



# National Transportation Safety Board

Washington, D.C. 20594

## Pipeline Accident Brief

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<b>Accident No.:</b>	DCA-08-FP-006
<b>Type of System:</b>	Natural gas distribution
<b>Accident Type:</b>	Leak, explosion, and fire
<b>Location:</b>	Plum Borough, Pennsylvania
<b>Date:</b>	March 5, 2008
<b>Time:</b>	1:39 p.m. eastern standard time <sup>1</sup>
<b>Owner/Operator:</b>	Dominion Peoples Natural Gas Company
<b>Property Damage and Losses:</b>	\$1,000,000
<b>Fatalities:</b>	1
<b>Injuries:</b>	1
<b>Material Released:</b>	Natural gas
<b>Pipeline Pressure:</b>	10 pounds per square inch, gauge
<b>Component Affected:</b>	2-inch steel natural gas distribution pipeline

### The Accident

On March 5, 2008, about 1:39 p.m., a natural gas explosion destroyed a residence at 171 Mardi Gras Drive in Plum Borough, Pennsylvania, killing a man and seriously injuring a 4-year-old girl. Two other houses were destroyed, and 11 houses were damaged. Property damage and losses were \$1,000,000.

### Postaccident Investigation

No report of a gas odor was filed with Dominion Peoples Natural Gas Company (Dominion) before the accident. Several neighbors and a postal worker who were on the property 30 minutes before the explosion stated during postaccident interviews that they had not smelled gas before the accident. The Pennsylvania Public Utility Commission (PUC) tested several homeowners to determine whether they could smell the odorant that indicates the presence of natural gas; each was able to smell the odorant at minimum levels.

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<sup>1</sup> All times in this brief are eastern standard time.

## Emergency Response

At 1:40 p.m., the Holiday Park Fire Department was notified about an explosion involving a home with two people inside. (See figure 1.) About 1:45 p.m., the police were on the scene. About 1:50 p.m., the fire chief arrived at the scene. About 1:59 p.m., an injured man was pulled from the debris. An injured girl, who had been blown free of the debris and rescued by a neighbor, received on-scene medical assistance. About 30 minutes after the explosion, a helicopter evacuated the man and the girl. The man died en route to the hospital. The local fire department declared the fire to be under control at 2:20 p.m.; at that time, the gas pipeline was feeding three small fires in the debris. The fire department remained at the scene until the fires were extinguished, at 6:59 p.m.



Figure 1. Damage to 171 Mardi Gras Drive.

## Dominion Peoples Natural Gas Company's Actions

Dominion operated two gas distribution pipelines in the neighborhood: a 2-inch carbon steel main pipeline in front of the destroyed home and an 8-inch carbon steel main pipeline across the street from the destroyed home. (See figure 2.) The 2-inch pipeline provided gas to the homes on the street; the 8-inch pipeline passed through the neighborhood.

At 1:44 p.m., Dominion was notified of the explosion by a neighbor who had called Dominion's emergency dispatch telephone number. At that time, Dominion dispatched personnel to the scene. By 2:12 p.m., a Dominion customer serviceperson had arrived at the scene. At 2:17 p.m., the maintenance crews arrived. About 2:20 p.m., Dominion supervisors arrived.

After arriving, Dominion began to shut down both pipelines. According to a Dominion crewmember, the crew had to shut off four gas control valves to stop the flow of gas to the two pipelines. Two other crewmembers told a Safety Board investigator that although they were able to close the shut-off valves, the valves were “a bit snug.” Consequently, the 2-inch pipeline was not shut down until about 5:50 p.m., and the 8-inch pipeline was not shut down until 5:55 p.m. Dominion provided the following explanation for the 4 hours needed to close the four shut-off valves. The two pipelines were two-way feeds in which pressurized gas flowed from either direction; thus, shutting them down required closing four valves. Two of the four valves closed properly; however, two other valves did not close completely. A Dominion crew had to dig up and fix the faulty valves before they could completely shut off the gas flow. Since the fire department had the fire under control at 2:20 p.m., the 4 hours needed by Dominion to close the four control valves did not increase the severity of the accident.

In November 2008, Dominion’s manager of delivery operations confirmed that Dominion was in the process of reclassifying many of the shut-off valves within its system as critical valves. These critical valves are subject to more frequent inspections and maintenance checks in accordance with the Federal natural gas pipeline safety regulations in 49 *Code of Federal Regulations* Section 192.747. According to these regulations, “each valve, the use of which may be necessary for the safe operation of a distribution system, must be checked and serviced, at intervals not exceeding 15 months, but at least once each calendar year.” The regulations also require an operator to take prompt remedial action to correct any such valve found to be inoperable unless the operator designates an alternative valve. Non-critical valves are to be checked and serviced every 5 years.

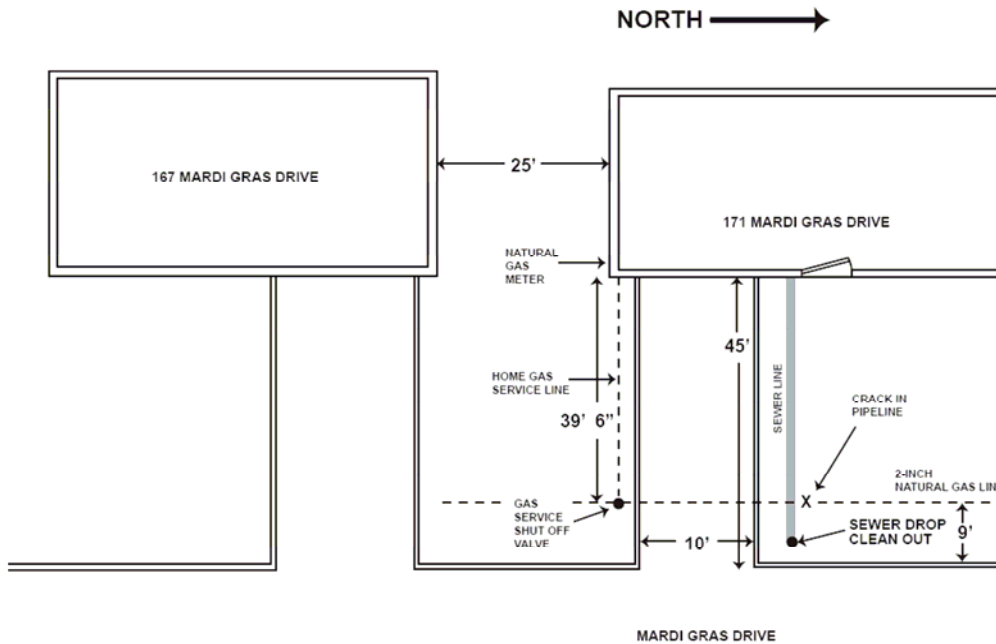


Figure 2. Diagram of accident. (North is to the right.)

According to a Dominion crewmember interviewed by a Safety Board investigator, the Dominion crewmembers began bar-hole testing shortly after their arrival, at 2:17 p.m. Their initial bar-hole testing focused on the 8-inch pipeline because the 2-inch pipeline was a loop off the 8-inch pipeline. However, after the crewmembers noticed “bubbling” in the wet ground above the 2-inch pipeline and in a sewer line in front of the accident residence, they started excavating these areas.

Under the supervision of the PUC, Dominion crews exposed the 2-inch pipeline at 8:29 p.m. A circumferential crack ran about 270 degrees around the pipe; the top section of the pipe was not cracked. The pipe was bowed with a dented underside. The pipe was marked and photographed. (See figure 3.) A 90-inch section of the pipe, which contained the circumferential crack and the dented area, was sent to the Safety Board’s Materials Laboratory for examination.



**Figure 3.** Cracked pipeline. (The large white mark indicates the top of the pipeline when it was excavated.)

During the next 2 days, bar-hole testing was conducted every 30 minutes on the 2-inch pipeline, the 8-inch pipeline, and all service pipelines in the area. At 10:00 p.m. on March 6, the day after the explosion, the gas readings were recorded as high as 18.8 percent along the 8-inch pipeline. Two days after the accident, at noon, the readings had diminished to zero. During pressure tests of the repaired 2-inch pipeline, no leakage occurred.

### **Pipeline Information and Leak History**

The 2-inch pipe had been manufactured in accordance with American Petroleum Institute (API) Specification 5L Grade B standard wall thickness (that is, 0.154-inch nominal wall thickness). Its exterior coating had been wrapped in coal tar enamel,

cathodically protected, and monitored. The pipeline had been installed on August 9, 1961, as a distribution main pipeline; it had a maximum allowable operating pressure of 30 pounds per square inch, gauge (psig) and was operated at about 10 psig.

The odorant used for the natural gas was a 50-50 blend of tertiary-butyl mercaptan and tetrahydrothiophene. Dominion's records indicate that the odorant was in the piping system, that the odorometer tests, which were conducted before and after the accident, met U.S. Department of Transportation (DOT) and Pennsylvania State requirements, and that the odorant level was within prescribed concentrations. The leak history was also examined, and no leaks on the 2-inch pipeline had been reported since its installation. The cathodic protection pipe-to-soil potentials were all above the DOT requirement<sup>2</sup> of 0.85 volts.

## Safety Board's Materials Laboratory Testing

The Safety Board's Materials Laboratory examined the section of 2-inch pipe that was removed from the accident site and noted that the pipe had several bends. The coal tar enamel coating was missing from a 3-foot section that included the pipeline's cracked bottom. The bottom was also dented and deformed upward at the crack.

General corrosion was found along the length of the pipeline. Intrusions of intergranular corrosion were found adjacent to the crack. The loss of wall thickness was estimated to be about 0.010 inches at the crack. Mechanical test results were consistent for a pipe that was manufactured in accordance with API 5L Grade B specifications. Based on the crack in the 2-inch pipeline and the results of bar-hole tests and laboratory examination, the crack was the most likely cause of the release of natural gas and the subsequent explosion.

## Prior Excavation Activity

On October 15, 2003, about 5 years before the accident, the owners of 171 Mardi Gras Drive had hired a master plumber to replace the sewage line so that the house would comply with the county code. The plumber hired an excavator to uncover the sewer line. The Pennsylvania One-Call records verified that it had been notified of the excavation and that Dominion and the local water company had made the markouts.<sup>3</sup>

During postaccident interviews with a Safety Board investigator, the plumber and excavator said that they had seen the markouts and that the markouts had been properly placed. The excavator said that he had used a backhoe to uncover the sewer line, that he had replaced the sewer's original terra cotta line with a plastic line, that he had backfilled most of the excavation with porous sandstone, and that he had not dug near the pipeline. The plumber said that he had done the digging near the pipeline and that he had done it by hand. Both said that they had not damaged the pipeline during the excavation.

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<sup>2</sup> Title 49 *Code of Federal Regulations* 192.463 requires that a steel gas pipeline have a pipe-to-soil electrical potential that exceeds 0.85 volts.

<sup>3</sup> A *markout* is a ground marking that is typically color coded and that indicates the location of underground utilities.

The sewer line that the plumber had installed was perpendicular to the pipeline and crossed below it on the north side of the driveway. The crack in the pipeline was 5 feet from the driveway; the sewer line was 3 feet, 8 inches, from the driveway. The gas service pipeline was on the south side of the driveway.

## **Failure of Pipeline**

The pipeline failure was probably rapid since no one had smelled gas 30 minutes before the explosion. The porous backfill for the new sewer line could have provided an easy pathway for the gas to migrate into the residence. Additionally, the crack on the pipeline, at 10 psig, could have quickly allowed a flammable amount of gas to collect within the residence, which had many potential ignition sources.

According to Pennsylvania One-Call, the only recorded excavation was the plumber's replacement of the sewer line in 2003. The dents and the deformation in the pipeline indicate that it had been struck from below by something more powerful than a hand shovel. The extent of the corrosion observed by the Safety Board's Materials Laboratory is consistent with 5 years of in-ground exposure. Therefore, it is likely that the excavator struck the pipeline with the backhoe, thereby stripping the pipeline of its protective coating and making the pipeline susceptible to corrosion and failure.

## **Probable Cause**

The National Transportation Safety Board determines that the probable cause of the leak, explosion, and fire in Plum Borough, Pennsylvania, on March 5, 2008, was excavation damage to the 2-inch natural gas distribution pipeline that stripped the pipe's protective coating and made the pipe susceptible to corrosion and failure.

**Adopted: November 21, 2008**