Testimony of

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Member
National Transportation Safety Board

Before the

Committee on Transportation and Infrastructure
Subcommittee on Railroads, Pipelines, and Hazardous Materials
United States House of Representatives

— On —

Pipeline Safety: Reviewing the Unmet Mandates and Examining Additional Safety Needs

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Good morning Chairman Lipinski, Ranking Member Crawford, and Members of the Subcommittee. Thank you for inviting the National Transportation Safety Board (NTSB) to testify today.

The NTSB is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents and incidents in other modes of transportation—railroad, highway, marine and pipeline. We determine the probable cause of accidents and other transportation events and issue safety recommendations aimed at preventing future accidents. In addition, we conduct special transportation safety studies and coordinate the resources of the federal government and other organizations to assist victims and their family members who have been impacted by major transportation disasters.

Our Office of Railroad, Pipeline and Hazardous Materials Investigations investigates pipeline accidents involving the release of natural gas, hydrocarbon liquid, ammonia, or carbon dioxide in which there are fatalities or substantial property damage. Pipeline accident investigations focus on the cause of the release, the emergency response, and in the case of hydrocarbon pipelines, the actions taken to mitigate the spill. Based on these accident investigations, the NTSB issues safety recommendations to federal and state regulatory agencies, industry and safety standards organizations, pipeline operators, and emergency response organizations.

Pipeline Safety in the United States

More than 2.5 million miles of pipelines that crisscross the nation, delivering important resources, such as natural gas, oil, and other hazardous liquids, to consumers. Pipelines are integral to our economy, providing the fuel that powers our homes and industries.[1]

Pipelines are one of the safest and most efficient modes of transportation, but when their integrity is compromised, the consequences can be devastating, especially when safety standards are not observed or implemented.

The NTSB has completed more than 120 investigations of hazardous liquid pipeline ruptures and natural gas pipeline explosions, since 1967, which have demonstrated the potential for loss of life and property damage. Additionally, NTSB has eight open pipeline investigations, including Merrimack Valley, Massachusetts, Silver Spring, Maryland, and Dallas, Texas, in which lives were lost, homes destroyed, and communities severely affected.[2]

In response to these accident investigations, the NTSB has issued more than 1,300 recommendations to federal, state, and local agencies, and industry. More than 80 percent of these recommendations have been closed favorably, meaning they have been adopted by their recipients, mandated by Congress, or implemented through federal agency action, resulting in significant improvements in pipeline safety.

[1] National Transportation Safety Board, *2019–2020 Most Wanted List*: Ensure the Safe Shipment of Hazardous Materials – Pipeline.
[2] See Appendix for all open pipeline investigations.

For example, in 1998, the NTSB investigated a natural gas pipeline explosion and fire in the South Riding community of Loudon County, Virginia. A family consisting of a husband and wife and their two children were spending their first night in their new home at the time of the explosion. As a result of the accident, the wife was killed, the husband was seriously injured, and the two children received minor injuries. The NTSB found that had an excess flow valve been installed on the line, the accident would never have occurred. Excess flow valves automatically close and restrict gas flow when there is an excess flow of gas in the pipeline. The NTSB had been recommending the installation of excess flow valves for nearly 30 years. In 2006, Congress enacted the *Pipeline Inspection, Enforcement, and Protection Act* which required the installation of excess flow valves on all new and replaced single-family residential service lines.[3] In 2012, Congress enacted the *Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011* which expanded that requirement to multi-family residences – including apartment buildings – and small commercial facilities.[4] I am proud to say that the NTSB closed the South Riding recommendation on December 5, 2016, following issuance of a final rule.

However, there are provisions in current law related to NTSB pipeline safety recommendations that have not been implemented, such as automatic or remote-control shutoff valves, and other recommendations that have not been acted upon. We continue to see accidents and incidents that remind us of the need to be ever-vigilant in improving safety.

Merrimack Valley, Massachusetts

On September 13, 2018, a series of explosions and fires occurred throughout the northeast region of the Merrimack Valley after high-pressure natural gas was released into a low-pressure distribution system, resulting in 1 fatality and injuring at least 21 individuals, including 2 firefighters. Seven other firefighters received minor injuries. The distribution system was owned and operated by Columbia Gas of Massachusetts, a subsidiary of NiSource, Inc. The system overpressure damaged 131 structures, including at least 5 homes that were destroyed in the city of Lawrence and the towns of Andover and North Andover. Most of the damage was a result of structure fires ignited by gas-fueled appliances.

While this investigation is ongoing, NTSB has issued five interim safety recommendations, including four which are classified as "urgent." We only issue urgent recommendations when we determine that the course of action requires immediate attention to avoid imminent loss due to a similar accident.

One recommendation calls upon the Commonwealth of Massachusetts to eliminate the existing professional licensure exemptions and require the seal of a professional engineer (PE) on all public utility engineering drawings.[5] The NTSB believes that it is critical that an engineer with appropriate qualifications and experience review engineering plans for a gas company, if not develop them. Massachusetts' exemption for the requirement of PE licensure to perform "industrial" and public utility work forecloses an opportunity to detect this design oversight. The

[3] Public Law 109-468
[4] Public Law 112-90
[5] National Transportation Safety Board, Safety Recommendation P-18-005.

seal of a PE should be required on all public utility engineering plans to reduce the likelihood of an accident. On December 31, 2018, Gov. Charlie Baker signed into law legislation requiring such; the Massachusetts Department of Public Utility is in the process of promulgating regulations.[6]

The four urgent safety recommendations were issued to NiSource: (1) revise the engineering and constructability review process to include all internal departments and require plans to be sealed by a PE prior to construction; (2) ensure that all natural gas systems records are complete and readily available; (3) incorporate risk assessments into project development; and, (4) while any modifications are being made to gas mains, actively monitor pressures and require personnel to be in place to immediately respond to any abnormal changes in the pipeline system. As this investigation progresses or following the Board's adoption of the final report, the NTSB may issue additional safety recommendations to improve pipeline safety and prevent occurrence of a similar tragedy.[7]

Most Wanted List of Transportation Safety Improvements

On February 4, 2019, we announced our Most Wanted List of Transportation Safety Improvements for 2019–2020.[8] This list identifies 10 focus areas for transportation safety improvements based on safety issues identified through our investigations. Many of the issues on the Most Wanted List address multimodal challenges for improving safety, including alcohol and other drug impairment and fatigue. One issue area is specific to pipeline safety: Ensuring the Safe Shipment of Hazardous Materials.

There are currently 36 open pipeline safety recommendations, 32 of which are on our Most Wanted List: 24 to the Pipeline and Hazardous Material Safety Administration (PHMSA), 9 to industry, and 3 to state regulators.[9] Three of the Most Wanted recommendations to PHMSA are designated as "Open – Unacceptable Response." While the NTSB appreciates progress made by PHMSA on many of our recommendations, they cannot lose focus and must see all safety recommendations through to completion.

Automatic Shutoff and Remote Control Valves

One significant NTSB recommendation urges the use of automatic shutoff or remote control valves in high consequence areas (HCAs) based on an investigation in San Bruno, California.[10]

On September 9, 2010, a 30-inch-diameter segment of an intrastate natural gas transmission pipeline owned and operated by the Pacific Gas and Electric Company (PG&E)

[6] An Act Further Providing for the Safety of the Commonwealth's Natural Gas Infrastructure. Mass. Gen. Laws ch. 339 (2018).
[7] National Transportation Safety Board, Safety Recommendations: P-18-006, P-18-007, P-18-008, P-18-009.
[8] National Transportation Safety Board, *2019–2020 Most Wanted List*.
[9] See Appendix for all open pipeline safety recommendations.
[10] HCAs are defined by federal regulation and are areas where a release could have the most significant adverse consequences, including populated areas, areas with a number of structures, drinking water sources, and unusually sensitive areas.

ruptured in a residential area in San Bruno. In the 95 minutes it took PG&E to stop the flow of natural gas, an estimated 47.6 million standard cubic feet of gas was released. The released natural gas ignited, resulting in a fire that destroyed 38 homes and damaged 70. Eight people were killed, many were injured, and many more were evacuated from the area.

The NTSB found that the 95 minutes it took PG&E to stop the flow of gas was excessively long and contributed to the extent and severity of property damage and increased the life-threatening risks to the residents and emergency responders. Use of automatic shutoff or remote control valves would have significantly reduced the amount of time taken to stop the flow of gas and to isolate the rupture.

The NTSB recommended that PHMSA amend Title 49 Code of Federal Regulations 192.935(c) to directly require that automatic shutoff or remote control valves in high consequence areas and in class 3 and 4 locations be installed and spaced at intervals that consider the factors listed in that regulation.[11] Current PHMSA regulations leave the decision of whether to install an automatic shutoff or remote control valve up to operators, based on their evaluation of certain factors. The NTSB believes the requirement should be mandatory.

This was not the first time that the NTSB recommended the installation of automatic shutoff or remote control valves. Several near identical recommendations were issued in the 1980s, 1990s, and early 2000s to the Office of Pipeline Safety of the Department of Transportation and the Research and Special Programs Administration, the predecessors of PHMSA, and the industry that were closed and designated as "Unacceptable Action" because of their failure to implement the recommendation.

Three months after NTSB issued its San Bruno recommendations, Congress passed the *Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011* (2011 Act) requiring the use of automatic shutoff or remote control valves within two years. PHMSA has initiated but not completed the rulemaking process. PHMSA's last communication with NTSB stated: "Publication of the proposed rule was initially expected to publish in spring 2017. Like many other issues before us, this is part of an ongoing regulatory review pursuant to the executive order issued by the President."

There are additional open recommendations from the San Bruno investigation to PHMSA that Congress addressed in the 2011 Act, including requirement (1) all operators of natural gas transmission and distribution pipelines equip their systems with tools to identify and pinpoint the location of leaks; (2) all gas transmission pipelines constructed before 1970 be subjected to a hydrostatic pressure testing; and (3) any manufacturing- and construction-related defects be tested by a postconstruction hydrostatic pressure test of at least 1.25 times the maximum allowable operating pressure.[12] These recommendations remain on the NTSB's Most Wanted List of Transportation Safety Improvements and should be implemented by PHMSA expeditiously.

[11] National Transportation Safety Board, Safety Recommendations: P-11-011
[12] National Transportation Safety Board, Safety Recommendations: P-11-010, P-11-014, P-11-015.

Leak Detection

The NTSB has investigated a number of accidents where operators failed to detect a leak, significantly impacting response time. In San Bruno, control center staff had difficulties determining that there had been a pipeline break and quickly pinpointing its location. Accordingly, the NTSB recommended that PHMSA require that all operators of natural gas transmission and distribution pipelines equip their supervisory control and data acquisition systems with tools to assist in recognizing and pinpointing the location of leaks, including line breaks. The recommendation remains on the NTSB's 2019-2020 Most Wanted List of Transportation Safety Improvements.

The NTSB's investigation of one of the largest inland oil spill in U.S. history found deficiencies in the operator's detection of a leak which led to significant delays in stopping the flow of crude oil. On July 25, 2010, a segment of a 30-inch-diameter pipeline, owned and operated by Enbridge Incorporated (Enbridge) ruptured in a wetland in Marshall, Michigan. The rupture was not discovered or addressed until Enbridge was notified by an outside caller more than 17 hours later. The oil saturated the surrounding wetlands and flowed into the Talmadge Creek and the Kalamazoo River; the total release was estimated to be 843,444 gallons of crude oil. Local residents self-evacuated from their houses, and the environment was negatively affected. Costs exceeded $1.2 billion. About 320 people reported symptoms consistent with crude oil exposure. Fortunately, there were no fatalities.

Similarly, the NTSB's investigation of a pipeline release near Centerville, Virginia, on September 21, 2015, found significant deficiencies in the ability of Colonial Pipeline Company (Colonial) to detect a leak in their large diameter pipeline that transports gasoline and other refined petroleum liquids. The incident was initially reported by an employee of a restaurant in Centerville who called the Fairfax County 911 Center to report a gasoline odor. Colonial confirmed the pipeline leak two days later, after their inspectors and control room center personnel reported that there were no abnormalities on the pipeline and that all line pressures were normal.

The leak occurred in an HCA. Fortunately, no fatalities or injuries resulted from the release. Colonial estimated that 4,000 gallons of gasoline were released from the pipe; flammable vapor in storm drains was as high as 100 percent of the lower explosive limit (potentially explosive in an ignition source is present).

The *Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011* included measures to improve leak detection capabilities; PHMSA has not yet implemented those measures. Leak detection remains on the NTSB's Most Wanted List for Transportation Safety Improvements. The NTSB recommendation stemming from the Colonial Pipeline incident is designated as "Open – Unacceptable Response."[13]

[13] National Transportation Safety Board, Safety Recommendation P-17-002.

Integrity Management Programs

In the last eight years, the NTSB has completed three major gas transmission pipeline accident investigations in which deficiencies with the operators' integrity management (IM) programs and PHMSA oversight were identified as a concern.[14] These three accidents—located in Palm City, Florida; San Bruno, California; and Sissonville, West Virginia—resulted in 8 fatalities, more than 50 injuries, and 41 homes destroyed, with many more damaged. As we have learned from these investigations, ensuring adequate IM programs and oversight of pipelines transporting natural gas and hazardous liquids remains critically important.

Since 2004, PHMSA has required the operators of these pipelines to develop and implement IM programs to ensure the integrity of their pipelines in HCAs to reduce the risk of injuries and property damage from pipeline failures.[15] An operator's IM program is a management system designed and implemented to ensure the operator's pipeline system is safe and reliable. It consists of multiple components, including procedures and processes for identifying HCAs, determining likely threats to the pipeline within the HCA, evaluating the physical integrity of the pipe within the HCA, and repairing or remediating any pipeline defects found. These procedures and processes are complex and interconnected. Effective implementation of an IM program relies on continual evaluation and data integration. The IM program is an ongoing program that PHMSA and state regulatory agencies periodically inspect to ensure operator compliance with regulatory requirements.

In January 2015, the NTSB's Safety Research Division conducted a safety study using the results from the completed investigations and additional research to identify weaknesses in the implementation of gas transmission pipeline IM programs in HCAs. The study, *Integrity Management of Gas Transmission Pipelines in High Consequence Areas*, found that, although PHMSA's gas IM requirements have kept the rate of corrosion failures and material failures of pipe or welds low, no evidence exists to show that the overall occurrence of gas transmission pipeline incidents in HCA pipelines has declined.[16] Rather, the study identified areas where improvements need to be made to further enhance the safety of gas transmission pipelines in HCAs.

We recognize that IM programs are complex and require expert knowledge and integration of multiple technical disciplines including engineering, material science, geographic information systems, data management, probability and statistics, and risk management. This complexity requires pipeline operator personnel and federal and state pipeline inspectors to have a high level of practical knowledge and skill to adequately perform their functions. This

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[14] National Transportation Safety Board, *Columbia Gas Transmission Corporation Pipeline Rupture Sissonville, West Virginia on December 11, 2012*, Rpt. No. NTSB/PAR-14/01 (February 19, 2014); *Rupture of Florida Gas Transmission Pipeline and Release of Natural Gas Near Palm City, Florida*, Accident Brief No. NTSB/PAB-13/01 (August 13, 2013); *Pacific Gas and Electric Company Natural Gas Transmission Pipeline Rupture and Fire San Bruno, California on September 9, 2010*, Rpt. No. NTSB/PAR-11/01 (August 30, 2011).

[15] Title 49 *Code of Federal Regulations* (CFR) Part 192, Subpart O.

[16] National Transportation Safety Board, *Integrity Management of Gas Transmission Pipelines in High Consequence Areas*, No. NTSB/SS-15/01 (January 27, 2015).

complexity can make IM program development and implementation, and the evaluation of operators' compliance with IM program requirements, difficult. The study illustrated the need to expand and improve PHMSA resources in guiding both operators and federal and state inspectors.

The effectiveness of an IM program depends on many factors, including how well threats are identified and risks are estimated. This information guides the selection of integrity assessment methods that discover pipeline system defects that may need remediation. The study found that aspects of the operators' threat identification and risk assessment processes require improvement. Further, the study found that of the four different integrity assessment methods (pressure test, direct assessment, in-line inspection, and other techniques), in-line inspection yields the highest per-mile discovery of pipe anomalies, and the use of direct assessment as the sole integrity assessment method has numerous limitations. Compared to their interstate counterparts, intrastate pipeline operators rely more on direct assessment and less on in-line inspection.

As a result of the safety study, the NTSB issued 28 new recommendations. Of these, 22 were issued to PHMSA and 1 previous recommendation issued to PHMSA was reiterated.[17] These include improvements to the training of state inspectors, the National Pipeline Mapping System, and the current process for identifying HCAs; requirements for in-line inspection of natural gas pipelines; and, eliminating the use of direct assessment as the sole integrity assessment method for gas transmission pipelines.

Nine of the recommendations to PHMSA resulting from the safety study are classified as closed with an acceptable action or reconsidered. The remaining 13 are open; 10 of them are listed on the NTSB's Most Wanted List of Transportation Safety Improvements. The remaining six recommendations, issued to industry, are all classified as "Closed – Acceptable Action."

"Open – Unacceptable Response" Recommendations to PHMSA

The NTSB would like to highlight three recommendations to PHMSA stemming from our investigations in Marshall, Michigan, Sissonville, West Virginia, and Centreville, Virginia that are designated as "Open – Unacceptable Response": P-12-3, P-14-1, and P-17-2. All three of these recommendations are included in the NTSB's Most Wanted List of Transportation Safety Improvements.

P-12-3 recommended PHMSA revise existing federal regulations to clearly state: (1) when an engineering assessment of crack defects, including environmentally assisted cracks, must be performed; (2) the acceptable methods for performing these engineering assessments, including the assessment of cracks coinciding with corrosion with a safety factor that considers the uncertainties associated with sizing of crack defects; (3) criteria for determining when a probable crack defect in a pipeline segment must be excavated and time limits for completing those excavations; (4) pressure restriction limits for crack defects that are not excavated by the required date; and (5) acceptable methods for determining crack growth for any cracks allowed

[17] National Transportation Safety Board, Safety Recommendations: P-15-001 through -028, and P-11-007.

to remain in the pipe, including growth caused by fatigue, corrosion fatigue, or stress corrosion cracking as applicable.[18]

This recommendation was issued following an investigation of the Enbridge pipeline rupture in Marshall, Michigan, which found, that five years prior to the rupture, in 2005, Enbridge identified crack defects during an in-line inspection of the pipeline ranging up to 51.6 inches that were left unrepaired.

While PHMSA published a notice of proposed rulemaking (NPRM) in October 2015 to address our recommendation, the changes proposed to requirements for scheduling crack defect remediation only addressed indications of significant stress corrosion cracking (SCC). We reiterated that the recommendation refers to all forms of crack defects, not just SCC. By only addressing crack indications identified as SCC colonies, the proposed regulation does not limit or otherwise describe requirements for remediating other types of crack indications, including the indication associated with the crack that led to the rupture in Marshall, Michigan.

P-14-1 recommended PHMSA revise existing federal regulations to add principal arterial roadways to the list of "identified sites" that establish an HCA.[19]

This recommendation was issued following an investigation into an explosion and subsequent fire from a 20-inch natural gas transmission pipeline in a sparsely populated area along Interstate 77 near Sissonville, West Virginia on December 11, 2012. About 76 million cubic feet of natural gas was released and burned. While there were no fatalities or serious injuries, three homes were destroyed. The Board determined the probable cause of the pipeline rupture was (1) external corrosion of the pipe wall due to deteriorated coating and ineffective cathodic protection and (2) the failure to detect the corrosion because the pipeline was not inspected or tested after 1988.

While PHMSA published an NPRM in April 2016 proposing an alternate approach by creating a "moderate consequence area (MCA)" that included a highway-size threshold. We disagreed with this proposal because it limited highway coverage to only four-lane configurations, which would exclude principal arterial roadways wider than four lanes. Although wider divided highways most likely coincide with the existing HCA criteria, we are concerned that some wider highways may not. While PHMSA has stated they are considering revising the definition, no formal action has been completed.

P-17-2 recommended PHMSA require operators to either (a) repair all excavated dent defects, or (b) install a local leak detection system at each location where a dent is not repaired, continuously monitor for hydrocarbons, and promptly take corrective action to stop a detected leak.[20]

This recommendation was issued following the NTSB's investigation into a release of the 2015 Colonial Pipeline release of about 4,000 gallons of gasoline in an HCA near Centerville,

[18] National Transportation Safety Board, Safety Recommendation P-12-003.
[19] National Transportation Safety Board, Safety Recommendation P-14-001.
[20] National Transportation Safety Board, Safety Recommendation P-17-002.

Virginia. As stated earlier, the leak was not identified by the pipeline operator, Colonial Pipeline Company, for two days after initial report of gasoline odor. The Board determined the probable cause of the release of gasoline from the pipeline was a through-wall corrosion fatigue crack that developed at a dent in the pipeline due to residual and operational stress and exposure to the underground environment. Contributing to the accident were PHMSA regulations that allowed the dent to remain in the pipeline.

PHMSA regulations do not specifically require dents having depths less than six percent of the pipeline diameter to be repaired unless there is an indication of metal loss, cracking, or a stress riser, or unless the dent affects pipe curvature at a girth weld or a longitudinal seam weld. The dent at the leak location was about 1.6 percent of the outer pipe diameter and the upstream dent was 1.57 percent of the outer pipe diameter. Colonial did not repair either dent because they did not meet PHMSA's repair criteria. During the investigation, Colonial reported to the NTSB that pipelines in Pelham, Alabama, Felixville, Louisiana, and Simpsonville, South Carolina also developed through wall-cracks in dented pipe. The depths of these dents were less than two percent of the pipe outer diameter.

The NTSB recommended that PHMSA require operators to either (a) repair all excavated dent defects, or (b) install a local leak detection system at each location where a dent is not repaired, continuously monitor for hydrocarbons, and promptly take corrective action to stop a detected leak. The recommendation remains "Open – Unacceptable Response."

PHMSA has communicated that compliance with current regulations, improved operator guidance, focused inspections, and an advisory bulletin would address the safety risks of dent defects and would be more cost- and safety-efficient than requiring leak-detection systems. However, existing regulations, guidance, and bulletins are inadequate. Pipeline operators should be required to act on all excavated dent defects, but PHMSA proposed wording gives pipeline operators a choice about whether and how to act on defects. Installing a leak-detection system at each location where a dent is not repaired should be the pipeline operators' only alternative when not repairing an excavated dent defect.

Conclusion

Over the last 52 years, our investigations have found that safe operation of pipelines is a shared responsibility among operators, government oversight agencies, and local communities.

Pipelines remain one of the safest and most efficient means of transporting vital commodities used to power homes, businesses, and vehicles in all modes of transportation. However, the consequences are tragic when there is insufficient safety planning and oversight. To that end, the NTSB urges expeditious implementation of all unimplemented safety recommendations issued to operators and government agencies – especially PHMSA.

We recognize the progress that has been made; yet, there will always be room for improvement. The NTSB stands ready to work with the Subcommittee to continue improving the safety of our nation's pipeline systems.

Thank you again for the opportunity to testify today. I am happy to answer your questions.

Current Investigations

Silver Spring, Maryland

On August 10, 2016, a Washington Gas natural gas pipeline ruptured, exploded, and destroyed a four-story apartment building in Silver Spring, Maryland, resulting in seven fatalities and injuries to 65 civilians and three emergency responders. Our investigation is ongoing and is looking into operations, survival factors, and regulatory oversight. The Board is scheduled to meet on April 23 to determine the probable cause of the rupture and explosion and issue any recommendations we believe will improve safety and prevent future tragedies, fatalities, and injuries.

Tekamah, Nebraska

On October 17, 2016, a Magellan pipeline ruptured and released 7,000 barrels of anhydrous ammonia, resulting in one fatality and evacuation of the area.

Helena, Alabama

On October 31, 2016, a Colonial Pipeline gas pipeline ruptured and caused a fire after being struck by a track hoe during maintenance operations, resulting in one fatality and four injuries.

Firestone, Colorado

On April 17, 2017, a house exploded, resulting in two fatalities and two injuries. The uncapped end of an abandoned but still connected flow line from a natural gas well owned and operated by Anadarko Petroleum Company was discovered near the home's foundation.

Minneapolis, Minnesota

On August 2, 2017, a building at the Minnehaha Academy North Campus was destroyed by a natural gas explosion, resulting in two fatalities and nine injuries. At the time of the explosion, two workers were installing new piping to support the relocation of gas meters from the basement of the building to the outside. Two new meters mounted on a wall were ready for the new piping to be connected. While workers were removing the existing piping, a full-flow natural gas line at pressure was opened. The workers were unable to mitigate the release of the gas and evacuated the area.

A school maintenance worker heard and smelled the natural gas release and went to its source in the basement meter room where the workers had been. As he exited the basement, he made an announcement over his hand-held radio that there was gas in the building and to evacuate immediately. As he made his radio announcement, he ran up the stairs and searched for occupants. Less than one minute later, the building exploded.

Dallas, Texas

On February 23, 2018, a house exploded, resulting in the death of a 12-year-old juvenile and injuries to four family members, all of whom were asleep at the time of the explosion. In the 48 hours prior to the explosion, work crews from Atmos Energy were in the neighborhood investigating gas-related fires and two residences. More than 300 residences were subsequently evacuated due to the nature and number of natural gas pipeline leaks discovered in the residential neighborhood.

Merrimack Valley, Massachusetts

On September 13, 2018, a series of explosions and fires occurred throughout the northeast region of the Merrimack Valley after high-pressure natural gas was released into a low-pressure distribution system, resulting in one fatality and injuring at least 21 individuals, including two firefighters. Seven other firefighters received minor injuries. The distribution system was owned and operated by Columbia Gas of Massachusetts, a subsidiary of NiSource, Inc. The system overpressure damaged 131 structures, including at least five homes that were destroyed in the city of Lawrence and the towns of Andover and North Andover. Most of the damage was a result of structure fires ignited by gas-fueled appliances.

San Francisco, California

On February 6, a Pacific Gas & Electric Corporation (PG&E) natural gas pipeline ruptured and caused a fire after being struck by a third-party contractor's excavation equipment, while installing fiberoptic conduit. Fortunately, there were no injuries or fatalities; however, the natural gas service to 328 customers was curtailed temporarily, and about 100 people were evacuated. The NTSB's investigative activity is focused on the third-party contractor's preparedness and qualifications to perform the excavation work and the execution of PG&E and local fire and police department emergency response plans. Investigators are also reviewing and assessing applicable rules and standards of oversight agencies for effectiveness.

All of these investigations are ongoing, and the NTSB has not determined the probable causes, issued findings, or drawn any conclusions.

Open Pipeline Recommendations (as of March 26th, 2019)

Number	Date Issued	Overall Status	Most Wanted List	Safety Recommendation
P-10-004	1/31/11	Open-Acceptable Response	✓	TO THE PACIFIC GAS AND ELECTRIC COMPANY: If you are unable to comply with Safety Recommendations P-10-2 (Urgent) and P-10-3 (Urgent) to accurately determine the maximum allowable operating pressure of Pacific Gas and Electric Company natural gas transmission lines in class 3 and class 4 locations and class 1 and class 2 high consequence areas that have not had a maximum allowable operating pressure established through prior hydrostatic testing, determine the maximum allowable operating pressure with a spike test followed by a hydrostatic pressure test.
P-10-006	1/31/11	Open-Acceptable Response	✓	TO THE CALIFORNIA PUBLIC UTILITIES COMMISSION: If such a document and records search cannot be satisfactorily completed, provide oversight to any spike and hydrostatic tests that Pacific Gas and Electric Company is required to perform according to Safety Recommendation (P-10-4).
P-11-009	9/26/11	Open-Acceptable Response		To PHMSA: Require operators of natural gas transmission and distribution pipelines and hazardous liquid pipelines to ensure that their control room operators immediately and directly notify the 911 emergency call center(s) for the communities and jurisdictions in which those pipelines are located when a possible rupture of any pipeline is indicated.
P-11-010	9/26/11	Open-Acceptable Response	✓	To PHMSA: Require that all operators of natural gas transmission and distribution pipelines equip their supervisory control and data acquisition systems with tools to assist in recognizing and pinpointing the location of leaks, including line breaks; such tools could include a real-time leak detection system and appropriately spaced flow and pressure transmitters along covered transmission lines.

P-11-011	9/26/11	Open-Acceptable Response	✓	To PHMSA: Amend Title 49 Code of Federal Regulations 192.935(c) to directly require that automatic shutoff valves or remote control valves in high consequence areas and in class 3 and 4 locations be installed and spaced at intervals that consider the factors listed in that regulation.
P-11-014	9/26/11	Open-Acceptable Response	✓	To PHMSA: Amend Title 49 Code of Federal Regulations 192.619 to delete the grandfather clause and require that all gas transmission pipelines constructed before 1970 be subjected to a hydrostatic pressure test that incorporates a spike test.
P-11-015	9/26/11	Open-Acceptable Response	✓	To PHMSA: Amend Title 49 Code of Federal Regulations Part 192 of the Federal pipeline safety regulations so that manufacturing- and construction-related defects can only be considered stable if a gas pipeline has been subjected to a postconstruction hydrostatic pressure test of at least 1.25 times the maximum allowable operating pressure.
P-11-023	9/26/11	Open-Acceptable Response	✓	TO THE CALIFORNIA PUBLIC UTILITIES COMMISSION: Require the Pacific Gas and Electric Company to correct all deficiencies identified as a result of the San Bruno, California, accident investigation, as well as any additional deficiencies identified through the comprehensive audit recommended in Safety Recommendation P-11-22, and verify that all corrective actions are completed.

P-12-003	7/25/12	Open-Unacceptable Response	✓	To PHMSA: Revise Title 49 Code of Federal Regulations 195.452 to clearly state (1) when an engineering assessment of crack defects, including environmentally assisted cracks, must be performed; (2) the acceptable methods for performing these engineering assessments, including the assessment of cracks coinciding with corrosion with a safety factor that considers the uncertainties associated with sizing of crack defects; (3) criteria for determining when a probable crack defect in a pipeline segment must be excavated and time limits for completing those excavations; (4) pressure restriction limits for crack defects that are not excavated by the required date; and (5) acceptable methods for determining crack growth for any cracks allowed to remain in the pipe, including growth caused by fatigue, corrosion fatigue, or stress corrosion cracking as applicable.
P-12-004	7/25/12	Open-Acceptable Response	✓	To PHMSA: Revise Title 49 Code of Federal Regulations 195.452(h)(2), the "discovery of condition," to require, in cases where a determination about pipeline threats has not been obtained within 180 days following the date of inspection, that pipeline operators notify the Pipeline and Hazardous Materials Safety Administration and provide an expected date when adequate information will become available.
P-14-001	3/5/14	Open-Unacceptable Response	✓	To PHMSA: Revise Title 49 Code of Federal Regulations Section 903, Subpart O, Gas Transmission Pipeline Integrity Management, to add principal arterial roadways including interstates, other freeways and expressways, and other principal arterial roadways as defined in the Federal Highway Administration's Highway Functional Classification Concepts, Criteria and Procedures to the list of "identified sites" that establish a high consequence area.
P-15-004	2/10/15	Open-Acceptable Response	✓	To PHMSA: Increase the positional accuracy of pipeline centerlines and pipeline attribute details relevant to safety in the National Pipeline Mapping System.

P-15-005	2/10/15	Open-Acceptable Response	✓	To PHMSA: Revise the submission requirement to include high consequence area identification as an attribute data element to the National Pipeline Mapping System.
P-15-010	2/10/15	Open-Acceptable Response	✓	To PHMSA: Update guidance for gas transmission pipeline operators and inspectors on the evaluation of interactive threats. This guidance should list all threat interactions that must be evaluated and acceptable methods to be used.
P-15-011	2/10/15	Open-Acceptable Response	✓	To PHMSA: Develop and implement specific risk assessment training for inspectors in verifying the technical validity of risk assessments that operators use.
P-15-012	2/10/15	Open-Acceptable Response		To PHMSA: Evaluate the safety benefits of the four risk assessment approaches currently allowed by the gas integrity management regulations; determine whether they produce a comparable safety benefit; and disseminate the results of your evaluation to the pipeline industry, inspectors, and the public.
P-15-013	2/10/15	Open-Acceptable Response	✓	To PHMSA: Update guidance for gas transmission pipeline operators and inspectors on critical components of risk assessment approaches. Include (1) methods for setting weighting factors, (2) factors that should be included in consequence of failure calculations, and (3) appropriate risk metrics and methods for aggregating risk along a pipeline.
P-15-015	2/10/15	Open-Acceptable Alternate Response		To PHMSA: Revise Form F7100.1, Annual Report Form, to collect information about which methods of high consequence area identification and risk assessment approaches were used.
P-15-016	2/10/15	Open-Acceptable Response		To PHMSA: Revise Form F7100.2, Incident Report Form, (1)to collect information about both the results of previous assessments and previously identified threats for each pipeline segment involved in an incident and (2) to allow for the inclusion of multiple root causes when multiple threats interacted.

P-15-017	2/10/15	Open-Acceptable Response	✓	To PHMSA: Develop a program to use the data collected in response to Safety Recommendations P-15-15 and P-15-16 to evaluate the relationship between incident occurrences and (1) inappropriate elimination of threats, (2) interactive threats, and (3) risk assessment approaches used by the gas transmission pipeline operators. Disseminate the results of your evaluation to the pipeline industry, inspectors, and the public annually.
P-15-018	2/10/15	Open-Acceptable Response	✓	To PHMSA: Require that all natural gas transmission pipelines be capable of being in-line inspected by either reconfiguring the pipeline to accommodate in line inspection tools or by the use of new technology that permits the inspection of previously uninspectable pipelines; priority should be given to the highest risk transmission pipelines that considers age, internal pressure, pipe diameter, and class location. (Safety Recommendation P-15-18 superseded Safety Recommendation P-11-17)
P-15-020	2/10/15	Open-Acceptable Response	✓	To PHMSA: Identify all operational complications that limit the use of in-line inspection tools in piggable pipelines, develop methods to eliminate the operational complications, and require operators to use these methods to increase the use of in-line inspection tools.
P-15-021	2/10/15	Open-Acceptable Response	✓	To PHMSA: Develop and implement a plan for eliminating the use of direct assessment as the sole integrity assessment method for gas transmission pipelines.
P-15-022	2/10/15	Open-Acceptable Response	✓	To PHMSA: Develop and implement a plan for all segments of the pipeline industry to improve data integration for integrity management through the use of geographic information systems.

P-15-034	6/29/15	Open-Acceptable Response	✓	TO CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.: Revise your plastic pipe fusion welding procedure to require cleaning of the surfaces to be welded with suitable solvents to remove all dirt, water, oil, paint, and other contaminants as recommended in ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
P-17-001	6/15/17	Open-Acceptable Response	✓	To PHMSA: Work with pipeline trade and standards organizations to modify the pipeline dent acceptance criteria to account for all the factors that lead to pipe failures caused by dents, and promulgate regulations to require the new criteria be incorporated into integrity management programs.
P-17-002	6/15/17	Open-Unacceptable Response	✓	To PHMSA: Require operators to either (a) repair all excavated dent defects, or (b) install a local leak detection system at each location where a dent is not repaired, continuously monitor for hydrocarbons, and promptly take corrective action to stop a detected leak.
P-17-003	6/15/17	Open-Await Response	✓	TO THE COLONIAL PIPELINE COMPANY: Revise the dent excavation evaluation procedure to require either (a) the repair of all excavated dent defects, or (b) the installation of a local leak detection system at each location where a dent is not repaired, continuous monitoring for hydrocarbons, and prompt corrective action to stop a detected leak.
P-17-004	6/15/17	Open-Response Received		TO THE ASSOCIATION OF OIL PIPE LINES AND THE AMERICAN PETROLEUM INSTITUTE: Communicate to your members the findings of this report on the susceptibility of dents to fatigue cracking even when the dent is acceptable under current criteria.

P-18-001	6/25/18	Open-Acceptable Response	✓	To PHMSA: Work with state pipeline regulators to incorporate into their inspection programs, a review to ensure that gas distribution pipeline operators are using best practices recommended by the manufacturer in their distribution integrity management programs, including using the specified tools and methods, to correctly install PermaLock mechanical tapping tee assemblies.
P-18-004	6/25/18	Open-Acceptable Alternate Response	✓	TO HONEYWELL: Specify in your PermaLock mechanical tapping tee assembly installation instructions a not-to-exceed torque limit for Nylon bolts and have that value checked and adjusted with a torque wrench immediately after installation.
P-18-005	11/15/18	Open-Await Response	✓	TO THE COMMONWEALTH OF MASSACHUSETTS: Eliminate the professional engineer licensure exemption for public utility work and require a professional engineer's seal on public utility engineering drawings.
P-18-006	11/15/18	Open-Acceptable Response	✓	TO NISOURCE: Revise the engineering plan and constructability review process across all of your subsidiaries to ensure that all applicable departments review construction documents for accuracy, completeness, and correctness, and that the documents or plans be sealed by a professional engineer prior to commencing work. (Urgent)
P-18-007	11/15/18	Open-Acceptable Response	✓	TO NISOURCE: Review and ensure that all records and documentation of your natural gas systems are traceable, reliable, and complete. (Urgent)
P-18-008	11/15/18	Open-Acceptable Response	✓	TO NISOURCE: Apply management of change process to all changes to adequately identify system threats that could result in a common mode failure. (Urgent)
P-18-009	11/15/18	Open-Acceptable Response	✓	TO NISOURCE: Develop and implement control procedures during modifications to gas mains to mitigate the risks identified during management of change operations. Gas main pressures should be continually monitored during these modifications and assets should be placed at critical locations to immediately shut down the system if abnormal operations are detected. (Urgent)