REGIONAL CARBON CAPTURE DEPLOYMENT INITIATIVE

Carbon Dioxide (CO_2) Pipeline Safety

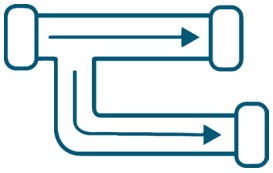
SAFELY BUILDING A CO_2 TRANSPORTATION AND STORAGE NETWORK

KEY TAKEAWAYS

- Overall, carbon dioxide (CO_2) pipelines have an excellent safety record over the 50 years they have been in operation in the United States (US), with only one reported injury and no fatalities.
- CO_2 pipeline operators are required to follow many steps to ensure their pipelines are safe.
- Pipeline safety oversight is administered by the Pipeline and Hazardous Materials Safety Administration (PHMSA). PHMSA continues to enhance safety measures related to CO_2 pipelines to ensure they are operated at the highest standards.

WHO OVERSEES CO_2 PIPELINE SAFETY?

The US Department of Transportation (DOT) has regulated CO_2 pipelines since the Hazardous Liquid Pipeline Act of 1979. The Pipeline and Hazardous Materials Safety Administration (PHMSA) was established in 2004 as an agency within the United States Department of Transportation and currently oversees CO_2 pipeline safety.



WHAT ARE PIPELINE OPERATORS REQUIRED TO DO TO ENSURE PIPELINE SAFETY?

There are many steps that CO_2 pipeline operators must take to ensure their pipelines are safe, including attention to pipeline design, protection against corrosion, monitoring for leaks, and safeguards against overpressure. When building new CO_2 pipelines, the pipeline and all components must comply with specific design, engineering, and construction standards.[1] CO_2 pipeline operators are required to submit an annual report to PHMSA. This report includes the length (miles) of the operated pipeline, the barrel-miles of CO_2 transported (total barrels transported multiplied by miles of pipeline)[2], and various safety inspections and pipeline assessments conducted that year.

PHMSA also has a variety of required safety programs that operators of CO_2 pipelines must follow. These programs include:

Operations Maintenance Emergency: The Operations & Maintenance Enforcement Guidance document provides guidance and regulations for operators.

Control Room Management: Most CO_2 pipeline operators monitor and manage their pipelines remotely through a control room. The Control Room Management safety program provides regulations for operators monitoring and managing pipelines to help reduce control room errors, especially in emergency situations.

Public Awareness: CO_2 pipeline operators are required to have a public awareness program that provides pipeline safety information to affected public, emergency officials, local public officials, and excavators.

Damage Prevention: PHMSA has regulations for excavations around CO_2 pipelines to prevent damage to pipelines. Damage to pipelines is a leading cause of pipeline incidents according to PHMSA.

Operator Qualification: PHMSA requires that operators have certain employees that are trained to respond to abnormal operating conditions related to their pipelines.

Drug and Alcohol Testing: Operators must have a drug and alcohol testing plan for employees who work on certain aspects of pipeline operations.

1 PHMSA does not oversee the permitting process for pipelines, which is conducted at the state level.

2 One barrel is equal to 42 gallons

The Regional Carbon Capture Deployment Initiative brings together state officials with diverse industry, NGO, labor, and other stakeholders to promote broad scale deployment of infrastructure for carbon management. The Initiative is staffed by the Great Plains Institute (GPI), a nonpartisan nonprofit working to transform the energy system to benefit the economy and environment.

For more information on this effort, go to carboncaptureready.org or contact Matt Fry at mfry@gpisd.net.

WHAT ARE PIPELINE OPERATORS REQUIRED TO DO AFTER A PIPELINE ACCIDENT?

PHMSA defines a reportable accident when any of the following occur: explosion or fire not intentionally set by the operator; release of five or more gallons of liquid (five barrels when release occurs during pipeline maintenance); death or injury requiring hospitalization; or the estimated property damage exceeds $50,000.

If an accident occurs, CO_2 pipeline operators must contact the federal National Response Center within one hour of the incident. The incident information is then forwarded to state and federal agencies for a response. Operators must also provide an update to the center within 48 hours and submit an Accident Report Form to PHMSA within 30 days of the reported accident.

WHAT HAPPENS IF CO_2 IS RELEASED FROM A PIPELINE?

Despite existing and enforced safety regulations, incidents do happen and it's important to know and understand what happens if CO_2 is released from a pipeline. If CO_2 is released from a pipeline, it will rapidly drop in pressure, going from a supercritical or dense phase[3] to a gas. As this occurs, solid CO_2 may form around the pipeline in the form of dry ice. Depending on the conditions, including wind direction, topography, and atmospheric conditions, CO_2 may travel from its release location to other locations as it dissipates into the surrounding air. Operators have pressure monitors on their pipelines to know when a leak or rupture occurs and can initiate shut-off valves to mitigate the release of CO_2 from the pipeline.

In small quantities, the CO_2 will dissipate around the pipeline and not create a hazardous situation. Since CO_2 is denser than the air we breathe, larger releases of CO_2 will create a vapor cloud around the release or rupture site. In rare cases, this vapor cloud could have negative health effects in high concentrations, including dizziness and asphyxiation. There have been no fatalities attributed to CO_2 pipelines in the US to date.

CO_2 PIPELINE SAFETY RECORD

The CO_2 pipeline safety record indicates that these pipelines can be operated at the highest safety standards. Since reporting began, CO_2 pipelines have had only one reported injury and no fatalities. Since the first incident was reported in 1994, most incidents have been small, with 60 percent of incidents releasing ten metric tonnes of CO_2 or less. For context, that is roughly the equivalent of the amount of CO_2 released from a stadium of people breathing throughout a football game. The total amount of CO_2 released from all reported incidents is also incredibly small compared to the amount of CO_2 transported annually, averaging less than 0.01 percent of the total CO_2 transported each year.

Although most incidents are small, a significant incident occurred with the Delhi Pipeline near Satartia, Mississippi in February of 2020. According to PHMSA's failure investigation report, heavy rains resulted in a landslide, which caused a rupture of the pipeline on a pipeline weld. Fortunately, the accident did not result in any deaths, though 200 residents were evacuated, and 45 sought medical attention. As a result of this incident, PHMSA issued a Notice of Probable Violation, Proposed Civil Penalty, and Proposed Compliance Order, with a proposed civil penalty of nearly $4 million. Following the incident, PHMSA announced intentions to update standards for CO_2 pipelines, issued a nationwide advisory bulletin to pipeline operators about the need to plan for and mitigate risks involving geohazards, such as sudden shifts in the ground from water or other causes, and is soliciting research grants for additional measures to further strengthen CO_2 pipeline safety. These steps build on existing CO_2 pipeline regulations and were supported by the Great Plains Institute-managed Carbon Capture Coalition's April 2022 comments to the White House's Council on Environmental Quality (CEQ) on their interim carbon capture utilization and storage guidance.

PHMSA's safety data show that CO_2 pipelines have been and can be operated at the highest level of safety by using industry best practices. In the rare case of pipeline incidents, PHMSA can and should hold industry accountable, while continuing to assess the existing regulatory framework to ensure that the industry can safely scale to meet midcentury decarbonization goals.

3 Having properties of both a gas and liquid

Authors: Emma Thomley and Ryan Kammer

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For more carbon management related resources visit the Carbon Capture Coalition, Industrial Innovation Initiative, Carbon Action Alliance, or Carbon Capture Ready websites.

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