



log P-280 SP-20

National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: February 27, 1986
In reply refer to: P-86-01 and -02

Mr. A. David Bufkin
Chairman, President and
Chief Executive Officer
Texas Eastern Corporation
1 Houston Center
Post Office Box 2521
Houston, Texas 77001

About 1300 1/ on November 25, 1984, Texas Eastern Gas Pipeline Company's (Texas Eastern) 30-inch-diameter natural gas transmission pipeline, constructed in 1955 and operating at 1,000 psig pressure, ruptured at a location about three miles west of Jackson, Louisiana 2/. Gas blowing from the rupture fractured the pipe into many pieces and created a hole in the earth about 90 feet long, 25 feet wide, and 10 feet deep. The escaping gas was quickly ignited by one of several potential sources of ignition (construction equipment engines, static electricity, sparks resulting from debris blown from the pipeline, etc.). The resulting fire incinerated an area extending from the rupture about 950 feet north, 500 feet south, and 180 feet to the east and to the west. Within this sparsely populated area, five persons involved with the pipeline "construction work were killed and 23 persons, construction workers and public, were injured. Additionally, several pieces of construction equipment were damaged extensively. Of the injured persons, most were located about 800 feet north of the rupture within a hunting club facility that included 11 trailers or campers also destroyed by fire.

A May 18, 1984, survey performed by Texas Eastern, determined that the population density along a one-mile segment of the pipeline had increased as a result of additions to a hunting club facility and the installation of mobile homes on adjacent property. As a result, a higher internal pipe pressure design safety factor was necessary to comply with federal safety requirements (49 CFR 192). To accomplish the required improvements, Texas Eastern contracted with Clarkeco Construction, a private pipeline construction company, to replace 1,500-foot segments of its two parallel pipelines in this area. This work required removing a pipe segment from each of the existing pipelines (pipe in both segments manufactured to American Petroleum Institute (API) standards for X-52 pipe); constructing new, stronger, and thicker pipe segments (API X-65) offset from the present pipeline route; testing the new pipeline segments; isolating, cutting, and purging the existing pipeline segments to be removed; and connecting the new pipeline segments to the existing pipelines.

1/ All times are based on the 24-hour clock and are reported in central standard time.
2/ For more detailed information, read Pipeline Accident/Incident Summary Report--
"Texas Eastern Gas Pipeline Company, Jackson, Louisiana, November 25, 1984"
(NTSB/PAR-86/01/SUM).

After the new pipeline segments were constructed and hydrostatically tested, on November 24, 1984 the contractor was ready to connect the new 30-inch pipeline segment to the existing 30-inch pipeline. To weld the new pipeline segment to the existing pipeline, the ends of the pipes were lifted 4 to 5 feet above the original elevation of the existing pipeline. This task required excavating a 40-foot segment of the existing pipeline adjacent to the area where the weld connection was to be made. After the connecting weld was completed, the lifting forces on the pipe were removed; however, the connected pipe segments remained about two feet above the original elevation of the existing pipeline at the weld connection. Several attempts were made by the contractor to lower the pipeline to its original elevation by removing soil from beneath pipe segments adjacent to the weld connection, but when the lowering was not successful, the 2-foot gap between the ditch bottom and the pipe was filled with uncompacted soil. It was estimated that 75 - 100 feet of pipe was not supported from beneath by a properly compacted soil foundation.

After welding the new pipeline segment to the existing pipeline, construction equipment began filling excavations, the weld was x-ray inspected, and the pipeline was purged of water and air. At 0100 on November 25, 1984, gas under pressure was flowed into the pipeline segment by opening a nearby valve until the pressure in the segment reached 700 psig. After the pressure in the segment stabilized, indicating the absence of a leak, the pressure in the segment was increased to the operating pressure of the pipeline, 1,016 psig., and the line was again placed in service. The backfill operations began on November 24, 1984, and were continued on November 25, 1984. Just before the rupture of the pipeline, contractor personnel were operating heavy equipment (backhoe and bulldozer) over the pipeline about 65 feet north and south of the final weld connection.

Texas Eastern's Specification No. P-6705, Backfilling, states that attention shall be given to ensure that a dirt cushion ^{1/} is placed around and under the pipe to completely fill all voids. In addition Paragraph 192.319 of 49 CFR 192 requires that when a ditch for a transmission line or main is backfilled, it must be backfilled to provide firm support under the pipe.

Metallurgical examination of the final weld connection revealed that the X-52 and X-65 pipe ends were misaligned vertically with the X-52 pipe being displaced upward relative to the X-65 pipe. Further, the misalignment was not uniformly distributed around the circumference of the pipe connection. Moreover, additional misalignment was caused by the pipes being out-of-round. Although the pipe ends were not fully aligned, there was no lack of filling or lack of penetration of the weld in excess of that allowed by API Standard 1104; however, the misalignment between the pipe ends was not uniformly distributed as required by API Standard 1104.

The weld on the final connection of the new pipeline segment to the existing pipeline met applicable standards and was capable of withstanding without failure all stresses normally anticipated during the operation of a pipeline, as evidenced by the following facts: the x-ray of the weld made before the pipeline was subjected to pressure met the quality standards of API Standard 1104; the weld withstood without failure or leakage more than 1,000 psig for about 12 hours; and metallurgical tests performed after the rupture confirmed that, except for the misalignment not being uniformly spaced, the weld complied with applicable API Standard 1104 requirements.

^{1/} The term "dirt cushion" means the addition of noncompacted soil to fill voids adjacent to the pipeline.

The installation of the pipe in the ditch violated federal regulations since the backfill did not provide firm support under the pipe. This installation also did not comply with the gas industry's recommended practices as compiled in the American Society of Mechanical Engineer's "ASME Guide for Gas Transmission and Distribution Piping Systems." This guide recommends that, "On pipelines operating at stresses of 20 percent or more of specified minimum yield strength, it is important that stresses induced into the pipeline by construction be minimized. The pipe should fit the ditch without the use of external force to hold it in place until the backfill is completed." Texas Eastern's contractor and Texas Eastern's own inspection personnel failed to comply with the federal requirement to provide a firm support beneath the pipeline. In addition, they failed to follow recommended industry guidance for supporting the pipeline. As the heavy construction equipment working over the pipeline to complete the backfill operations approached the inadequately supported segment of pipeline, the weight of the construction equipment forced the pipeline downward, thereby increasing the level of stress in the pipe wall and weld. As the equipment worked nearer the final connection weld where a greater depth of uncompacted soil had been filled beneath the pipe, the stresses in the pipe wall increased beyond the stress carrying capability of the weld connection and the fracture initiated. The nonuniform spacing of the misalignment between the pipe ends most likely facilitated the initiation of the fracture; however, the fracture most likely would have initiated even had this point of stress concentration not been present.

Therefore, the National Transportation Safety Board recommends that the Texas Eastern Gas Pipeline Company:

Revise its construction specifications to require that proper support be provided beneath gas pipelines when they are installed. (Class II, Priority Action) (P-86-01)

Train its construction/inspection personnel in the revised backfill procedures and monitor periodically their inspection of pipeline construction projects to verify conformance with these procedures. (Class II, Priority Action)(P-86-02)

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 recommendation(s) in this letter. Please refer to Safety Recommendations P-86-01 and P-82-02 in your reply.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER, Member, concurred in these recommendations.


By: Jim Burnett
Chairman