



# Carbon Dioxide Pipelines: Safety Issues

June 3, 2022

Carbon dioxide (CO<sub>2</sub>) pipelines are essential components of [carbon capture and storage \(CCS\)](#) systems which are proposed to reduce atmospheric emissions of man-made CO<sub>2</sub>, a greenhouse gas. Pipelines are needed to transport the CO<sub>2</sub> from where it is captured (e.g., power plants) to the underground geologic formations where it can be stored. Approximately [5,000 miles of pipeline](#) already carry CO<sub>2</sub> in the United States, primarily linking natural CO<sub>2</sub> sources to aging oil fields where the CO<sub>2</sub> is used for [enhanced oil recovery](#). However, a much more expansive CO<sub>2</sub> pipeline network could be needed for CCS to meet national goals for greenhouse gas reduction. One [recent study](#) suggests that such a network could total some 66,000 miles of pipeline by 2050, requiring some \$170 billion in new capital investment. Because CO<sub>2</sub> in high concentrations can be hazardous to human health, building out a national CO<sub>2</sub> pipeline network raises safety issues which may affect nearby communities and may hinder CCS deployment.

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

CO<sub>2</sub> occurs naturally in the atmosphere and is produced by the human body, so it is often perceived to be relatively harmless. However, as concentrations increase, CO<sub>2</sub> displaces oxygen—which may cause a range of [negative health impacts, including suffocation](#). Pipeline CO<sub>2</sub> also may contain potentially hazardous contaminants, such as hydrogen sulfide. Because CO<sub>2</sub> is colorless, odorless, and heavier than air, an uncontrolled release may spread undetected near the ground or in confined spaces. Therefore, CO<sub>2</sub> pipelines pose a public safety risk, as demonstrated by a 2020 [CO<sub>2</sub> pipeline rupture](#) in Satartia, MS, which led to a local evacuation and caused 45 people to be hospitalized.

Transporting CO<sub>2</sub> in pipelines is similar to transporting fuels such as natural gas and oil; it requires attention to pipeline design, protection against corrosion, monitoring for leaks, and safeguards against overpressure, especially in populated areas. The [Pipelines and Hazardous Materials Safety Administration \(PHMSA\)](#) within the Department of Transportation (DOT) has [statutory authority](#) over CO<sub>2</sub> pipeline safety. PHMSA promulgates and enforces regulations ([49 C.F.R. §190, 195-199](#)) for the construction, operation and maintenance, and spill response planning for CO<sub>2</sub> pipelines. Although CO<sub>2</sub> is listed as a Class 2.2 (non-flammable gas) hazardous material under [DOT regulations](#), PHMSA currently applies safety requirements to CO<sub>2</sub> pipelines similar to those for pipelines carrying hazardous liquids such as crude oil and anhydrous ammonia.

**Congressional Research Service**

<https://crsreports.congress.gov>

IN11944

Prior to the Satartia accident, according to PHMSA statistics, CO<sub>2</sub> pipeline operators reported only one injury and no fatalities caused by regulated pipelines over the last 20 years. However, [stakeholders have argued](#) that PHMSA's regulations for CO<sub>2</sub> pipelines are insufficient with respect to hazard zones around CO<sub>2</sub> releases, potential pipeline fractures, and corrosion of CO<sub>2</sub> pipeline steel, among other things. In response to these criticisms and findings from its own Satartia [accident investigation](#), PHMSA [announced](#) on May 26, 2022, a rulemaking to update its CO<sub>2</sub> pipeline safety standards and a research solicitation to study the impact of CO<sub>2</sub> pipeline releases. The agency also issued a [Notice of Proposed Violation](#) of its regulations to the Satartia pipeline operator and proposed \$3.9 million in civil penalties.

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

Concerns about CO<sub>2</sub> pipeline safety have emerged as an issue for proposed CCS projects, especially in the Upper Midwest. Summit Carbon Solutions is pursuing a project to carry CO<sub>2</sub> from over 30 ethanol plants in five states through a [2,000-mile pipeline network](#) to a carbon storage site in North Dakota. Navigator CO<sub>2</sub> Ventures is developing a similar project to transport CO<sub>2</sub> from ethanol and fertilizer plants in five states through a [1,300-mile pipeline network](#) to sequestration sites in Illinois. Wolf Carbon Solutions has proposed a third, [350-mile CO<sub>2</sub> pipeline](#) project in Iowa. These pipelines face opposition among affected landowners and [advocacy groups](#) for reasons including risks to public safety. As a consequence, the developers [reportedly have faced resistance](#) securing voluntary agreements with landowners for pipeline rights-of-way through their properties. Without voluntary agreements, developers may still secure rights-of-way through eminent domain authority, which typically accompanies siting permits from state utility regulators with jurisdiction over CO<sub>2</sub> pipeline siting. However, CO<sub>2</sub> pipeline siting authorities, landowner rights, and eminent domain laws reside with the states and vary from state to state, so securing rights-of-way for interstate projects is not guaranteed. Furthermore, there have been [regulatory interventions](#) and [legislative](#) efforts to limit state eminent domain authority for such projects.

## Considerations for Congress

Consistent with [other federal initiatives](#) to promote CCS deployment, Congress has acted to facilitate the construction of regional CO<sub>2</sub> pipeline networks. The USE IT Act (Section 102 of Division S of P.L. 116-260) clarified CO<sub>2</sub> pipeline eligibility for streamlined review of any necessary federal permits (e.g., for federal lands) which might be required and directed the Council on Environmental Quality to set guidance to expedite CO<sub>2</sub> pipeline development. The Infrastructure Investment and Jobs Act (P.L. 117-58) establishes a Carbon Dioxide Transportation Infrastructure Finance and Innovation (CIFIA) program for CO<sub>2</sub> pipelines and authorizes \$2.1 billion over five years for low-interest CIFIA loans and grants. These acts and other legislative proposals deal primarily with financial and administrative issues, however, rather than CO<sub>2</sub> pipeline safety.

Given the fundamental need for pipelines in CCS systems, actual or perceived safety risks associated with CO<sub>2</sub> pipelines may limit the potential of CCS as a [greenhouse gas mitigation option](#). Siting opposition due to safety concerns may prevent CO<sub>2</sub> pipeline development in certain localities and increase development time and costs in others. [Some advocates](#) have suggested that Congress take a more active role by directing federal agencies to develop safety regulations specifically tailored to the distinct characteristics of CO<sub>2</sub> pipelines. How PHMSA might update its CO<sub>2</sub> pipeline safety standards remains to be seen, but CO<sub>2</sub> pipeline safety, and its implications for CCS deployment, may be an oversight issue for Congress.

## Author Information

Paul W. Parfomak  
Specialist in Energy Policy

---

## Disclaimer

This document was prepared by the Congressional Research Service (CRS). CRS serves as nonpartisan shared staff to congressional committees and Members of Congress. It operates solely at the behest of and under the direction of Congress. Information in a CRS Report should not be relied upon for purposes other than public understanding of information that has been provided by CRS to Members of Congress in connection with CRS's institutional role. CRS Reports, as a work of the United States Government, are not subject to copyright protection in the United States. Any CRS Report may be reproduced and distributed in its entirety without permission from CRS. However, as a CRS Report may include copyrighted images or material from a third party, you may need to obtain the permission of the copyright holder if you wish to copy or otherwise use copyrighted material.