P-154

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: September 24, 1980

Forwarded to:

Mr. R. J. Evans
President
Texas Pipeline Company
Box 42130
Houston, Texas 77042

SAFETY RECOMMENDATION(S)

P-80-66 through -68

On January 2, 1980, crude oil leaked from a fractured 22-inch pipeline at a levee crossing at Berwick, Louisiana; the pipeline is owned by the Texas Pipeline Company and runs between Houma and Erath, Louisiana. At 9:54 a.m., the crude oil ignited. One person was killed, one person was injured, and six homes were either destroyed or damaged.

The 22-inch coated and wrapped steel pipeline was installed in 1952. The crude oil it carried was gathered in the Houma area and was being pumped to Erath; additional crude oil was being injected at the Gibson and Patterson pump stations. Berwick is located between these two stations.

Local residents had detected the leak about 9 a.m. After some delay, the local police were notified. Personnel were dispatched at 9:24 a.m. and arrived on scene at 9:26. The volunteer fire department was alerted at 9:26 a.m. and arrived on scene at 9:28. However, even though a marker containing the Texas Pipeline Company's telephone number was located near the leak site, the company was not notified of the leak until 9:53 a.m. By that time, the oil had flowed under houses along the levee. Although emergency personnel evacuated persons from the houses and shut off natural gas appliances, the oil ignited as the last house was being entered for appliance shutoff.

Immediately upon receiving notification of the leak, the company shut down the single unit which was pumping at Houma and the two remotely operated units at Gibson. At 10:20 a.m., Houma began to take suction on the pipeline in an attempt to pull as much crude oil as possible out of the pipeline at the leak site.

Gates valves were closed manually 1 mile upstream and 300 feet downstream of the fracture in order to isolate the leak further. However, about 1,888 barrels, or 79,300 gallons, of crude oil escaped under an initial pressure of 140 psig. This volume was estimated from the cumulative total of barrels pumped to Erath at 10 a.m. less the amount received at Erath. The flow rate at Houma and the overall system pressure did not alert company personnel to a leak because the leak began about the same

time that Houma began pumping. Hourly totals for the 28-hour period before the shutdown varied erratically, from 526 barrels over to 249 barrels short; only a very large leak could be detected by monitoring receipts for any given hour. Since the pipeline monitoring system failed to detect a loss of over 1,800 barrels of oil, a more effective monitoring system should be developed and implemented.

Examination of the failed pipe revealed that a tie-in weld between horizontal sections of pipe had been made near the top of the levee. Two pairs of field bends were used to make the crossing to meet U.S. Army Corps of Engineers design requirements, which prohibit penetration of the levee. The weld was reinforced by a full encirclement, fillet-welded sleeve--the operator's normal practice at levee crossings. The initiating fracture had begun immediately adjacent to the fillet weld at one end of the sleeve. It was located at the 6 o'clock position on the pipe and had apparently existed for some time without completely penetrating the pipe wall. The ultimate failure was a circumferential fracture, about 29 inches long from the 3 to the 8 o'clock position.

Metallurgical tests 1/ revealed that the failure of the pipe was caused by underbead cracking that originated when the sleeve was welded to the pipe. Underbead cracks result from hydrogen absorbed during welding. The absorbed hydrogen may diffuse out of the steel during cooling; however, certain circumstances can cause the heat-affected zone to crack before the hydrogen is able to diffuse out of the steel. Low heat input, high carbon and manganese, and rapid cooling increase the hardness of the heat-affected zone and promote underbead cracking. The heat-affected zone that cracked in this case was extremely hard for line pipe steel, indicating that it had cooled rapidly. A large crack grew from the underbead cracks, the growth of which was likely promoted by periodic bending stresses at the edge of the sleeve due to soil movement, thermal expansion and contraction, or other forces. The fact that the fracture was brittle but arrested after propagating halfway around the circumference indicated a bending stress caused the fracture.

The Safety Board is concerned about the use of fillet-welded reinforcement sleeves for levee crossings because moment forces are transferred to the ends of the sleeve where the pipe may have been weakened by the fillet weld heat, and because the pipe is rigid where flexibility is needed. Therefore, it believes that the practice of using reinforcement sleeves should be reviewed.

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

> Review the practice of using fillet-welded reinforcement sleeves for tie-in welds to determine if these sleeves have been the cause of any pipeline failures in its system, and based on the results of this review, revise company practices and procedures for the use of these sleeves. (Class II, Priority Action) (P-80-66)
>
> Notify the pipeline patrol of the location of existing fillet-welded sleeves and instruct it to examine, during periodic patrols, the areas around the sleeve installations for signs of leakage. (Class II, Priority Action) (P-80-67)

1/ "Report 396-80-3434 on Investigation of Crude Oil Pipeline Failure for the Texas Pipeline Company," Metallurgical Consultants, Inc., Houston, Texas 77004, May 15, 1980.

Evaluate existing procedures for leak detection and take steps to make these procedures more effective. (Class II, Priority Action) (P-80-68)

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

By: James B. King
Chairman