**HB 1573: Pore Space Utilization**
**House Finance & Taxation Committee**
**February 3, 2015**
**Presented by Rep. SuAnn Olson**

Mr. Chairman and members of the committee, HB 1573 introduces a tax on a new industry in North Dakota and that is the business of pore space utilization. Utilization of pore space can be thought of as the inverse of oil and gas development and coal mining. In North Dakota, we have a severance tax on oil and gas and coal because they are "wasting" resources; they are finite and used up over time. In that sense, utilization of pore space is the same; it is finite and used up over time. If ND taxes the utilization of the established industries of oil and gas production and coal mining, then this new industry of pore space utilization should mirror them. The bill exempts the use of pore space that is part of another industrial process in the state; for example, coal mines or ethanol plants sequestering CO2 near their own plant.

Section 1 of the bill imposes a tax of $5/ton on a substance that travels through a pipeline of greater than 25 miles from onloading site to offloading site. The remainder of page 1 and most of page 2 describes how the tax is paid. Page 2, line 24 describes the allocation of the tax collected. The first $500 million dollars will be placed in a new fund, the North Dakota Disaster Fund, with any remaining funds going to the general fund. Page 3 describes the uses of the disaster fund. It can be accessed for damages related to transporting the substance subject to the tax. It can be accessed for specialized equipment and training that may be needed to respond to transporting hazards which are not provided by any other party. It can be accessed by declaration of the Governor for other purposes as well.

Members of the committee, this is a bill that equitably taxes an industry that is effectively new to the nation. Sequestering any substance in pore space is in its infancy. There is sufficient evidence that there can be significant problems. As recently as last year, several leaks were found in Illinois in a project run by ADM. In those instances, ground water wasn't contaminated, but the incident highlights the fact that expensive clean up is not impossible. Denbury's 2020 incident in Sartatia Mississippi is another reminder that incidents are possible. In fact, a well-referenced report by Great Plains Institute from August 2024, says there have been 4.1 CO2 accidents per year since 1988, a period of time when the existence of CO2

pipelines have gone from virtually zero to the current approximately 5,000 miles of pipeline, a number which is almost unmeasurable compared to the nearly 1.3 million miles of oil and gas distribution, gathering and transmission lines in service today. The report also states that, based on the data, we can expect an accident rate of .001 per mile. This means that the new line bringing 19 million tons of CO2 per year from a 5-state area could average 2.5 accidents per year. The severity of a disaster can't be predicted but if water sources are contaminated, if there is loss of life, livestock, buildings or infrastructure, the costs can be significant. A disaster fund makes sense.

Most of the miles the newly permitted CO2 line traverses in North Dakota is rural, except for the area around Bismarck. Nearly all of that footprint is serviced by volunteer fire departments and small ambulance departments. The volunteers go through some training, but emergency response is not their full-time job. I live north of Bismarck about 12 miles, but Wilton has been my home base for many years. I live in Wilton's emergency response district and the proposed new CO2 pipeline, which is just north of my home, is in their district. One of the volunteer firemen has asked me several times, "What are we supposed to do if there's a CO2 incident?" He recognizes that they don't have the people, the knowledge, or the equipment to handle something like this. The disaster fund will help supply equipment and training if they are needed beyond what is otherwise required to be supplied.

Members of the committee, I don't know if $5/ton is the right amount, and it can certainly be adjusted. $500 million is a good target for the disaster fund though and we should determine a tax structure that will fully fund it as quickly as possible.

Mr. Chairman and members of the committee, I respectfully urge you to give HB 1295 as amended a DO PASS recommendation.  Thank you.

GREAT PLAINS INSTITUTE

ISSUE BRIEF

# A Review of the Safety Record of $CO_2$ Pipelines in the United States

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# Introduction

Totaling over 5,000 miles, carbon dioxide ($CO_2$) pipelines have operated in various regions of the United States for decades, largely between natural sources of $CO_2$ and enhanced oil recovery fields. While estimates for the number of miles needed vary, deploying carbon capture technologies at power and industrial facilities to aid in the decarbonization of the US economy will necessitate an expansion of the nation's $CO_2$ pipeline network.[1]

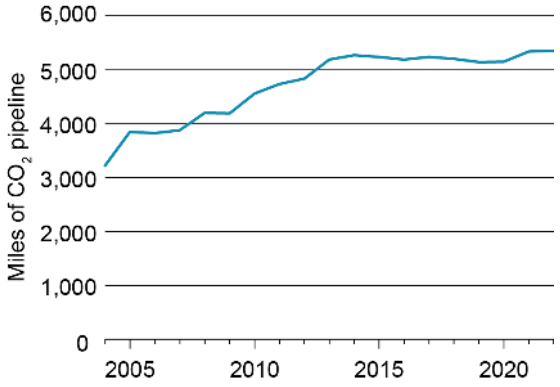
The Pipeline and Hazardous Materials Safety Administration (PHMSA), a federal agency under the US Department of Transportation, is responsible for developing and enforcing regulations related to the safe operation of pipeline infrastructure in the US, including supercritical $CO_2$ pipelines.[2]

This issue brief provides an overview of the historical accident record of $CO_2$ pipelines in the US. The brief aims to provide publicly available data reported by pipeline operators to PHMSA to understand a variety of aspects related to $CO_2$ pipeline safety in the US. For a more detailed review of $CO_2$ pipeline construction, operation, and oversight, see a recent report from the Global CCS Institute, which included collaboration with the Great Plains Institute.[3]

# History of $CO_2$ pipelines in the united states

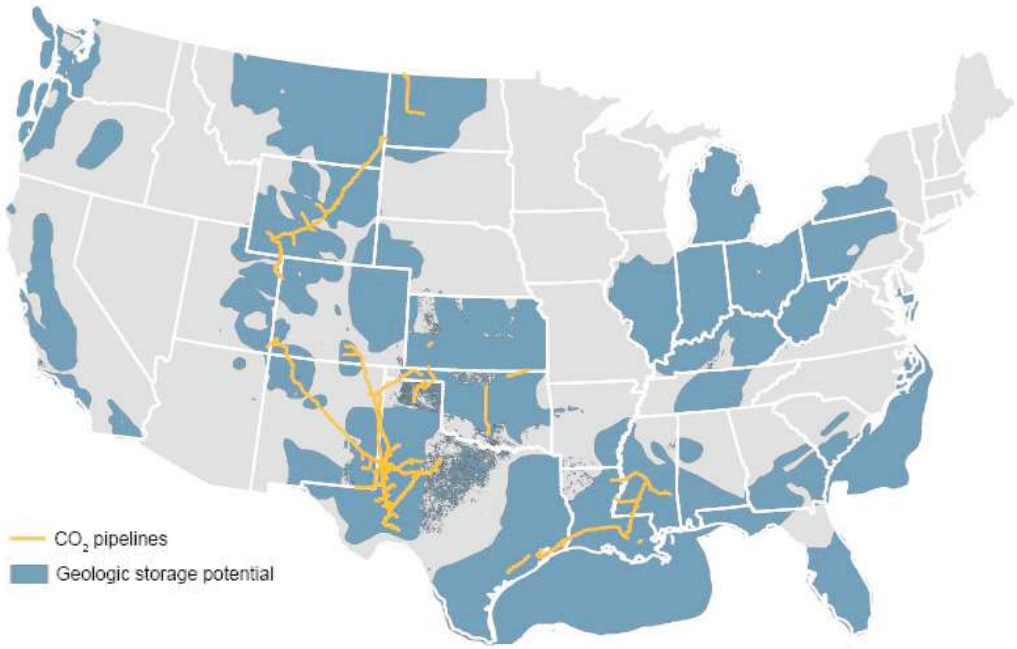
The first large-scale $CO_2$ pipelines were built in the 1970s for use during the enhanced oil recovery process in the Permian Basin in West Texas.[4] Growing to over 3,000 miles by the early 2000s, US $CO_2$ pipeline infrastructure has steadily climbed to over 5,000 miles in operation today (figure 1). $CO_2$ pipeline infrastructure is present in multiple regions of the US and includes natural and anthropogenic sources of $CO_2$, as well as oil reservoirs and saline geologic formations as storage locations (figure 2).

Figure 1. Miles of pipeline in the United States classified as $CO_2$ from 2004 to 2022.




**Source: Pipeline and Hazardous Materials Safety Administration, "Annual Report Mileage for Hazardous Liquid or Carbon Dioxide Systems."**

Figure 2. $CO_2$ pipelines and geologic formations with $CO_2$ storage potential in the United States.




**Sources: Bauer et al., "NATCARB."; Pipeline and Hazardous Materials Safety Administration, "Active $CO_2$ Pipelines in the NPMS."**

1 Abramson, McFarlane, and Brown, *Transport Infrastructure for Carbon Capture and Storage*; Larson et al., *Net-Zero America: Potential Pathways, Infrastructure, and Impacts*, 17; Wallace et al., "A Review of the $CO_2$ Pipeline Infrastructure in the U.S.," 12–30.
2 United States Code of Federal Regulations, "49 CFR Part 195 - Transportation of Hazardous Liquids by Pipeline."
3 Minervini et al., *Building Our Way to Net-Zero: Carbon Dioxide Pipelines in the United States.*
4 Wallace et al., "A Review of the $CO_2$ Pipeline Infrastructure in the US."

# Review of accident record

Accidents in a $CO_2$ pipeline must be reported to PHMSA if any one of the following events occur:

a. Explosion or fire not intentionally set by the operator

b. Release of 5 gallons or more, or 5 barrels or more if release occurs during maintenance

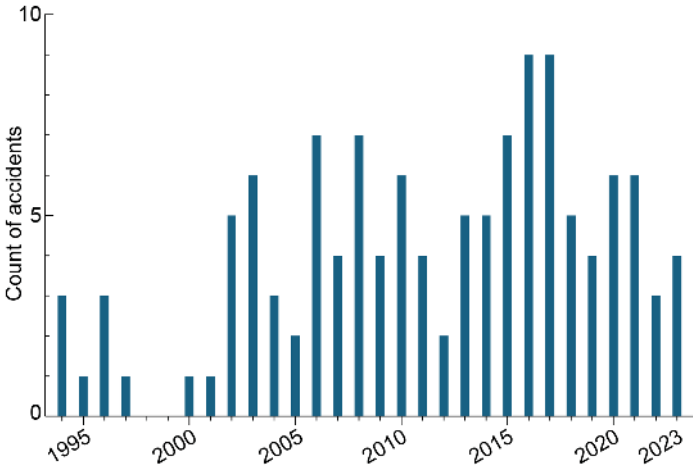
c. Injury requiring hospitalization or a death

d. Estimated total property damage exceeding $50,000 [5]

In the event of a reportable accident, an operator must submit an accident report to PHMSA within 30 days and may be required to notify the National Response Center within one hour if the accident meets certain criteria.

PHMSA publishes data from pipeline accident reports on its website, which are used in this analysis.[6] The first recorded $CO_2$ pipeline accident was in 1994, after PHMSA was authorized to enforce safety regulations related to $CO_2$ pipelines beginning in 1988. Since then, $CO_2$ pipelines have had an average of 4.1 accidents per year and have never had more than nine accidents in a single year (figure 3). From 2004 to 2022, $CO_2$ pipelines had an average accident rate of 0.001 per mile in operation per year.

## Figure 3. Count of accidents by year.




**Source: Pipeline and Hazardous Materials Safety Administration, "Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data."**

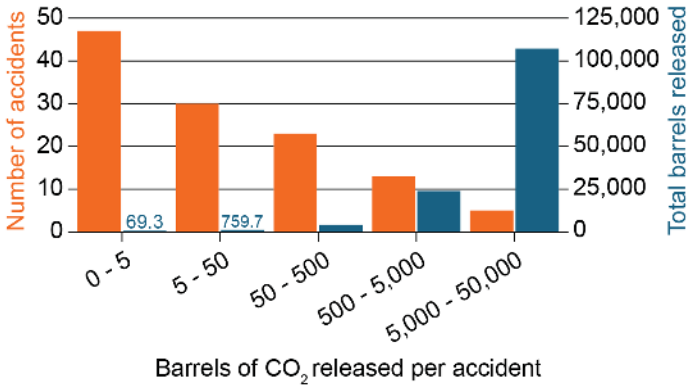
# Unintentional releases of $CO_2$

Accidents have ranged in size from 0.1 (i.e., 5 gallons, the minimum amount required to be reported) to 41,177 barrels of $CO_2$ unintentionally released, with an average unintentional release of 1,150 barrels and a median release amount of 20 barrels.

In total, $CO_2$ pipeline accidents have resulted in roughly 135,000 barrels of $CO_2$ being unintentionally released, an average of 4,500 barrels per year. The density of $CO_2$ is affected by temperature and pressure, but a barrel of $CO_2$ is roughly between 0.13 and 0.16 metric tons of $CO_2$ at pipeline operating conditions. Current $CO_2$ pipeline infrastructure transports over 66 million metric tons of $CO_2$ per year,[7] equating to 0.001 percent of transported $CO_2$ being lost to unintentional releases from $CO_2$ pipeline accidents in an average year.

Most releases (65.3 percent) have resulted in 50 barrels or less released, while the five releases with a volume greater than 5,000 barrels have accounted for 79 percent of all unintentionally released $CO_2$ from pipeline accidents (figure 4).

## Figure 4. Number of accidents and total barrels released by size of release, per accident.




**Note: Orange bars indicate the number of accidents of a given size, blue bars indicate total barrels of $CO_2$ released for all accidents of the given size range. Five accidents did not report amount of $CO_2$ released and are not included.**

**Source: Pipeline and Hazardous Materials Safety Administration, "Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data."**

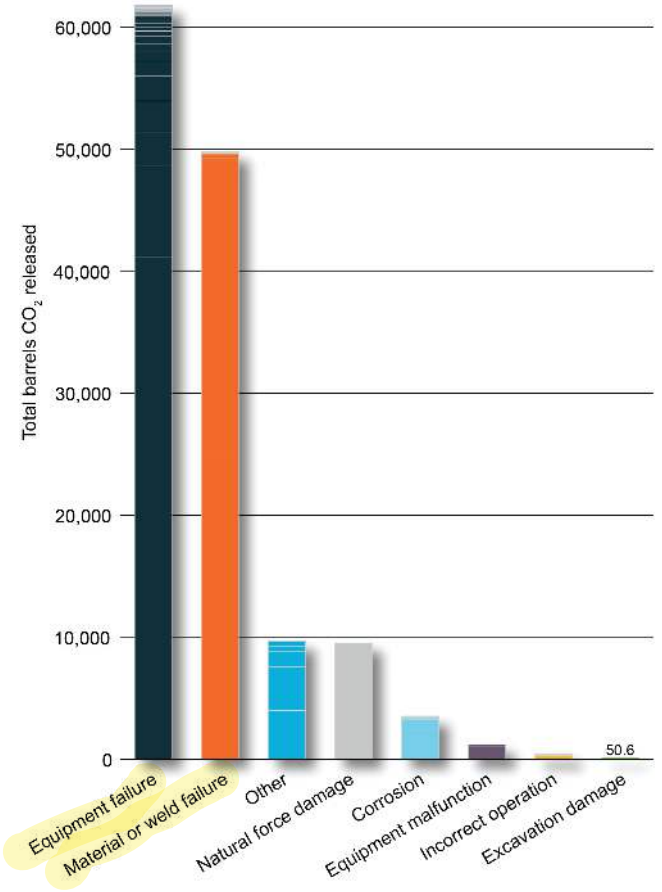
5 United States Code of Federal Regulations, "49 CFR Part 195 - Transportation of Hazardous Liquids by Pipeline."

6 Pipeline and Hazardous Materials Safety Administration, "Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data." The reported data fields and naming conventions used by PHMSA have changed over time. This analysis has aggregated the data fields presented, with an explanation of crosswalks included as an appendix.

7 National Petroleum Council, *Meeting the Dual Challenge. A Roadmap to At-Scale Deployment of Carbon Capture, Use, and Storage. Volume III, Chapter Six - $CO_2$ Transport.*

A variety of causes for pipeline accidents have been reported, with the primary causes of $CO_2$ pipeline accidents related to equipment and material or weld failure in both the number of accidents and the total volume released (figure 5). Accidents due to equipment failures have typically involved various valve, O-ring, gasket, or seal failures and have resulted in a wide range of releases.

Figure 5. Total barrels $CO_2$ released by cause of accident.




**Note: Each colored bar indicates a cause of release, each bar within a color indicates a separate accident.**

**Source: Pipeline and Hazardous Materials Safety Administration, "Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data."**

Material or weld failures also have a wide range of total barrels released, though most involved releases of less than 1,000 barrels of $CO_2$. Many of these accidents involved small cracks, typically a few inches long, that resulted in slow but noticeable releases of $CO_2$. Repairs related to material or weld failures typically involve replacing 5 to 10 feet around the failed location, though some accidents reported replacing up to 70 feet of affected pipeline.

## Intentional releases of $CO_2$

In some cases, an intentional release of $CO_2$ may be required while remediating a $CO_2$ pipeline after an accident. In these instances, the operator releases $CO_2$ to depressurize the pipeline prior to repair, often referred to as blowdown, in a controlled manner that does not pose a risk to the area or the public.[8]

PHMSA began requiring operators to include intentionally released $CO_2$ in 2010. Since then, accidents involving intentional releases have had an average intentional release amount of 7,735 barrels and a median release amount of 923. A total of 278,000 barrels of $CO_2$ have been intentionally released due to reportable pipeline accidents, with 90 percent of the intentionally released $CO_2$ resulting from the ten largest intentional releases.

## High consequence areas

Pipeline operators must create an integrity management program to ensure the ongoing safe operation and maintenance of their pipelines.[9] During the development of the integrity management program, a pipeline segment or facility may be identified as one that could affect a high consequence area (HCA) in the event of an accident. PHMSA defines HCAs as urbanized or high population areas (defined by the Census Bureau), commercially navigable waterways, and unusually sensitive areas.[10] If a pipeline segment or facility could affect an HCA, the operator is required to include the pipeline segment or facility in its integrity management program, which may require additional safety measures and assessments. If a pipeline segment is identified as one that could affect an HCA as new information becomes available (e.g., new Census data), the operator must add the pipeline section to its integrity management program.[11]

Over the past ten years, an average of 565 miles of $CO_2$ pipeline has been identified as capable of affecting an HCA in the event of an accident. Ten accidents have occurred where $CO_2$ released during an accident reached an HCA. Seven of those accidents had identified the segment of pipeline as having the potential to reach an HCA, while three of the accidents where $CO_2$ reached an HCA had not identified an HCA along the pipeline segment affected by the accident. An additional four accidents were identified as potentially impacting an HCA in the event of an accident, but no $CO_2$ reached an HCA due to the reported accident.

8 Pipeline and Hazardous Materials Safety Administration, "Instructions for Form PHMSA F 7000-1."
9 Pipeline and Hazardous Materials Safety Administration, Pipeline Integrity Management.
10 United States Code of Federal Regulations, "49 CFR Part 195 - Transportation of Hazardous Liquids by Pipeline."
11 Pipeline and Hazardous Materials Safety Administration, "Implementing Integrity Management - Final Rule (as Amended)."

# Impacts of $CO_2$ pipeline accidents

Operators must report any injuries, fatalities, and/or damage to property and additional costs associated with a pipeline accident. Property damage includes damage to operator, public, and non-operator property, the value of the $CO_2$ lost upon release during the accident, costs associated with repairs to the pipeline segment or facility, emergency response, environmental remediation, and other costs related to a pipeline accident.[12]

$CO_2$ pipelines have not had a reported fatality since reporting began in 1988 and have only had one reported injury, which was a contracted worker during an excavation.[13] While only one accident has reached the threshold for a reportable accident, which requires overnight hospitalization, it is important to note that a serious accident occurred involving natural force damage to a $CO_2$ pipeline in Satartia, Mississippi. As a result of this accident, 200 residents near the rupture location were evacuated, and 45 people were taken to the hospital.[14]

$CO_2$ pipeline accidents are typically smaller in scale than pipeline accidents involving hazardous liquids and have a different makeup of the associated property damage costs. At the time of this report, $CO_2$ pipeline accidents have resulted in $9.2 million (2023$) in property damage.[15]

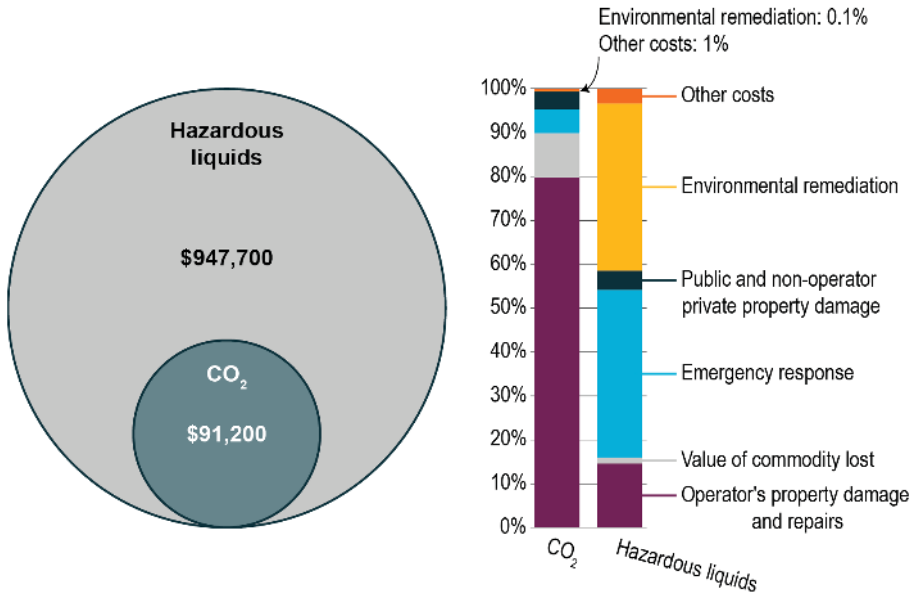
Nearly half of the reported total property damage resulted from one accident involving natural force damage to a $CO_2$ pipeline. Since 2010, $CO_2$ pipeline accidents have had an average total property damage of $91,200 (2023$), compared to an average total property damage of $947,700 for pipeline accidents involving hazardous liquids. Over 80 percent of the property damage associated with $CO_2$ pipeline accidents has been related to damage to an operator's property. In contrast, other types of hazardous liquid pipeline accidents have a much higher portion of the overall costs to property damage associated with emergency response and environmental remediation since 2010 (figure 6).

# Conclusion

The safe operation of $CO_2$ pipelines is paramount to the effective deployment of carbon capture technologies to decarbonize the power and industrial sectors of the US. This issue brief provides a review of the safety record of $CO_2$ pipelines in the US, highlighting the quantity, size, and general cause of $CO_2$ pipeline accidents since PHMSA began regulating them in 1988.

$CO_2$ pipelines have a strong overall safety record, as evidenced in this issue brief, but serious accidents are still possible, necessitating continued advancement of safety standards and oversight by PHMSA.

Figure 6. Property damage associated with $CO_2$ and hazardous liquid pipeline accidents since 2010.




**Note: Left circles show the average total property damage of $CO_2$ and hazardous liquid pipeline accidents (2023$, not to scale). Right bars show the average percent cost by damage type.**

**Source: Pipeline and Hazardous Materials Safety Administration, "Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data."**

12 Pipeline and Hazardous Materials Safety Administration, "Instructions for Form PHMSA F 7000-1."
13 Pipeline and Hazardous Materials Safety Administration, *Background for Regulating the Transportation of Carbon Dioxide in a Gaseous State*; Pipeline and Hazardous Materials Safety Administration, "Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data."
14 Pipeline and Hazardous Materials Safety Administration, *Failure Investigation Report - Denbury Gulf Coast Pipelines, LLC - Pipeline Rupture/Natural Force Damage.*
15 Pipeline and Hazardous Materials Safety Administration, "Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data."

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# Appendix

| Value | 1986 to 2001 | 2002 to 2009 | 2010 to present |
|---|---|---|---|
| **Year** | IDATE | IYEAR | IYEAR |
| **Unintentional barrels released** | LOSS | SPILLED* | UNINTENTIONAL_RELEASE_BBLS |
| **Intentional barrels released**** | N/A | N/A | INTENTIONAL_RELEASE_BBLS |
| **Total property damage***** | PRPTY | PRPTY | PRPTY |
| **Cause of accident** | CAUS | GEN_CAUSE_TXT | CAUSE |

*From 2002 to 2009, accident report data included "SPUNIT_TXT," which identifies whether the reported volume is in gallons or barrels. Accidents with volumes reported in gallons have been converted to barrels at a conversion rate of 42 gallons per barrel.

**PHMSA did not begin requiring the reporting of intentional barrels released until 2010. All barrels reported released prior to 2010 are assumed to be unintentional in this issue brief.

***Property damage values have been converted to 2023$ using the GNP Implicit Price Deflator, annual average.