



# National Transportation Safety Board

Washington, D.C. 20594  
Safety Recommendation

SP-20  
Log P-284

**Date:** August 13, 1986

**In reply refer to:** P-86-15

Ms. Cynthia Douglass  
Administrator  
Research and Special Programs  
Administration  
Department of Transportation  
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About 4:20 a.m. on July 8, 1986, line 2N, an 8-inch products pipeline at Mounds View, Minnesota, operated by Williams Pipe Line Company (WPL) ruptured. Unleaded gasoline under about 1,480 psig spewed from the 7 1/2-foot-long opening along the longitudinal seam of the pipe. Vaporized gasoline combined with the air, and liquid gasoline flowed along neighborhood streets. About 20 minutes later, the gasoline vapor was ignited by sparks from an automobile which had entered the area. Following an explosion-like noise, fire spread rapidly through the neighborhood along the path of the liquid gasoline. Two persons were burned severely and later died, and one person suffered serious burns. There was substantial property damage and soil and water pollution.

As part of the Safety Board's investigation of this accident, the ruptured section of American Petroleum Institute (API) Standard X42 electric resistance welded (ERW) pipe containing the rupture was metallurgically examined to determine the failure mechanism. The Safety Board also examined 16 "Pipeline Failure Reports" completed by WPL personnel during the 1984 hydrostatic tests conducted on line 2N and metallurgical reports involving two previous failures of pipe manufactured to the same standard. One failure occurred in 1983 on line 2N, and the other failure occurred on May 19, 1984, on WPL's fuel oil pipeline to Wausau, Wisconsin. A copy of these documents was provided to the Research and Special Programs Administration (RSPA) which participated in the Safety Board's investigation.

As a part of its ongoing investigation, the Safety Board has reviewed RSPA's Final Order CPF No. 3541-H, issued July 11, 1986 to WPL. The Order contains RSPA's preliminary findings of the July 8 accident and corrective actions it believes necessary to ensure safe continued operation of the pipeline. However, based on the evidence uncovered during the investigation, the Safety Board has the following comments about RSPA's Final Order:

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1. A preliminary finding in the Order states that corrosion appears not to be a significant factor in the failure. The Safety Board believes there is insufficient evidence at this time to rule out corrosion as a significant factor in the failure. Corrosion may have been involved in the weakening of the longitudinal weld seam; however, insufficient information exists at this time to determine what role, if any, corrosion may have had in this failure.
2. The preliminary findings of the Order do not address the potential effects of the pressure reversal phenomenon 1/ with respect to the future operating pressure for this pipeline, i.e., the possibility of future failures at lower-than-test pressure levels. Moreover, because this pipeline was tested hydrostatically in 1984 at pressures ranging from 1,700 to 2,125 psig and because the July 8, 1986, failure occurred at a pressure somewhat less than 1,500 psig, the maximum allowable operating pressure for this pipeline, the latest failure may be associated with pressure reversal. API X42, ERW pipe has been documented to have failed at a pressure of only 38 percent of the initial test pressure. 2/
3. The Order requires hydrostatic testing of the pipeline only to 1,900 psig. The practice of many pipeline companies for eliminating potential material defects is to test pipe to at least a pressure that would result in a stress level of 90 percent or more of the specified minimum yield strength of the pipe material. For line 2N, a pressure of 2,200 psig would result in a stress level equal to 90 percent of the specified minimum yield strength of line 2N.
4. The Order allows the Chief, Central Region, to waive the metallurgical test requirement for failures without establishing the qualifications of persons who are to perform the visual inspections on which any waiver is to be based. Furthermore, the Order establishes by an example cited that failures likely caused by corrosion would be exempted from the required metallurgical testing. The Safety Board believes that all seam failures should be visually examined by an independent metallurgist and that when the cause is not visually apparent, the failure should be metallurgically tested to gain information necessary for assessing the structural integrity of the pipeline. Furthermore, the Board believes that seam failures that may involve corrosion would be especially important to test since corrosion has not been ruled out as a causative factor in the July 8, 1986, failure.
5. The Order establishes an interim maximum allowable operating pressure of 900 psig. Without having completed the testing of the pipe and analyzing the data obtained, the Safety Board believes that a safe operating pressure cannot be established.

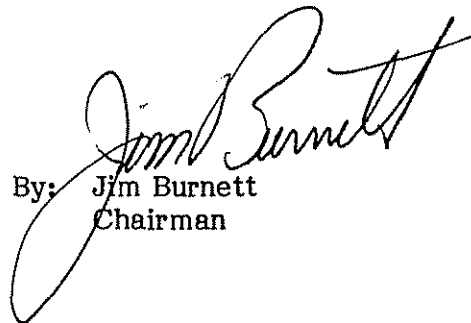
1/ A pipeline phenomenon in which a defect in a pipe may survive a given test pressure only to fail upon subsequent pressurization at a level below that of the previous test.

2/ Eiber, R. J., "Hydrostatic Testing," 5th Symposium on Line Pipe Research, Pipeline Research Committee of the American Gas Association, Houston, Texas, November 1974.

The Safety Board is aware that WPL is working on a plan for complying with Final Order CPF No. 3541-H. However, the Safety Board remains concerned that this plan may not adequately address the safety issues noted above. Therefore, the National Transportation Safety Board recommends that the Research and Special Programs Administration:

Amend Final Order CPF No. 3541-H to Williams Pipe Line Company: (1) to require the development and the submission to the Research and Special Programs Administration for its approval of a plan for testing line 2N that incorporates the findings of research into the pressure reversal phenomenon and that includes a test pressure level capable of eliminating potentially harmful defects; (2) to require metallurgical testing of all seam failures unless the failure mechanism is determined visually by an independent metallurgist; and (3) to establish a maximum allowable operating pressure based on the results of the tests. (Class I, Urgent Action) (P-86-15)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER and NALL, Members, concurred in this recommendation.

  
By: Jim Burnett  
Chairman