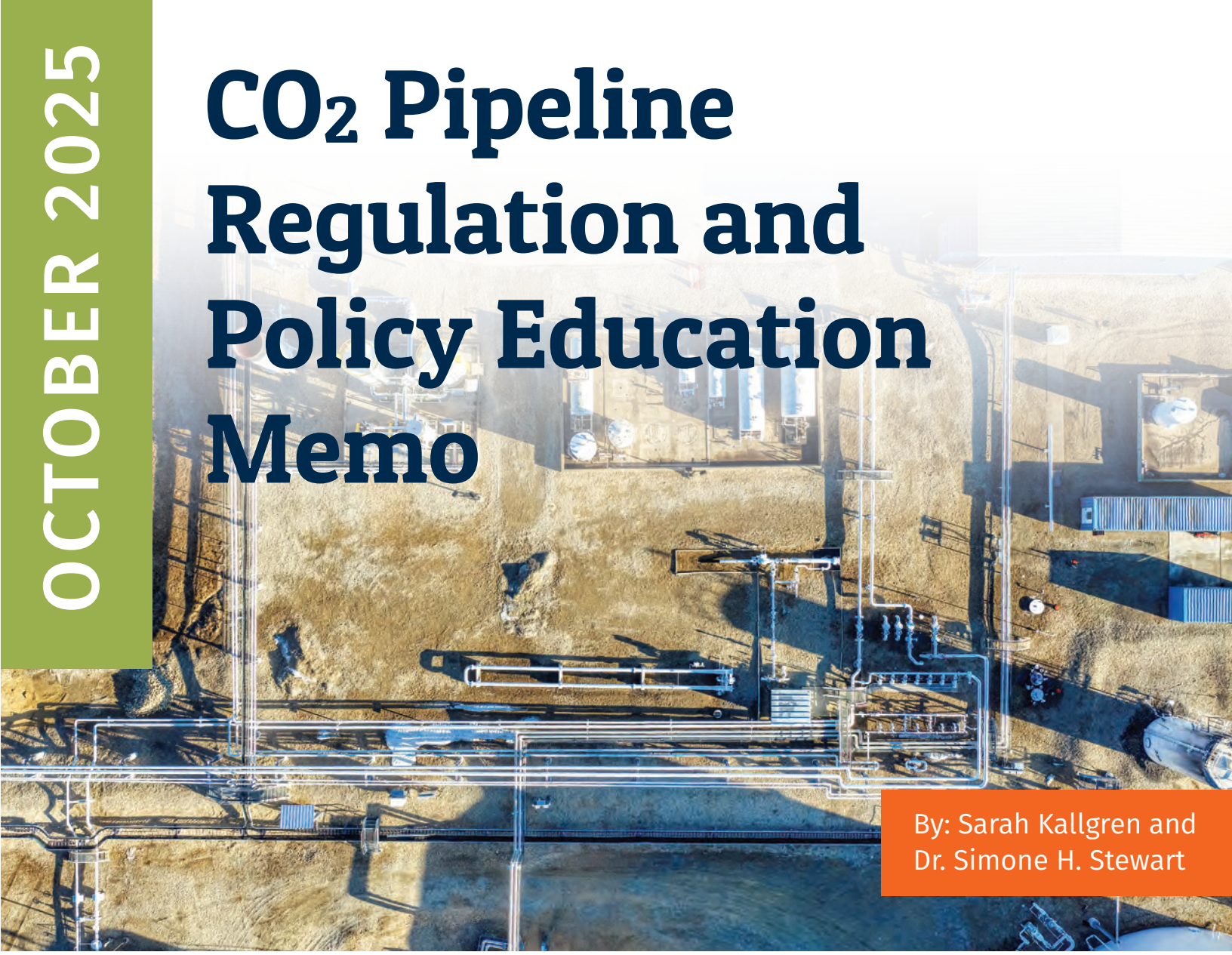
OCTOBER 2025

CO_2 Pipeline Regulation and Policy Education Memo



By: Sarah Kallgren and Dr. Simone H. Stewart

Aerial View of Manufacturing Plant, Tom Fisk

Purpose of Memo

The Intergovernmental Panel on Climate Change (IPCC) has confirmed that to meet our climate goals, carbon capture and removal technologies at some level of commercial scale are needed.[1] These strategies use chemical filters to remove carbon dioxide (CO_2) from smokestack emissions, or from the ambient air. These technologies also require additional development of supporting infrastructure like pipelines to transport the CO_2 to its final destination. When carbon capture equipment is installed on a facility or a carbon removal project is developed, the CO_2 emissions that are captured and condensed are either stored deep underground or recycled to create other materials. Some industrial facilities have underground storage capacity on site, but not always. Sometimes the storage or utilization site may be miles away. In this case, pipelines are the industry-standard method of transporting CO_2 from where it is captured to where it will be used or stored.

[1] Hunt, Kara. "What Does the Latest IPCC Report Say about Carbon Capture?" Clean Air Task Force, April 20, 2022.

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Carbon capture, utilization, and storage (CCUS) is a technological process that separates CO_2 from other air emissions released from burning fossil fuels at an industrial source, such as a cement or chemical factory, and captures it before it can enter the atmosphere. CO_2 is a planet-warming gas. As more is emitted by industrial sources, it creates a greenhouse effect that traps heat in our atmosphere and contributes to climate change. When CO_2 is captured at an industrial source it can then either be stored deep underground for permanent storage or can be used to create products such as low-carbon cement, textiles, or other goods that require carbon-based inputs.

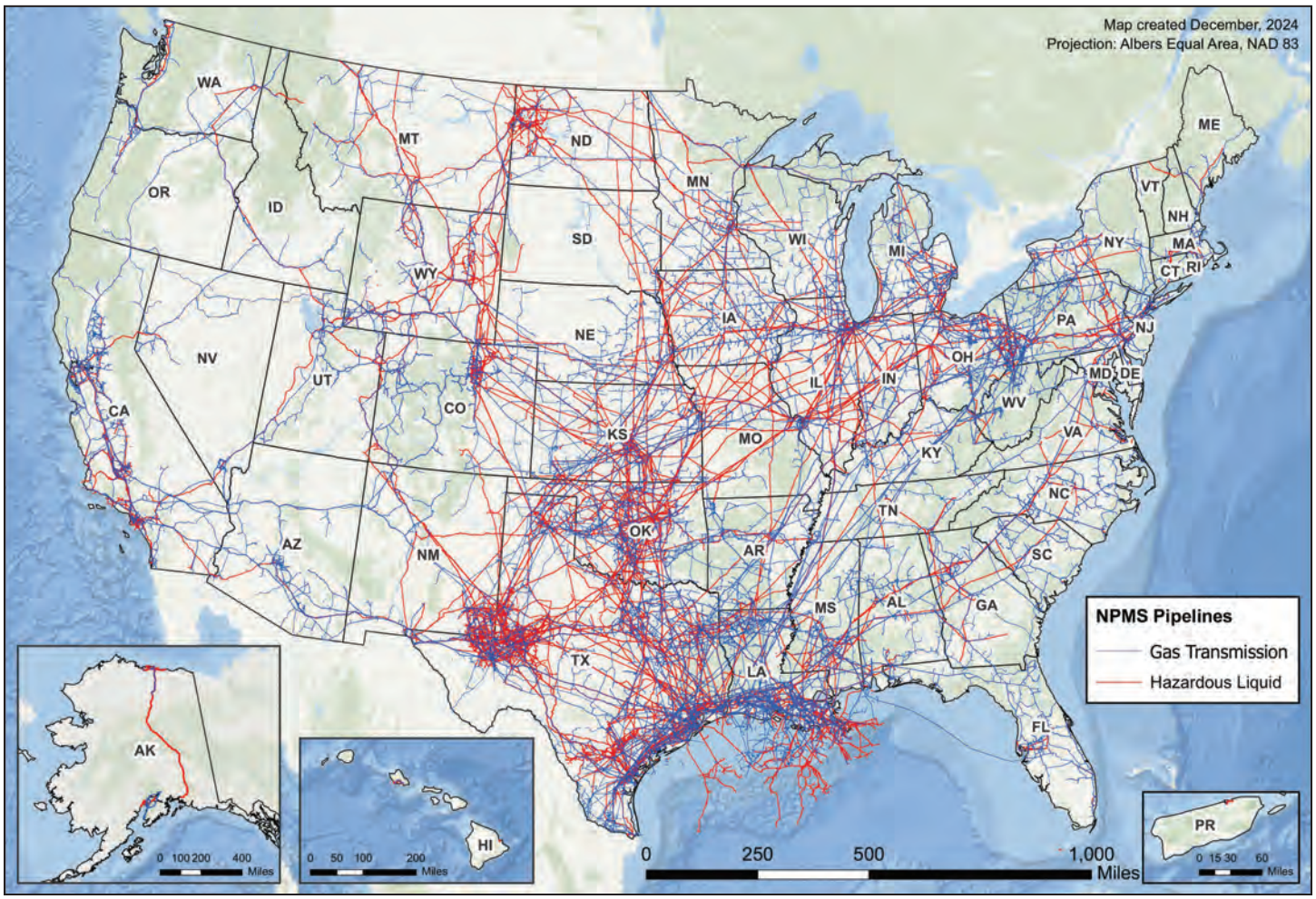
Carbon dioxide removal (CDR) is a strategy where CO_2 is removed directly from the ambient air using either nature-based solutions, technological strategies, or a combination of the two. Examples of CDR include reforestation, native prairie restoration, enhanced weathering of rocks and mineralization of CO_2 into new rocks, and direct air and ocean capture of CO_2. Whether using photosynthetic processes like those occurring in trees or other plants to absorb CO_2 or chemical filters like those often found in direct air capture (DAC), the strategy draws down CO_2 from the surrounding environment. This is different from carbon capture (CC) where technological equipment is retrofitted or built into a facility to capture CO_2 directly from an emitting source. This mitigation technique is useful in heavy industries that often emit CO_2 as a part of their manufacturing processes, like steel or cement factories.

Pipelines are a common transportation method for fuel and other hazardous materials, but they can also be vulnerable to leaks and accidents that have real impacts on communities and the environment. Infrastructure like pipelines and refineries have caused a great deal of harm to communities across the U.S., but most especially for Black, Indigenous, people of color (BIPOC) and low-income communities that often host such infrastructure and may have less political influence, plus fewer resources to handle negative impacts. Because of the harm that these industrial projects have caused, communities have many justified concerns about the continuation of any infrastructure related to the fossil fuel industry.

Communities across the U.S. have values as diverse as their geographies, and as such it is impossible to address every concern one might have about CO_2 pipelines with one set of solutions. Advocates of a variety of backgrounds including technical, academic, and community organizing have a multitude of concerns around CO_2 pipelines, and scientists and policy makers are working to address these concerns with robust safety regulations. The broadest concern often stems from the fact that people view carbon capture and storage and carbon dioxide removal as perpetuating the use of fossil fuels and fossil fuel infrastructure (such as pipelines) which have historically caused harm to both communities and the environment. More specifically related to CO_2 pipelines, some community advocates express a variety of concerns around the risk of ductile fractures or other pipeline leaks and the implications of a leakage event, including the phase of CO_2 transport; the odorless and asphyxiant nature of CO_2; and the accuracy of dispersion modeling given the multitude of factors that can impact how or where CO_2 may leak in the ambient air. This coming wave of infrastructure development—spurred in part by federal investments and tax credits— represents an opportunity for regulators to learn from previous mistakes, and to center equity and environmental justice from siting all the way to construction and operation.

Given the energy policy priorities of the second Trump administration and the necessity of addressing the climate crisis and legacy emissions, it is likely that the U.S. will see more CO_2 pipelines built in the coming years. The map below shows the hazardous liquids and gas transmission pipeline network in the U.S. Hazardous liquids include crude oil, petroleum products, carbon dioxide, and other highly volatile liquids.[2] Collectively the U.S. has nearly 3.3 million

[2] "Why Pipelines?" Energyinfrastructure.org.



Gas Transmission and Hazardous Liquid Pipelines, US DOT National Pipeline Mapping System.

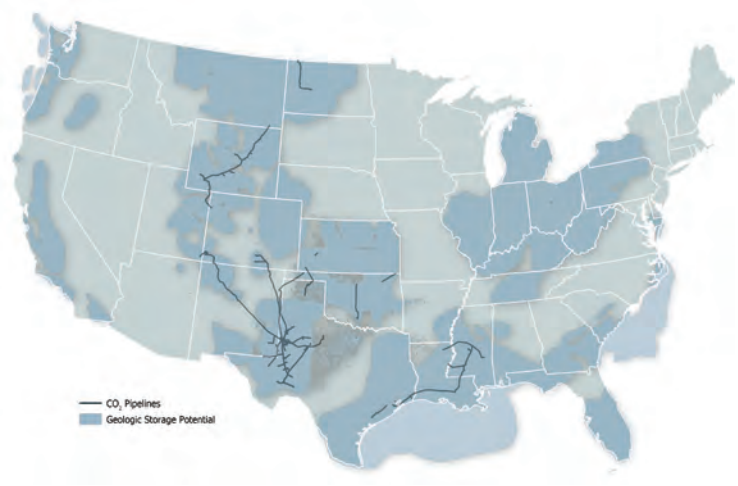
miles of oil, gas, and hazardous liquids pipelines. Only around 5,000 miles of these pipelines are for transporting CO_2.[3] The majority of these are based in the Gulf South or closeby (Texas, Louisiana, Mississippi, Oklahoma) and the West (New Mexico, Wyoming, North Dakota, Colorado). They are primarily used for enhanced oil recovery (EOR): the process of pumping CO_2 into depleted oil wells to push out the remaining oil.[4]

The National Wildlife Federation created this educational memo in response to requests from several of NWF's state-level affiliated organizations for a consolidated resource that explains the federal policy and regulatory landscape of CO_2 pipelines. This interest is primarily due to the increased funding for and development of CCS and CDR projects in the last few years. The purpose of this memo is to inform readers about the complex world of how pipelines are regulated in the U.S., the state of the likely increase in development of CO_2 pipelines, and regulatory and policy gaps that should be addressed to ensure pipeline buildout is done as safely and responsibly as possible. This memo does not advocate for or against CO_2 pipelines, although the Federation has advocated for equitable, wildlife-responsible carbon capture and carbon removal at the federal level. You can find our carbon management **policy statement here.**

[3] Fueling America's Economy: Legislation to Improve Safety and Expand U.S. Pipeline Infrastructure." U.S. Department of Transportation.
[4] Grant, Kelsey. "Carbon Dioxide Pipelines 101." Clear Path, March 13, 2025.

State of Increased Build Out

Carbon capture technology has been around since the 1970's but has become more common in the U.S. in the last decade, especially with federal investments in carbon capture and storage and carbon dioxide removal technologies written in the Bipartisan Infrastructure Law and the Inflation Reduction Act. This increase in funding, as well as advancement in its technology and engineering, plus the intensifying effects of a warming planet, has resulted in increased interest in CCS and CDR projects as commercially viable climate solutions.



CO_2 Pipelines and Storage, Great Plains Institute.

As of May 2025 more than 270 carbon management projects have been announced, are in development, or already operating in the U.S. Only 19 of these were operational prior to 2025.[5] This rapid increase in carbon management facilities will require an increase in pipeline infrastructure to carry the CO_2 from its source to where it will be stored underground or recycled into another product. The Global CCS Institute estimates that 78 percent of current and slated CCS facilities will store their collected CO_2 underground rather than use it for EOR or to create new goods or materials—further cementing the likelihood of an increase in CO_2 pipeline buildout.[6] The Department of Energy estimates that the U.S. will need between 30,000 and 96,000 miles of CO_2 pipelines by 2050 if we are to meet the goal of reaching net zero emissions by 2050.[7] This is a dramatic increase from our current CO_2 pipeline system, which stretches just 5,000 miles.

This increase in pipeline infrastructure could impact a variety of states in the U.S. but especially places that have geology that is favorable for storing CO_2 underground long term. The map above shows current CO_2 pipeline infrastructure in the U.S. as well as potential areas for geologic storage (in blue).

There are four CO_2 pipelines that have been proposed across the midwest since 2021 that would stretch a total of 4,000 miles from North Dakota to Illinois. Three of these projects would have involved creating new pipelines and one project would be retrofitting an existing pipeline to transport CO_2.[8] While four might not seem like a lot, these projects would have increased the mileage of CO_2 pipelines in the U.S. by nearly 4,000 miles. Given that the U.S. currently has around 5,000 miles of CO_2 pipelines, this would have been a dramatic increase.

Three of these projects, however, have since been canceled: the Summit project, the Navigator project, and the Wolf Carbon Solutions project. In April of 2023 the South Dakota Public Utilities Commission withheld Summit's pipeline permit citing that the project's route relied on the use of eminent domain that would force landowners to comply with the project regardless of their opposition.[9] In September of 2023 South Dakota also denied Navigator's request for a permit due to concerns around safety, lack of support from impacted landowners, and a lack of transparency from the company.[10] Wolf Carbon Solutions withdrew their permit application in December of 2024 for unspecified reasons, only saying that continuing to seek a permit in the current regulatory conditions would be inefficient.[11] The Trailblazer

[5] Grant, Kelsey. "Carbon Dioxide Pipelines 101." Clear Path, March 13, 2025. and "U.S. CCS Facilities Status by Stage 2024." Statista, July 10, 2025.
[6] "Building our way to net-zero: Carbon dioxide pipelines in the United States" Global CCS Institute.
[7] Martin Lockman "Permitting CO2 Pipelines." Sabin Center for Climate Change Law, September 28, 2023.
[8] "Carbon dioxide (CO2) Pipelines: Safety, siting, and eminent domain." Congress.gov.
[9] Douglas, Leah. 'South Dakota Regulators Deny Summit Carbon Solutions a carbon dioxide pipeline permit" Reuters, April 23, 2025.
[10] Douglas, Leah. "South Dakota Regulator rejects navigator CO2 ventures carbon pipeline application." Reuters, September 7, 2023.

Iowa Field, Photo by Pixaby.

project is still under construction but should be operational later in 2025.[12] It's important to note that all of the projects that were canceled faced strong local opposition. It is clear that there is a disconnect between what communities want for their land and what companies think will be beneficial for their bottom line.

Existing Federal Regulation

The Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) regulates the safety of onshore pipelines in conjunction with state agencies, but is not responsible for the siting of pipelines. When reviewing an application for a pipeline permit, state agencies consider

[11] George, Violet. "Wolf Carbon Solutions Abandons Carbon Pipeline Plans in Iowa." Carbon Herald, December 3, 2024.
[12] "Poet and Tallgrass Announce Collaboration on Carbon Capture Project." Tallgrass Energy, February 13, 2025.

potential impacts on buildings, agriculture, water sources, soil, vegetation, wildlife, air quality, noise pollution, landowner interests among other geographic factors.[13] The state agencies that review permit applications vary between states but tend to be a part of the state's utility commission, commerce commission, or some similar agency. CO_2 pipeline projects have also historically triggered an Environmental Impact Statement through the National Environmental Policy Act (NEPA) due to the fact that their paths typically crossed over federally owned land or federally protected resources like navigable waters.[14]

General pipeline safety regulation in the U.S. began with the Natural Gas Pipeline Safety Act of 1968. This Act authorized the Secretary of the Department of Transportation to prescribe pipeline safety standards for the transportation of natural gas and other gases. CO_2 pipeline specific oversight was first enacted with the Hazardous Liquid Pipeline Safety Act of 1979, however CO_2 was only added to the regulation in 1991.[15] This regulation grants PHMSA the authority to establish and enforce safety standards to inspect pipelines carrying hazardous materials.[16]

The Pipeline Inspection, Protection, Enforcement, and Safety Act of 2006 (PIPES Act) focused more deeply on preventing damage to pipelines during other construction projects that would break ground. It also strengthened PHMSA's authority to enact more stringent safety and environmental standards, plus strengthened PHMSA's enforcement power granting the agency the ability to use non-judicial actions (which are commonly used by government agencies to enforce regulations) against developers who did not adhere to their set standards.[17]

The Pipeline Safety, Regulatory Certainty, and Job Creation act of 2011 builds on the PIPES Act by continuing to improve pipeline damage prevention and leak detection standards and programs. It also called for an evaluation of pipeline integrity management systems, and for the development of a National Pipeline Mapping system to increase public education and awareness.[18]

The Protecting our Infrastructure of Pipelines Enhancing Safety (PIPES) Acts of 2016 and 2020 continue to expand safety and damage prevention programs. Notably the 2016 PIPES Act also states that the Great Lakes, coastal beaches, and marine coastal waters are "unusually sensitive areas" which is a designation used when deciding where to site pipelines.[19] The 2016 PIPES Act also called for more robust yearly pipeline integrity assessments and emergency response plans as well as a PHMSA review of state-level policies.[20] The 2020 PIPES Act was partially informed by the Merrimack Valley Incident in 2018 wherein a natural gas pipeline exploded in Massachusetts.[21] The 2020 PIPES Act calls for additional updates to integrity management, emergency response, and general operations plans. It also calls for leak detection and repair programs to consider the environment when taking potential impacts of a leak into consideration.[22]

In 2022, after a pipeline leak in Satartia, Mississippi containing CO_2 among other substances, PHMSA announced a new rulemaking for CO_2 pipeline safety. This leak was caused by pipeline rupture due to a mudslide triggered by heavy rains in Satartia in the weeks leading up to the incident. While no one was killed, 45 people were hospitalized.[23] The rule called for funding research to strengthen CO_2 pipeline safety, conducting a report on the Satartia incident, penalizing the pipeline operator,

[13] "Phases of Pipeline Construction: An Overview." PHMSA.
[14] Martin Lockman "Permitting CO2 Pipelines." Sabin Center for Climate Change Law, September 28, 2023.
[15] "Building our way to net-zero: Carbon dioxide pipelines in the United States" Global CCS Institute.
[16] "Hazardous Liquid Pipeline Safety Act of 1979." PHMSA.
[17] "Pipeline Inspection, Enforcement, and Protection Act of 2006 (Pipes)." PHMSA, December 29, 2006.
[18] "Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011." PHMSA, February 16, 2023.
[19] "S.2276 - 114th Congress (2015-2016): Pipes act of 2016." Congress.gov, June 22, 2016.
[20] "S.2276 - 114th Congress (2015-2016): Pipes act of 2016." Congress.gov, June 22, 2016.
[21] "AGA Summary of 2020 Pipes Act." American Gas Association, December 14, 2020.
[22] "AGA Summary of 2020 Pipes Act." American Gas Association, December 14, 2020.
[23] Simon, Julia. "The U.S. Is Expanding CO2 Pipelines. One Poisoned Town Wants You to Know Its Story." NPR, September 25, 2023.

and recommending updated CO_2 pipeline standards that require better emergency response planning and take land movement from localized weather events into account.[24] A draft of the final rulemaking was released at the end of the Biden administration but was never finalized or approved. In May 2025, PHMSA solicited feedback from stakeholders in preparation to update this rule with industry best practices and more stringent safety standards.[25]

Finally, the White House Council on Environmental Quality CCUS Permitting Task Forces will be completing a report before the end of 2025 with recommendations pertaining to pipelines and other CO_2 infrastructure on public and private lands.

Pipeline regulations are multi-layered, confusing, and often iterate upon one another. To simplify what to look for in the best practices for pipeline standards the Global CCS Institute suggests the following topics to be addressed:[26]

- **Specific properties of CO2**
- **Safety aspects of transportation of CO2 in pipelines relevant in the context of CCS**
- **Emergency response**
- **Concept development and design premises**
- **Materials and pipeline design**
- **Pipeline construction**
- **Operation and integrity management**
- **Public awareness**

It is important to note that states also have a large role in the pipeline regulating space, especially with siting and construction. See the best practices section for more detail on ways the federal government can be effective partners to states on pipeline safety and siting.

Common Concerns and Recommendations

The National Wildlife Federation, while not advocating specifically for CO_2 pipeline development in particular localities, has had conversations with communities about the implications of carbon management infrastructure and has created a variety of materials referencing those learnings, such as: Carbon Management: Community Takeaways in Louisiana, Geologic Sequestration: The State of Responsible Primacy, and Public Perceptions of Carbon Dioxide Removal in Wyoming, Texas, Louisiana, and Colorado. From the Federation's work in this space, we have developed overarching themes that help guide what we believe to be the responsible implementation of CO_2 pipelines, including:

- It is important that technologies that are meant to address climate change move away from fossil fuel development, addressing the moral hazard that these technologies are part of the climate solution and should not be an excuse for business as usual, and these technologies will continue to develop and scale to address difficult to mitigate sector (e.g. industry) and legacy emissions.

- Project developers are responsible for understanding the history of a particular locality and understanding historic harm perpetuated in the geography or upon certain vulnerable groups–in addition to doing research, developers should seek to make projects that not only protect communities and prevent harm but also remedy past harms.

- Not every community wants to have or is suited for carbon management projects and developments; informed community consent is vital to infrastructure development.

- It is important to recognize that CO_2 pipelines are monitored and regulated by PHMSA to address these

[24] "Building our way to net-zero: Carbon dioxide pipelines in the United States" Global CCS Institute.
[25] "Pipeline Safety: Repair Criteria for Hazardous Liquid and Gas Transmission Pipelines." Federal Register, May 21, 2025.
[26] "Building our way to net-zero: Carbon dioxide pipelines in the United States" Global CCS Institute.

concerns, but updated rules and regulations, more funding, and cooperation of project developers can help prioritize the protection of communities and the environment around pipeline projects.

Below are some common concerns raised about CO_2 pipelines and their development via the Pipeline Safety Trust, as well as considerations, including those from the Biden-era rulemaking draft, that might go toward addressing them:[27]

- **Structural security, transport** - To address the concern of possible pipeline rupture resulting in CO_2 release back into the air PHMSA should:

  - Issue clear guidance on all phases of CO_2 transport, including the design, installation, operation, maintenance, and reporting requirements for CO_2 gas pipelines (though supercritical remains the most common phase of transport). This guidance should include:

    - Encouragement of project developers to follow regulatory frameworks that require frequent in-person inspection and modeling of potential geo-hazards of the region;

    - Pipeline design that takes into account the changing climate and potential environmental impacts on structural design;

    - Employment of various monitoring protocols including employing technological advancements in sensors/monitoring for real time tracking–e.g. remote or automatic shut off valves.

    - Establishment of new requirements that pipeline operators must adhere to when converting existing pipelines to transport CO_2 in non-supercritical phases.[28]

- **Siting of CO_2 pipelines** - CO_2 is an odorless asphyxiant that tends to hover low to the ground due to its dense nature, thus posing dangerous risks to nearby people and wildlife in the event of a rupture. Given PHMSA does not have jurisdiction over the siting of CO_2 pipelines, a task that is largely left to regional and state bodies, developers should:

  - As standard protocol when possible, locate CO_2 pipelines in remote areas where they are unlikely to impact population centers. When it is not, nearby population centers and potential wildlife impacts in the case of leakage should be considered;

  - Evaluate options to add odorizers to CO_2 pipelines that would make leakage more detectable, while avoiding potential chemical reactions given the volatility of CO_2.

- **Modeling and emergency response** - Dispersion modeling is currently required by PHMSA in the case of rupture or accident regardless of the location of the pipeline, but updated modeling rules and emergency response protocols should:

  - Include more detailed vapor dispersion analyses to better protect the public and the environment in the case of pipeline failure;[29]

  - Take into account nearby population centers and update with ongoing feedback around the environmental conditions of the locality;

  - Require all CO_2 pipeline operators to provide training to emergency responders and ensure carbon dioxide detection and other equipment is available for local first responders to use and efficiently respond during an emergency. Implement more robust requirements for communicating with the public during an emergency.[30]

[27] Carbon Dioxide Pipelines." Pipeline Safety Trust.
[28] "USDOT Proposes New Rule to Strengthen Safety Requirements for Carbon Dioxide Pipelines." U.S. Department of Transportation, January 15, 2025.
[29] "USDOT Proposes New Rule to Strengthen Safety Requirements for Carbon Dioxide Pipelines." U.S. Department of Transportation, January 15, 2025.
[30] "USDOT Proposes New Rule to Strengthen Safety Requirements for Carbon Dioxide Pipelines." U.S. Department of Transportation, January 15, 2025.

- Provide ongoing funding and engagement with the community, ensuring the population is up to date and able to respond appropriately and quickly to any issues that might arise.

Policy Opportunities to Improve Deployment of CO_2 Pipelines

Under the Trump administration, numerous environmental regulations are experiencing rollbacks and PHMSA as an agency is experiencing staff cuts and potential weakening of enforcement through the removal of "out of date requirements" for hazardous liquid and natural gas pipeline developers to meet increased demand. While streamlining regulatory efficiency to meet demand is important, it cannot be at the expense of necessary safety requirements. Regulations exist to keep communities and the environment safe and must continue to do so. The federal government should work to update the necessary regulatory oversight and safety frameworks and protocols as well as provide clarity and recommendations around siting for CO_2 pipelines. This might include but is not limited to:

- Follow through on the proposed rulemaking for PHMSA, allowing the agency to update their safety standards and protocols based on the latest technological advancements in pipeline development and stakeholder feedback;

- Advance legislation supporting RD&D for CO_2 pipelines, such as **H.R.7073 Next Generation Pipelines Research and Development Act**;

- Collaborate with state pipeline authorities to improve siting processes, especially across multi-state corridors;

- Sufficiently fund PHMSA to increase and maintain staff capacity and to meet technological needs of the agency for reviews and rulemakings.

State agencies should work to develop transparent and public frameworks around CO_2 pipeline safety that expand upon federal guidelines, as well as work with project developers in the private sector to enforce these standards and hold actors accountable. Opportunities like this might include but are not limited to:

- Increased education around public participation and public comment periods on projects;

- Support of or mandating project developers engage communities in the development of community benefit plans (see example from **Tallgrass & Bold Alliance**);

- Funding for state-wide and local emergency response plans and trainings;

- Funding for remediation and clean-up of pipeline related damages.

For more information, please visit NWF's Carbon Management Toolkit or contact Dr. Simone H. Stewart, senior industrial policy specialist, at StewartS@nwf.org or Sarah Kallgren, carbon management coordinator, at KallgrenS@nwf.org.

Footnote Links

[1] https://www.catf.us/2022/04/what-does-latest-ipcc-report-say-about-carbon-capture/
[2] https://www.energyinfrastructure.org/pipeline/why-pipelines
[3] https://www.transportation.gov/fueling-americas-economy-legislation-improve-safety-and-expand-us-pipeline-infrastructure
[4] https://clearpath.org/tech-101/carbon-dioxide-pipelines-101/#:~:text=According%20to%20the%20U.S.%20Department,pipelines%20in%20the%20U.S.%20today
[5] https://clearpath.org/tech-101/carbon-dioxide-pipelines-101/#:~:text=According%20to%20the%20U.S.%20Department,pipelines%20in%20the%20U.S.%20today
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[6] https://www.globalccsinstitute.com/
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[19] https://www.congress.gov/bill/114th-congress/senate-bill/2276
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[23] https://www.npr.org/2023/05/21/1172679786/carbon-capture-carbon-dioxide-pipeline
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