National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: June 22, 2001

In reply refer to: P-01-1 and -2

Ms. Elaine Joost
Acting Deputy Administrator
Research and Special Programs Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

About 12:25 a.m. on July 7, 1998, a natural gas explosion and fire destroyed a newly constructed residence in the South Riding community in Loudoun 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. Five other homes and two vehicles were damaged.[1]

The National Transportation Safety Board determined that the probable cause of this accident was the corrosion and subsequent overheating and arcing at a splice in one of the conductors of the triplex electrical service line, which, because of inadequate separation between the electrical conductors and the gas service line, led to the failure of the gas service line and the subsequent uncontrolled release of natural gas that accumulated in the basement and was subsequently ignited. Precipitating the electrical service line failure was damage done to the electrical service line during installation of the gas service line and/or during subsequent excavation of the electrical line.

Postaccident excavation revealed that one of the failed electrical conductors may have been touching the gas service line; in any case, the conductors were close enough to the gas service line to damage it when a splice connection in one of the conductors faulted under load and generated an arc. The Safety Board therefore concluded that had the gas and electrical service lines involved in this accident been adequately separated, the heat from the arcing electrical conductor failure would probably not have damaged the gas service line, and the accident would not have occurred.

Before the accident, Washington Gas Light Company (which had installed the gas service line involved in this accident) specified separation distances for steel pipelines but not for polyethylene pipelines. Company management indicated that the company routinely applied the requirements for steel pipelines to polyethylene pipelines, and the installation contractor's

[1] For more information, see National Transportation Safety Board, *Natural Gas Explosion and Fire in South Riding, Virginia, July 7, 1998*, Pipeline Accident Report NTSB/PAR-01/01 (Washington, D.C.: NTSB, 2001).

foreman stated that he placed the gas service line in a trench with 12 inches of horizontal separation from the electrical line. Nonetheless, the Northern Virginia Electric Cooperative (NOVEC) crew reported that when they excavated to repair an electrical line fault after the gas service line was installed, they found the gas service line only 6 inches above the electrical cables.

Since the accident, Washington Gas Light Company has revised its *Operating Instructions Manual* to require at least 12 inches of clearance between new polyethylene gas pipelines and existing electrical facilities. Allowances are made for lesser separation if specific protections are implemented. The revision also requires that existing polyethylene gas pipelines be separated from electrical facilities as necessary if a lack of separation is discovered during maintenance activities.

Before the accident, NOVEC trench specifications required various separation patterns between their own electrical facilities; however, the company did not have a written procedure requiring a minimum separation between its buried secondary electric lines and other underground facilities, such as gas pipelines. NOVEC's procedures did require NOVEC personnel to follow the National Electrical Safety Code, which called for electrical cables to be installed and maintained with a vertical separation of 12 inches when crossing other underground structures. But several NOVEC personnel stated that, as a general practice, they maintained at least 6 inches of clearance between electrical cables and all other underground facilities, which was not consistent with the code's separation requirements.

Since the accident, NOVEC has adopted voluntary standards through its participation in the Utility Industry Coalition of Virginia that require a minimum separation distance of 12 inches from other underground facilities unless an acceptable barrier is provided.

While the Office of Pipeline Safety (OPS) has promulgated regulations that establish minimum underground clearance requirements for gas transmission lines and mains, no similar regulation applies to a residential gas service line such as the one involved in this accident. Since the accident, OPS representatives have met with various industry and governmental organizations to discuss the issue of separation between underground gas pipelines and electrical lines. These representatives also reported to the Safety Board staff that the OPS plans to include the issue in the OPS "Best Practices" initiative focusing on damage prevention. The Research and Special Programs Administration (RSPA) has not, however, initiated any regulatory action to ensure that residential gas service pipelines are separated from other underground structures.

Excess flow valves (EFVs) are available that respond to an excessive flow of gas—such as may occur as a result of a leak—by automatically closing and restricting the gas flow. Depending on the manufacturer, EFVs compatible with the operating conditions in this accident are available that are designed to close when the flow rate exceeds about 550 to 850 cubic feet per hour—about 1/10 of the flow rate measured in the service pipeline after the South Riding accident. Based upon the leakage flow rate measured after the explosion and before the pipeline was excavated, the Safety Board concluded that, had an EFV been installed in the gas line to the residence, the EFV would have closed after the hole in the pipeline developed, and the explosion likely would not have occurred.

In the early 1980s, the Safety Board advocated using EFVs on service lines to schools and other buildings in which large numbers of people gather. As EFVs became cheaper and more widely available, the Safety Board began advocating the installation of EFVs on new or renewed residential service lines. During the 1980s, RSPA did not require EFVs. Consequently, the Safety Board included the use of EFVs on its 1990 list of Most Wanted safety improvements.[2]

On September 26, 1990, as a result of its investigation of five natural gas accidents in the Kansas City-Topeka area, the Safety Board recommended that RSPA:

> P-90-12
> Require the installation of excess flow valves on new and renewed single-family, residential high pressure service lines which have operating conditions compatible with the rated performance parameters of at least one model of commercially available excess flow valve.

On April 4, 1995, RSPA notified Congress by letter that it had decided not to require universal installation of EFVs and instead would issue performance standards and customer-notification requirements for EFVs. In a September 28, 1995, letter to RSPA, the Safety Board expressed its disappointment with this decision. The Board noted the continued strong evidence that a way was needed to quickly restrict the flow of gas to a failed pipe segment. On September 28, 1995, as a result of RSPA's failure to issue EFV requirements, the Safety Board classified Safety Recommendation P-90-12 "Closed-Unacceptable Action."

On March 6, 1996, as a result of its investigation of a June 9, 1994, natural gas explosion in Allentown, Pennsylvania, the Safety Board wrote to the Governors of all 50 States and the District of Columbia asking that they require gas distribution operators to install EFVs in all new or replaced gas service lines when operating conditions are compatible with commercially available valves (Safety Recommendation P-96-3). Of the States that replied, most advised that they intended to follow the lead of RSPA and had no plans to require the installation of EFVs. The State of Virginia did not initially respond to Safety Recommendation P-96-3.

Also on March 6, 1996, the Safety Board recommended that RSPA:

> P-96-2
> Require gas distribution operators to notify all customers of the availability of excess flow valves; any customer to be served by a new or renewed service line with operating parameters that are compatible with any commercially available excess flow valve should be notified; an operator should not refuse to notify a customer because of the customer's classification or the diameter or operating pressure of the service line.

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[2] In October 1990, the Safety Board developed the "Most Wanted" list, drawn up from previously issued safety recommendations, to bring special emphasis to the safety issues the Board deems most critical. The Most Wanted list is reviewed, revised, and reissued annually. The Most Wanted list is available on the Web at <http://www.ntsb.gov/Recs/MostWant.htm>.

On February 3, 1998, RSPA issued its final rule regarding EFVs. The rule requires gas distribution operators either to install EFVs on new or replaced single-residence service lines expected to operate continuously at not less than 10 psig or to inform customers of the availability and benefits of EFVs and install them if the customer agrees to pay for their installation and maintenance.

On October 6, 1998, the Safety Board classified Safety Recommendation P-96-2 "Closed-Unacceptable Action," in part because RSPA's final rule limits required notifications by gas operators to residential customers, even though many commercial service lines have operating characteristics compatible with the same EFVs used for residential service lines.

Because the Safety Board had no reasonable expectation that further action on EFVs was likely by either RSPA or the States, the Safety Board, on May 3, 2000, removed the recommendations regarding EFVs from its Most Wanted list. After the South Riding accident, on August 3, 2000, the Safety Board wrote the Governor of Virginia asking for information about Virginia's intentions with respect to Safety Recommendation P-96-3. In an August 16, 2000, response, the Virginia Corporation Commission noted that the State had adopted and will enforce RSPA's final rule. The commission further noted that it had not identified any noncompliance relative to the EFV provisions. It also noted that many Virginia gas operators install EFVs for existing customers upon request, provided the customer pays for the installation, and that all Virginia operators were now installing EFVs on all new and replaced service lines when operating conditions are compatible with commercially available EFVs. As a result, on October 3, 2000, the Safety Board classified Safety Recommendation P-96-3 to the State of Virginia "Closed-Acceptable Alternate Action."[3]

According to an American Gas Association survey provided to the Safety Board in the spring of 2000, since the issuance of the RSPA final rule on EFVs, approximately one-half of the operators of gas distribution systems have elected to install EFVs, and one-half have developed procedures to inform customers of their availability. In the latter case, the RSPA rule permits operators to pass along the cost of EFV installation and maintenance to those customers who choose to have the valve installed. While the Safety Board is encouraged that utility companies that do not provide the valves are at least making them available to their customers, the Safety Board is concerned that customers may not fully understand the safety benefits that EFVs can provide when they are faced with a decision that may require that they pay for the installation and maintenance of the device.

Furthermore, Safety Board investigation of a fatal gas pipeline accident in St. Cloud, Minnesota, (four fatalities)[4] indicates that commercial establishments can also benefit from the protection offered by EFVs. Likewise, an accident in Bridgeport, Alabama, (three fatalities)[5]

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[3] Safety Recommendation P-96-3 was classified "Closed" to 30 States. In a July 5, 2000, letter, the Safety Board asked for updates from the States for which the recommendation remained in an "Open" status.

[4] National Transportation Safety Board, *Natural Gas Pipeline Rupture and Subsequent Explosion, St. Cloud, Minnesota, December 11, 1998*, Pipeline Accident Report NTSB/PAR-00/01 (Washington, D.C.: NTSB, 2000).

[5] National Transportation Safety Board, *Natural Gas Service Line Rupture and Subsequent Explosion and Fire, Bridgeport, Alabama, January 22, 1999*, Pipeline Accident Brief PAB-00-01 (Washington, D.C.: NTSB, 2000).

may have been prevented if the gas service line had been equipped with an EFV. Both accidents involved excavation damage to underground natural gas service lines, and both involved gas that migrated underground to nearby buildings, where it subsequently exploded. Although both the St. Cloud and Bridgeport accidents involved older gas lines that would not have been subject to a RSPA requirement unless they had required maintenance, an EFV may have prevented both accidents. Without a requirement that, where appropriate for operating conditions, commercial gas service lines be equipped with EFVs, further accidents involving pipeline failures leading to fires and explosions can be expected. As noted earlier, current RSPA rules do not require that new commercial customers be informed about the availability of EFVs, even though their operating environments may be compatible with commercially available and relatively inexpensive EFVs.

Based on its investigation of the pipeline accident and fire in South Riding, Virginia, the National Transportation Safety Board makes the following safety recommendations to the Research and Special Programs Administration:

> Require gas utility operators to maintain a specified minimum separation distance, sufficient to protect against both thermal and mechanical damage, between plastic gas service lines and underground electrical facilities whenever they install a new gas service line or perform maintenance on existing lines. (P-01-1)

> Require that excess flow valves be installed in all new and renewed gas service lines, regardless of a customer's classification, when the operating conditions are compatible with readily available valves. (P-01-2)

The Safety Board also issued safety recommendations to the Edison Electric Institute, the National Rural Electric Cooperative Association, the American Public Power Association, and the U.S. Department of Agriculture's Rural Utilities Service.

Please refer to Safety Recommendations P-01-1 and -2 in your reply. If you need additional information, you may call (202) 314-6607.

Acting Chairman CARMODY and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

Original Signed

By: Carol J. Carmody
Acting Chairman