P-299 A

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 17, 1991

In reply refer to: P-91-1 through -4

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On March 13, 1990, the Texas Eastern Products Pipeline Company (TEPPCO) line P-41, an 8-inch-diameter liquid propane pipeline, ruptured within a pipeline casing beneath County Road 43 (CR 43) near the Village of North Blenheim, New York. Liquid propane gas escaped from the ends of the casing, vaporized, and formed a white, heavier-than-air gas cloud. The gas cloud flowed downhill along CR 43 until it entered North Blenheim and ignited. The fire quickly consumed the propane vapor and flashed back to the pipeline rupture. Two people were killed, seven persons injured, and more than $4 million in property damage and other costs resulted.[1]

The nearest monitoring location, Gibertsville, was about 47 miles from the rupture and its pressure differential alarm monitor was set to alert the control point operator (CPO)[2] if pressure differentials were 80 psig pressure or more per minute. Because the average pressure drop per minute as the result of the rupture of CR 43 was only 23 psig, the monitor did not provide an alert to the CPO, and he was unaware of the rupture.

After the accident, the TEPPCO lowered the alarm point, to 20 psig pressure drop per minute on the pressure differential monitor at Gilbertsville. The Safety Board staff questioned the sensitivity of this monitor to detect similar or smaller releases along the 83 miles of pipeline between Gilbertsville and Selkirk, and the TEPPCO installed remote terminal units to monitor the pressure at its pump stations and receiving terminals.

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[1] For more detailed information, read Pipeline Accident Report--"Propane Pipeline Rupture and Fire, Texas Eastern Products Pipeline Company, North Blenheim, New York, March 13, 1990" (NTSB/PAR-91/01).

[2] A control point operator coordinates regional pipeline operations, consistent with directions provided by the dispatch center in Houston, Texas, and is in direct contact with regional and terminal managers.

Although the operation of line P-41 is now better monitored, the Safety Board remains concerned about the adequacy of the monitoring system for protection of the public near this pipeline and other pipelines. Federal regulations require that, for facilities that are not designed to fail safely, pipeline operators must provide for the detection of abnormal operating conditions by monitoring appropriate operational data and transmitting it to an attended location. The regulations do not include any criteria on detection sensitivity or timeliness of detection. Consequently, the monitoring system installed by the TEPPCO before this accident complied with the requirement because eventually it would have detected an abnormal pressure drop at Gilbertsville. However, the TEPPCO's monitoring system was not adequate to detect the March 13, 1990, release from line P-41 in a timely manner and to promptly alert the CPO. Moreover, because no performance criteria for monitoring systems have been established by the Research and Special Programs Administration (RSPA), the adequacy of the improved system is uncertain. Therefore, the Safety Board believes that the Office of Pipeline Safety (OPS) of the RSPA should develop performance criteria for monitoring systems installed by pipeline operators to detect abnormal operating conditions and incorporate these criteria into its regulations.

The TEPPCO procedure No. 70 on repairs to pipelines included the Federal requirement for lowering the pressure in the line section to be moved, and in addition, it required that the line section be isolated before movement. However, it did not include the Federal requirement for protecting the public, by adequate warning to evacuate, from the hazards of moving highly volatile liquid (HVL) pipelines. Additionally, neither this procedure nor the Federal regulations contain guidance or criteria on the extent that a pipe of specific strength, grade, diameter, and wall thickness that contains hazardous products may be safely moved, nor do the procedure and regulations require that this information to be calculated before movement. Although the pipe did not fail during its movement, additional elevation by jacking probably would have caused a failure. Fortunately, the TEPPCO supervisor attained the clearance he needed between the pipe and its casing before the pipe failed. This was a fortuitous event rather than the result of a prudent judgment.

This accident shows that the stress limits can be easily exceeded during repairs. It underscores the need for operators to make site specific stress calculations relative to the pipe to determine how to move it safely. Because of the low fracture toughness of most pipe steel, pipes are most susceptible to failure at low ambient temperatures. Therefore, the RSPA should require pipeline operators, especially of HVL pipelines, to determine before pipe movement the amount of pipe to be uncovered, the proper site for force application, and the maximum movement a pipe can safely withstand.

The TEPPCO information to educate the public about how to recognize and report leaks and the protective actions to take was provided to residents living within 1/8 mile of the pipeline. This action exceeded Federal requirements. The information appeared to be effective as it was used by the resident who first alerted the CPO of the leak. However, the residents injured in this accident lived beyond the 1/8-mile limit and had not received the information. Additionally, since the propane did not naturally have a

distinctive odor, nor was the TEPPCO required to add one, the vapor cloud could be perceived as fog, a condition normal for that time of year and day, unless residents had knowledge of the characteristic of HVLs to form vapor clouds.

As noted in the July 1987 American Petroleum Institute research study, "The Safety of Interstate Liquid Pipeline: An Evaluation of Present Levels and Proposals for Change," 24 percent of the fatalities and 7 percent of the injuries caused by releases from liquid pipelines occurred between 1/8 and 1 mile of the pipeline. This accident again demonstrates the need to provide essential hazard recognition information to persons most likely to be harmed by a release of HVL from pipelines. The Safety Board urges the RSPA to require that all operators of HVL pipelines extend their public education programs to include persons who reside at elevations lower than and within 1 mile of the pipeline.

The TEPPCO procedure No. 270 required that liaison be established and maintained with fire, police, and other appropriate officials, who may respond to an emergency involving TEPPCO pipelines, to learn each party's responsibilities and resources and to acquaint them with TEPPCO's response capabilities and means of communication. The TEPPCO operating personnel were responsible for conducting periodic briefings to provide public officials with information about the pipeline system, its operation, and current safety and emergency procedures. The TEPPCO had implemented these procedures only with public agencies located near pumping and receiving facilities. Before the accident, the TEPPCO representatives had not contacted the Schoharie County Emergency Management Office to advise or to coordinate with them TEPPCO's response procedures.

In the Safety Board report on a propane pipeline accident at West Odessa, Texas,[3] the Safety Board addressed the deficiencies in the liquid pipeline regulations compared with the natural gas pipeline regulations. On March 15, 1983, the Safety Board recommended that the RSPA:

P-84-26

Amend Federal Regulations governing pipelines that transport highly volatile liquids to require a level of safety for the public comparable to that now required for natural gas pipelines.

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[3]Pipeline Accident Report--"Mid American Pipeline System Liquified Petroleum Gas Pipeline Rupture, West Odessa, Texas, March 15, 1983" (NTSB/PAR-84/01).

The Safety Board reiterated this recommendation on July 20, 1987, in its report on a products pipeline accident at Mounds View, Minnesota, on July 8, 1986.[4] Also in the report, the Safety Board recommended that the RSPA:

P-87-22

Require the installation of remote-operated valves on pipelines that transport hazardous liquids, and base the spacing of the remote-operated valves on the population at risk.

The RSPA responded to these recommendations in its June 8, 1990, "Proposals for Pipeline Safety; Disposition for Safety Proposals, Notice 2 of Docket PS-93." The RSPA contended that Part 195 now contains many safety standards that vary in stringency according to population characteristics even though a class location scheme is not used and that a study was underway to determine if further rulemaking on this issue was required. The Safety Board addressed the RSPA's comment on Safety Recommendations P-84-26 and P-87-22 in a 1990 accident report on a pipeline rupture in San Bernardino, California.[5] The Safety Board stated that the RSPA's comments on Safety Recommendation P-84-26 were directed more at supporting existing regulations than at objectively assessing the need to improve the existing regulations. The Safety Board reclassified this recommendation as "Open-Unacceptable Action."

On the issue of more rapid shutdown of failed pipelines in populated areas, the RSPA proposal advised that a study, as required by the Congress, was being conducted to determine whether remote- or automatic-operated valves are needed to enhance safety. It stated that should this study provide a basis for improving pipeline safety, new rulemaking would be initiated.

Also in the San Bernardino accident report, the Safety Board addressed the usefulness of check valves in HL pipelines to limit the quantity of product released in the event of a rupture. From its review of Federal regulations and based on testimony from an OPS representative, the Safety Board determined that Federal regulations do not include specific requirements on the location, accessibility, and maintenance of valves and, in particular, do not address the need for check valves. In that report, the Safety Board once again cited the need for Federal regulations to include requirements for the prompt detection and shutdown of failed liquid pipelines and urged the RSPA to objectively assess the increased operating, maintenance, and emergency response requirements essential to public safety

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[4]Pipeline Accident Report--"Williams Pipe Line Company, Liquid Pipeline Rupture and Fire, Mounds View, Minnesota, July 8, 1986" (NTSB/PAR-87/01).

[5]Railroad Accident Report, "Derailment of Southern Pacific Transportation Company Freight Train on May 12, 1989, and Subsequent Rupture of Calnev Petroleum Pipeline on May 25, 1989, San Bernardino, California," (NTSB/RAR-90/02). Both Safety Recommendations P-84-26 and P-87-22 were reiterated in this report.

when populated areas are exposed to the risks of unintended releases of HLs from pipelines.

Because of the RSPA's reluctance to consider the Safety Board's recommendation until required to do so by the Congress and because of the time elapsed before the RSPA initiated action, the Safety Board affirmed the status of Safety Recommendation P-87-22 as "Open--Unacceptable Action."

Releases of HVLs from pipelines cause more than 60 percent of the fatalities attributable to HL pipeline operations; nevertheless, the OPS has not adequately addressed the additional hazards present from the operation of these pipelines. Federal regulations governing liquid pipeline operations do not include specific valve spacing requirements, as do the regulations governing natural gas pipelines; the need for check valves in pipelines that traverse areas with large variations in elevations; and the need for remote- or automatic-operated mainline valves to minimize the quantity of hazardous liquids released.

The TEPPCO does not have a program to identify individual employee needs for initial or recurrent training. The TEPPCO's management failed to recognize the need to provide progressive technical training to supplement its employees' operational experience. In this accident, the TEPPCO misplaced its reliance on experience because the maintenance supervisor, with more than 20 years experience, had never performed the type of work required and had never seen the TEPPCO's written procedures for clearing casings, even if the usefulness of the procedures was limited.

The CPO's actions were also insufficient, which brings the adequacy of the TEPPCO's training for CPOs into question. The maintenance supervisor notified the CPO on duty of the work to be performed at CR 43, including the moving of the pipe. Had the CPO been trained on the TEPPCO procedure No. 70, he likely would have questioned the maintenance supervisor about performing such work without first isolating the pipe section and requesting a reduction in pressure. In addition, on the day of the accident when the resident's call alerted the CPO then on duty about the possibility of a rupture, that CPO did not effectively use available operating data within the supervisory control and data acquisition (SCADA) system to determine if the pressure was dropping.

The TEPPCO's management believed that the maintenance supervisor's training was adequate because he had attended 54 training sessions in the previous 4 years. However, he had no experience in the work he performed on February 20-21, 1990; he had minimal training on applicable Federal regulations; and he had no training on TEPPCO's procedures for clearing casing shorts. Likewise, management believed that the CPO's training was adequate. However, this training did not include either information on Federal regulations or on the TEPPCO procedures that required pipeline segments to be isolated and pressure reduced before work begins. Also, it did not adequately prepare the CPO to use the SCADA system computer capabilities to identify abnormal operating conditions.

The Safety Board has previously identified deficient pipeline operator training and employee selection practices in its February 18, 1987, report[6] on accidents at Beaumont and Lancaster, Kentucky. In that report, the Safety Board found that no requirement existed for operators of pipelines to develop and conduct training and testing programs to annually qualify their employees to perform assigned responsibilities, even though the incorrect performance of such work could adversely affect public safety. Additionally, Federal regulations do not provide criteria for assessing the adequacy of the experience and training of persons performing or directing actions required for corrosion control. Thus, the Safety Board recommended that the RSPA:

> P-87-2
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> Amend 49 CFR Parts 192 and 195 to require that operators of pipelines develop and conduct selection, training, and testing programs to annually qualify employees for correctly carrying out each assigned responsibility which is necessary for complying with 49 CFR Parts 192 or 195 as appropriate.

On March 23, 1987, in response to this recommendation, the RSPA issued an Advance Notice of Proposed Rulemaking (ANPRM), "Pipeline Operator Qualifications," Docket No. PS-94, to obtain information on the need to establish employee qualification and training requirements. The Safety Board responded to the ANPRM on May 14, 1987, advising the RSPA that among other improvements needed, operators should be required to develop and, under the direction of a responsible person, implement an employee qualification and training program that includes the following activities:

> (a) Identification of each employee whose successful accomplishment of assigned responsibilities or tasks is a necessary part of an operator's actions for complying with Federal pipeline safety regulations.
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> (b) Analyses sufficient to identify for each employee the individual jobs, tasks, and responsibilities necessary to be performed as a part of the operator's program for complying with Federal requirements. These analyses should be documented and should include routine job performance, in-plant emergency duties, and emergency responsibilities for events that occur along the pipeline right-of-way. Furthermore, these analyses should be used for establishing measurable performance standards.

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[6] Pipeline Accident Report--"Texas Eastern Gas Pipeline Company Ruptures and Fires, at Beaumont, Kentucky, April 27, 1985, and Lancaster, Kentucky, February 21, 1986" (NTSB/PAR-87/01).

(c) Identification and implementation of the specific training methods to be employed to provide adequate knowledge to each employee for effectively carrying out applicable jobs, tasks, and responsibilities identified in the analyses.

(d) Identification of the method(s) to be used in evaluating the effectiveness of the training including the identification of standard(s) for acceptance.

(e) Documentation for each employee of the training provided and the training evaluations.

Because the OPS informed the Safety Board that it intended to publish a Notice of Proposed Rulemaking (NPRM) in fall 1988, the Safety Board classified Safety Recommendation P-87-2 as "Open--Acceptable Action." However, the NPRM has not yet been published. Because of the time elapsed, the Safety Board now classifies this recommendation as "Open--Unacceptable Action" and urges the RSPA to expedite this rulemaking.

Therefore, the National Transportation Safety Board recommends that the Research and Special Programs Administration:

Define the operating parameters that must be monitored by pipeline operators to detect abnormal operations and establish performance standards that must be met by pipeline monitoring systems installed to detect and locate leaks. (Class II, Priority Action) (P-91-1)

Require pipeline operators to conduct analyses, before moving pressurized pipelines, to determine:

- the extent to which the pipe may be safely moved,
- the specific procedures required for the safe movement of the pipe, and
- the actions to be taken for protection of the public. (Class III, Longer Term Action) (P-91-2)

Require operators of pipelines that transport highly volatile liquids to extend their public education program to include persons who reside at elevations lower than and within 1 mile of the pipeline. (Class III, Longer Term Action) (P-91-3)

Require pipeline operators to extend their emergency preparedness programs to include liaison with all community response agencies adjacent to their pipelines. (Class III, Longer Term Action) (P-91-4)

In addition, the Safety Board reiterates the following safety recommendations to the Research and Special Programs Administration:

P-84-26

Amend Federal regulations governing pipelines that transport highly volatile liquids to require a level of safety for the public comparable to that now required for natural gas pipelines.

P-87-2

Amend 49 CFR Parts 192 and 195 to require that operators of pipelines develop and conduct selection, training, and testing programs to annually qualify employees for correctly carrying out each assigned responsibility which is necessary for complying with 49 CFR Parts 192 or 195 as appropriate.

P-87-22

Require the installation of remote-operated valves on pipelines that transport hazardous liquids, and base the spacing of the remote-operated valves on the population at risk.

Also, the Safety Board issued Safety Recommendations P-91-5 through -10 to the Texas Eastern Products Pipeline Company and P-91-11 to the American Petroleum Institute, the Interstate Natural Gas Association of America, and the American Gas Association.

KOLSTAD, Chairman, COUGHLIN, Vice Chairman, LAUBER, BURNETT, and HART, Members, concurred in these recommendations.

By: James L. Kolstad
Chairman