the life of the project.
- Well materials, including casing and cement, are corrosion resistant and compatible with the conditions and fluids to which they may be exposed.

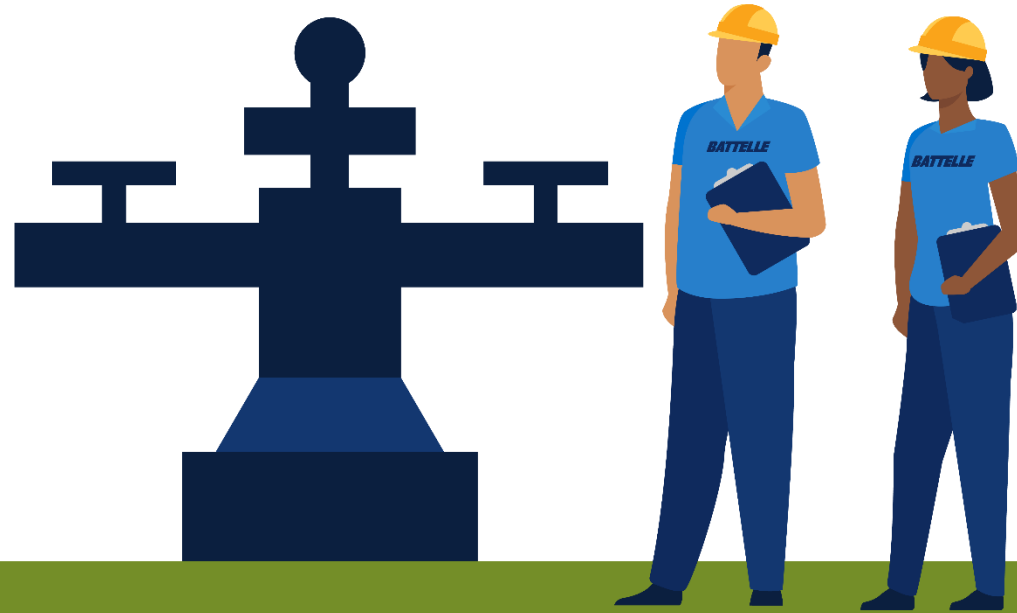
# The Fate of Injected CO<sub>2</sub>



# Roadmap of a CCS site







***BATTELLE***

**It can be done**

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