

NATIONAL TRANSPORTATION SAFETY BOARD WASHINGTON, D.C.

ISSUED: August 8, 1979

Forwarded to:

Mr. L.D. Santman
Director
Materials Transportation Bureau
Department of Transportation
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

P-79-20 and 21

At 12:20 p.m., c.s.t., on April 18, 1979, a 24-inch natural gas transmission pipeline owned by the Natural Gas Pipeline Company of America (gas company) pulled out of a compression coupling during a line-lowering project under Iowa State Highway 181 in a rural area near Dallas, Iowa. Within seconds, the natural gas ignited and burned a 900-foot by 400-foot area. Five of the eight injured workers were hospitalized. Two cars, a pickup truck, and a trailer housing construction equipment were destroyed. A backhoe was partly damaged, and windows were broken in a nearby farmhouse.

The natural gas pipeline system, which includes three lines constructed parallel to each other (24, 26, and 36 inches in diameter), extends 980 miles from West Texas through New Mexico, Oklahoma, Kansas, Nebraska, Iowa, and Illinois, and serves approximately 12 million customers. The 24-inch pipeline, the oldest of the three, was installed in 1931 by welding two lengths of pipe together on top of the trench and then joining the double lengths of pipe in the trench with compression couplings. There are approximately 51,700 couplings on this line, and 15,135 couplings are located in the State of Iowa.

Two days before the accident, in preparation for the line lowering, a gas company crew closed mainline valves which were 8.7 miles apart, thereby isolating a section of the pipeline. Crossover valves on either side of the section were opened so that natural gas could continue to flow around the isolated section without interrupting customer service beyond. The pressure in the isolated section was then lowered from 635 psig to 5 psig and was to have been monitored while a contractor's crew

lowered and replaced a segment of the pipeline under Iowa State Highway 181. A pressure gauge, which had been installed on the isolated line section to monitor the pressure, apparently was removed sometime before the accident. There were no written company procedures for the pressure monitoring; the orders were given orally.

The contractor exposed the first compression coupling on the east side of the highway to verify the location of the pipeline and the coupling. The contractor did not install a welded sleeve on this coupling because it was included in the section to be replaced. The excavation was then backfilled and a compression coupling was uncovered 80 feet east of the first coupling. A welded sleeve was installed on this coupling to reinforce it against pullout, and a trench exposing the pipeline was dug to within 10 feet of the first coupling. A 13-degree bend in the pipeline was exposed just west of the second coupling.

While the contractor was exposing the pipeline and welding the sleeves on, the gas company did not monitor the pressure; therefore, the construction crew was unaware that gas at some pressure up to a maximum of 635 psig had leaked by one of the closed valves and had increased the pressure in the isolated section. The pressure apparently increased to a point where the axial force, acting on the 13-degree pipe bend, exceeded the pullout resistance of the first coupling. The 80-foot-long exposed section of 24-inch pipe pulled out of the first coupling that had been exposed but not sleeved. The pullout force caused the pipe to rise straight up in the air and then slam down to the ground, causing it to crimp and finally break in the middle of the 80-foot section.

The gas company's accident records indicated that this 24-inch pipeline had experienced 12 previous failures since it was constructed; 9 of these involved compression coupling pullouts. Five of the six failures that occurred in Iowa were coupling pullouts. On March 3, 1979, in Mills County, Iowa, the 24-inch pipeline pulled out of a compression coupling where the pipeline extended over a hill (overbend). On March 4, 1979, in Washington County, Iowa, more than 200 miles away, the same line pulled out of another compression coupling in an overbend. Both ruptures occurred in open fields, and no injuries were reported. Five of the 10 coupling pullouts were located either at a sidebend or at an overbend. The causes of these pullouts are still under investigation.

The 26-inch pipeline was completed in 1948, and the 36-inch pipeline was completed in 1963. In both of these pipelines, all of the joints were welded and, therefore, not susceptible to pullout failures. Over the years the gas company has welded sleeves over 4,800 compression couplings on the 24-inch pipeline where those couplings were exposed for various projects. The sleeve welding is done to prevent future pullout of the pipe from the coupling.

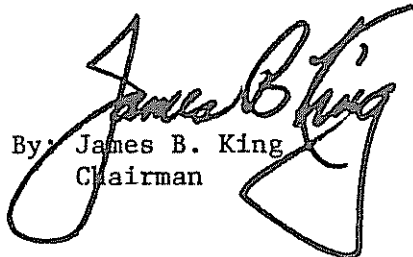
Gas transmission pipelines constructed in the 1920's and very early 1930's were often installed with compression couplings. These couplings were dependable and capable of holding high pressures; however, they were neither designed for nor intended to restrain longitudinal pipe movement.

Therefore, the National Transportation Safety Board recommends that the Materials Transportation Bureau of the Department of Transportation:

Coordinate with the appropriate State agencies, by field test reports and on-site inspection, in monitoring the excavation of the compression couplings on the 24-inch transmission pipeline to insure the integrity of the pipeline. (Class I, Urgent Action)(P-79-20)

Coordinate with the appropriate State agencies in the monitoring of the 24-inch transmission pipeline to determine if the problem of compression coupling pullouts persists. In the event of a continuing pullout problem, consider the reduction of pressure or the shutdown, in sections or in total, of the pipeline until the problem can be corrected. (Class I, Urgent Action) (P-79-21)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and GOLDMAN, Members, concurred in these recommendations.


By: James B. King
Chairman