



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

P-296A

Date: April 20, 1990

In reply refer to: P-90-7 through -11

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In a 7-month period beginning September 16, 1988, the National Transportation Safety Board investigated 5 natural gas accidents in the Kansas City-Topeka area that involved the gas distribution systems owned by Kansas Power and Light Company (KPL). Corrosion damage was involved on each of the 3 gas service lines and the 2 cast iron gas mains. Each of the gas lines involved were installed before the Federal minimum gas pipeline safety regulations became effective and the failures on the gas service lines involved customer-owned pipe that had not been protected against corrosion damage. These accidents killed 4 people, injured 12 others and destroyed 4 houses.¹

Two and possibly three of the accidents experienced by KPL may have been prevented or at a minimum, the consequences markedly reduced had excess flow valves been installed on the service lines at their connection to the gas main. The Safety Board has advocated the use of excess flow valves since 1971 and in 1981, based on its study findings², the Safety Board recommended that the Research and Special Programs Administration (RSPA) of the U.S. Department of Transportation require excess flow valves be installed on all new and renewed high-pressure gas distribution service lines. Although RSPA currently has no plans to require the installation of excess flow valves, one gas operator's experience with excess flow valves was discussed in a recent

¹ For more detailed information, read Pipeline Accident Report--"Kansas Power and Light Company, Natural Gas Pipeline Accidents, September 16, 1988, to March 29, 1989," (NTSB/PAR-90/01).

² National Transportation Safety Board Special Study--"Pipeline Excess Flow Valves" (NTSB-PSS-81-1).

article.³ In this article, the Assistant Vice President of Bay State Gas Company (Bay State)⁴ reviewed his company's 13-year history with excess flow valves installed on gas service lines. The purpose of installing these valves was to reduce the number of emergency situations resulting from excavation-caused damages. Based on its successful trial experience with these valves, in 1977, Bay State Gas Company establish a policy calling for the installation of excess flow valves in all intermediate- and high-pressure⁵ service lines and it now has more than 40,000 such valves in its gas system. Bay State Gas has found these valves to provide increased public and employee safety at a nominal cost and that they operate dependably and automatically to stop the flow of gas to the service line should it be damaged substantially. In 1987, Bay State experienced 34 closures of excess flow valves where the valve prevented a potentially hazardous situation from developing when service lines were broken because of excavation damage.

While excess flow valves are used by some gas operators primarily to stop the flow of gas from excavation-caused damages to service lines, the valve will shut off the flow of gas no matter what the source of the damage so long as the increased flow rate is sufficient to cause the valve to operate. Also, the cost of an excess flow valve and its installation in a gas service line connection to a gas main, when performed at the time a service line is being initially constructed or when being renewed or replaced, is about the same as the cost of purchasing and installing a home smoke detector. The experiences of Bay State support the Board's contention of the benefit to public safety provided by excess flow valves and the Safety Board urges KPL to install excess flow valves on all new and renewed single family, residential high pressure gas service lines.

The Safety Board's investigation of the five natural gas accidents indicated that KPL had recognized that it was responsible for monitoring both its own and customer-owned portions of service lines. However, it did not use effective monitoring procedures to detect leaks or to determine that the customer-owned portions of the service lines were maintained in a safe condition. KPL's failure to collect and analyze the data needed to effectively evaluate the condition of customer-owned portions of the service lines may, in part, have occurred because the Federal regulations do not establish explicit criteria on how a gas operator should perform the required 3-year periodic evaluation of gas lines not protected against corrosion

³ "Bay State Gas Reduces Costs and Improves Safety Record: Automatic Shut-off Valves," Paul LaShoto, Assistant Vice President for Operations, Pipeline & Gas Journal, November 1989, p. 30.

⁴ Bay State is the largest independent gas company in New England and serves more than 250,000 customers in Massachusetts.

⁵ The term "high pressure" as define in the Federal regulations is any pressure in which the gas pressure in the gas main is higher than the pressure provided to the customer. However, many in the gas industry use the term "intermediate pressure" to mean gas pressures between 10 and 30 psig and the term "high pressure" to mean pressures from 30 to 60 psig.

damage and the required program for continuing surveillance. However, KPL management was aware that the make-up of its distribution systems, including service lines, were quite diverse and that the pipelines were buried in generally corrosive soils. The Safety Board believes that KPL should have protected against corrosion all of the service lines for which it was responsible or it should have developed a program to identify and replace, before the occurrence of damage sufficient to cause leakage, those unprotected lines subject to severe corrosion.

KPL also implemented several procedures, such as leakage surveys, periodic patrols of mains on bridges and at highway crossings, and various routine inspections of facilities all of which are required by Federal regulations. However, it did not implement a program to analyze the results of these surveys, patrols, and inspections so it could detect changes in gas system failure rates, leakage histories, corrosion protection requirements, and other unusual operating and maintenance conditions.

KPL standards for replacing cast-iron mains based on previous failures within a block or an intersection did not require adequate investigation to identify the causes of the failures, such as subjecting random samples of the failures to metallurgical analysis to determine the extent graphitization had occurred. Also, it did not collectively analyze the failures in its cast-iron systems to identify sections that, because of severe graphitization or limited beam strength, required priority replacement. KPL should analyze, on a system basis, the results of metallurgical tests being made of coupons taken from its cast-iron pipes, the results of subsidence surveys now being conducted, and the results of annual leakage surveys of its cast-iron mains to identify those mains most subject to failure because of graphitization, insufficient beam strength, or changes in the soil support beneath these pipes. KPL then should implement a program, using the results of these analyses, to replace those cast-iron mains within areas where these mains are most subject to failure.

KPL's excavation damage prevention procedures contain much guidance to its employees for inspecting and protecting cast-iron mains and other KPL facilities. These procedures establish on site inspection requirements for the larger, higher pressure mains; however, there was no explicit requirement that its employees periodically inspect the excavation activities performed adjacent to cast-iron pipelines and other facilities that could endanger public safety should they be damaged. Further, according to the actions of the KPL supervisor and the employees who periodically visited the water main construction project at Kansas City, Missouri, KPL employees did not understand correctly the requirements of KPL's excavation damage prevention procedures or the need to record their actions when inspecting such excavations. KPL needs to review and, as necessary, modify its excavation damage prevention procedures to explicitly identify the excavation activities capable of causing damage to its pipelines and to explicitly define the steps to be taken by its employees to inspect and protect its pipelines when exposed to such potential dangers.

There has been substantial potential for KPL employees to incorrectly interpret KPL's procedures or to continue following the procedures of their

previous system management because KPL did not have an effective training program when it merged the employees of several gas systems that operated under procedures different from KPL. The need for improved training on KPL's procedures for its employees surfaced during the investigation of the accidents at Kansas City, Kansas, where employees did not adequately perform inspections of excavations adjacent to KPL's pipeline and at Topeka, Kansas, where employees did not test completely around the house foundation for the presence of gas in the ground or determine the location of the gas facilities when checking for the presence of gas "over the main." KPL needs to implement a system-wide training program that establishes objectives and standards for the training of its employees based on their assigned responsibilities and it needs to develop evaluation standards or criteria to be used by district supervisors in evaluating employee performance. In this manner, KPL can achieve effective, uniform execution by its employees of all procedures applicable to their assigned duties.

On November 2, 1989, KPL responded to previously issued Safety Recommendations and advised the Safety Board of improvements it had made for surveillance of its gas pipeline systems. This response advised of improvements were being made in the States of Kansas and Missouri, including the use of flame ionization leakage surveys of the uncoated, unprotected steel service lines, renewal of gas service lines, and survey and replacement of portions of its cast-iron gas mains. However, it was not clear which of the reported improvements were to be voluntarily extended to KPL's gas facilities in the State of Oklahoma. The Safety Board believes that most, if not all, of KPL's system improvements would be applicable also to its Oklahoma gas facilities and urges KPL to extend all appropriate improvements to its facilities in the State of Oklahoma.

Therefore, the National Transportation Safety Board recommends that the Kansas Power and Light Gas Service Company:

Install excess flow valves on all new and renewed single-family, residential high pressure services which have operating conditions compatible with the rated performance parameters of at least one model of commercially available excess flow valve. (Class II, Priority Action) (P-90-7)

Extend, as applicable, the current programs for leak surveys, renewal of customer-owned portions of service lines and yard lines, and replacement of cast-iron pipe to its gas systems in the State of Oklahoma. (Class II, Priority Action) (P-90-8)

Implement for all pipeline facilities a comprehensive surveillance program that: (1) identifies the types and extent of data to be collected on gas system failures, on gas leakage histories, on changes in corrosion protection levels or requirements, and on abnormal operating and maintenance conditions; (2) establishes the types and frequencies of analyses that will be performed to

identify potentially unsafe conditions; and (3) specifies the actions to be taken to correct unsafe conditions that are identified. (Class II, Priority Action) (P-90-9)

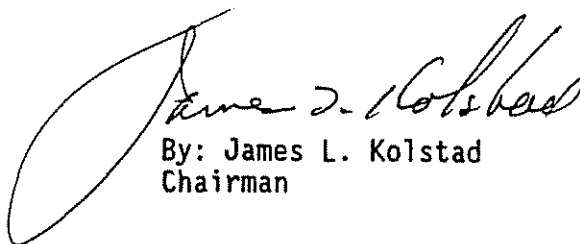
Include in its excavation damage prevention program the frequency of on site inspections when excavation activities are of an extended duration. (Priority Action, Class II) (P-90-10)

Implement, under the direction of a qualified person, a system-wide employee training program that is based on an analysis of the tasks to be performed by employees during normal and emergency conditions and that incorporates measurable performance standards and tests or evaluations to determine that each employee meets established training objectives. (Priority Action, Class II) (P-90-11)

Also, the Safety Board issued safety recommendations to the Research and Special Programs Administration, the American Gas Association, and the American Public Gas Association.

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 vitally 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-90-7 through -11 in your reply.

KOLSTAD, Chairman, COUGHLIN, Acting Vice Chairman, and BURNETT, Member, concurred in these recommendations. LAUBER, Member, did not participate.



By: James L. Kolstad
Chairman