



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Log P-292

Date: March 30, 1989

In reply refer to: P-89-1 through -4

Mr. David S. Black
Chairman of the Board and CEO
KPL Gas Service Company
P.O. Box 889, 818 Kansas Avenue
Topeka, Kansas 66601

The National Transportation Safety Board is currently investigating four accidents involving high pressure distribution facilities operated by the KPL Gas Service Company (KPL).

(1) A September 16, 1988, natural gas explosion in Overland Park, Kansas, involving gas leaking from corrosion holes in the customer-owned^{1/} service line. Gas migrated underground to the house and was ignited. The house was destroyed and the four residents were injured.

(2) A November 25, 1988, natural gas explosion and fire in Kansas City, Missouri, involving a break in a customer-owned service line at a threaded joint that was affected by corrosion. One person was killed and five persons injured in the explosion that severely damaged the residence.

(3) A December 5, 1988, natural gas fire in Kansas City, Missouri, involving a cracked, 6-inch cast-iron gas main that was affected by graphitic corrosion. One person was injured and two vehicles were damaged after the escaping natural gas ignited in a driveway.

(4) A February 10, 1989, natural gas explosion and fire in Oak Grove, Missouri, involving the failure of a customer-owned service line at a threaded joint. Two persons were killed and their house was destroyed in the explosion.

^{1/} Customer-owned pipe was installed by the building contractor at the time gas service to the customer was initiated. It was a part of the piping, defined in 49 CFR Part 192 as a service line, between the gas main and KPL's meter located at the customer's building. Before the Federal regulations in 49 CFR Part 192 became effective in 1970, gas companies were not responsible for the condition of customer-owned piping between a gas main and a gas company's meter.

Concern about the number of accidents within a short time and the possibility that corrosion may be involved in each failure prompted Safety Board staff to meet with KPL officials to review the company's procedures for monitoring system integrity. During the review it was learned that KPL had experienced over the past 18 years a number of gas leaks from its cast-iron system and from customer-owned pipe. Because KPL's procedures for repairing leaks on either service lines or its cast-iron mains do not normally include action to determine the reason for the failure, the company could not identify why these failures had occurred or detect if there was any pattern to the failures.

In discussing the repair of leaks in cast-iron systems, KPL officials stated that, where possible, a split sleeve clamp or a full encirclement clamp is installed over leaks in gas mains. Work crews are instructed to visually examine the cast-iron main for signs of graphitization and to attempt to probe a pointed tool into the cast iron to determine if the cast iron is graphitized. The examinations performed by KPL are capable of detecting only instances of severe graphitization. The Safety Board has learned through accident investigations that graphitization not detectable by the methods used by KPL has caused major failures of cast-iron pipe. Such graphitization can be detected only by metallurgical examination. KPL, however, does not have a program that routinely requires the metallurgical testing of cracked pipe sections to determine the cause of failure. Only when a leak results in an incident, which in KPL's opinion is an occurrence causing substantial property damage or injury, is the failed section of main cut out and tested. Because such a small and irregular sample of all failures are tested, KPL is unable to detect trends in the failures of its cast-iron mains.

The Safety Board found that KPL does, however, monitor failures of cast-iron mains as part of its replacement program. As explained by KPL, its cast-iron replacement policy requires the replacement of a one-block section of main when three failures occur within the block during a 5-year period. The policy further requires replacing sections of pipe within an intersection when two failures occur within the intersection during a 5-year period. To keep track of the failures of cast-iron pipes, KPL plots them on a map. The work order number, on which actions are recorded for repairing the leak, is also plotted on the map. When a new leak is plotted, an employee is to determine if the section of main or the intersection meets KPL's criteria for replacement. If so, the employee is to implement action to schedule its replacement.

In discussing procedures used for repair of customer-owned service lines, KPL officials explained that when a leak is reported outside a residence, a maintenance crew is dispatched. If crew members discover a leak on the service line, they will

replace the line by inserting plastic pipe into the existing steel service line rather than excavate the area of the leak to repair the service line. KPL officials explained that inserting plastic pipe costs less than excavating and improves the safety of the gas distribution system by preventing further leaks on the same service line. Service lines also may be replaced when mains are replaced.

During its review, the Safety Board could find no evidence that KPL had a program for the planned replacement of service lines based upon their history of failure. Between 1970 and 1980, KPL maintained area maps on which it plotted service lines that had been replaced and mains that had corrosion leaks. These maps were useful for visually identifying areas within KPL's system in which greater replacement activity had occurred. These maps were not useful, however, for identifying areas of greater corrosion activity: the maps showed all replaced services without indicating the reasons for replacement, and KPL had not determined the cause of leaks on service lines. In 1980, KPL discontinued plotting service line replacements on these maps; however, data on service line replacements is maintained in KPL's files. When a service line is replaced, a new service card is completed and filed, with all of KPL's other service cards, according to the street address. Because KPL does not have a program to monitor service line replacements, the only way to know if a specific service is a replacement or an original is to read the service card. The service card does not indicate the reason for replacement.

Until 1968, gas service lines in many parts of KPL's service area were installed by plumbers employed by the building contractor. These lines typically were uncoated steel lines connected in about 21-foot sections with screw-type joints; the lines ran from the edge of the building to the front property line. KPL would connect its service line, installed from the gas main to the front property line, to the customer-owned service line using a coupling that provided electrical isolation between the two portions of the service line. When these lines were installed, KPL did not provide maintenance, corrosion protection, or leak surveys for the customer-owned portion of the service line nor did KPL repair the lines without charge to the customer. Because Federal regulations now include these customer-owned portions of pipe within the definition of the term "service line" and require gas operators to maintain service lines, KPL performs leak surveys and repairs on these customer-owned portions of the service lines. Unlike steel service lines installed by KPL, KPL does not include customer-owned service lines within its cathodic protection program.

After the September 16, 1988, accident in Overland Park, Kansas, KPL met with the Kansas Corporation Commission (KCC)--the agency responsible for regulating gas pipeline safety in Kansas--to discuss leak survey procedures. In October, KPL notified the KCC of its intent to perform leak surveys, using flame ionization equipment, on an expedited schedule, over all service lines in its system. Testing began on October 3, 1988. All service lines over which gas leaks are detected are being replaced with plastic pipe. KPL has revised its procedures to require that uncoated steel service lines be resurveyed every 3 years rather than the previous 5 years; mains are to be resurveyed every 3 years. On November 30, 1988, after reviewing the number of serious leaks being found by KPL's flame ionization leak surveys, the KCC ordered all gas operators in Kansas to perform flame ionization leak surveys of cathodically unprotected, steel service lines by December 31, 1988, if they had not been using that method.

The Safety Board believes that gas detector leak surveys need to be done over the uncoated, unprotected steel service lines in KPL's system to identify and eliminate present gas leakage. Flame ionization leak surveys, however, detect gas leakage only; they provide no information about the extent of damage caused by ongoing corrosion or the length of time until a leak will occur. Although such data can be obtained, KPL has not collected, through tests or visual observations, information on the condition of uncoated, unprotected, steel services lines or on its cast-iron mains that would help determine the extent of corrosion damage in the gas distribution system. Therefore, the company is unable to provide, through analysis, surveillance of its system sufficient to comply with 49 CFR 192.613. This regulation requires that pipeline operators have a monitoring program to determine where and when segments of its system require more frequent survey or replacement to minimize the occurrence of gas leaks that may threaten public safety. The Safety Board believes KPL must develop procedures for collecting and analyzing data on failures and leaks sufficient for it to make decisions on replacements and frequency of surveys. Until sufficient data have been collected to establish trends in failures and leaks using the new procedures, KPL should perform leak surveys at least annually over all uncoated, unprotected steel service lines and cast-iron mains.

Therefore, the National Transportation Safety Board recommends that KPL Gas Service:

Develop procedures for the collection and analysis of information on the causes of system leaks and failures sufficient to identify areas where uncoated, unprotected steel service lines and cast-iron mains should be replaced.
(Class II, Priority Action) (P-89-1)

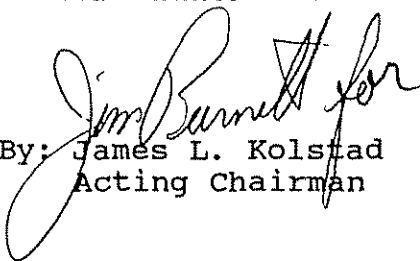
Perform gas detector surveys at least annually over uncoated, unprotected steel service lines and cast-iron mains until data of sufficient quantity and type have been gathered on the causes of leaks and failures and have been analyzed to identify those sections of the gas distribution system that should be replaced. (Class II, Priority Action) (P-89-2)

Implement a program for the early replacement of or for the application of corrosion protection to uncoated, unprotected steel customer-owned service lines based on analysis of failure trends. (Class II, Priority Action) (P-89-3)

Institute a company practice for metallurgically examining failed segments of pipe to identify cause of failure and to assist in determining when portions of pipe in its system should be replaced. (Class II, Priority Action) (P-89-4)

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 actions taken as a result of its safety recommendations and 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-89-1 through P-89-4 in your reply.

KOLSTAD, Acting Chairman, and BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in these recommendations.


By: James L. Kolstad
Acting Chairman