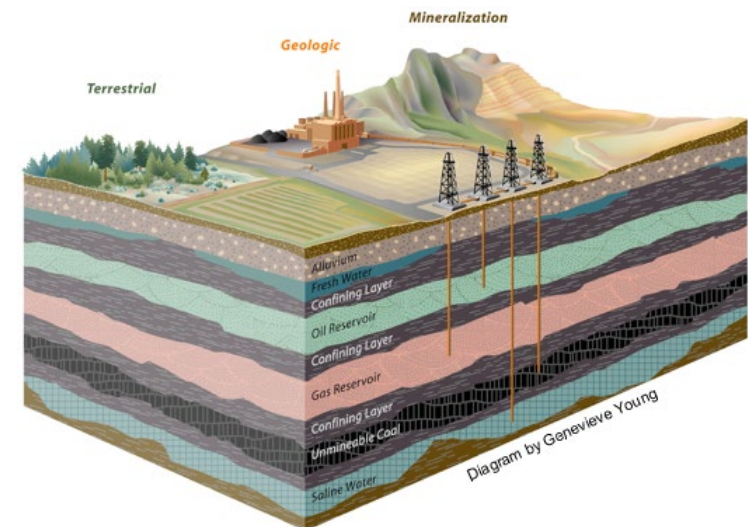


The University of Texas at Austin  
Center for Subsurface Energy  
and the Environment  
*Cockrell School of Engineering*

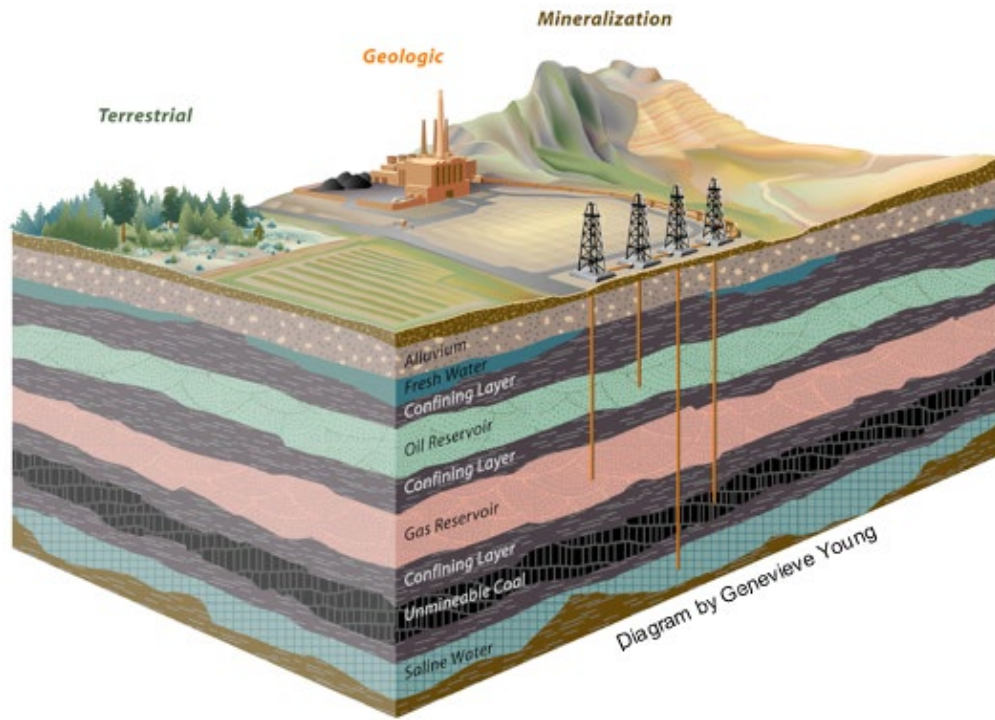
# CLEAN HYDROGEN PRODUCTION AND CARBON CAPTURE STORAGE AND UTILIZATION (CCS, CCUS)

**MOJDEH DELSHAD**



# Bayou Bend CCS Project- Chevron & Talos & Equinor

- Bayou Bend is positioned to be one of the largest CCS solutions in the US for industrial emitters,
- Nearly 140,000 gross acres of pore space for permanent carbon dioxide (CO<sub>2</sub>) sequestration and gross potential storage resources of more than 1 billion metric tons.



EOR  
CCS or Enhanced gas recovery  
CCS in Saline aquifer

September 2023

# Commercial-Scale CCS Projects

**Petra Nova** facility was designed to transport CO<sub>2</sub> captured from a coal-fired power plant located about 80 miles away for enhanced oil recovery at a mature oil field operated by Houston-based Hilcorp.

“Petra Nova proved that the employed technology works at commercial scale; however, the Petra Nova team encountered several challenges, as one would expect with any first-of-a-kind large-scale facility”.

- Power outages at the coal plant
- CO<sub>2</sub> pipeline shutdowns
- Bottlenecks at field facilities
- A Category 4 hurricane that impacted the entire region (2017)

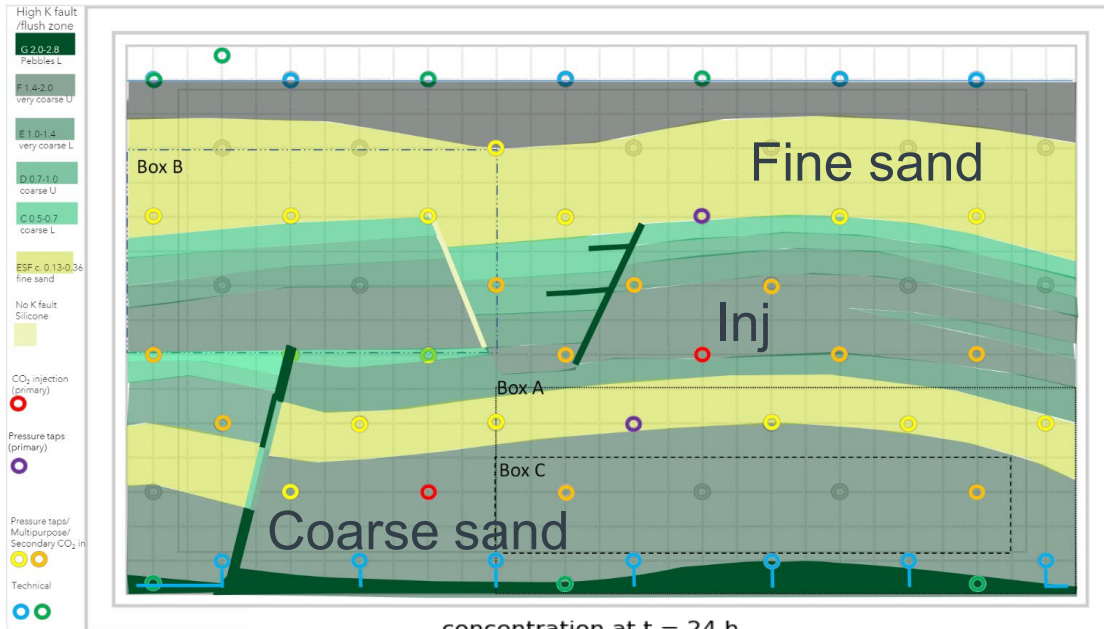


Carbon capture facility (coal plant) at the Petra Nova facility near Houston (1.4 mtpa target)

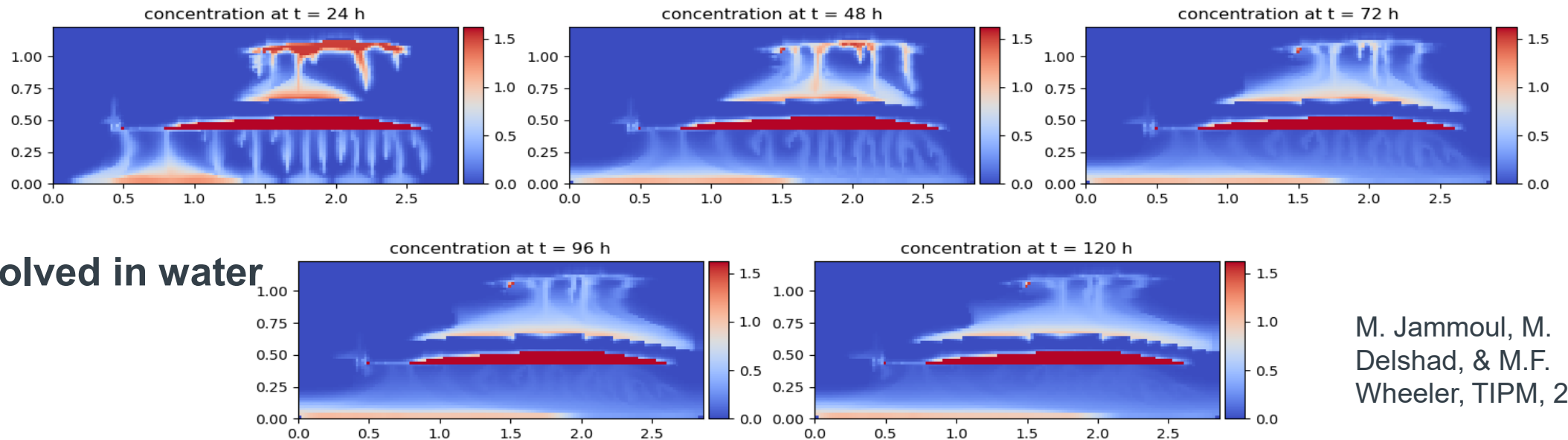
# CCS History & Challenges

- Terrell Natural Gas processing plant, Texas (1971)
- 50 years of CCS projects (Canada, Europe, The Middle East, Asia pacific). The United States leads with 12 projects, 17 new projects were announced in 2020, and a surge in new Class VI applications (~ 98) attributed to Inflation Reduction Act (IRA). 93% are planned for permanent storage (not EOR)
- **Persisting challenges**
  - Class VI Injection permit, lease attractive pore space, and pipeline
  - Reduce project cost and improve efficiency for both capture and storage
  - Safety and security of storage (site selection, injectivity, capacity estimate, caprock integrity, etc.)
  - Modeling underground storage and accurate predictions over a long time storage project
  - Innovation to improve project economics
  - Pore space availability for CO<sub>2</sub>, Natural Gas, and Hydrogen
  - Construction equipment and labor cost increase

# Large-Scale CCS Experiment and Simulation



FluidFlower Rig - Intended Geometry motivated by a Norwegian reservoir



CO<sub>2</sub> dissolved in water

M. Jammoul, M. Delshad, & M.F. Wheeler, TIPM, 2023