Log P-260

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

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Forwarded to:

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SAFETY RECOMMENDATION(S)

P-84-37 through -41

At 11:15 a.m. e.d.t., on October 17, 1983, while excavating for the installation of a large diameter, concrete, storm drain pipe, a backhoe operator snagged and punctured a 3-inch steel gas line on the south side of State Route 214, thereby fracturing a 3-inch cast iron valve connecting the 3-inch gas line to the 4-inch gas line on the north side of State Route 214 in South Charleston, West Virginia. Gas at 45 psig began to escape from both breaks and, while it seemed to be venting into the atmosphere, it was also migrating below ground. The contractor immediately notified Columbia Gas of West Virginia Inc., and gas company personnel were dispatched to the site to respond to the emergency. At 1:52 p.m., the Foodland supermarket, located 35 feet from the fractured valve, exploded, and then burned. Eighteen persons who were inside the store and 1 gas company employee who was outside the building were injured; the supermarket and an adjacent commercial building were destroyed. 1/

In this accident, an accurate sketch showing the 50-foot stub line did exist in the form of a work order for the line abandonment. An up-to-date inventory map also existed which also showed the 50-foot stub line. However, the gas company engineer responsible for locating the gas company facilities on the highway construction prints did not receive either the work order sketch or the inventory maps, and he did not request them. Instead, the gas company engineer used an older inventory map as a guide in locating the gas company facilities on the highway construction print. The older inventory map, which had been up-to-date when the engineer first was assigned to the highway construction project in 1977, showed the gas line as complete and in operation from the valve at Foodland all the way to the residential community approximately 700 feet away to the

1/ For more detailed information, read Pipeline Accident Report, "Columbia Gas of West Virginia, Inc., Explosion and Fire, South Charleston, West Virginia, October 17, 1983." (NTSB/PAR-84/4).

south. However, even though a meeting was held between the gas company engineer and the operations personnel for the purpose of verifying the accuracy of the map which was to be sent to the contractor, neither the engineer nor the operations personnel were precise when referring to where the 3-inch gas line was to be cut off. The operations personnel were referring to the gate valve at the end of the stub line, while the gas company engineer was referring to the gate valve at its connection with the 4-inch gas line 50 feet away at Foodland. Because the work order and the inventory map showing the existence of the stub line were not available to and, therefore, were not referred to by the engineer, and because the review of the construction map by all persons concerned failed to identify the inaccuracies in that map, the gas company supplied the contractor with an incorrect map.

Some months before the accident, but after the map showing the abandoned gas line had been provided to the contractor, the contractor blasted rock through the area and removed 300 feet of the 3-inch gas line (south of the end of the stub line) while making the initial grading for the storm drain project. Having successfully blasted in that area, having removed most of the 3-inch gas line, and having a map that showed an abandoned gas line marked on it, the contractor had reason to believe that the path for additional excavation was clear of gas lines under pressure.

The gas company inventory map used by the area plant supervisors to locate valves to shut off the flow of escaping gas accurately showed the location of the 3-inch cast iron, gate valve at the connection of the 3-inch gas line with the 4-inch gas line 35 feet away from Foodland. Unfortunately, the map failed to show some critical information: the depth of the valve (7 feet), that it was laid on its side with its valve stem horizontal, and that there was no hand wheel to operate it. If the area plant supervisors could have read this information directly from the map, they would not have wasted valuable time in trying to locate and close it on the day of the accident.

The gas company's written procedures involving damage to company facilities is quite specific as to what actions to be taken to protect the public and how checks to be made for migrating gas beyond the immediate leak site. Specifically mentioned in the procedures are gas checks adjacent to buildings and inside buildings, and evacuation of buildings. None of these prescribed procedures were followed in this accident. All responding gas company personnel (the serviceman and the area plant supervisors) were aware of the leak severity, but none of them followed the written procedures calling for them to check for gas adjacent to buildings and inside buildings, and to evacuate buildings. All of them stated that since the gas was venting freely into the atmosphere, in their opinion, it presented no problem.

The gas company serviceman, who arrived shortly after the backhoe snagged the 3-inch line, asked a person leaving Foodland if there were any gas odors in the store. Because he was told that everything was all right, he did not check again. Apparently, he did not realize that it takes gas time to accumulate under a black-topped parking lot, to migrate toward a building, to pool underneath the building slab, and to enter the building in sufficient quantity to be noticed. The area plant supervisors also failed to follow any of the company procedures. They too thought that since gas was venting into atmosphere, it posed no problem and because they were more concerned with trying to find valves to shut off the flow of gas to the rupture, they did not check inside Foodland.

The serviceman and the three area plant supervisors testified that the gas seemed to be venting into the atmosphere through the open valve boxes and that they were not overly concerned about the buildings. Unfortunately, because of this attitude, they passed

on misinformation to the co-manager of Foodland telling him that everything was under control. The gas company area plant supervisors forgot or ignored the fact that gas under pressure can migrate, and that a black-topped parking lot provides an excellent lid to hold escaping gas in the ground, and to allow gas to travel substantial distances beyond.

After arriving on the scene, gas company personnel should have broken the black-topped parking lot between the leak and Foodland and should have used a combustible gas indicator (CGI) to check for gas; a gas indication of any amount would have alerted them to the threat of gas migration. They then should have been checked for gas using a CGI adjacent to Foodland and then inside the supermarket; the presence of gas at there locations undoubtedly would have led to the evacuation of Foodland and adjacent buildings. Since there were few people in the store, 18 at the time of the explosion, evacuation would not have been complicated or time-consuming. These three steps could have been carried out by one person in a continuous manner before the gas buildup reached critical proportions. If gas company emergency procedures had been followed, persons could have been evacuated before the explosion and personal injuries would have been prevented. All of the gas company personnel at the accident site had received company training in these procedures but that training failed to motivate gas company personnel to take correct, positive action when it was most needed. This accident demonstrates the need for more intensive training in emergency procedures for all gas company personnel who must be dispatched to investigate leak complaints or pipeline damage.

Since 1970, the Safety Board has urged more extensive use of systems and methods to rapidly shutdown failed pipelines. In the introduction of its Special Study, "Effects of Delay in Shutting Down Failed Pipeline Systems and Methods of Providing Rapid Shutdown," 2/ the Board states, in part:

> In almost all recent pipeline accidents, the delay in shutting down the failed pipeline system has resulted in an increased magnitude of catastrophe. Had the flow of gas or hazardous liquid been stopped soon after the initial rupture, the effects of many accidents would have been minimized or eliminated. With the ever increasing use of pipelines for natural gas and other hazardous materials and the proximity of these lines to expanding populated areas, it is imperative that systems and methods be developed and put to use which will provide for the rapid shutting down of failed pipeline systems.

Since the study, the Safety Board has investigated more than 22 accidents caused by, or intensified by, delay in shutting down failed pipeline facilities. The October 17, 1983, accident exemplifies the effects of not shutting down a failed pipeline facility rapidly. The puncture notification at 11:16 a.m by Holloway to the gas company and the arrival of the gas company serviceman about 11:20 a.m., were timely actions, as were the gas company serviceman's initial survey of the situation (a severe leak) and call for additional help about 11:40 a.m. Additional help arrived about noon and a gas company area plant supervisor arrived about 12:10 p.m. Up to this point the gas company response, situation survey, analysis of leak severity, and crew arrival were conducted within a reasonable time frame. However, from 12:10 p.m. until the explosion at 1:52 p.m. (1 hour 42 minutes later) the gas company crew and three area plant supervisors searched for a valve next to Foodland for an extended time and could not find it, searched for critical valve No. 246 for an extended time and could not find it, selected a location to squeeze

2/ Special Study, "Effects of Delay in Shutting Down Failed Pipeline Systems and Methods of Providing Rapid Shutdown" (NTSB-PSS-71-1).

off the 4-inch plastic gas main, requested a backhoe to excavate the gas line at this location, and updated the dispatcher by radio, but never gave consideration to checking for gas accumulations in buildings or to the desirability of evacuating buildings.

While the actions of the gas company employees are difficult to understand considering the leak severity, several factors that contributed to these time delays warrant examination. First, the map of the gas company facilities in the Foodland area showed a 3-inch valve in the parking lot, but it did not show that it was 7 feet deep or that it was lying on its side without a hand wheel to operate it. Had this information been shown on the map that gas company personnel were using, they would not have wasted time trying to locate the valve since it would have been evident that it would require a backhoe and shoring to reach it, both time-consuming activites. Second, critical valve No. 246, which was supposed to have been inspected and operated on February 5, 1983, had been covered over with soil and could not be located. It should have been evident to the gas company employees that the measuring points shown on the inventory map to locate this valve were buried and would be difficult and time-consuming to locate, and that since they could not locate the telephone pole which was shown to be 38 feet from valve No. 246, they should have concentrated sooner on other shutoff valves further along the system.

Finally, after the explosion, the gas company did not shut off gas to the rupture until 3:20 p.m., almost 4 hours after the initial notification and almost 1 1/2 hours after the explosion; an unreasonable delay in shutting down a failed facility when other valves were accessible. The final shutoff was made by squeezing the 4-inch plastic pipe about 1,000 feet west of the fractured 3-inch gate valve, but by this time, all the damage had been done.

Proper procedures in the preparation of gas company maps and records would include the timely delivery to the gas company engineering department of any change order or work order showing facilities added, facilities altered, or facilities deleted. These orders, together with prints or sketches of the changes made in the field by the maintenance, operations or construction crews normally are sent, among other places, to the gas company engineering department so that they can be incorporated into the system maps to keep them updated. There is a time lapse between the date of the actual field work and the date that the engineering department receives notice of this work; the foreman needs time to make out the work report and sketch, the supervisor needs time to review the changes and so on. In this case, the procedure was followed, the information showing the stub line was recorded on the gas company inventory maps and those maps were in the hands of the persons who used them, the area plant supervisors. However, the gas company engineer assigned to the highway project was not on the list to receive the updated inventory maps and he did not make any effort to see if the inventory map he was using (an older map showing the line extended to the residential community) was the current one. Because the highway construction program had been on-going for several years the gas company engineer used an inventory map as a reference which although up-to-date at that time, was not up-to-date when the highway construction plans were finalized.

In addition, the information about the stub line could have been verbally communicated between the gas company engineer and the area plant supervisor at any one of four occasions: when they jointly reviewed the plans to be given to the contractor, when the 3-inch line was abandoned for the first time, when the 3-inch line was reconnected, and when it was abandoned for the last time. It is difficult to understand how so much activity could have been taking place in the gas company and so little critical information disseminated between its departments.

As a result of its investigation, the National Transportation Safety Board recommends that Columbia Gas of West Virginia, Inc., and the Mountaineer Gas Company:

> Emphasize in its training of operating personnel the importance of following company gas leak emergency procedures involving checking for gas in and adjacent to buildings, ventilating buildings, and evacuating persons from buildings; and test the operating personnel in these procedures. (Class I, Urgent Action) (P-84-37)
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> Review its atlases and inventory maps and denote on them those valves which cannot be accessed readily. (Class III, Longer Term Action) (P-84-38)
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> Emphasize to its area plant supervisors the importance of knowing the location and the availability of at least the critical valves within their jurisdiction. (Class II, Priority Action) (P-84-39)
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> Instruct its operating personnel to be alert for and to report in the course of their normal duties, missing pipeline markers, ground cover over valve locations, construction activities near its facilities and other occurrences which might adversely affect pipeline operations or pipeline integrity. (Class II, Priority Action) (P-84-40)
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> Establish quality control procedures to assure that all temporary or permanent changes made to its pipeline system are recorded and made available promptly to its engineering and operating departments. Initiate checks to see that these procedures are followed. (Class II, Priority Action) (P-84-41)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY and GROSE, Members, concurred in these recommendations.

By: Jim Burnett
Chairman