

# Carbon Dioxide Pipelines

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# Carbon Dioxide (CO<sub>2</sub>) Pipelines

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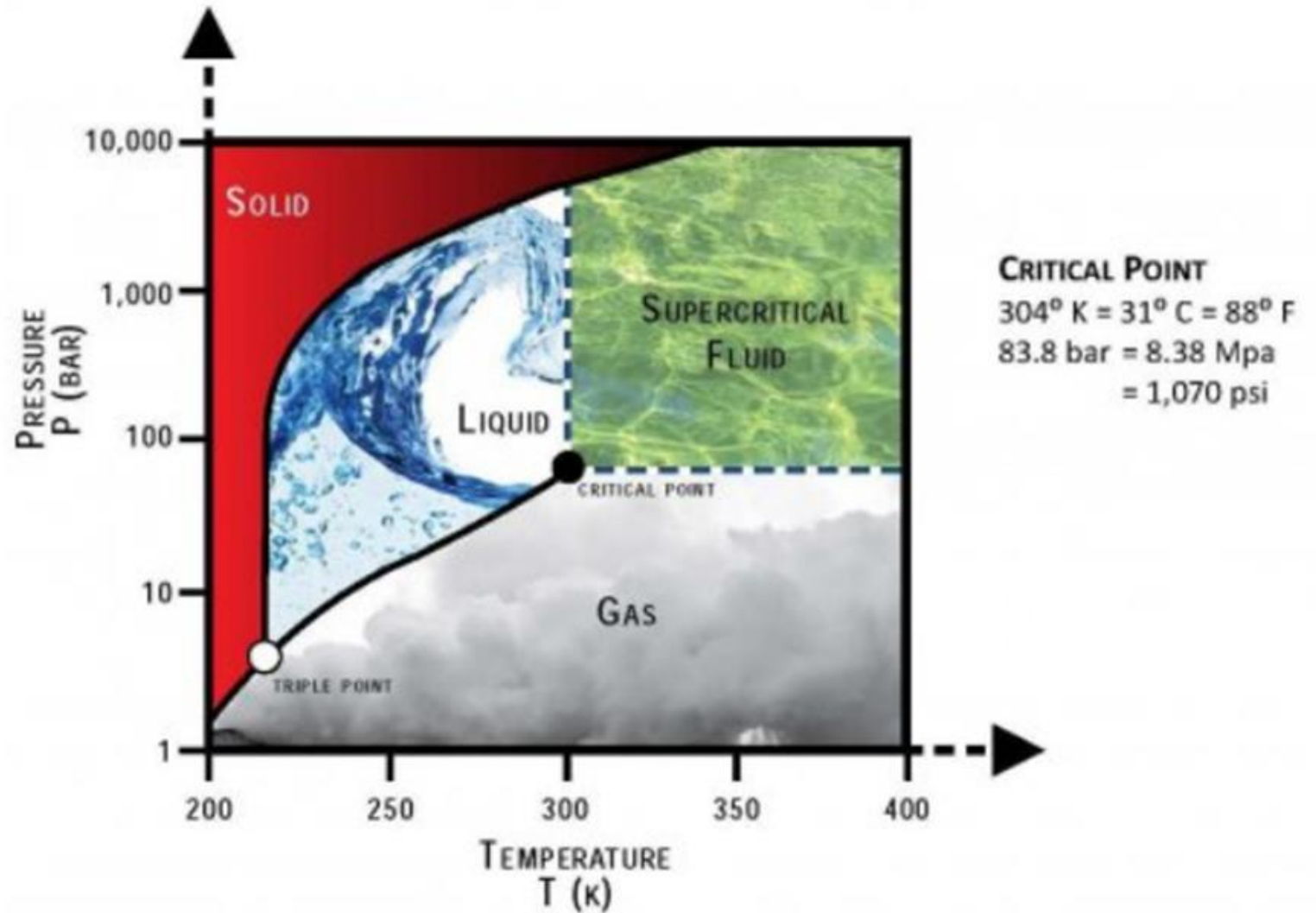
# Why are we talking about carbon dioxide?

- ◆ Midwest/Central Plains proposed pipelines projects
  - ◆ Meeting strong landowner opposition
- ◆ Capturing carbon dioxide from ethanol facilities and other industrial sources
- ◆ Transporting carbon dioxide to sequestration site – stored deep underground
- ◆ Federal Tax Credit - Section 45Q – tax break of \$50 per metric ton of carbon stored for project launched before 2026 and utilized for 12 years.  
<https://spp.fas.org/crs/misc/IF11455.pdf>
- ◆ Satartia, Mississippi Failure

# Properties of Carbon Dioxide

- ◇ Non-flammable
- ◇ Colorless
- ◇ Odorless at low concentrations
- ◇ Non-toxic/slightly toxic (asphyxiant in large amounts – threshold limit of 5,000 ppm)
  - ◇ Causes unconsciousness at approximately 12% or more CO<sub>2</sub> in air.
- ◇ At standard temperature and pressure is 1.5x heavier than air (can accumulate in low-lying areas)
- ◇ Transforms to a gas when it escapes from the pipeline
- ◇ Expansion Ratio of 535:1
- ◇ Transported in pipelines as a super critical fluid

# Carbon Dioxide Properties – Super Critical Point



# CO<sub>2</sub> Regulation History

House Committee on Energy and Commerce in 1987 pointed out:

- ◆ The Committee has for some time recommended the safety regulation and inspection of CO<sub>2</sub> pipelines." The Committee further notes that:
- ◆ The CO<sub>2</sub> pipeline industry has a good safety record and performs an essential service for enhanced oil recovery, but it is a very new industry. It is not a question of its safety record that caused the requirement for safety regulation, but rather the unique potential for disaster if there were ever a break in a CO<sub>2</sub> pipeline .
- ◆ A recent event demonstrated just how lethal CO<sub>2</sub> can be. On August 21, 1986, a catastrophic release of gas dissolved in Lake Nyos in Cameroon, Africa, killed 1,700 people. At the time, the news media characterized the gas as "toxic," "poisonous" and "lethal." Subsequent investigation proved the gas was carbon dioxide.
- ◆ The Committee believes that since CO<sub>2</sub> is deadly, CO<sub>2</sub> pipelines should have appropriate Federal safety regulations
- ◆ Consequently, the requirement to issue regulations for the pipeline transportation of carbon dioxide was included in section 211 of title II of the **Pipeline Safety Reauthorization Act of 1988**, 49 U.S.C. 2015.

# CO2 Regulation History Cont.

- ◇ Regulation was developed to include Carbon Dioxide - Docket No. PS-112; Amdt. 195-45 – effective July 12, 1992 (published 6/12/1991)
- ◇ Pipeline Safety Act of 2011
  - ◇ (Sec. 15) Directs the Secretary to prescribe minimum safety standards for the pipeline transportation of carbon dioxide in gaseous form.
  - ◇ Also mandated that, in establishing those standards, the Secretary consider whether applying the existing minimum safety standards in Part 195 “for the transportation of carbon dioxide in a liquid state to the transportation of carbon dioxide in a gaseous state would ensure safety.”
- ◇ Report from PHMSA February 2015 “Background for Regulating the Transportation of Carbon Dioxide in a Gaseous State”.

# CO2 Regulation History Cont.

- ◆ DOE sponsored a workshop in April 2016 to identify and promote best practices for siting and regulating CO2 infrastructure.
- ◆ In June 2016 PHMSA sought public input on the report they did. (“Background for regulating...”) Docket Number: PHMSA-2016-0049
- ◆ February 2020 - Satartia, Mississippi Failure
- ◆ May 2022 - PHMSA Failure Report Complete  
<https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2022-05/Failure%20Investigation%20Report%20-%20Denbury%20Gulf%20Coast%20Pipeline.pdf>



# CO2 Regulation History Cont.

- ◆ May 2022 -PHMSA Announces New Safety Measures to Protect Americans From Carbon Dioxide Pipeline Failures After Satartia, MS Leak
- ◆ 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.

# Current Regulations on CO2

- ◇ Currently, the Pipeline and Hazardous Materials Safety Administration (PHMSA) regulates pipelines transporting carbon dioxide (CO2) in a supercritical fluid state under 49 C.F.R. Part 195, but does not regulate pipelines transporting CO2 in a subcritical liquid or gaseous state.
- ◇ 195.2 carbon dioxide (definition) -A fluid consisting of more than 90 percent carbon dioxide molecules compressed to a supercritical state.
- ◇ 195.102 (b) Components of carbon dioxide pipelines that are subject to low temperatures during normal operation because of rapid pressure reduction or during the initial fill of the line must be made of materials that are suitable for those low temperatures.
- ◇ 195.111 A carbon dioxide pipeline system must be designed to mitigate the effects of fracture propagation.
  - ◇ <https://www.projectconsulting.com/pcs-insights/preventing-fracture-in-co2-transmission-system>
- ◇ 195.258 - rupture mitigation valves
- ◇ 195.260 - valve location

# CO2 Pipeline Concerns

- ◇ Concentrations of less than 90% CO2 not regulated.
- ◇ Gaseous or Liquid CO2 not regulated.
- ◇ Effects of water and other contaminants on pipeline – corrosion issues
  - ◇ Water and CO2 makes carbonic acid
- ◇ Plume studies – accuracy and safety margin
- ◇ Leak detection
  - ◇ Odorant?
- ◇ Fracture propagation
- ◇ Emergency Responder Training
- ◇ ???

# Questions?

