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DOT's Federal Pipeline Safety Program: Background and Key Issues for Congress

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Summary

The U.S. energy pipeline network includes approximately 3.3 million miles of onshore pipeline transporting natural gas, crude oil, and other hazardous liquids. Over the past decade, safety incidents in California, Massachusetts, and other states have drawn criticism from stakeholders and have raised concerns in Congress about pipeline safety regulation. Recent incident statistics suggest there is opportunity for safety improvement. The 2021 ransomware attack on the Colonial Pipeline Company has also drawn attention to federal pipeline security activities, including various agency roles and the linkage between pipeline safety and security.

The federal safety program for onshore pipelines is administered by the Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA), which relies heavily on state partnerships for inspection and enforcement. PHMSA may reimburse states for up to 80% of their pipeline safety expenditures through State Pipeline Safety Grants. PHMSA's pipeline safety program is authorized through FY2023 under the Protecting our Infrastructure of Pipelines and Enhancing Safety Act of 2020 (PIPES Act, P.L. 116-260, Div. R). For FY2022, the agency has been working under a continuing resolution at an annualized rate of $168 million, the same level as its FY2021 authorization. The Biden Administration's requested budget for PHMSA for FY2022 is $182.65 million, roughly 9% greater than the FY2021 budget authority. In addition, the Infrastructure Investment and Jobs Act (IIJA, P.L. 117-58) authorizes funding through FY2026 for a new Natural Gas Distribution Infrastructure Safety and Modernization Grant Program to be administered by PHMSA.

PHMSA uses various strategies to promote compliance with its standards. The agency conducts programmatic inspections of management systems, procedures, and processes; conducts inspections of facilities and construction; investigates safety incidents; and maintains a dialogue with pipeline operators. The agency clarifies its expectations through published protocols and orders, guidance manuals, and public meetings. PHMSA is also involved with pipeline security oversight and incident response in cooperation with the Transportation Security Administration.

As oversight of PHMSA's pipeline safety program continues, Congress may examine PHMSA staffing, which faces persistent shortfalls affecting the agency's ability to inspect pipelines and revise its regulations. Other potential topics for congressional oversight could include:

- the structure and effectiveness of PHMSA's new distribution modernization grant program, which is in the process of being implemented;
- the effects of the agency's rule for natural gas gathering lines, finalized on November 15, 2021, bringing 425,000 miles of gathering lines under regulation;
- PHMSA's implementation of the PIPES Act mandating that pipeline operators protect "the environment," which is widely viewed as expanding PHMSA's traditional safety mission to include climate considerations; and
- what role PHMSA might play in any future pipeline security initiatives and what resources it might require to perform that role.

In addition to these issues, Congress may assess how the many elements of U.S. pipeline safety and security fit together in the nation's overall approach to protect the public and the environment. Pipeline safety necessarily involves various groups: federal and state agencies, tribal governments, pipeline associations, large and small pipeline operators, local communities, and other interest groups. Reviewing how these groups work together to achieve common goals or resolve conflicting approaches could be an overarching concern for Congress.

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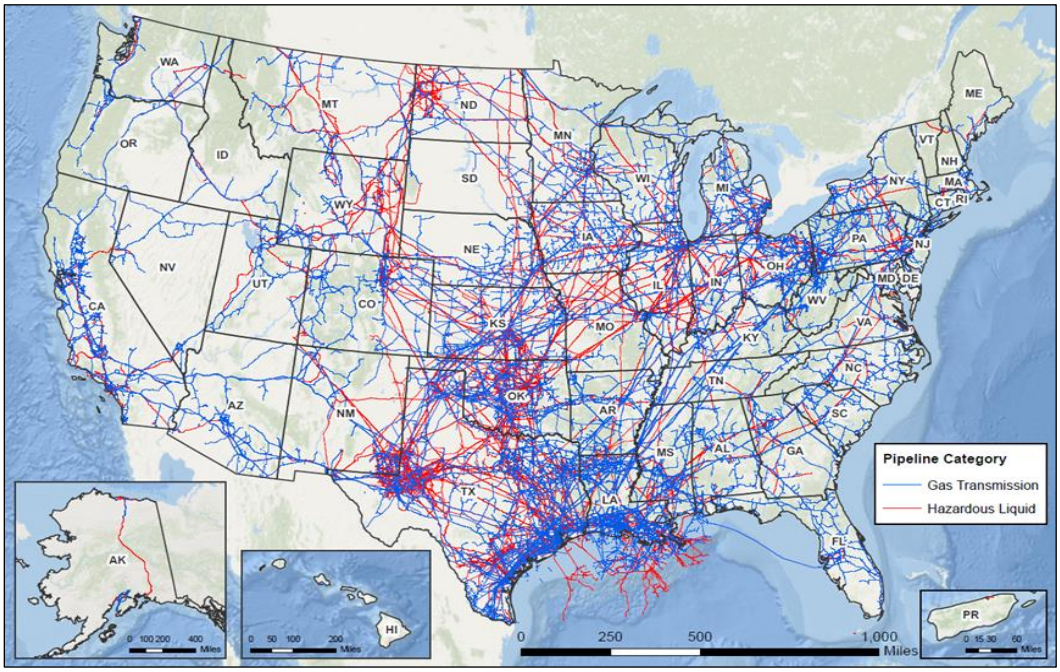
Introduction

The U.S. energy pipeline network is integral to the nation's energy supply and provides vital links to other critical infrastructure, such as power plants, airports, and military bases. These pipelines are geographically widespread, running alternately through remote and densely populated regions—from Arctic Alaska to the Gulf of Mexico and nearly everywhere in between (**Figure 1**). Because energy pipelines carry volatile, flammable, or toxic materials, they have the potential to injure the public, destroy property, and harm the environment. Although they are considered an efficient and comparatively safe means of transport, pipeline systems are also vulnerable to accidents, operational failure, and malicious attacks. Recent major incidents in California and Massachusetts, among other places, have demonstrated the risks of pipeline failure and have heightened congressional concern about U.S. pipeline safety. A 2021 cyberattack on the Colonial Pipeline likewise demonstrated the economic impacts of a major pipeline disruption and put a focus on the linkage between pipeline safety and security.

Figure 1. U.S. Natural Gas Transmission and Hazardous Liquid Pipelines



Source: National Pipeline Mapping System, October 5, 2021, https://www.npms.phmsa.dot.gov/Documents/NPMS_Pipelines_Map.pdf

Notes: Map does not show gas distribution or gas gathering pipelines. Hazardous liquids primarily include crude oil, gasoline, jet fuel, diesel fuel, home heating oil, propane, and butane. Other hazardous liquids transported by pipeline include anhydrous ammonia, carbon dioxide, kerosene, liquefied ethylene, and petrochemical feedstock.

The federal safety program for onshore pipelines resides primarily within the Department of Transportation's (DOT's) Pipeline and Hazardous Materials Safety Administration (PHMSA), although its inspection and enforcement activities rely heavily upon partnerships with the states. Together, the federal and state pipeline safety agencies administer a comprehensive set of regulatory authorities that has changed significantly over the past decade and continues to evolve. DOT's pipeline safety program is authorized through the fiscal year ending September 30, 2023, under the Protecting our Infrastructure of Pipelines and Enhancing Safety Act of 2020 (PIPES Act, P.L. 116-260, Div. R) signed by President Trump on December 27, 2020.

This report reviews the history and role of the federal program for pipeline safety, including a discussion of pipeline safety trends and major accidents. It discusses significant regulatory changes in reauthorization statutes and summarizes ongoing developments in key policy areas. It discusses PHMSA's relationship with other federal agencies involved in pipeline safety. Although pipeline security is not mainly under PHMSA's jurisdiction, the report examines the agency's role in pipeline security and its recent work on security-related issues with other agencies.

The U.S. Pipeline Network

The onshore U.S. energy pipeline network is composed of approximately 3.3 million miles of pipeline transporting natural gas, oil, and other hazardous liquids (**Table 1**). Of the nation's approximately half-million miles of long-distance transmission pipeline, roughly 229,000 miles carry hazardous liquids—over 80% of the nation's crude oil and refined products—along with other products.[1] It also contains some 47,000 miles of crude oil gathering pipeline, which connects extraction wells to processing facilities prior to long-distance shipment. The U.S. natural gas pipeline network consists of around 302,000 miles of transmission and 434,000 miles of gathering lines. The natural gas transmission pipelines feed around 2.3 million miles of regional pipeline mains in some 1,500 local distribution networks serving over 70 million customers.[2]

Table 1. U.S. Hazardous Liquid and Natural Gas Pipeline Mileage 2020

Category	Miles
Hazardous Liquids Transmission	229,264
Hazardous Liquids Gathering	47,126
Natural Gas Transmission	301,655
Natural Gas Gathering	434,076
Natural Gas Distribution Mains and Service Lines	2,284,379
TOTAL	**3,296,500**

Sources: Hazardous liquids transmission, natural gas transmission, and natural gas distribution mains and service lines mileage is from PHMSA, "Annual Report Mileage Summary Statistics," web tables, January 4, 2022, http://www.phmsa.dot.gov/portal/site/PHMSA/menuitem.7c371785a639f2e55cf2031050248a0c/?vgnextoid=3b6c03347e4d8210VgnVCM1000001ecb7898RCRD&vgnextchannel=3b6c03347e4d8210VgnVCM1000001ecb7898RCRD&vgnextfmt=print; Hazardous liquids and natural gas gathering lines mileage is from Environmental Protection Agency, "Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2020: Updates Under Consideration for Activity Data," memorandum, September 2021, p. 3, https://www.epa.gov/system/files/documents/2021-09/2022-ghgi-update-activity-data_sept-2021.pdf. PHMSA also estimates "that there are over 400,000 miles of onshore gas gathering lines throughout the U.S." See 86 *Federal Register* 2017, November 15, 2021.

Notes: Hazardous liquids primarily include crude oil, gasoline, jet fuel, diesel fuel, home heating oil, propane, and butane. Other hazardous liquids transported by pipeline include anhydrous ammonia, carbon dioxide, kerosene, liquefied ethylene, and petrochemical feedstock. Hazardous liquids gathering mileage is for crude oil pipelines.

[1] Bureau of Transportation Statistics, "Crude Oil and Petroleum Products Transported in the United States by Mode," https://www.bts.gov/content/crude-oil-and-petroleum-products-transported-united-states-mode, accessed January 10, 2022.

[2] PHMSA, "Annual Report Mileage for Gas Distribution Systems," January 4, 2022, https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-gas-distribution-systems.

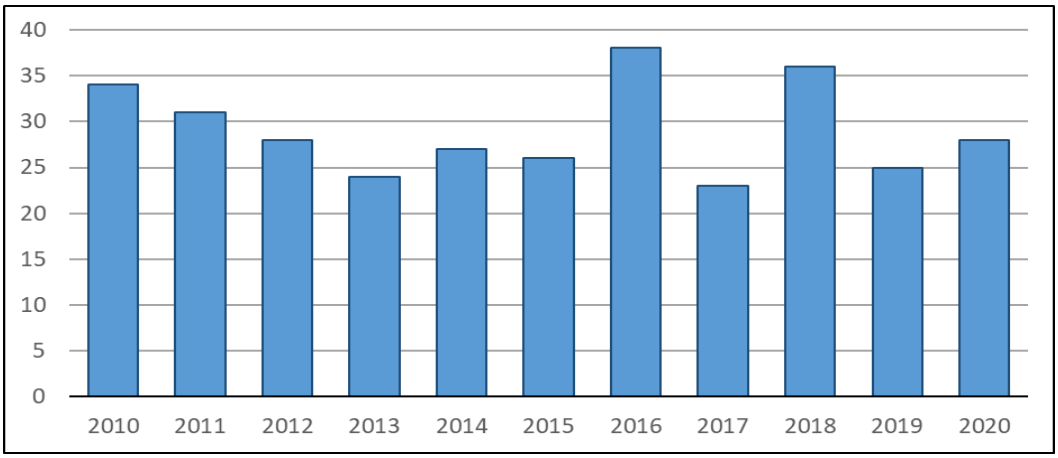
Natural gas pipelines also connect to 165 active liquefied natural gas (LNG) storage sites, as well as underground storage facilities, both of which can augment pipeline gas supplies during peak demand periods.[3]

Safety in the Pipeline Industry

Uncontrolled pipeline releases can result from a variety of causes, including third-party excavation, corrosion, mechanical failure, control system failure, operator error, and malicious acts. Natural forces, such as floods and earthquakes, can also damage pipelines. Taken as a whole, releases from pipelines cause few annual injuries or fatalities compared to other product transportation modes.[4] According to PHMSA statistics, there were, on average, 12 deaths and 60 injuries annually caused by 29 pipeline incidents in all U.S. pipeline systems from 2010 through 2020.[5] After a decline between 2010 and 2013, the average incident count increased and recently shows an upward trend (**Figure 2**). A total of 28 serious pipeline incidents were reported for 2020.

Figure 2. Pipeline Incidents Causing Injuries or Fatalities 2019-2020

(Annual "Serious" Incidents)



Source: PHMSA, "Pipeline Incident 20 Year Trends," online database, January 11, 2020, https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-20-year-trends.

Note: PHMSA defines "serious" incidents as those including a fatality or injury requiring inpatient hospitalization.

Apart from injury to people, some accidents may cause local environmental damage or other physical impacts, which may be significant, particularly in the case of oil spills or fires. PHMSA requires the reporting of such incidents involving

- $50,000 or more in total costs, measured in 1984 dollars,
- highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more, or

[3] PHMSA, "Liquefied Natural Gas (LNG) Facilities and Total Storage Capacities," January 4, 2022, https://www.phmsa.dot.gov/data-and-statistics/pipeline/liquefied-natural-gas-lng-facilities-and-total-storage-capacities.

[4] Bureau of Transportation Statistics, *National Transportation Statistics: 2021*, Table 2-4.

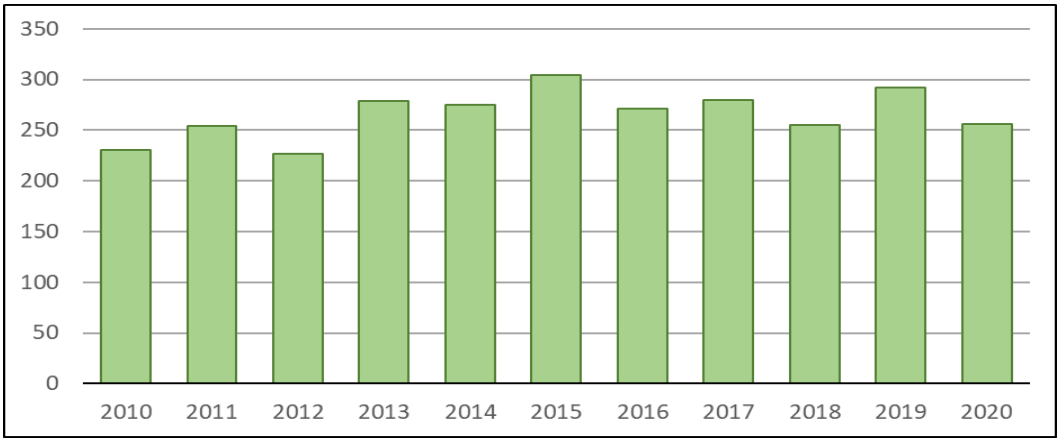
[5] PHMSA, PHMSA, "Pipeline Incident 20 Year Trends," January 11, 2020, https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-20-year-trends.

- liquid releases resulting in an unintentional fire or explosion.[6]

On average there were 265 such "significant" incidents (not involving injury or fatality) per year from 2010 through 2020. There is no clear trend for pipeline incidents affecting only the environment or property over the past five years (**Figure 3**). It should be noted that federally regulated pipeline mileage overall rose approximately 8% over this period; neither the annual statistics for injury nor environmental incidents are adjusted on a per-mile basis.[7]

Figure 3. Pipeline Incidents Causing Environmental or Property Damage 2010-2020

(Annual "Significant" Incidents)



Source: PHMSA, "Pipeline Incident 20 Year Trends," online database, October 29, 2021, https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-20-year-trends.

Note: Includes "significant" incidents, with $50,000 or more in total costs (1984 dollars), highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more, or liquid releases resulting in an unintentional fire or explosion. Excludes incidents causing a fatality or injury requiring inpatient hospitalization.

Although pipeline releases have caused relatively few fatalities in absolute numbers, a single pipeline accident can be catastrophic in terms of public safety and environmental damage. For example, in 2015, the Aliso Canyon Underground Storage Facility near the Porter Ranch community in Los Angeles County, CA, began experiencing an uncontrolled natural gas leak that ultimately released an estimated 109,000 metric tons of methane, a potent greenhouse gas (GHG).[8] The risk to safety from the fugitive methane and the presence of odorants and other chemicals in the gas led to the temporary relocation of over 8,000 households and two schools in nearby Porter Ranch. In 2018, overpressure in a natural gas distribution main in Merrimack Valley, MA, killed one person, injured 21 others, damaged 131 structures, and caused 30,000 residents to evacuate their homes for several days.[9] Such incidents have generated persistent scrutiny of pipeline risks and have increased federal, state, and community activity related to pipeline safety.

[6] PHMSA, "Pipeline Incident Flagged Files," October 29, 2021, https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-flagged-files. The definition excludes natural gas distribution incidents caused by a nearby fire or explosion impacting the pipeline system.

[7] For detailed annual pipeline mileage statistics, see PHMSA, "Annual Report Mileage Summary Statistics," September 1, 2020, https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-summary-statistics.

[8] County of Los Angeles, Department of Public Health, "Aliso Canyon Disaster Health Research Study," 2021, http://publichealth.lacounty.gov/eh/healthresearch/background.htm.

[9] NTSB, "Pipeline Over-Pressure of a Columbia Gas of Massachusetts Low-Pressure Natural Gas Distribution System Merrimack Valley, Massachusetts, September 13, 2018," preliminary report, PLD18MR003, October 10, 2018.

Notable Pipeline Safety Incidents since 2010

- **2010—**A pipeline spill in Marshall, MI, released 19,500 barrels of crude oil into a Kalamazoo River tributary.
- **2010**—A pipeline explosion in San Bruno, CA, killed 8 people, injured 60 others, and destroyed 37 homes.
- **2011**—An explosion caused by a natural gas pipeline in Allentown, PA, killed 5 people, damaged 50 buildings, and caused 500 people to be evacuated.
- **2011**—A pipeline near Laurel, MT, spilled an estimated 1,000 barrels of crude oil into the Yellowstone River.
- **2012**—A natural gas pipeline explosion in Springfield, MA, injured 21 people and damaged over 12 buildings.
- **2014**—An explosion caused by a natural gas distribution pipeline in New York City killed 8 people, injured 50 others, and destroyed two 5-story buildings.
- **2015**—A pipeline in Santa Barbara County, CA, spilled 3,400 barrels of crude oil, including 500 barrels reaching Refugio State Beach on the Pacific Ocean.
- **2015**—The Aliso Canyon natural gas storage facility in Los Angeles County, CA, released 5.4 billion cubic feet of gas, causing the temporary relocation of over 2,000 households and two schools in Porter Ranch.
- **2016**—An explosion caused by a natural gas distribution pipeline in Canton, OH, killed one person, injured 11 others, and damaged over 50 buildings.
- **2018**—Explosions and fires caused by natural gas distribution pipelines in Merrimack Valley, MA, killed one person, injured 21 others, damaged 131 structures, and caused 30,000 residents to evacuate.
- **2020**—An underwater oil pipeline off of Long Beach, CA, damaged by a ship's anchor spilled over 500 barrels of oil into San Pedro Bay.

PHMSA's Pipeline Safety Program

PHMSA has the primary responsibility for the formulation, administration, and oversight of onshore pipeline safety regulations in the United States. The agency does so through its Office of Pipeline Safety (OPS), whose functions include oversight of pipeline operators, support of state pipeline safety agencies, and cooperation with other federal agencies that have pipeline safety responsibilities. The latter include the Department of Interior's Bureau of Safety and Environmental Enforcement (BSEE), which regulates offshore oil and natural gas facilities, and the Federal Energy Regulatory Commission (FERC), which has siting authority for interstate natural gas pipelines. PHMSA also cooperates with the National Transportation Safety Board (NTSB), an independent agency that investigates accidents and issues safety recommendations.

Pipeline and Hazardous Materials Safety Administration

The Natural Gas Pipeline Safety Act of 1968 (P.L. 90-481) and the Hazardous Liquid Pipeline Act of 1979 (P.L. 96-129) are the principal acts establishing the federal role in pipeline safety. Under both statutes, the Secretary of Transportation is given primary authority to regulate key aspects of pipeline safety: design, construction, operation and maintenance, and spill response planning. Pipeline safety regulations are covered in Title 49 of the *Code of Federal Regulations*.[10]

Organization and Funding

As of December 19, 2021, PHMSA's organizational chart listed 285 full-time equivalent (FTE) staff in OPS—including 146 pipeline safety inspectors.[11] There are also 35 positions elsewhere in

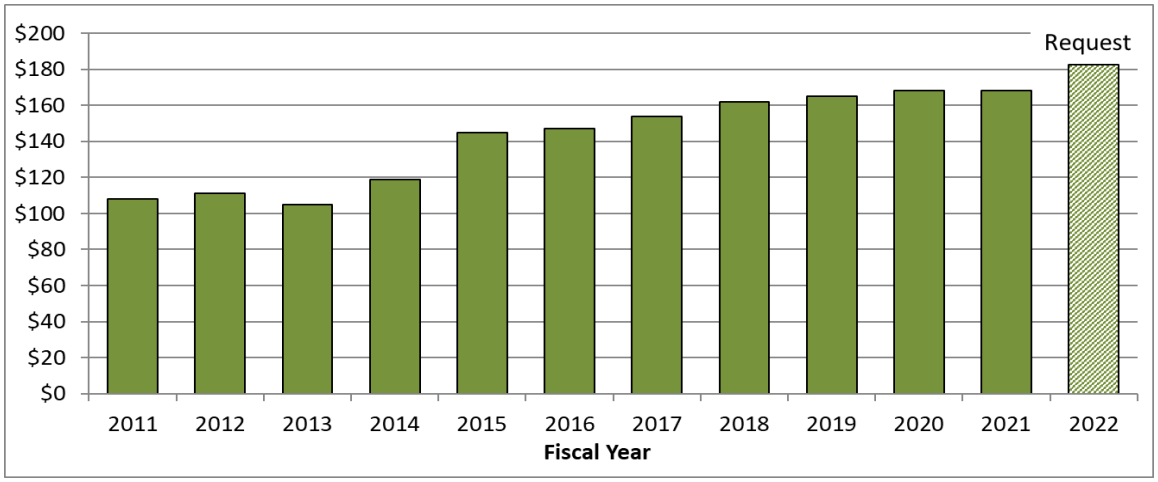
[10] Safety and security of LNG facilities used in gas pipeline transportation is regulated under Title 49, Part 193, of the *Code of Federal Regulations*.

[11] PHMSA, "PHMSA Pipeline Safety Program," December 19, 2021, https://www.phmsa.dot.gov/sites/phmsa.dot.gov/

PHMSA that provide support for certain pipeline safety functions.[12] In addition to federal staff, PHMSA's enabling legislation allows the agency to delegate authority to *intra*state pipeline safety offices, enabling them to act as "agents" administering *inter*state pipeline safety programs (excluding enforcement) for those sections of *inter*state pipelines within their boundaries.[13] According to the DOT, "PHMSA relies on state inspectors for inspecting the vast network of intrastate pipelines."[14] A few states serve as agents for inspection of interstate pipelines as well. There were 433 state inspectors in 2021.[15] PHMSA may reimburse states for up to 80% of their pipeline safety expenditures through State Pipeline Safety Grants. In 2020 (the latest year with published data) actual grant awards to states covered approximately 70% of state expenditures, on average.[16] PHMSA may also fund states through Underground Natural Storage Grants, State Damage Prevention Grants, and State One-Call Grants.

Figure 4. PHMSA Pipeline Safety Total Annual Budget Authority 2011-2022

(Millions of Dollars)



Source: U.S. Office of Management and Budget, *Budget of the United States Government, Appendix*, Fiscal Years 2011 through 2022, "Pipeline Safety," Line 1900 "Budget authority (total)."

Notes: Column values are "actual" budget authority totals except for 2021, which is "enacted," and 2022, which is reported in the Biden Administration's FY2022 budget appendix. For FY2022, the agency has been working under a continuing resolution at an annualized rate of $168 million. Values are not adjusted for inflation.

PHMSA's pipeline safety program is funded primarily by user fees assessed on a per-mile basis on each regulated pipeline operator.[17] The agency's total annual budget authority has grown since 2011, with the largest increase in FY2015 (**Figure 4**). For FY2022, the agency has been working under a continuing resolution at an annualized rate of $168 million, the same level as its FY2021

files/2021-12/PHP-Org-Chart-Dec-19-2021.pdf.

[12] Linda Daugherty, PHMSA, personal communication, February 16, 2022. Those staff include attorneys, data analysts, information technology specialists, and regulatory specialists required for certain enforcement actions, promulgating regulations, issuing pipeline safety grants, and issuing agreements for pipeline safety research and development.

[13] 49 U.S.C. 60107.

[14] DOT, *Budget Estimates Fiscal Year 2020, Pipeline and Hazardous Materials Safety Administration*, 2019, p. 24, https://www.transportation.gov/sites/dot.gov/files/docs/mission/budget/334301/fy-2020-phmsa-budget-508-compliant.pdf.

[15] PHMSA, "Federal Effort," April 29, 2021 https://www.phmsa.dot.gov/pipeline/effort-allocation/federal-effort.

[16] PHMSA, "Base Grant Payment Info 2008-2020," February 3, 2021, https://www.phmsa.dot.gov/grants/pipeline/base-grant-payment-info-2008-2020.

[17] 49 U.S.C. 60125.

authorization. The Biden Administration's requested budget for PHMSA for FY2022 is $182.65 million, roughly 9% greater than the FY2021 budget authority. The FY022 request includes $66.6 million for grant programs funding state pipeline inspections and damage prevention.

Regulatory Activities

PHMSA uses a variety of strategies to promote compliance with its safety standards. The agency conducts programmatic inspections of management systems, procedures, and processes; conducts physical inspections of facilities and construction projects; investigates safety incidents; and maintains a dialogue with pipeline operators. The agency clarifies its regulatory expectations through published protocols and regulatory orders, guidance manuals, and public meetings.

In 1997, PHMSA began requiring industry to implement "integrity management" programs on pipeline segments near "high consequence areas." Integrity management provides for continual evaluation of pipeline condition, assessment of risks to the pipeline, inspection or testing, data analysis, and follow-up repair as well as preventive or mitigative actions. High consequence areas include population centers, commercially navigable waters, and environmentally sensitive areas, such as drinking water supplies or ecological reserves. The integrity management approach is intended to prioritize resources to locations of highest consequence rather than applying uniform treatment to the entire pipeline network. PHMSA made integrity management programs mandatory for most oil pipeline operators with 500 or more miles of regulated pipeline as of March 31, 2001 (49 C.F.R. §195). Congress subsequently mandated the expansion of integrity management to natural gas pipelines and has continued to make other significant changes to federal pipeline safety requirements through PHMSA budget reauthorizations as discussed below.

Regulation of Offshore Pipelines

Offshore pipelines are regulated primarily by BSEE within the Department of the Interior, which is responsible for the safety and environmental oversight of oil and gas operations as well as oil spill response on the Outer Continental Shelf.[18] PHMSA shares with BSEE oversight of certain offshore pipeline facilities. Under the terms of a December 2020 Memorandum of Understanding (MOU) between the two agencies, PHMSA is responsible for "all OCS pipelines beginning downstream of the point at which operating responsibility transfers from a producing operator to a transporting operator, or downstream of the last valve on the last production facility on the OCS for pipelines that cross into State waters."[19] In addition, BSEE regulations allow a producer to petition to have its pipeline operate under PHMSA regulations for pipeline design, construction, operation, and maintenance.[20] Likewise, a transporter who operates a PHMSA-regulated pipeline may petition to operate under BSEE regulations for pipeline operation and maintenance.[21]

[18] BSEE was established in 2011 under a secretarial order reorganizing the former Minerals Management Service. See Secretary of the Interior, Order No. 3299, Amendment No. 2, August 29, 2011, https://www.doi.gov/sites/doi.gov/files/elips/documents/3299a2-establishment_of_the_bureau_of_ocean_energy_management_the_bureau_of_safety_and_environmental_enforcement_and_the_office_of_natural_resources_revenue.pdf. BSEE's regulations are found under Title 30 (Mineral Resources) of the *Code of Federal Regulations*.

[19] BSEE and PHMSA, "Memorandum of Understanding Between the U.S. Department of Transportation and the U.S. Department of the Interior Regarding Outer Continental Shelf Pipelines," December 22, 2020, p. 3, https://www.bsee.gov/sites/bsee.gov/files/mou-est-17430-doi-dot-outer-continental-shelf-pipelines-mou-2020-12-22.pdf.

[20] 30 C.F.R §250.1000(c)(12).

[21] 30 C.F.R §250.1000(c)(13).

Pipeline Safety Enforcement

PHMSA relies upon a range of enforcement actions, including administrative actions such as safety orders and civil penalties, to try to ensure that operators correct safety violations and take measures to preclude future safety problems. From 2017 through December 6, 2021, PHMSA initiated 1,081 enforcement actions against pipeline operators.[22] Of these cases, 323 resulted in notices of probable violation, which allege specific regulatory violations, and 14 resulted in corrective action orders, which "usually address urgent situations arising out of an accident, spill, or other significant, immediate, or imminent safety or environmental concern."[23] Civil penalties proposed by PHMSA for safety violations during this period totaled approximately $26 million.[24] PHMSA also conducts accident investigations and system-wide reviews focusing on high-risk operational or procedural problems and areas of the pipeline near sensitive environmental areas, high-density populations, or navigable waters.

Reauthorization and Pipeline Safety Statutes

The PIPES Act was preceded by a periodic series of pipeline safety statutes, each of which reauthorized funding for PHMSA's pipeline safety program and included other provisions related to PHMSA's authorities, administration, or regulatory activities.

Pipeline Safety Improvement Act of 2002

On December 12, 2002, President George W. Bush signed into law the Pipeline Safety Improvement Act of 2002 (P.L. 107-355). The act strengthened federal pipeline safety programs, state oversight of pipeline operators, and public education regarding pipeline safety.[25] Among other provisions, P.L. 107-355 required operators of regulated natural gas pipelines in high consequence areas to conduct risk analysis and implement integrity management programs similar to those required for oil pipelines. The act authorized DOT to order safety actions for pipelines with potential safety problems and increased violation penalties. The act streamlined the permitting process for emergency pipeline restoration by establishing an interagency committee—including the DOT, the Environmental Protection Agency, the Bureau of Land Management, FERC, and other agencies—to ensure coordinated review and permitting of pipeline repairs. The act required DOT to study ways to limit pipeline safety risks from population encroachment and ways to preserve environmental resources in pipeline rights-of-way. P.L. 107-355 also included provisions for public education, grants for community pipeline safety studies, "whistleblower" and other employee protection, employee qualification programs, and mapping data submission.

[22] PHMSA, "PHMSA Pipeline Safety Program: Summary of Enforcement Actions," December 6, 2021, http://primis.phmsa.dot.gov/comm/reports/enforce/Actions_opid_0.html?nocache=8828.

[23] PHMSA, "PHMSA Pipeline Safety Program: Summary of Enforcement Actions."

[24] PHMSA, "PHMSA Pipeline Safety Program: Summary of Cases Involving Civil Penalties," December 6, 2021, http://primis.phmsa.dot.gov/comm/reports/enforce/CivilPenalty_opid_0.html?nocache=9288#_TP_1_tab_1. Proposed penalties may change in the resolution of a case.

[25] P.L. 107-355 encourages the implementation of state "one-call" excavation notification programs (§2) and allows states to enforce "one-call" program requirements. The act expands criminal responsibility for pipeline damage to cases where damage was not caused "knowingly and willfully" (§3). The act adds provisions for ending federal-state pipeline oversight partnerships if states do not comply with federal requirements (§4).

Pipeline Inspection, Protection, Enforcement, and Safety Act of 2006

On December 29, 2006, President Bush signed into law the Pipeline Inspection, Protection, Enforcement and Safety Act of 2006 (P.L. 109-468). The main provisions of the act address pipeline damage prevention, integrity management, corrosion control, and enforcement transparency. The act created a national focus on pipeline damage prevention through grants to states for improving damage prevention programs, establishing 811 as the national "call before you dig" one-call telephone number, and giving PHMSA limited "backstop" authority to conduct civil enforcement against one-call violators in states that have failed to conduct such enforcement. The act mandated the promulgation by PHMSA of minimum standards for integrity management programs for natural gas distribution pipelines.[26] It also mandated a review of the adequacy of federal pipeline safety regulations related to internal corrosion control and required PHMSA to increase the transparency of enforcement actions by issuing monthly summaries including violation and penalty information and a mechanism for pipeline operators to make response information available to the public.

Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011

On January 3, 2012, President Obama signed the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 (Pipeline Safety Act, P.L. 112-90). The act contains a broad range of provisions addressing pipeline safety. Among the most significant are provisions to increase the number of federal pipeline safety inspectors, require automatic shutoff valves for transmission pipelines, mandate verification of maximum allowable operating pressure for gas transmission pipelines, increase civil penalties for pipeline safety violations, and mandate reviews of diluted bitumen pipeline regulation. Altogether, the act imposed 42 mandates on PHMSA regarding studies, rules, maps, and other elements of the federal pipeline safety program. P.L. 112-90 authorized the federal pipeline safety program through the fiscal year ending September 30, 2015.

Protecting Our Infrastructure of Pipelines and Enhancing Safety Act of 2016

On June 22, 2016, President Obama signed the Protecting our Infrastructure of Pipelines and Enhancing Safety Act of 2016 (P.L. 114-183). Among other provisions, the act requires PHMSA to promulgate federal safety standards for underground natural gas storage facilities and grants PHMSA emergency order authority to address urgent "industry-wide safety conditions" without prior notice. The act also requires PHMSA to report regularly on the progress of outstanding statutory mandates. The act authorized the federal pipeline safety program through FY2019.

Protecting Our Infrastructure of Pipelines and Enhancing Safety Act of 2020

On December 27, 2020, President Trump signed the PIPES Act (P.L. 116-260, Div. R).[27] The act authorizes the federal pipeline safety program through FY2023. Among its key provisions, the act requires PHMSA to review and update its safety standards for large-scale LNG facilities, adopting a risk-based regulatory approach. The act also imposes stricter standards for natural gas pipeline leak detection and repair, requiring repair of all leaks hazardous to human safety or the environment or with the potential to become hazardous. It also mandates new safety requirements for natural gas distribution systems in response to the 2018 Merrimack Valley incident.[28] These

[26] PHMSA issued final regulations requiring operators of natural gas distribution pipelines to adopt integrity management programs similar to existing requirements for gas transmission pipelines on December 4, 2009.

[27] P.L. 116-260 is the Consolidated Appropriations Act, 2021.

[28] These provisions are included as the "Leonel Rondon Pipeline Safety Act," Title II of the PIPES Act.

requirements include updates to distribution integrity management, emergency response plans to address over-pressurization risks, and a requirement for PHMSA to report on industry adoption of pipeline safety management systems. The act also includes provisions intended to help PHMSA attract and maintain a sufficient workforce of pipeline inspection and enforcement personnel.

In addition to the authorization in the PIPES Act, IIJA authorizes annual funding through FY2026 for a new Natural Gas Distribution Infrastructure Safety and Modernization Grant Program to be administered by PHMSA.[29]

Cooperation with FERC

One area related to pipeline safety not under PHMSA's primary jurisdiction is the siting approval of interstate natural gas pipelines, which is the responsibility of FERC. Companies building interstate natural gas pipelines must first obtain from FERC certificates of public convenience and necessity. (FERC does not oversee oil pipeline siting or construction.) FERC must also approve the abandonment of gas facility use and services. These approvals may include safety provisions with respect to pipeline routing, safety standards, and other factors.[30] In particular, pipeline and aboveground facilities associated with a proposed pipeline project must be designed in accordance with PHMSA's safety standards regarding material selection and qualification, design requirements, and protection from corrosion.[31]

PHMSA and FERC cooperate on pipeline safety-related matters according to an MOU signed in 1993. According to the MOU, PHMSA agrees to

- promptly alert FERC when safety activities may impact commission responsibilities,
- notify FERC of major accidents or significant enforcement actions involving pipelines under FERC's jurisdiction,
- refer to FERC any complaints and inquiries by state and local governments and the public about environmental or certificate matters related to FERC-jurisdictional pipelines, and
- when requested by FERC, review draft mitigation conditions considered by the commission for potential conflicts with PHMSA's regulations.

Under the MOU, FERC agrees to

- promptly alert PHMSA when the commission learns of an existing or potential safety problem involving natural gas transmission facilities;
- notify PHMSA of future pipeline construction;
- periodically provide PHMSA with updates to the environmental compliance inspection schedule and coordinate site inspections, upon request, with PHMSA officials;

[29], Division J, Title VIII.

[30] In making permitting decisions for cross-border oil and natural gas pipelines, the State Department or FERC, respectively, must also consult with the Secretary of Transportation regarding pipeline safety, among other matters, in accordance with directives in Executive Order 13337.

[31] 18 C.F.R. 157.

- notify PHMSA when significant safety issues have been raised during the preparation of environmental assessments or environmental impact statements for pipeline projects; and
- refer to PHMSA complaints and inquiries made by state and local governments and the public involving safety matters related to FERC-jurisdictional pipelines.[32]

FERC may also serve as a member of PHMSA's Technical Pipeline Safety Standards Committee, which determines whether proposed safety regulations are technically feasible, reasonable, cost-effective, and practicable.

In April 2015, FERC issued a policy statement to provide "greater certainty regarding the ability of interstate natural gas pipelines to recover the costs of modernizing their facilities and infrastructure to enhance the efficient and safe operation of their systems."[33] FERC's policy statement was motivated by the commission's expectation that governmental safety and environmental initiatives could cause greater safety and reliability costs for interstate gas pipeline systems.[34]

PHMSA and the NTSB

The NTSB is an independent federal agency charged with determining the probable cause of transportation incidents—including pipeline releases—and promoting transportation safety. The board's experts investigate significant incidents, develop factual records, and issue safety recommendations to prevent similar events from reoccurring. The NTSB has no statutory authority to regulate transportation, however, and it does not perform cost-benefit analyses of regulatory changes; its safety recommendations to industry or government agencies are not mandatory. Nonetheless, because of the board's strong reputation for thoroughness and objectivity, 82% of the NTSB's safety recommendations have been implemented across all transportation modes.[35]

In the pipeline sector, the NTSB's past safety recommendations have led to changes in pipeline safety regulation regarding one-call systems before excavation ("call before you dig"), use of pipeline internal inspection devices, facility response plan effectiveness, hydrostatic pressure testing of older pipelines, and other safety improvements.[36] As of January 18, 2022, the NTSB listed 12 open pipeline safety recommendations to PHMSA dating back to 2011. In nine cases, the NTSB has classified these recommendations as "Open—Acceptable Response" or "Open—Acceptable Alternate Response" because they are being incorporated satisfactorily in ongoing PHMSA rulemakings or because PHMSA is implementing other measures to meet the same objectives. Three recommendations are classified as "Open—Unacceptable Response," because the NTSB is not satisfied with PHMSA's actions to implement them. Detailed discussion of NTSB pipeline accident investigations and safety recommendations are publicly available through the NTSB's Case Analysis and Reporting Online online query tool.[37] In addition to

[32] DOT and FERC, "Memorandum of Understanding Between the Department of Transportation and Federal Energy Regulatory Commission Regarding Natural Gas Transportation Facilities," January 15, 1993. Note that the MOU refers to DOT's Research and Special Programs Administration, the predecessor agency to PHMSA.

[33] FERC, *Cost Recovery Mechanisms for Modernization of Natural Gas Facilities*, 151 FERC ¶ 61,047, April 16, 2015, http://www.ferc.gov/whats-new/comm-meet/2015/041615/G-1.pdf.

[34] FERC, April 16, 2015, p. 1.

[35] NTSB, *Annual Report to Congress 2020*, 2021, p. 8.

[36] NTSB, *Annual Report to Congress 2017*, 2018, p. 15.

[37] Accessible at https://data.ntsb.gov/carol-main-public/landing-page.

making specific safety recommendations, the NTSB also comments on proposed changes to PHMSA's pipeline safety regulations, such as those involving pipeline hazard class locations and standards for valve installation and rupture detection, among other standards.[38]

PHMSA's Role in Pipeline Security

Pipeline safety and security are distinct issues involving different threats, statutory authorities, and regulatory frameworks. Nonetheless, aspects of pipeline safety and security can be intertwined. PHMSA has historically played a significant role in pipeline security and continues to be involved in pipeline security oversight and incident response. The 2021 ransomware attack on the Colonial Pipeline Company, which disrupted gasoline supplies throughout the East Coast, elevated concern in Congress about federal oversight of pipeline security, including PHMSA's role within the nation's pipeline security framework.[39]

DOT's Early Role in Pipeline Security

DOT played the leading role in pipeline security through the late 1990s. Presidential Decision Directive 63 (PDD-63), issued during the Clinton Administration, assigned lead responsibility for pipeline security to DOT.[40] These responsibilities fell to OPS, at that time a part of DOT's Research and Special Programs Administration, because the agency was already addressing some elements of pipeline security in its role as safety regulator.[41] The DOT's pipeline (and LNG) safety regulations already included provisions related to physical security, such as requirements to protect surface facilities (e.g., pumping stations) from vandalism and unauthorized entry.[42] Other regulations required continuing surveillance, patrolling pipeline rights-of-way, damage prevention, and emergency procedures.[43]

On September 5, 2002, OPS circulated formal guidance developed in cooperation with the pipeline industry associations defining the agency's security program recommendations and implementation expectations. This guidance recommended that operators identify critical facilities, develop security plans consistent with prior trade association security guidance, implement these plans, and review them annually.[44] While the guidance was voluntary, OPS expected compliance and informed operators of its intent to begin reviewing security programs and to test their effectiveness.[45]

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[38] NTSB, 2021, 41.

[39] Colonial Pipeline, "Media Statement Update: Colonial Pipeline System Disruption," May 17, 2021, https://www.colpipe.com/news/press-releases/media-statement-colonial-pipeline-system-disruption.

[40] PDD-63, *Protecting the Nation's Critical Infrastructures*, May 22, 1998.

[41] In November 2004, the President signed the Norman Y. Mineta Research and Special Programs Improvement Act (P.L. 108-426), which eliminated the Research and Special Programs Administration (RSPA) and placed OPS within the newly established PHMSA. This administrative restructuring did not significantly affect the authorities or activities of OPS.

[42] 49 C.F.R. §195.436, "Security of Facilities."

[43] 49 C.F.R. §192.613, 192.614, 192.705, 193.2509.

[44] James K. O'Steen, RSPA, *Implementation of RSPA Security Guidance*, presentation to the National Association of Regulatory Utility Commissioners, February 25, 2003.

[45] PHMSA, "Briefing: Addressing Pipeline Security Issues," https://primis.phmsa.dot.gov/comm/pipelinesecurityissuesbrief.htm.

PHMSA Cooperation with TSA

In November 2001, President Bush signed the Aviation and Transportation Security Act (P.L. 107-71) establishing the Transportation Security Administration (TSA) within DOT. According to TSA, the act placed DOT's pipeline security authority (under PDD-63) within TSA. The act specified for TSA a range of duties and powers related to general transportation security, such as intelligence management, threat assessment, mitigation, security measure oversight, and enforcement. On November 25, 2002, President Bush signed the Homeland Security Act of 2002 (P.L. 107-296) creating the Department of Homeland Security (DHS). Among other provisions, the act transferred TSA from DOT to DHS (§403). On December 17, 2003, President Bush issued Homeland Security Presidential Directive 7 (HSPD-7), clarifying executive agency responsibilities for identifying, prioritizing, and protecting critical infrastructure.[46] HSPD-7 maintained DHS as the lead agency for pipeline security (paragraph 15) and instructed DOT to "collaborate in regulating the transportation of hazardous materials by all modes (including pipelines)" (paragraph 22h).

In 2004, the DOT and DHS entered into an MOU concerning their respective security roles in all modes of transportation. The MOU notes that DHS has the primary responsibility for transportation security with support from the DOT and establishes a general framework for cooperation and coordination. The MOU states that "specific tasks and areas of responsibility that are appropriate for cooperation will be documented in annexes … individually approved and signed by appropriate representatives of DHS and DOT."[47] On August 9, 2006, the departments signed an annex "to delineate clear lines of authority and responsibility and promote communications, efficiency, and nonduplication of effort through cooperation and collaboration between the parties in the area of transportation security."[48]

In January 2007, the PHMSA administrator testified before Congress that the agency had established a joint working group with TSA "to improve interagency coordination on transportation security and safety matters, and to develop and advance plans for improving transportation security," presumably including pipeline security.[49] According to TSA, the working group developed a multiyear action plan specifically delineating roles, responsibilities, resources, and actions to execute 11 program elements: identification of critical infrastructure/key resources and risk assessments, strategic planning, developing regulations and guidelines, conducting inspections and enforcement, providing technical support, sharing information during emergencies, communications, stakeholder relations, research and development, legislative matters, and budgeting.[50]

[46] HSPD-7 supersedes PDD-63 (paragraph 37).

[47] DHS and DOT, "Memorandum of Understanding Between the Department of Homeland Security and the Department of Transportation on Roles and Responsibilities," September 28, 2004, p. 4.

[48] TSA and PHMSA, "Transportation Security Administration and Pipelines and Hazardous Materials Safety Administration Cooperation on Pipelines and Hazardous Materials Transportation Security," August 9, 2006.

[49] T. J. Barrett, Administrator, PHMSA, testimony before the Senate Committee on Commerce, Science, and Transportation hearing on Federal Efforts for Rail and Surface Transportation Security, January 18, 2007.

[50] Jack Fox, TSA, Pipeline Security Division, personal communication, July 6, 2007.

Clarifying PHMSA and TSA Security Roles

P.L. 109-468 required the DOT inspector general (IG) to assess the pipeline security actions taken by the DOT in implementing its 2004 MOU with the DHS (§23). The IG published this assessment in May 2008. The IG report stated:

> PHMSA and TSA have taken initial steps toward formulating an action plan to implement the provisions of the pipeline security annex…. However, further actions need to be taken with a sense of urgency because the current situation is far from an "end state" for enhancing the security of the Nation's pipelines.[51]

The report recommended that PHMSA and TSA finalize and execute their security annex action plan, clarify their respective roles, and jointly develop a pipeline security strategy that maximizes the effectiveness of their respective capabilities and efforts.[52] According to TSA, working with PHMSA "improved drastically" after the release of the IG report; the two agencies began to maintain daily contact, share information in a timely manner, and collaborate on security guidelines and incident response planning.[53] Consistent with this assertion, in March 2010, TSA published a *Pipeline Security and Incident Recovery Protocol Plan*, which lays out in detail the separate and cooperative responsibilities of the two agencies with respect to a pipeline security incident. Among other notes, the plan states:

> DOT has statutory tools that may be useful during a security incident, such as special permits, safety orders, and corrective action orders. DOT/PHMSA also has access to the Regional Emergency Transportation Coordinator (RETCO) Program…. Each RETCO manages regional DOT emergency preparedness and response activities in the assigned region on behalf of the Secretary of Transportation.[54]

The plan also refers to the establishment of an Interagency Threat Coordination Committee established by TSA and PHMSA to organize and communicate developing threat information among federal agencies that may have responsibility for pipeline incident response.[55]

DOT has continued to cooperate with TSA on pipeline security in recent years. For example, TSA coordinated with DOT and other agencies to address ongoing vandalism and sabotage against critical pipelines by environmental activists in 2016.[56] In April 2016, the director of TSA's Surface Division testified about her agency's relationship with DOT:

> TSA and DOT co-chair the Pipeline Government Coordinating Council to facilitate information sharing and coordinate on activities including security assessments, training, and exercises. TSA and DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) work together to integrate pipeline safety and security priorities, as measures installed by pipeline owners and operators often benefit both safety and security.[57]

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[51] DOT, Office of Inspector General, *Actions Needed to Enhance Pipeline Security, Pipeline and Hazardous Materials Safety Administration*, Report No. AV-2008-053, May 21, 2008, p. 3.

[52] Ibid., pp. 5-6.

[53] Jack Fox, TSA, personal communication, February 2, 2010.

[54] TSA, *Pipeline Security and Incident Recovery Protocol Plan*, March 2010, p. 7.

[55] TSA, March 2010, p. 20.

[56] GAO, *Critical Infrastructure Protection: Actions Needed to Address Significant Weaknesses in TSA's Pipeline Security Program Management*, GAO-19-48, December 2018, p. 23.

[57] Sonya Proctor, Surface Division Director, TSA, testimony before the House Committee on Homeland Security, Subcommittee on Transportation Security hearing on "Pipelines: Securing the Veins of the American Economy," April 19, 2016.

In December 2016, PHMSA issued an Advisory Bulletin "in coordination with" TSA regarding cybersecurity threats to pipeline Supervisory Control and Data Acquisition systems.[58] In July 2017, the two agencies collaborated on a web-based portal to facilitate sharing sensitive but unclassified incident information among federal agencies with pipeline responsibilities.[59] In February 2018, the director of TSA's Surface Division again testified about cooperation with PHMSA, stating, "TSA works closely with [PHMSA] for incident response and monitoring of pipeline systems," although she did not provide specific examples.[60]

In June 2019, the Government Accountability Office (GAO) published a report examining the relative roles and responsibilities of DOT and DHS in pipeline security.[61] GAO concluded that, while the 2006 TSA-PHMSA MOU Annex delineated the agencies' mutually agreed-upon roles and responsibilities, it had not been reviewed to consider pipeline security developments since its inception. TSA's *Pipeline Security and Incident Recovery Protocol Plan* likewise had not been updated since it was issued in 2010 "to reflect changes in pipeline security threats, technology, federal law and policy, and any other factors."[62] Among other things, GAO recommended that TSA and PHMSA update these documents and put in place formal processes to periodically update them in the future. In response to this recommendation, TSA and PHMSA signed an update to the MOU Annex in February 2020.[63]

Colonial Pipeline Incident

Following the Colonial Pipeline ransomware attack, PHMSA joined TSA and the Cybersecurity and Infrastructure Security Agency (CISA) on a teleconference call with pipeline operators to provide updates on the incident, answer questions, and provide resources to support cybersecurity mitigation efforts.[64] The Deputy Secretary of Transportation subsequently testified that PHMSA intends to "leverage its authorities to inspect and enforce three critical components of pipeline operations" related to cybersecurity: system control room regulations, integrity management plan

[58] PHMSA, "Pipeline Safety: Safeguarding and Securing Pipelines from Unauthorized Access," 81 *Federal Register* 89183, December 9, 2016.

[59] GAO, *Critical Infrastructure Protection: Actions Needed to Address Significant Weaknesses in TSA's Pipeline Security Program Management*, p. 23.

[60] Sonya Proctor, Surface Division Director, TSA, testimony before the House Committee on Homeland Security Subcommittee on Transportation and Maritime Security and Subcommittee on Cybersecurity, Infrastructure Protection, and Innovation joint hearing on "Securing U.S. Surface Transportation from Cyber Attacks," February 26, 2019.

[61] GAO, *Critical Infrastructure Protection: Key Pipeline Security Documents Need to Reflect Current Operating Environment*, GAO-19-426, June 2019.

[62] GAO, *Critical Infrastructure Protection: Key Pipeline Security Documents Need to Reflect Current Operating Environment*, pp. 29-30.

[63] PHMSA and TSA, "Annex to the Memorandum of Understanding Between the Department of Homeland Security and the Department of Transportation Concerning Transportation Security Administration and Pipeline and Hazardous Materials Safety Administration Cooperation on Pipeline Transportation Security and Safety," February 26, 2020, https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/regulatory-compliance/phmsa-guidance/73466/phmsa-tsa-mou-annexexecuted.pdf.

[64] TSA, "TSA Response to Congressional Research Service Inquiry on Colonial Pipeline Incident," memorandum, June 29, 2021. Congress created CISA in the Cybersecurity and Infrastructure Security Agency Act of 2018 (). However, predecessor organizations executed similar authorities and capabilities.

requirements,[65] and emergency response plan regulations.[66] The Deputy Secretary also stated that DOT's Office of Intelligence, Security, and Emergency Response was collaborating with the National Security Council and interagency partners on a natural gas pipelines Industrial Control Systems Cybersecurity Initiative and that "DOT continues work with [its] sister agencies, especially TSA and CISA, to invest in world class research and pursue initiatives to address cybersecurity threats."[67]

Key Policy Issues

PHMSA's pipeline safety program is authorized through FY2023. In considering reauthorization, Congress may focus on oversight of the agency's ongoing regulatory activities and implementation of recent legislative mandates. Among these issues, several may be of particular interest: PHMSA staffing resources, pipeline modernization, new regulation of gas gathering lines, PHMSA regulation of methane leaks, and PHMSA's role in pipeline security. These issues are discussed in the following sections.

Staffing Resources for Pipeline Safety

The U.S. pipeline safety program employs a combination of federal and state staff to implement and enforce federal pipeline safety regulations. To date, PHMSA has relied heavily on state agencies for pipeline inspections, with approximately 75% of inspectors being state employees. As the PHMSA administrator remarked in 2018:

> PHMSA faces a manpower issue. It is obvious that [PHMSA] … cannot oversee 2.7 million miles of pipeline all by itself. In fact, PHMSA makes no attempt to do so. Most actual safety inspections are performed by our state partners.[68]

Nonetheless, some in Congress have criticized staffing at PHMSA for being insufficient to inspect pipelines under the agency's jurisdiction and to revise its regulations in line with legislative mandates and deadlines. In considering PHMSA staff levels, issues of particular interest have been the number of federal inspectors and the agency's historical use of staff funding.

In FY2021, PHMSA was funded for 316 FTE employees in pipeline safety. This total included eight new FTE positions required by the PIPES Act (§102) "to finalize outstanding rulemakings and fulfill congressional mandates." The President's requested budget authority for PHMSA's pipeline safety program in FY2022 would fund 328.5 FTE staff.

[65] "An integrity management program is a set of safety management, operations, maintenance, evaluation, and assessment processes that are implemented in an integrated and rigorous manner to ensure operators provide enhanced protection" for high consequence areas. See PHMSA, "Overview: Integrity Management," https://primis.phmsa.dot.gov/comm/Im.htm.

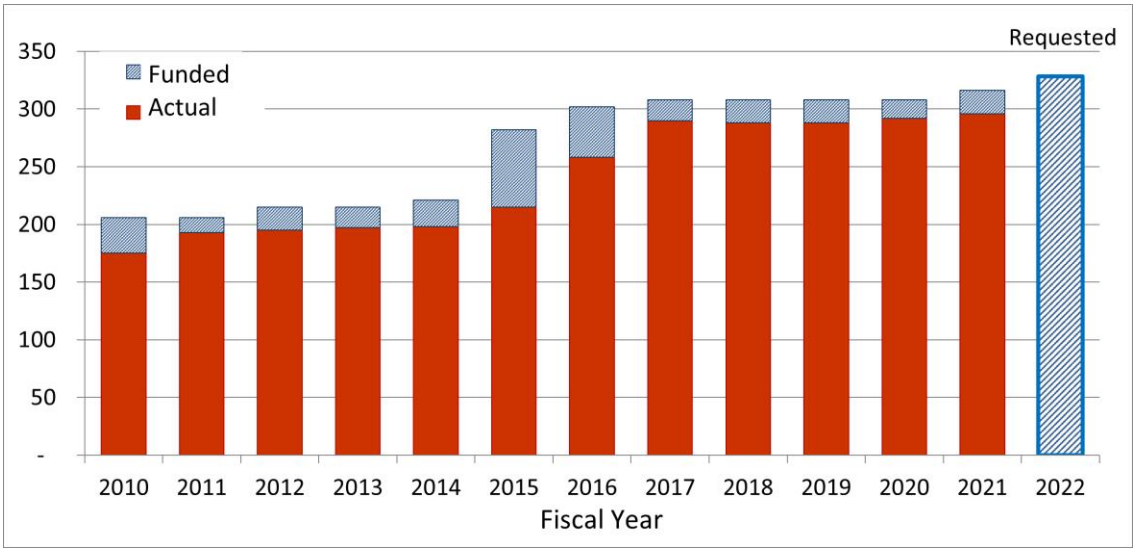
[66] Polly Trottenberg, Deputy Secretary of Transportation, written testimony submitted for the Senate Committee on Commerce, Science, and Transportation hearing on "Pipeline Cybersecurity: Protecting Critical Infrastructure," July 27, 2021, p. 3.

[67] Ibid., pp. 4-5.

[68] Howard "Skip" Elliott, PHMSA Administrator, remarks to the Fall Pipeline Leadership Meeting of the Association of Oil Pipe Lines and the American Petroleum Institute, October 25, 2018, p. 3, https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/news/69671/aopl-api-speech.pdf.

Figure 5. PHMSA Pipeline Safety Staffing, Historical and Requested

(Full-Time Equivalent Staff)



Sources: U.S. Office of Management and Budget, *Budget of the United States Government: Appendix*, Fiscal Years 2010-2019, "Pipeline Safety," line 1001, "Direct civilian full-time equivalent employment"; DOT, *Budget Estimates Fiscal Year 2021: Pipeline and Hazardous Materials Safety Administration*, Exhibit II-7; Linda Daugherty, PHMSA, personal communication, February 16, 2022.

Notes: These figures assume all staff are full-time equivalent employees (FTEs). Funded staff are "estimated staff" anticipated by the agency as reported in annual budget requests. They differ from actual staff employed (for the same fiscal year) as reported in subsequent budget requests. Actual FTEs for 2021 were provided by PHMSA as of February 8, 2022, including pipeline safety positions reporting directly through the Office of Pipeline Safety and through other program offices.

As **Figure 5** shows, PHMSA has faced a persistent staffing shortfall, which has generally been due to a shortage of inspectors. Agency officials have offered a number of reasons for the shortfall, including a scarcity of qualified inspector job applicants, delays in the federal hiring process (during which applicants accept other job offers), and PHMSA inspector turnover—especially due to retirements and departures to pipeline companies. Because PHMSA pipeline inspectors are extensively trained by the agency—typically for two years before being allowed to operate independently—they are highly valued by pipeline operators seeking to comply with federal safety regulations.

A 2017 DOT IG report supported PHMSA's assertions about industry-specific hiring challenges and confirmed "a significant gap between private industry and Federal salaries for the types of engineers PHMSA hires."[69] PHMSA has continued to experience staff losses due to an aging workforce and continued difficulty hiring and retaining engineers and technical staff because of competition from the oil and natural gas industry. For example, as of February 8, 2022, PHMSA had filled two of the eight new regulatory positions created under its last reauthorization.[70]

Although PHMSA has acted in recent years to shore up its workforce, there have been recommendations for improvement. A 2018 GAO study stated that PHMSA had not "planned for

[69] DOT, Office of Inspector General, "PHMSA Has Improved Its Workforce Management but Planning, Hiring, and Retention Challenges Remain," Report No. ST2018010, November 21, 2017, p. 12. Congress mandated the IG study in P.L. 114-183 (§9(a)).

[70] Linda Daugherty, PHMSA, February 16, 2022.

future workforce needs for interstate pipeline inspections" and, in particular, had not assessed the resources and benefits available from its state partners.[71] GAO concluded that without this type of forward-looking analysis, PHMSA could not "proactively plan for future inspection needs to ensure that federal and state resources are in place to provide effective oversight of interstate pipelines."[72] According to GAO, PHMSA concurred with its recommendation to develop a workforce plan for interstate pipeline inspections.

The PIPES Act (§102(b)) establishes a yearly minimum number of FTEs for pipeline safety inspection and enforcement for FY2021-FY2023. The act also requires PHMSA to "use incentives, as necessary, to recruit and retain a qualified workforce" as permitted under Title 5 of the *U.S. Code*, including special pay rates, student loan repayment, tuition assistance, and retention incentives. The agency states that, in addition to its ongoing staffing efforts, it "has established a diverse, cross-agency and cross-generational working group" to examine how PHMSA can better recruit and talented staff. The group "is considering financial incentives such as special pay rates, student loan repayment, and non-financial incentives such as workplace flexibilities."[73] What impact PHMSA's workforce actions and staff incentives have had on its ongoing staff recruitment, retention, and deployment may be of interest to Congress.

Aging Pipeline Modernization

The NTSB listed the safe shipment of hazardous materials by pipeline among its *2019-2020 Most Wanted List of Transportation Safety Improvements*, stating "as infrastructure ages, the risk to the public from pipeline ruptures also grows."[74] Likewise, Congress has long been concerned about the safety of older transmission pipelines—a key factor in the San Bruno accident—and in leaky and deteriorating cast iron pipe in natural gas distribution systems—at issue in Merrimack Valley.[75] Construction work in Merrimack Valley, which led to the release of natural gas, was part of a cast iron pipe replacement project. According to the American Gas Association and other stakeholders, antiquated cast iron pipes in natural gas distribution systems, many over 50 years old, "have long been recognized as warranting attention in terms of management, replacement and/or reconditioning."[76] Old distribution pipes have also been identified as a significant source of methane leakage, which poses safety risks and contributes to U.S. GHG emissions.[77]

Natural gas distribution system operators with antiquated pipes in their systems all have programs for their replacement, although some are constrained by costs and rate regulation. Upgrading or replacing natural gas distribution infrastructure involves substantial capital investment. According to a 2015 Department of Energy analysis, the total cost of replacing cast iron and bare steel

[71] GAO, *Interstate Pipeline Inspections: Additional Planning Could Help DOT Determine Appropriate Level of State Participation*, GAO-18-461, May 2018, p. 16. Congress mandated the IG study in P.L. 114-183 (§24).

[72] GAO, *Interstate Pipeline Inspections*, p. 16.

[73] Linda Daugherty, PHMSA, February 16, 2022.

[74] NTSB, "Ensure the Safe Shipment of Hazardous Materials," March 28, 2019.

[75] See, for example, U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Energy, *Legislative Solutions to Make Our Nation's Pipelines Safer*, committee print, 116th Cong., 1st sess., June 19, 2019; and Office of Senator Edward Markey, "Markey Report: Leaky Natural Gas Pipelines Costing Consumers Billions," press release, Thursday, August 1, 2013.

[76] American Gas Association, "Managing the Reduction of the Nation's Cast Iron Inventory," 2013, summary.

[77] Kathryn McKain et al., "Methane Emissions from Natural Gas Infrastructure and Use in the Urban Region of Boston, Massachusetts," *Proceedings of the National Academy of Sciences*, vol. 112, no. 7 (February 27, 2015), pp. 1941-1946.

distribution pipes would be approximately $270 billion (2015 dollars).[78] These costs, in turn, could be passed on to consumers through increased natural gas rates. They could pose particular challenges for publicly owned (e.g., municipal) gas utilities with constrained budgets and limited access to capital. Practical barriers, such as urban excavation and disruption of gas supplies, also constrain annual pipe replacement. Nonetheless, as the Department of Energy stated in a 2017 report, "many policymakers and the utilities responsible for delivering natural gas to customers broadly recognize the need to accelerate ongoing efforts to replace aging infrastructure while embracing new approaches to operations and maintenance."[79]

Although the federal role in natural gas distribution systems is limited because they are under state jurisdiction, there have been past legislative proposals in Congress to provide federal support for the replacement of old cast iron pipe.[80] Likewise the House Select Committee on the Climate Crisis majority staff report, released June 2020, concluded that Congress should "provide financial support for cities and states to eliminate methane leaks from natural gas distribution lines within 10 years."[81] Consistent with these efforts, IIJA authorizes a new Natural Gas Distribution Infrastructure Safety and Modernization Grant Program to be administered by PHMSA. The program is to provide grants to municipal or community-owned natural gas distribution utilities (excluding for-profit utilities) for the repair, rehabilitation, or replacement of some or all of their pipeline systems in order to reduce safety incidents and "avoid economic losses." IIJA appropriated a total of $1.0 billion for the program in $200 million increments annually from FY2022 to FY2026 to remain available until expended.

As of the date of this report, PHMSA had not yet finalized the details of the new grant program, and the agency was in the process of hiring an employee to administer it. As PHMSA's implementation of the program continues, Congress may examine its structure and effectiveness along with the industry's overall progress in addressing the safety of antiquated distribution lines.

Gathering Line Regulation

Natural gas gathering lines are pipelines that collect produced gas from wellheads and transport it to centralized collection points. The latter are usually gas processing facilities where impurities are removed and gas constituents (e.g., methane, propane) are separated into distinct products for further shipment to market. Natural gas gathering lines have historically operated in mostly rural areas at lower pressure than transmission lines and with smaller diameters—typically 20 inches or less. However, due to differences in extraction techniques, especially in shale gas production with hydraulic fracturing, newer gathering lines have been constructed up to 36 inches in diameter and operated at pressures similar to those in transmission lines.[82] Shale gas production has also been occurring in relatively more populated areas, notably the Marcellus basin in Ohio, Pennsylvania, and West Virginia. The construction of larger gathering lines in more populous regions, together

[78] Department of Energy, *Quadrennial Energy Review*, April 2015, p. 1-4.

[79] Department of Energy, *Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations*, January 2017, p. 5.

[80] The Pipeline Revolving Fund and Job Creation Act (S. 1209, 114th Congress) introduced by Senator Markey and two cosponsors on May 6, 2015.

[81] House Select Committee on the Climate Crisis, *Solving the Climate Crisis*, majority staff report, June 2020, p. 7.

[82] PHMSA, "Pipeline Safety: Safety of Gas Transmission and Gathering Pipelines," 81 *Federal Register* 20721, April 8, 2016, p. 20728.

with recent gathering pipeline accidents, has raised concerns about safety risks in nearby communities.[83]

The Pipeline Safety Act of 1992 (P.L. 102-508, §109) authorized PHMSA to regulate the safety of gas gathering lines that "warrant regulation," taking account of "such factors as location, length of line from the well site, operating pressure, throughput, and the composition of the transported gas." Under these provisions, PHMSA issued a 2006 final rule defining *regulated gathering line* that covered less than 10% of U.S. natural gas gathering line mileage at the time.[84] The remaining gathering lines were judged to pose little risk to the public due to their physical characteristics and more remote locations.

In 2011, PHMSA published an Advance Notice of Proposed Rulemaking to begin examining, among other things, whether new regulations were needed to govern the safety of natural gas gathering lines—with specific reference to shale gas lines.[85] Continuing this rulemaking process, in 2016, PHMSA published a Notice of Proposed Rulemaking (NPRM) to modify the regulation of onshore gas gathering lines—repealing an exemption for operator reporting and extending specific regulatory requirements to certain gas gathering lines with large diameters and high operating pressures in certain locations.[86]

The PIPES Act (§112(a)) required PHMSA to finalize its rule for onshore gas gathering lines by March 27, 2021. PHMSA published its final rule in the *Federal Register* on November 15, 2021.[87] Among its key provisions, the rule requires operators to report incidents and file annual reports for *all* natural gas gathering lines to "help determine the need for future regulatory changes to address the risks to the public, property and the environment."[88] According to PHMSA's announcement, under this requirement, "there are at least 425,000 miles of onshore gas gathering lines that have not been subject to PHMSA oversight but will be after this rule takes effect."[89]

The final rule also imposes new safety requirements (e.g., for damage prevention, construction, and operation) on gathering lines that have outer diameters of 8.625 inches or greater and operate at higher stress levels or pressures, with greater requirements for lines larger than 16 inches and certain gathering lines that could directly affect homes and other structures.[90] PHMSA estimates that approximately 91,000 miles of gathering lines fall into this category.[91] Operators are required to comply with safety requirement for the larger gathering lines as of May 16, 2022, with initial annual reports due by May 15, 2023.

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[83] See, for example, *Midland Reporter-Telegram*, "Report: Explosion That Killed Girl, 3, Caused by Hole in Pipeline," September 12, 2018.

[84] PHMSA, "Gas Gathering Line Definition; Alternative Definition for Onshore Lines and New Safety Standards," 71 *Federal Register* 13289, March 15, 2006.

[85] PHMSA, "Pipeline Safety: Safety of Gas Transmission Pipelines," 76 *Federal Register* 5308, August 25, 2011, pp. 3086-53102.

[86] PHMSA, "Pipeline Safety: Safety of Gas Transmission and Gathering Pipelines," pp. 20722-20856.

[87] PHMSA, "Pipeline Safety: Safety of Gas Gathering Pipelines: Extension of Reporting Requirements, Regulation of Large, High-Pressure Lines, and Other Related Amendments," 86 *Federal Register* 217, November 15, 2021, pp. 63266-63299.

[88] 86 *Federal Register* 217, p. 63268.

[89] PHMSA, "New Federal Regulations Add More Than 400,000 Miles of 'Gas Gathering' Pipelines Under Federal Oversight," press release, November 15, 2021.

[90] 86 *Federal Register* 217, p. 63268.

[91] 86 *Federal Register* 217, p. 63292.

Pipeline stakeholder representatives participated in PHMSA's gathering line rulemaking process both as members of technical panels and as commenters on the proposed rule. While stakeholders reached a consensus on many provisions in PHMSA's final rule, some remain the subject of disagreement. In December 2021, two pipeline trade associations filed with PHMSA to stay enforcement and reconsider a number of specific requirements due to disagreement with the agency's risk assessment and cost-benefit determination, arguing that PHMSA is imposing excessive and unnecessary burdens on operators.[92] Conversely, pipeline safety advocates support implementing the agency's final rule "unhindered," citing the perceived "progress" in gathering line safety and concerns about industry's potentially negative influence on PHMSA's safety regulation.[93]

As PHMSA's final gathering line rule is implemented, potential changes to the rule, legal challenges, and compliance among operators may be oversight issues for Congress in the near term. The effects of the final rule on overall safety in the pipeline sector over time may also be an important consideration if Congress considers future gathering line legislation.

PHMSA Regulation of Methane Emissions

The Environmental Protection Agency's Greenhouse Gas Inventory lists "natural gas systems" as among the highest U.S. emissions sources of atmospheric methane, a potent GHG.[94] Within this category, studies have identified pipeline emissions—arising from leaks, maintenance blowdowns, accidents, and other releases—as a major source of fugitive methane.[95] Given national goals to reduce GHG emissions in an effort to limit climate change, some in Congress have long called for tighter regulation of pipeline methane releases to reduce the sector's GHG contribution.[96] Reflecting these views, the PIPES Act (§113) mandates that PHMSA promulgate regulations requiring natural gas pipeline operators "to conduct leak detection and repair programs … to meet the need for gas pipeline safety, as determined by the Secretary; and … *to protect the environment*" (emphasis added). The act similarly requires PHMSA to evaluate "protection of the environment" as a factor in its review of pipeline operators' inspection and maintenance plans (§114).

The inclusion by Congress of explicit language in the PIPES Act about protecting "the environment" is widely viewed as expanding PHMSA's traditional safety mission to include climate considerations. As PHMSA's acting administrator has stated, "we need to do all we can to prevent climate change and reducing leaks which contribute to methane emission is a critical part of that."[97] The Biden Administration has likewise cited the PIPES Act provisions as elements of a

[92] GPA Midstream Association and American Petroleum Institute, Petition for Reconsideration of Final Rule, "Safety of Gas Gathering Pipelines: Extension of Reporting Requirements, Regulation of Large, High-Pressure Lines, and Other Related Amendments," Docket No. PHMSA-2011-0023, December 20, 2021.

[93] Pipeline Safety Trust, "Pipeline Safety Trust Denounces Petition from API and GPA Midstream to Remove Important Safety Measures," press release, December 15, 2021.

[94] Environmental Protection Agency, "Data Highlights, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019," 430-F-21-010, p. 2.

[95] See, for example: Zachary D. Weller, Steven P. Hamburg, and Joseph C. von Fischer, "A National Estimate of Methane Leakage from Pipeline Mains in Natural Gas Local Distribution Systems," *Environmental Science and Technology*, vol. 54, no. 14 (2020), pp. 8958-8967.

[96] See for, example: House Select Committee on the Climate Crisis, June 2020, pp. 200-201; Office of Senator Edward Markey, "Markey: When We Fix Leaky Natural Gas Pipelines, We Can Save Lives and Money, Create Jobs," press release, May 6, 2015.

[97] Tristan Brown, PHMSA Acting Administrator, "Remarks of PHMSA Acting Administrator Tristan Brown Before the AOPL-API Fall Meeting," October 14, 2021, https://www.phmsa.dot.gov/news/remarks-phmsa-acting-

national strategy to "to tackle super-polluting methane emissions—a major contributor to climate change."[98]

The provisions in the PIPES Act (§114) are self-executing, applying directly to pipeline operators. PHMSA published an advisory bulletin in the *Federal Register* in June 2021 reminding pipeline operators to update their inspection and maintenance plans by the statutory deadline of December 27, 2021.[99] The agency is in the process of drafting a NPRM for new pipeline leak detection and repair regulations in compliance with Section 113. PHMSA conducted virtual public meetings in May 2021 to gather stakeholder perspectives on the proposed rule and expects to publish its NPRM in the *Federal Register* by July 29, 2022.[100]

Given PHMSA's mandate to incorporate new environmental considerations, its Section 114 enforcement and Section 113 rulemaking are of great interest among industry and environmental stakeholders as well as in Congress.[101] As PHMSA implements the expanded environmental protection provisions in the PIPES Act, Congress may examine how the agency quantifies the costs and benefits of climate-related regulatory requirements, potential impacts to pipeline operations, how new information on methane leaks can inform future regulation, and how new technologies could improve leak identification and mitigation.

PHMSA and Pipeline Security

Ongoing physical and cyber threats against the nation's pipelines have heightened concerns about pipeline security risks. In a December 2018 study, GAO stated that, since the terrorist attacks of September 11, 2001, "new threats to the nation's pipeline systems have evolved to include sabotage by environmental activists and cyber attack or intrusion by nations."[102] The 2021 ransomware attack on the Colonial Pipeline Company brought pipeline security to the fore. Recent oversight of federal pipeline security activities has included discussion of PHMSA's role in pipeline security.

In October 2021, the PHMSA acting administrator stated that the agency's security role "includes coordination efforts with [TSA] and other federal agencies to ensure there is a collaborative and efficient approach to monitoring, inspecting, and promulgating regulations related to cybersecurity in the pipeline industry."[103] While PHMSA reports cooperation with TSA in pipeline security under the terms of the pipeline security annex and subsequent collaboration, questions may remain regarding exactly what this cooperation entails and the ongoing roles of the

administrator-tristan-brown-aopl-api-fall-meeting.

[98] The White House, "Biden Administration Tackles Super-Polluting Methane Emissions," January 31, 2022.

[99] PHMSA, "Pipeline Safety: Statutory Mandate to Update Inspection and Maintenance Plans to Address Eliminating Hazardous Leaks and Minimizing Releases of Natural Gas From Pipeline Facilities," 86 *Federal Register* 110, June 10, 2021, pp. 31002-31003.

[100] PHMSA, "PIPES Act Web Chart," January 27, 2022, https://www.phmsa.dot.gov/legislative-mandates/pipes-act-web-chart.

[101] See, for example: Sen. Cory Booker et al., letter to The Honorable Pete Buttigieg, Secretary, U.S. Department of Transportation, October 29, 2021, https://www.booker.senate.gov/imo/media/doc/booker_colleagues_urge_dot_to_implement_regulations_to_detect_and_reduce_methane_leaks.pdf. "We request that PHMSA act quickly to issue robust implementing regulations for the deployment of advanced methane leak detection technology, which will both improve safety and address the potent greenhouse gas emissions associated with methane leaks in natural gas pipelines and gathering lines, as called for under the Protecting Our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act of 2020."

[102] GAO, *Critical Infrastructure Protection: Actions Needed to Address Significant Weaknesses in TSA's Pipeline Security Program Management*, p. 1.

[103] Tristan Brown, October 14, 2021.

two agencies. Some in Congress have proposed changes to the overall federal regulatory structure overseeing pipeline security and incident response. For example, the Pipeline and LNG Facility Cybersecurity Preparedness Act (H.R. 3078) would require the Secretary of Energy to enhance coordination among "appropriate Federal agencies," state government agencies, and the energy sector in pipeline security; coordinate incident response and recovery; support the development of pipeline cybersecurity applications, technologies, demonstration projects, and training curricula; and provide technical tools for pipeline security. What role PHMSA might play in any future pipeline security initiatives, and what resources it might require to perform that role, may be a consideration for Congress.

Conclusion

Both government and industry have taken numerous steps to improve pipeline safety over the past 10 years. Nonetheless, major oil and natural gas pipeline accidents and security incidents continue to occur. Both Congress and the NTSB have called for additional regulatory measures to reduce the likelihood of future pipeline failures. Recent PHMSA reauthorizations have included expansive pipeline safety mandates, such as requirements for the agency to regulate underground natural gas storage, significantly increase inspector staffing, and account for the climate impacts of methane leaks. Congress may consider new regulatory mandates on PHMSA or may impose new requirements directly on the pipeline industry. However, a number of significant changes to pipeline safety regulation are being implemented, and certain rulemakings and NTSB recommendations remain outstanding, so their effects on pipeline safety have yet to be determined. As Congress continues its oversight of the federal pipeline safety program, an important focus may be the practical effects of the many changes being made to particular aspects of PHMSA's pipeline safety regulations.

In addition to the specific issues highlighted in this report, Congress may assess how the many elements of U.S. pipeline safety activity fit together in the nation's overall strategy to protect the public and the environment. Pipeline safety necessarily involves various groups: federal and state agencies, tribal governments, pipeline associations, large and small pipeline operators, local communities, and other interest groups. Reviewing how these groups work together to achieve common goals or resolve conflicting approaches could be an overarching concern for Congress.

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