



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

Carbon Dioxide Pipeline Regulation and Safety Oversight  
Linda Daugherty, DAA Field Operations  
March 21, 2023

**EXHIBIT  
C**



# Key Message 1: Safety and Regulatory Oversight

- PHMSA currently regulates and has safety oversight for about 5,200 miles of CO2 pipelines: PHMSA has regulated CO2 pipelines since the 1970s.
- Any new CO2 pipelines will be subject to both our safety oversight and regulatory compliance inspections to assure they are built to operate safely.



## Key Message 2: CO2 Safety Record

- The February 22, 2020 CO2 pipeline failure near Satartia, MS significantly impacted the community and without swift action from First Responders could have been much worse. Impacts also could have been mitigated if our existing regulations were followed.
- In 2022, PHMSA initiated a new rulemaking for CO2 pipelines to strengthen protections in each area where we saw failures in Satartia.



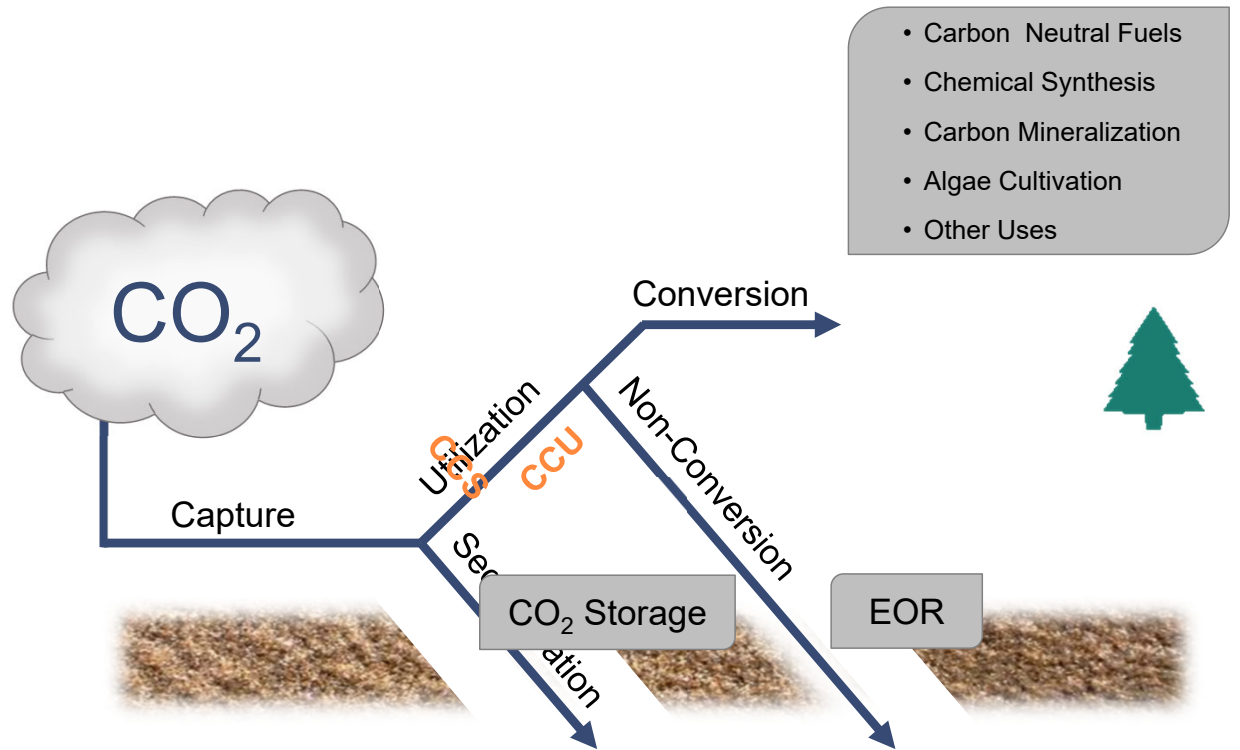
# Key Message 3: PHMSA Continuing Actions

- PHMSA issued a nearly 300 page report on the findings from the Satartia incident, as well as a proposed safety order, and national advisory bulletin.
- PHMSA is working with other Federal agencies, as well as international partners, to leverage global knowledge and experience.
- PHMSA is investing in CO2 research to further mitigate safety risks.



# What is CCUS?

**Carbon Capture Utilization and Storage (CCUS)** is an umbrella term for processes that remove CO<sub>2</sub> where it is generated and then stores it or transports it for use in various industrial applications. Both outcomes remove the CO<sub>2</sub> from green house gas (GHG) emissions.



# Where do Pipelines Fit With CCUS?

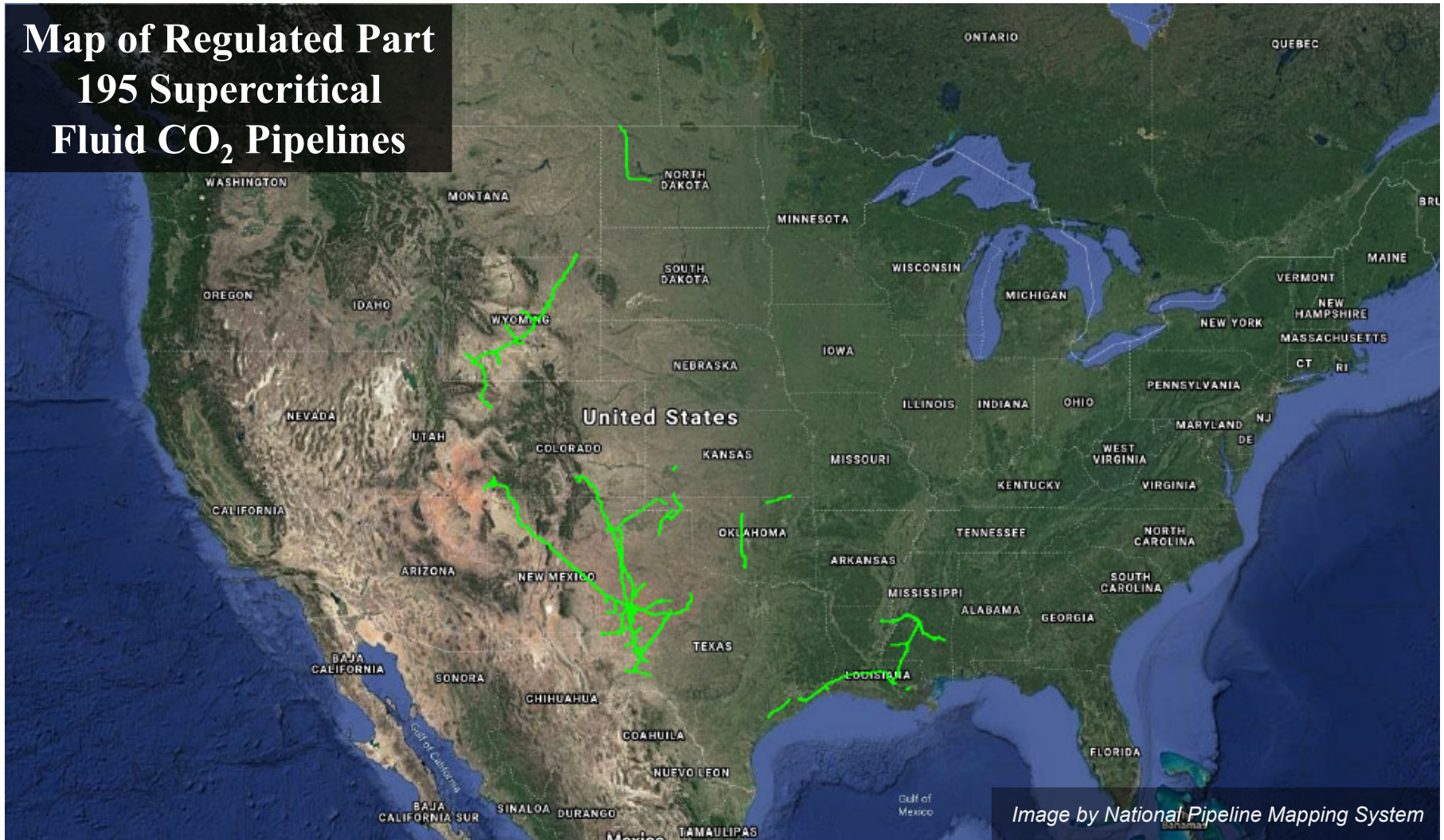


- Pipelines connect carbon capture locations to carbon storage and to carbon utilization locations.
- This primarily involves transportation of supercritical CO<sub>2</sub> through PHMSA regulated pipelines.
- The Inflation Reduction Act and Bipartisan Infrastructure Law included new incentives for CCUS, which is prompting new CO<sub>2</sub> pipeline projects as well.



# Carbon Dioxide Pipelines

## Map of Regulated Part 195 Supercritical Fluid CO<sub>2</sub> Pipelines



# Dual Track Oversight

## Safety Authority

Investigate and Address  
any Safety Issue

Can Issue Safety Orders

Verify Compliance with  
Safety Orders

## Regulatory Authority

Inspect for Compliance  
with Regulations

Can Issue  
Enforcement(s) Orders

Verify Compliance with  
Enforcement Orders





# Dual Track Oversight



# CO<sub>2</sub> Pipeline Projects

## Summit Carbon Solutions (ethanol plants)

- Over \$3 Billion
- 1,400 Miles of Pipeline
- 6-inch through 24-inch
- Carbon Capture Sequestration (CCS)



# CO<sub>2</sub> Pipeline Projects (*cont.*)

## Navigator Heartland Greenway LLC (mostly biofuel production)

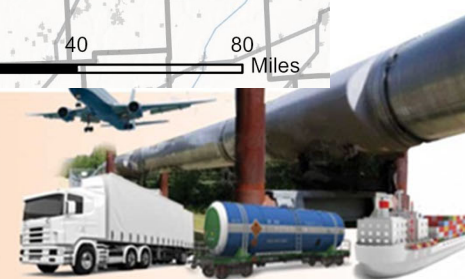
- Over \$2.5 Billion Dollars
- 1,200 miles of Pipeline
- 6-inch through 24-inch pipe
- Carbon Capture Sequestration (CCS)



# CO<sub>2</sub> Pipeline Projects (*cont.*)

## Wolf Carbon Solutions/ Wolf Midwest CCS Project (ethanol & cogen)

- ~300 miles
- 8-inch through 24-inch pipe,
- Carbon Capture Sequestration (CCS)



All Three Proposed Large Scale Projects in IA would transport CO2 in a supercritical phase.



# Part 195 Regulations Unique to CO<sub>2</sub>

## § 195.2 Definitions.(...)

*Carbon dioxide* means a fluid consisting of more than 90 percent carbon dioxide molecules compressed to a supercritical state.

## § 195.4 Compatibility necessary for transportation of hazardous liquids or carbon dioxide.

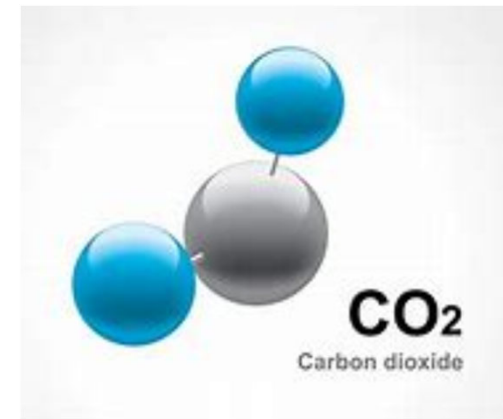
No person may transport any hazardous liquid or carbon dioxide unless the hazardous liquid or carbon dioxide is chemically compatible with both the pipeline, including all components, and any other commodity that it may come into contact with while in the pipeline.

## § 195.8 Transportation of hazardous liquid or carbon dioxide in pipelines constructed with other than steel pipe.

No person may transport any hazardous liquid or carbon dioxide through a pipe that is constructed after October 1, 1970, for hazardous liquids or after July 12, 1991 for carbon dioxide of material other than steel unless(...)



In concentrated/large quantities, carbon dioxide (CO<sub>2</sub>) can displace oxygen and become dangerous as an asphyxiant. In large concentrations, CO<sub>2</sub> can be toxic.



Statistics on the transportation of carbon CO<sub>2</sub> in its supercritical form has been safer relative to other hazardous liquids/gases; releases have been rare, and releases have rarely impacted people or the environment.



# CO<sub>2</sub> Pipeline Incident Data

Calendar Year	Number	Fatalities	Injuries	Total Cost as Reported	Barrels Spilled	Net Barrels Lost
2001	1	0	0	\$11,052	18	18
2002	4	0	0	\$12,383	317	317
2003	7	0	0	\$62,871	11	11
2004	3	0	0	\$74,101	8,128	8,182
2005	2	0	0	\$3,888	2,401	2,401
2006	7	0	0	\$763,912	25,086	25,086
2007	4	0	1	\$115,425	24,540	24,540
2008	7	0	0	\$11,444	103	103
2009	4	0	0	\$153,134	1,077	1,077
2010	6	0	0	\$212,521	329	329
2011	4	0	0	\$168,770	2,542	2,542
2012	2	0	0	\$5,823	19	19
2013	5	0	0	\$270,387	52	52
2014	5	0	0	\$32,948	2,190	2,190
2015	7	0	0	\$67,224	1,281	1,281
2016	9	0	0	\$71,029	1,709	1,709
2017	9	0	0	\$132,993	218	218
2018	5	0	0	\$299,047	406	406
2019	4	0	0	\$375,395	480	480
2020	6	0	0	\$4,035,553	16,003	50,903
<b>Total</b>	<b>101</b>	<b>0</b>	<b>1</b>	<b>\$6,870,000</b>	<b>121,866</b>	<b>121,866</b>



# Reporting of Accidents

## Reportable Accidents §195.50

- Report required no later than 30 days after discovery of accident
- Failure of a pipeline in which there is a release of carbon dioxide and results in the following:
  - Explosion or fire not intentionally set
  - Release of 5 or more gallons of carbon dioxide
  - Death or injury requiring hospitalization
  - Estimated damages in excess of \$50,000

## Immediate Notification §195.52

- Report required at the earliest practicable moment following discovery
- Failure of a pipeline in which there is a release of carbon dioxide and results in the following:
  - Death or injury requiring hospitalization
  - Explosion or fire not intentionally set
  - Estimated damages in excess of \$50,000
  - Pollution of water source
  - Judgement of the operator



# Sartoria, MS

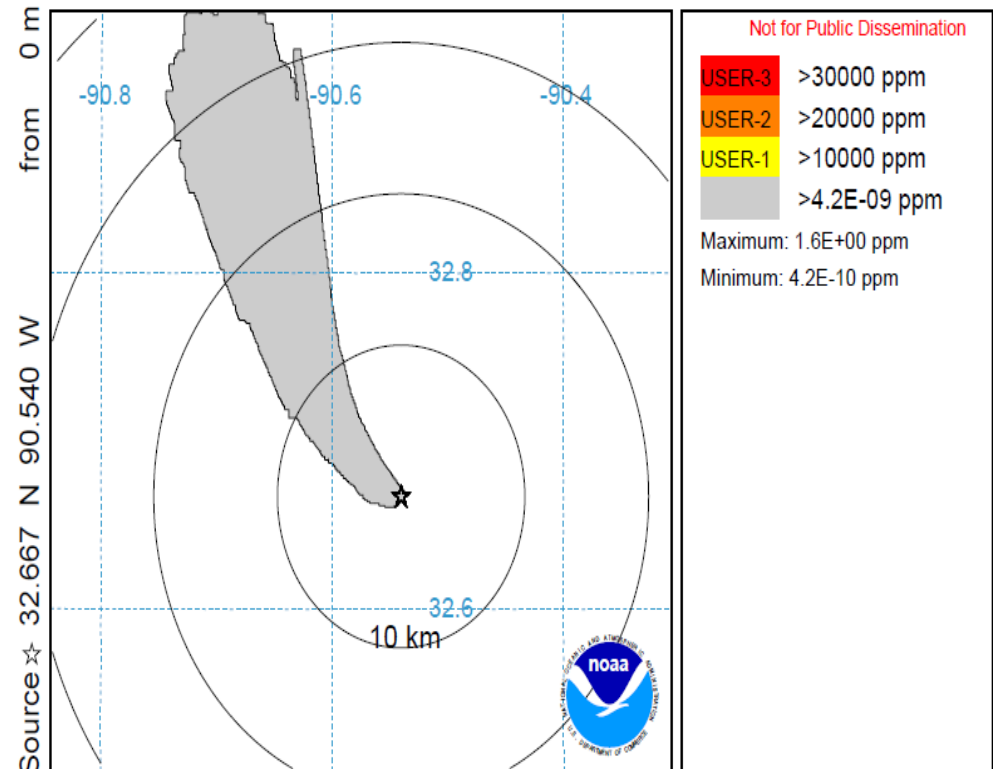
*February 22, 2020*

**24-inch CO<sub>2</sub> pipeline failure, releasing 31,405 barrels (1.32 million gallons) of supercritical CO<sub>2</sub>**



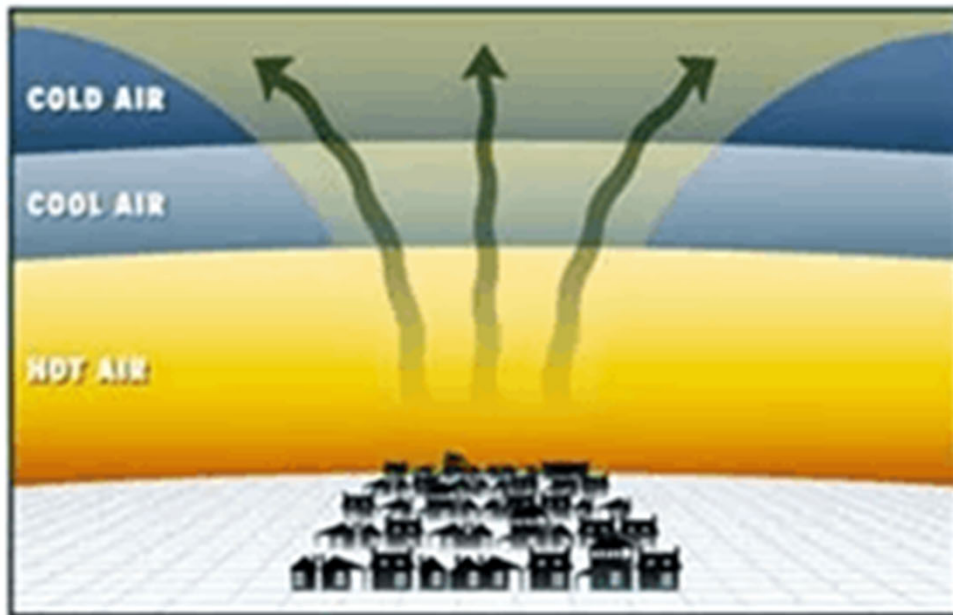
# Incident Details

- Release occurred at night approximately one mile southeast of Satartia, Mississippi
- 45 individuals sought medical attention
- 200 Satartia, MS residents and those in the area evacuated
- Atmospheric inversion



However, in certain unique environmental conditions (cold/no breeze), a large release of CO<sub>2</sub> can be dangerous – such as the situation that occurred in February 2020 in near Satartia, Mississippi.

**Normal Situation**



**Temperature Inversion**





# Findings

The failure was a result of soil movement which caused excessive axial loading leading to failure at the girth weld.

Area topography, soil type and large amounts of rain over the preceding months saturated and vertically eroded the loess soil on the side of the hill above the pipeline.



# Findings

- Geohazard
  - Procedures
  - Integrity Management Program
  - Aerial patrols
- Emergency response and preparedness
  - CO<sub>2</sub> dispersion model underestimated the potential affected area
  - The company did not notify local responders advising them of a potential failure



# PHMSA Safety Advisory Bulletin

- Potential for damage to pipeline facilities caused by earth movement in variable, steep, and rugged terrain and terrain with varied or changing subsurface geological conditions.
- Changing weather patterns due to climate change, including increased rainfall and higher temperatures, that may impact soil stability in areas that have historically been stable.
- Owners and operators should consider monitoring geological and environmental conditions, including changing weather patterns, in proximity to their facilities.





# PHMSA May 2022 Press Release

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

Thursday, May 26, 2022

PHMSA 05-22

Contact: [PHMSAPublicAffairs@dot.gov](mailto:PHMSAPublicAffairs@dot.gov)

**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.

- Dep. Admin. visit to MS
- Issued safety order
- Issued enforcement
- Issued failure investigation report
- Issued a safety advisory related to land movements and geohazards
- Initiating rulemaking
- Conducting research solicitations



# Actions since PHMSA May Press Release

- Initiated rulemaking. Limited on providing additional details due to ex-parte. Summary of meetings required.

## **117. Pipeline Safety – Safety of Carbon Dioxide Pipelines**

**Popular Title:** Carbon Dioxide Pipelines

**RIN 2137-AF60**

**Stage:** NPRM

**Abstract:** This Proposed rulemaking would amend PHMSA's Pipeline Safety Regulations (49 CFR parts 190-199) to adopt revisions that would enhance the safe transportation of carbon dioxide by pipelines to accommodate an anticipated increase in the number of carbon dioxide pipelines and volume of carbon dioxide transported. Also, this proposed rulemaking would include requirements related to emergency preparedness and response for carbon dioxide.

### **Dates for NPRM:**

Action	Publication Date	FR Cite
NPRM	10/00/2024	



# Research awards since PHMSA May Press Release

- Texas A&M Engineering Experiment Station  
"Determination of Potential Impact Radius for CO2 Pipelines using Machine Learning Approach"
- BMT Commercial USA, Inc. "Developing Design and Welding Requirements Including Material Testing and Qualification of New and Existing Pipelines for Transporting CO2"



# Upcoming CO2 Public Meeting

Location: TBD Date: May-June



# Key Messages

- PHMSA is working to strengthen existing CO2 pipeline regulations—and aims to publish its proposal for public comment this year.
- PHMSA has taken a half-dozen other major actions to reduce risk from pipelines; including record levels of enforcement, Valve Rule, safety order, and bulletin.
- PHMSA is collaborating with all stakeholders through public meetings and research projects to mitigate risk.



# Thank You



# Resources

- PHMSA May 2022 Press Release
  - <https://www.phmsa.dot.gov/news/phmsa-announces-new-safety-measures-protect-americans-carbon-dioxide-pipeline-failures>
- Rulemaking status
  - <https://www.transportation.gov/regulations/report-on-significant-rulemakings>
- CAAP Project (PIR for CO<sub>2</sub>) Public Page:  
<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=987>
- Core Project (Design and Welding Requirements for CO<sub>2</sub>) Public Page:  
<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=996>
- PHMSA December Public Meeting
  - General Meeting Page with full agenda and recordings:  
<https://primis.phmsa.dot.gov/meetings/MtgHome.mtg?mtg=161>

