log P-308

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: April 22, 1994
In Reply Refer To: P-94-1 through -3

Mr. William Eckles
President and Chief Executive Officer
New Jersey Natural Gas Company
1415 Wyckoff Road
Wall, New Jersey 07719

About 11:35 a.m. on June 9, 1993, a cinderblock duplex at 634 Cliffwood Avenue in Cliffwood Beach, New Jersey, exploded as a New Jersey Natural Gas Company (NJNG) contractor was trenching in front of the building. The explosion killed 3 residents of the duplex and seriously injured 3 others.

The NJNG had hired a contractor to replace the bare steel main on Cliffwood Avenue with a plastic main (figure 1). The contract included removing and replacing the service lines to 628 and 630 Cliffwood Avenue with plastic piping. The project did not require that excess flow valves (EFVs) be installed on the new gas service lines.

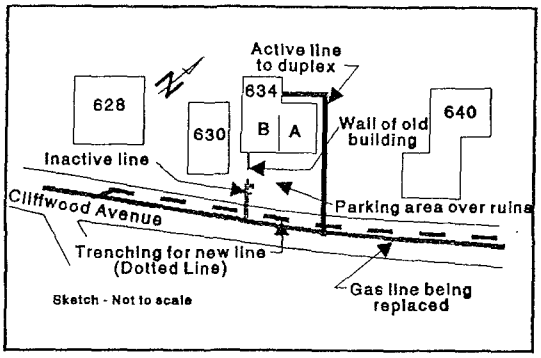

Figure 1. Sketch of the work area.

Prior to the project, the NJNG provided the contractor with a microfiche of NJNG mains for a 4-square-mile area, which included Cliffwood Avenue. The microfiche did not show service lines. The contractor also received a construction drawing showing where to locate the new plastic main. The drawing indicated buildings 628 and 630 and that services to these buildings were to be renewed. It did not show the service lines or their locations relative to the main. Neither the microfiche plate nor the drawing indicated a service line to 634.[1] According to the contractor, he walked along the route of the main and marked out the points where the 628 and 630 service lines connected to the main using a pipe locator. He said that while he was walking along the

[1] Like many utility companies, the NJNG maintains service cards that provide additional information on service line and meter locations. The NJNG did not provide any such cards to the contractor. The Safety Board determined that the company had no card for 634 Cliffwood Avenue.

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main, he received no indication from the locator of a service line in front of 634.

At 10:30 a.m., while excavating from west to east in front of 634 Cliffwood Avenue, the contractor's trencher hit and punctured a bare steel gas service line that was perpendicular to the street, causing a gas escape. The crew foreman later stated that he had no prior knowledge of any service line to 634 Cliffwood Avenue and was "shocked" to encounter this line.

After one contractor crewmember had clamped the punctured service line to stop the escape of gas and tested the clamp for leaks, another crewmember tried to trace the path of the punctured line using a pipe locator but could not find the end of the line. In the meantime, another crewmember went around the exterior of 634 Cliffwood to the building's furnace room at the rear of the duplex to see if and where any service lines entered the building. He did not smell gas in the furnace room. He determined that the only gas service line entering the room and the building was connected to the gas main 36 feet east of the punctured service line.

One of the contract crewmembers then radioed his office, explained to a secretary that the crew had struck a service line, and requested that she call the NJNG to ask whether service to 634 Cliffwood was active. She telephoned the NJNG and asked a clerk about the status of service to 634 Cliffwood but failed to tell her that the contracting crew had damaged a service line. The NJNG clerk advised the secretary that service to 634 Cliffwood Avenue was active.

During the time the contractor's secretary was calling the NJNG office, two NJNG inspectors arrived to oversee the contract work and an NJNG distribution crew stopped by the site en route to another job. One inspector observed the clamped pipe and a nearby blue mark-out and asked the contractor foreman whether the clamped line was a water line[2]. The foreman maintains that he told the inspector the clamped line was a gas line. The inspector stated that the foreman responded "yes" when he asked if the clamped pipe was a water line, whereupon he advised the contractor to call the water company and make them aware of the repair. Soon afterwards, the inspector and the NJNG distribution crew left the site.

An NJNG collector then arrived to shut off service to 634 Cliffwood Avenue for non-payment. About 11:35 a.m., just as he was shutting the meter in the rear of the building, the duplex exploded. Six people were trapped inside the burning duplex. Rescuers removed five adult residents, one of whom kept repeating, "I lit a cigarette and it blew."

At 11:40 a.m., the NJNG distribution crew heard a radio report of the accident and returned from their nearby job site. An NJNG crewmember saw the clamped, punctured service line and asked the contracting crew's foreman if it contained gas, whereupon the foreman responded yes. The NJNG crew immediately cut and capped the punctured line at the street. Firefighters noted that after the line was capped, flames coming out of the asphalt parking lot in front of 634 Cliffwood Avenue began to decrease.

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[2]A blue mark-out is a blue paint mark on the surface indicating the presence of a water line.

After pressure-testing the gas main and the punctured service line, an NJNG crew excavated the damaged service line and found that it had a crack where the pipe met an elbow (90-degree turning fitting), about 25 feet from the bare steel main and 21 feet from the facade of 634 Cliffwood Avenue. A Safety Board metallurgist subsequently determined that the fractures on the crack were typical of an overstress separation.

Research revealed that the duplex and its parking lot at 634 Cliffwood Avenue had been built over the remains of another building that had been destroyed by fire. Excavation of the accident site revealed that the side foundation wall of the old building, which its gas service line paralleled, ran perpendicular to the street. The gas line servicing the old building entered its foundation at the pipe elbow near the overstress crack. The gas service line was sleeved where it went through the old foundation wall and connected to an unlocked shutoff valve in the off position. In the course of constructing the duplex, the builder flattened and paved over the remains of the old building to serve as a parking lot for the newer building. Paving over debris created voids beneath the pavement. These voids, sealed above by the pavement and to one side by the side foundation wall of the old building, provided a path for the gas to migrate to the duplex at 634 Cliffwood Avenue.

The Safety Board determined that upon awarding the contract, the NJNG did not brief or determine whether the contractor knew what procedures to follow should his crew damage a main or service line. In addition, the Safety Board found no record or evidence of the contractor being properly trained in emergency procedures. The NJNG operating procedures do not include emergency response training for contractors. The contractor stated that he had past experience in shutting down a gas service line and that if he had known the line was inactive, he would have called the gas company for permission to shut the line down. In this accident, the contractor clamped the service line before checking the condition of the rest of the inactive line, an action that allowed the gas to escape through the second crack in the pipe near the old foundation wall and into the duplex, where it accumulated and ignited.

During its investigation, the Safety Board examined NJNG's policy for EFV installation. When the service line was installed to the old building, EFVs were not available. When the duplex was built in the 1960s, EFVs were not readily accepted by industry representatives who were dubious as to the benefit and/or reliability of the then-new device. Despite the proven effectiveness and reliability of today's EFVs, the NJNG still has a very limited policy regarding their installation. The company only considers installing EFVs on new service lines where it has identified soil movement or ground subsidence as a problem. The NJNG does not currently have a policy of installing EFVs on all new and renewed high-pressure residential service lines. In this accident, the NJNG contract for replacing the main and service lines on Cliffwood Avenue did not include installing EFVs on the new and replacement lines nor did regulations require their installation.

The Safety Board believes that by failing to install EFVs on new and renewed Cliffwood Avenue service lines and comparable future projects, the NJNG leaves its system vulnerable to the type of damage and leaks suffered in this accident.

Had an EFV been installed on the inactive service line in this accident, the chance of the building exploding would have been minimized even though the contractor failed to locate the overstress crack. The line rupture would have activated an EFV, which would have shut off the flow of gas. An EFV would not have reset and not have opened the line for gas flow until workers discovered and repaired both the puncture at the point of impact and the overstress crack at the pipe elbow. Either leak would have kept the piping downstream of the EFV from being pressurized, which is necessary for an EFV to open. The National Transportation Safety Board has recommended the use of EFVs for over 20 years and believes that EFVs should be installed on all new and renewed high-pressure single-customer[3] residential services.

Service to the damaged Cliffwood service line was discontinued in 1965; the line had been inactive for more than 25 years. At that time, neither NJNG operating procedures nor Federal regulations had standards for abandonment of gas lines. Since then, the company has adopted procedures and the Federal government has enacted regulations requiring that specific actions be taken when abandoning a gas pipeline.

Title 49, U.S. Code of Federal Regulations, at 192.727(d) requires that whenever service to a customer is discontinued, the service line valve should be closed and locked, a mechanical device should be installed in the service line or the meter assembly to block flow of gas, or the line should be disconnected from the gas supply and the open ends sealed. The NJNG Operating and Maintenance Procedures Manual is consistent with Federal requirements with respect to discontinuing service lines. Additionally, the NJNG Manual requires that each service abandoned in place be physically disconnected from all sources and supplies of gas (including mains) within 2 years after becoming inactive. The manual also states that an abandoned service must be purged of gas and all open ends capped, plugged, or otherwise effectively sealed.

In its investigation, the Safety Board determined that the abandoned service line to 634, left in place for many years, was not an isolated case. At the accident area, the Safety Board observed an improperly abandoned or inactive gas service line entering the basement of a neighboring house on Cliffwood Avenue. The Safety Board believes that this accident highlights the need for the NJNG to clarify its policy to include service lines abandoned prior to the adoption of the operating manual. The NJNG should review old records, maps, service cards, and billing statements to identify lines that need to be abandoned and ensure that the lines are disconnected from all sources of gas; purged of gas; and capped, plugged, or otherwise effectively sealed.

Recommendations

As a result of its investigation of this accident, the National Transportation Safety Board makes the following recommendations to the New Jersey Natural Gas Company:

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[3] In this accident, the duplex was considered a single residential customer because it contained one furnace, one hot water heater, and two gas appliances.

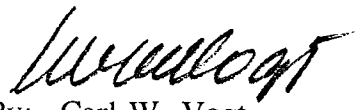
Train all gas operations construction contractors for emergencies involving struck pipelines; training should stress immediately reporting natural gas pipeline strikes to New Jersey Natural Gas's emergency phone number. (Class II, Priority Action) (P-94-1)

Review your records, maps, service cards, and billing statements to identify inactive service lines for which prospective reuse is doubtful and properly abandon them. (Class II, Priority Action) (P-94-2)

Install excess flow valves on new and renewed single-customer residential high-pressure service lines that have operating conditions compatible with available excess flow valves. (Class II, Priority Action) (P-94-3)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations P-94-1 through -3.

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HAMMERSCHMIDT, and HALL concurred in these recommendations.



By: Carl W. Vogt
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

Pipeline Accident Brief No. DCA93FP004

System Type:	Distribution
Accident Type:	Explosion and Fire
Location:	634 Cliffwood Avenue, Cliffwood Beach, New Jersey
Date:	June 9, 1993
Time:	11:35 a.m. EDT
Owner/Operator:	New Jersey Natural Gas Company (NJNG)
Property Damage:	$100,000
Injuries:	3 Fatal 3 Nonfatal
Material Released:	Natural Gas
Pressure:	52 psig in main and service line
Type Failure:	Crack in pipe adjacent to elbow due to tensile stress
Component Affected:	3/4-inch-diameter inactive bare steel gas service line

Description of the Accident

About 11:35 a.m. on June 9, 1993, a cinderblock duplex at 634 Cliffwood Avenue in Cliffwood Beach, New Jersey, exploded as an NJNG contractor was trenching in front of the building. The explosion killed 3 residents of the duplex and seriously injured 3 others.

In 1993, the NJNG hired a contractor to replace the 2-inch-diameter bare steel main on Cliffwood Avenue with a plastic main. The contractor was to lay the 2-inch-diameter plastic main parallel to the street, between the bare steel main and the curb, about 36 feet from the facade of the duplex at 634 Cliffwood Avenue (figure 1). The contract included removing and replacing the bare steel service lines to 628 and 630 Cliffwood Avenue with plastic piping. The project did not require that excess flow valves (EFVs) be installed on the new gas service lines.

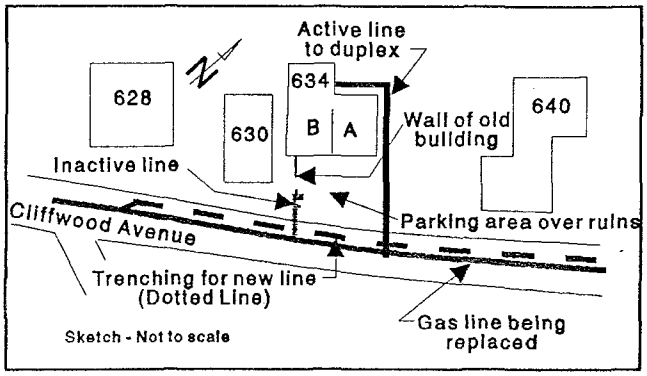


Figure 1. Sketch of the work area.

Prior to the project, the NJNG provided the contractor with a microfiche of NJNG mains for a 4-square-mile area, which included Cliffwood Avenue. The microfiche did not show service lines off the gas mains. The contractor also received a construction drawing showing where to locate the new plastic gas main. The drawing indicated buildings 628 and 630 and that services to these buildings were to

be renewed (replaced with plastic). It did not show the service lines or their locations relative to the gas main. Neither the microfiche plate nor the drawing indicated a gas service line to 634.[1] According to the contractor, he walked along the route of the main and marked out the points where the 628 and 630 service lines connected to the main using a pipe locator. He said that while he was walking along the main, he received no indication from the locator of a service line in front of 634.

At 10:30 a.m., while excavating a 12-inch-wide trench from the west to the east in front of 634 Cliffwood Avenue, the contractor's trencher hit and punctured a 3/4-inch-diameter bare steel gas service line that was perpendicular to the street, causing a gas escape. The crew foreman later stated that he had no prior knowledge of any service line to 634 Cliffwood Avenue and was "shocked" to encounter this line.

After one contractor crewmember had clamped the punctured service line to stop the escape of gas and tested the clamp for leaks, another crewmember tried to trace the path of the punctured line using a pipe locator but could not find the end of the line. In the meantime, another crewmember went around the exterior of 634 Cliffwood to the building's furnace room at the rear of the duplex to see if and where any service lines entered the building. He did not smell gas in the furnace room. He determined that the only gas service line entering the room and the building was connected to the gas main 36 feet east of the punctured service line.

One of the contract crewmembers then radioed his office, explained to a secretary that the crew had struck a service line, and requested that she call the NJNG to ask whether service to 634 Cliffwood was active. She telephoned the NJNG and asked a clerk about the status of service to 634 Cliffwood but failed to tell her that the contracting crew had damaged a service line. The NJNG clerk advised the secretary that service to 634 Cliffwood Avenue was active.

During the time the contractor's secretary was calling the NJNG office, two NJNG inspectors arrived to oversee the contract work and an NJNG distribution crew stopped by the site en route to another job. One inspector observed the clamped pipe and a nearby blue mark-out and asked the contractor foreman whether the clamped line was a water line.[2] The Safety Board received conflicting information regarding the foreman's response to the inspector. The foreman stated that he told the inspector the clamped line was a gas line. The inspector stated that the foreman responded "yes" when he asked if the clamped pipe was a water line, whereupon he advised the contractor to call the water company and make them aware of the repair (clamp). Soon afterwards, the inspector went to place a phone call and the NJNG distribution crew continued on to their nearby job.

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[1] Like many utility companies, the NJNG maintains service cards that provide additional information on service line and meter locations. The NJNG did not provide any such cards to the contractor. The Board determined that the company had no card for 634 Cliffwood Avenue.

[2] A blue mark-out is a blue paint mark on the surface indicating the presence of a water line.

Shortly after the inspector left, an NJNG collector arrived to shut off service to 634 Cliffwood Avenue for non-payment. About 11:35 a.m., just as he was shutting the meter in the rear of the building, the duplex exploded. Six people were trapped inside the burning duplex. Emergency responders, including NJNG personnel, police, and firefighters arrived at the accident site within 10 minutes of the explosion. Rescuers removed five adult residents, one of whom kept repeating, "I lit a cigarette and it blew."

At 11:40 a.m., the NJNG distribution crew heard a radio report of the accident and returned from their nearby job site. An NJNG crewmember saw the clamped, punctured service line and asked the contracting crew's foreman if it contained gas, whereupon the foreman responded yes. The distribution crew immediately cut and capped the punctured line at the street. Firefighters noted that after the line was capped, flames coming out of the asphalt parking lot in front of 634 Cliffwood Avenue began to decrease.

Postaccident Investigation

After pressure-testing the gas main and the punctured service line, an NJNG crew excavated the damaged service line and found that it had a crack where the pipe met an elbow (90-degree turning fitting), about 25 feet from the high-pressure bare steel gas main and 21 feet from the facade of 634 Cliffwood Avenue. A Safety Board metallurgist subsequently determined that the fractures on the crack were typical of an overstress separation.

Research revealed that the duplex and its parking lot at 634 Cliffwood Avenue had been built over the remains of another building that had been destroyed by fire. Excavation of the accident site revealed that the side foundation wall of the old building, which its gas service line paralleled, ran perpendicular to the street. The gas line servicing the old building entered its foundation at the pipe elbow near the overstress crack. The gas service line was sleeved where it went through the old foundation wall and connected to an unlocked shutoff valve in the off position. In the course of constructing the duplex, the builder flattened and paved over the remains of the old building to serve as a parking lot for the newer building. Paving over debris created voids beneath the pavement. These voids, sealed above by the pavement and to one side by the side foundation wall of the old building, provided a path for the gas to migrate to the duplex at 634 Cliffwood Avenue.

The Safety Board determined that upon awarding the contract, the NJNG did not brief or determine whether the contractor knew what procedures to follow should his crew damage a main or service line. In addition, the Safety Board found no record or evidence of the contractor being properly trained in emergency procedures. The NJNG operating procedures do not include emergency response training for contractors. The contractor stated that he had past experience in shutting down a gas service line and that if he had known the line was inactive, he would have called the gas company for permission to shut the line down. In this accident, the contractor clamped the service line before checking the condition of the rest of the inactive line, an action that allowed the gas to escape through the second crack in the pipe near the old

foundation wall and into the duplex, where it accumulated and ignited.

During its investigation, the Safety Board examined NJNG's policy for EFV installation. When the service line was installed to the old building, EFVs were not available. When the duplex was built in the 1960s, EFVs were not readily accepted by industry representatives who were dubious as to the benefit and/or reliability of the then-new device. Despite the proven effectiveness and reliability of today's EFVs, the NJNG still has a very limited policy regarding their installation. The company only considers installing EFVs on new service lines where it has identified soil movement or ground subsidence as a problem. The NJNG does not currently have a policy of installing EFVs on all new and renewed high-pressure residential service lines. In this accident, the NJNG contract for replacing the main and service lines on Cliffwood Avenue did not include installing EFVs on the new and replacement lines nor did regulations require their installation.

The Safety Board believes that by failing to install EFVs on new and renewed Cliffwood Avenue service lines and comparable future projects, the NJNG leaves its system vulnerable to the type of damage and leaks suffered in this accident.

Had an EFV been installed on the inactive service line in this accident, the chance of the building exploding would have been minimized even though the contractor failed to locate the overstress crack. The line rupture would have activated an EFV, which would have shut off the flow of gas. An EFV would not have reset and would not have opened the line for gas flow until workers discovered and repaired both the puncture at the point of impact and the overstress crack at the pipe elbow. Either leak would have kept the piping downstream of the EFV from being pressurized, which is necessary for an EFV to open. The National Transportation Safety Board has recommended the use of EFVs for over 20 years and believes that EFVs should be installed on all new and renewed high-pressure single-customer[3] residential services.

Service to the damaged Cliffwood Avenue service line was discontinued in 1965; the line had been inactive for more than 25 years. At that time, neither NJNG operating procedures nor Federal regulations had standards for abandonment of gas lines. Since then, the company has adopted procedures and the Federal Government has enacted regulations requiring that specific actions be taken when abandoning a gas pipeline.

Title 49, U.S. Code of Federal Regulations, at 192.727(d) requires that whenever service to a customer is discontinued, the service line valve should be closed and locked, a mechanical device should be installed in the service line or the meter assembly to block flow of gas, or the line should be disconnected from the gas supply and the open ends sealed. The NJNG Operating and Maintenance Procedures Manual is consistent with Federal requirements with respect to discontinuing service lines. Additionally, the NJNG Manual requires that each service abandoned

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in place be physically disconnected from all sources and supplies of gas (including mains) within 2 years after becoming inactive. The manual also states that an abandoned service must be purged of gas and all open ends capped, plugged, or otherwise effectively sealed.

In its investigation, the Safety Board determined that the abandoned service line to 634, left in place for many years, was not an isolated case. At the accident area, the Safety Board observed an improperly abandoned or inactive gas service line entering the basement of a neighboring house on Cliffwood Avenue. The Safety Board believes that this accident highlights the need for the NJNG to clarify its policy to include service lines abandoned prior to the adoption of the operating manual. The NJNG should review old records, maps, service cards, and billing statements to identify lines that need to be abandoned and ensure that the lines are disconnected from all sources of gas; purged of gas; and capped, plugged, or otherwise effectively sealed.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the failure by New Jersey Natural Gas to train the contractor in proper emergency response actions, which resulted in the contract crew failing to identify and repair all damage to the service line. Contributing to the accident was the failure by the gas company either to provide the contractor with adequate information for locating system facilities or to mark the location of the system facilities before the contractor began excavation.

Recommendations

As a result of its investigation of this accident, the National Transportation Safety Board makes the following recommendations to the New Jersey Natural Gas Company:

> Train all gas operations construction contractors for emergencies involving struck pipelines; training should stress immediately reporting natural gas pipeline strikes to New Jersey Natural Gas's emergency phone number. (Class II, Priority Action) (P-94-1)
>
> Review your records, maps, service cards, and billing statements to identify inactive service lines for which prospective reuse is doubtful and properly abandon them. (Class II, Priority Action) (P-94-2)
>
> Install excess flow valves on new and renewed single-customer residential high-pressure service lines that have operating conditions compatible with available excess flow valves. (Class II, Priority Action) (P-94-3)

Approved by the Board on April 15, 1994.