

NATIONAL TRANSPORTATION SAFETY BOARD
Virtual Meeting of January 12, 2021
(Information subject to editing)

Atmos Energy Corporation Natural Gas-Fueled Explosion
Dallas, Texas
February 23, 2018
NTSB/PAR-21/01

This is a synopsis from the NTSB's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

Executive Summary

On February 23, 2018, about 6:38 a.m. local time, a natural gas-fueled explosion occurred at 3534 Espanola Drive, Dallas, Texas, injuring all five occupants, one fatally. The one-story two-bedroom residence sustained major structural damage. Following the explosion, National Transportation Safety Board investigators located a through-wall crack in the 71-year-old natural gas main that served the residence and positive gas measurements leading from this crack to the residence.

In the 2 days before this explosion, two gas-related incidents occurred on the same block at houses that were served by the same natural gas main, each resulting in significant structural damage and burn injuries to one occupant. The first occurred on February 21, 2018, at 5:49 a.m., and resulted in one injury involving second-degree burns and significant structural damage to 3527 Durango Drive. The second incident occurred on February 22, 2018, at 10:21 a.m., and resulted in one injury involving second-degree burns and significant structural damage to 3515 Durango Drive.

The accident investigation focused on the following safety issues:

- **Incident investigation.** Neither the Dallas Fire-Rescue Department nor Atmos Energy Corporation identified the causes of the two incidents that occurred in the days immediately preceding the explosion. Dallas Fire-Rescue Department arson investigators and Atmos Energy Corporation technicians did not effectively investigate, communicate, or collaborate to determine the cause of either incident. Further, Atmos Energy Corporation did not gather enough evidence to determine if gas migrated from their piping and fueled the first two incidents.
- **Leak investigations and repairs.** Atmos Energy Corporation dedicated significant resources to its response following the second incident, finding 13 leaks determined to present an existing or probable future hazard. However, none of its employees questioned the integrity of the system. As a result, Atmos Energy Corporation did

not take appropriate action to secure the safety of the area and its residents. This was attributed, in part, to inadequate procedures for performing leak investigations in wet weather conditions.

- **Methane detection.** Although Atmos Energy Corporation added odorant to its gas distribution system in a manner consistent with Pipeline and Hazardous Materials Safety Administration regulations, none of the residents at any of the affected homes smelled gas. Although odorant can act as an early warning of a gas release to prevent an explosion and fire, it is known to become depleted if it travels through soil.
- **Incident reporting.** Incident reporting requirements mandated by the Pipeline and Hazardous Materials Safety Administration rely on the judgement of the operator to determine whether an incident resulted from a leak in their system and do not specify the level of investigation necessary to make the determination. While operators have an option to report events that may have been caused by their system, Atmos Energy Corporation relied on an incomplete investigation to support its position not to report the first two incidents.
- **Integrity management.** Although Atmos Energy Corporation's integrity management program was generally consistent with regulatory requirements and industry practice, the program did not adequately evaluate and address the risk of its 71-year-old system. This failure to adequately address risk was illustrated by the 26 leaks determined to present an existing or probable future hazard in the area around the explosion, as well as the additional 740 leaks found in northwest Dallas in the weeks that followed.

Findings

1. None of the following were factors in the explosion: (1) ongoing maintenance activities; (2) overpressurization of the gas distribution system; (3) materials used for the construction of the gas main and external coating; and (4) natural gas composition.
2. The natural gas main was damaged by mechanical excavation equipment, likely when the sanitary sewer lateral was replaced in 1995.
3. A circumferential crack in the main propagated through the pipe wall prior to the first incident, allowing natural gas to leak into the surrounding environment for an extended period.
4. Soil absorbed and depleted the natural gas odorant, eliminating the opportunity for occupants to detect it.
5. Natural gas leaking from Atmos Energy Corporation's cracked gas main in the alley behind 3534 Espanola Drive migrated through the soil and into the house where it was ignited by an unknown source.

6. Dallas Fire-Rescue Department's initial misclassification of the first incident delayed the sharing of information that could have helped Atmos Energy Corporation identify the origin of the leak.
7. Had the Dallas Fire-Rescue Department's arson investigators been adequately trained on natural gas systems, their investigation findings may have provided more timely and accurate assistance to Atmos Energy Corporation in locating the source of the gas leak.
8. Timely pressure testing of the customer piping by Atmos Energy Corporation could have eliminated potential sources of the gas leaks and helped focus their efforts on outside leak detection to locate the damaged and leaking gas system piping more quickly.
9. Atmos Energy Corporation did not adequately investigate the first two gas-related incidents that occurred at 3527 and 3515 Durango Drive.
10. Damage to the structure involved in the first incident on 3527 Durango Drive was consistent with a fuel gas/air mixture explosion, which was most likely caused by natural gas that migrated from underneath the structure.
11. Fuel gas was involved in both incident homes; there was insufficient evidence to exclude natural gas from Atmos Energy Corporation's system from either incident, evidence of leaks present prior to the first two incidents occurring, and the probability of two or three structure fires/explosions occurring independently on the same block during the same week is very low. Therefore, the two prior incidents that occurred on the same block on subsequent days and the explosion at 3534 Espanola Drive were all likely related.
12. Limitations of the equipment and procedures due to the wet weather conditions on the ability of Atmos Energy Corporation to reliably detect the presence of leaked gas during its response to the first two incidents, and the number and severity of leaks identified following the first two incidents and prior to the explosion, should have prompted Atmos Energy Corporation to shut down or isolate the pipeline.
13. Had Atmos Energy Corporation pressure tested the main in the alley behind the first two incident homes on February 21 or 22, it could have found that the main did not hold pressure, spurring additional protective actions that could have prevented the fatal injury at 3534 Espanola Drive.
14. Atmos Energy Corporation's wet weather leak investigation procedures were insufficient given the known limitations of its equipment.
15. The assistance of the Dallas Fire-Rescue Department's Hazardous Materials Response Team, particularly after the second incident, could have enhanced Atmos Energy Corporation's leak investigation.
16. Had methane detectors been installed at the residences located on Durango and Espanola Drives, an alarm would have alerted residents to a gas release, reducing the potential for and consequences of the resulting natural gas fires and explosions.

17. The lack of official reporting of the first two incidents by Atmos Energy Corporation delayed the response from regulatory authorities, the Railroad Commission of Texas and the Pipeline and Hazardous Materials Safety Administration.
18. The Pipeline and Hazardous Materials Safety Administration does not provide clear requirements regarding the level of investigation necessary to determine whether an event is subject to its reporting requirements, potentially resulting in the underreporting of natural gas incidents.
19. If Dallas Fire-Rescue Department reported the first two incidents in a timely manner, it could have prompted further investigation or regulatory oversight prior to the explosion.
20. The high number of leaks observed in northwest Dallas after the explosion were due to the degradation of Atmos Energy Corporation's gas distribution system, not sudden, unanticipated geologic loadings.
21. Atmos Energy Corporation did not adequately consider or mitigate against threats that were degrading its pipeline system, the likelihood of failure associated with these threats, or the potential consequences of such a failure as required by gas distribution integrity management requirements.
22. While Atmos Energy Corporation's periodic leak survey methodology and frequency complied with the minimum state and federal requirements, it did not identify the degraded system that was found after the explosion.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the explosion at 3534 Espanola Drive was the ignition of an accumulation of natural gas that leaked from the gas main that was damaged during a sewer replacement project 23 years earlier and was undetected by Atmos Energy Corporation's investigation of two related natural gas incidents on the 2 days prior to the explosion. Contributing to the explosion was Atmos Energy Corporation's insufficient wet weather leak investigation procedures. Contributing to the severity of the explosion was Atmos Energy Corporation's inaction to isolate the affected main and evacuate the houses. Contributing to the degradation of the pipeline system was Atmos Energy Corporation's inadequate integrity management program.

Recommendations

New Recommendations

To the Pipeline and Hazardous Materials Safety Administration:

1. Expand incident reporting requirements in Title 49 *Code of Federal Regulations* Part 191 so that events that may meet the definition of "incident" are immediately reported to the National Response Center even when the source of the natural gas has not been determined.

2. Evaluate industry's implementation of the gas distribution pipeline integrity management requirements and develop updated guidance for improving their effectiveness. The evaluation should specifically consider factors that increase the likelihood of failure such as age, increase the overall risk (including factors that simultaneously increase the likelihood and consequence of failure), and limit the effectiveness of leak management programs.
3. Assist the Railroad Commission of Texas in conducting the audit recommended in Safety Recommendation P-21-XX (number 4, below).

To the Railroad Commission of Texas:

4. With assistance from the Pipeline and Hazardous Materials Safety Administration, conduct a comprehensive audit of Atmos Energy Corporation's incident reporting practices; policies and procedures for responding to leaks, fires, explosions, and emergency calls; and integrity management programs.

To the Dallas Fire-Rescue Department:

5. Revise the continuing education requirement for your arson investigators to include training on building fuel gas systems.
6. Revise your procedures to require gas monitoring after the occurrence of a gas-related structure fire or explosion.
7. Develop and implement a formal process to alert appropriate local, state, and federal agencies of potential systemic safety issues that should be investigated further.

To Atmos Energy Corporation:

8. Provide initial and recurrent training to Dallas Fire-Rescue Department arson investigators and firefighters on the local natural gas distribution system and associated hazards.
9. Develop and implement more rigorous inside leak investigation requirements in response to fires and explosions when gas involvement cannot be excluded, including clear guidance on pressure testing and inside gas measurements and the potential need to return to the property after firefighters have departed.
10. Develop a clear procedure to coordinate with local emergency responders when investigating all fires and explosions that may be gas related to conclusively determine whether your system can be excluded as a potential contributor, and collecting the necessary evidence to support the conclusion of your investigations.

11. Revise your policies and procedures for responding to leaks, fires, explosions, and emergency calls to address the challenges caused by wet weather conditions. The revised policies and procedures should include (1) leak investigation methods that are reliable in wet weather; (2) leak investigation procedures that assess all viable gas migration paths; (3) criteria for when to shut down or isolate gas distribution systems and pressure test main and service lines; and (4) an alternate safe response such as evacuation when reliable leak investigations are not possible due to wet weather or other circumstances.
12. Without delay, assess your integrity management program, paying particular attention to the areas identified in this investigation, and revise the program to appropriately consider: (1) threats that degrade a system over time, and (2) the increased risk that can result from factors that simultaneously increase the likelihood and consequence of failure.

To the American Gas Association Gas Piping Technology Committee:

13. Develop additional guidance that identifies steps gas distribution operators can take to safely respond to leaks, fires, explosions, and emergency calls, considering the limitations due to wet weather conditions, that includes: (1) criteria for when to shut down or isolate gas distribution systems, pressure test main and service lines, and begin evacuations; (2) leak investigation methods that are reliable in wet weather; (3) require an alternate safe response, such as an evacuation when reliable leak investigations are not possible due to wet weather; and (4) leak investigations that assess all viable gas migration paths, including granular backfill and crawlspaces.
14. Develop guidance that identifies steps that gas distribution operators can take to ensure that their gas distribution integrity management program, at a minimum, appropriately considers (1) threats that degrade a system over time, and (2) the increased risk that can result from factors that simultaneously increase the likelihood and consequence of failure.

Previously Issued Recommendations Reiterated in this Report

To the International Code Council:

1. In coordination with the Gas Technology Institute and the National Fire Protection Association, incorporate provisions in the International Fuel Gas Code that requires methane detection systems for all types of residential occupancies with gas service. At a minimum, the provisions should cover the installation, maintenance, placement of the detectors, and testing requirements. (P-19-006)

This recommendation is currently classified “Open—Acceptable Alternate Response.”

To the National Fire Protection Association:

2. In coordination with the Gas Technology Institute and the International Code Council, revise the National Fuel Gas Code, National Fire Protection Association 54 to require methane detection systems for all types of residential occupancies with gas service. At a minimum, the provisions should cover the installation, maintenance, placement of the detectors, and testing requirements. (P-19-007)

This recommendation is currently classified “Open—Acceptable Alternate Response.”

To the Gas Technology Institute:

3. In coordination with the National Fire Protection Association and the International Code Council, work to develop standards for methane detection systems for all types of residential occupancies in both the International Fuel Gas Code and the National Fuel Gas Code, National Fire Protection Association 54. At a minimum, the provisions should cover the installation, maintenance, placement of the detectors, and testing requirements. (P-19-008)

This recommendation is currently classified “Open—Acceptable Alternate Response.”