



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

Date: July 17, 1991

In reply refer to: P-91-5 through -10

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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.<sup>1</sup>

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 control point operator's (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.

<sup>1</sup>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).

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 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, pipeline operators should determine before pipe movement, especially on HVL pipelines, the amount of pipe to be uncovered, the proper site for force application, and the maximum movement a pipe can safely withstand.

The TEPPCO repair program did not incorporate several essential industry-recommended practices that: repairs be covered in the maintenance plan, they be performed under qualified supervision, they be performed by trained personnel, and all employees be briefed on the procedures to be followed for accomplishing the repairs. In deciding to implement a special program to correct longstanding deficiencies, the TEPPCO's management should have recognized that this program was different from routine maintenance work because the TEPPCO had not previously assigned such work to its employees. The TEPPCO then should have evaluated its procedures, supervision requirements, and the experience and training of its maintenance employees in light of the industry recommended practices.

Had the TEPPCO recognized that the casing repair program was different from routine maintenance and evaluated the procedures, maintenance personnel would have been better directed and guided to correctly perform the required

work. A review of the experience and training of employees revealed that many had not been trained on applicable procedures or did not possess the work experience needed for moving pressurized pipe for the purpose of eliminating casing electrical shorts. These deficiencies should have been recognized by the TEPPCO's management and corrected before the program was implemented. At a minimum, the TEPPCO management should require that work be closely supervised by a person knowledgeable of the procedures and the methods to successfully perform the work. Also, employees should be briefed on the procedures they are to perform.

An evaluation might have made the TEPPCO management aware that the CPOs' responsibilities for operating line P-41 would be affected at times when a segment of pipe was to be moved. This should have prompted a review of the training and experience of the CPOs on the TEPPCO procedures and Federal requirements applicable to their responsibilities. This would identify whether the CPOs had been trained on the TEPPCO requirements for reducing the pressure and isolating pipe segments to be moved. By providing additional training to the CPOs, the TEPPCO would then be able to have them assist maintenance employees to comply with the TEPPCO procedures and the Federal requirements about work to be performed on the pipeline.

Although the crew, selected to perform the work at CR 43 in February 1990, did not possess the knowledge and experience to safely perform the work assigned, opportunities were available to correct this error. The maintenance supervisor should have acknowledged at the time the work was assigned that he was not experienced in moving pressurized pipes, that he had never been instructed on the use of the link seal, and that he had not received training for this work. Had he advised his supervisor of these facts, his supervisor might have delayed the work until a qualified person could perform the work or, at least, supervise it.

Although the maintenance supervisor may not have known at the time of the work assignment that the pipe required lifting to install the new casing seal, he should have recognized this when he inspected the casing and saw the broken insulator. At that time, he should have alerted his superintendent that he was not qualified to perform the work. Instead, he elected to use his "good judgment."

Although the Safety Board believes that the maintenance supervisor should have advised his superintendent that he needed assistance, it is not reasonable for management to rely on such notice to fulfill its supervisory responsibility. Rather, it is incumbent on the TEPPCO's management to assign work projects only to employees who possess the training and experience essential to the safe performance of the work, to determine that its employees are knowledgeable of the procedures applicable to the work assigned, and to periodically check that work has been completed correctly.

In this accident, the volume of liquid propane in a 1-mile length of this pipeline would have provided a sufficient quantity of propane vapor to engulf the nearby village. Because ignition of the propane occurred within 10 minutes after the leak was detected, the delayed shutdown did not cause

additional casualties or loss of property. However, prompt detection and isolation of a rupture would provide more time to evacuate residents if its location was farther from populated areas.

After the CPO was alerted about the release of propane, it required more than an hour to shut down the pumps and to close the mainline valves nearest the rupture. Although the CPO and the TEPPCO employees dispatched to close the valves did all they could to shut down the system, their actions were limited because of the distance of the valve from the rupture.

The release of propane from TEPPCO's pipeline could have been substantially limited if remote- or automatic-operated valves were installed. After the CPO remotely closed the valve at Gilbertsville, a check valve located just east of the rupture could have prevented the release of propane from flowing to the rupture from pipe located at higher elevations. In recognition of this, the TEPPCO installed a check valve near the mainline block valve on the east side of the Schoharie Creek; a manual mainline valve on the west side of CR 43; remote-operated valves at Marathon, Jefferson, and Oneonta; and remote terminal units at Marathon, Jefferson, Oneonta, and Selkirk. Additionally, at all pump stations, the TEPPCO set the pressure differential monitor units to detect pressure loss rates of 20 psig per minute instead of 80 psig per minute. Although these actions have improved the TEPPCO's overall monitoring and control capabilities, they have not improved its ability to remotely isolate a pipeline leak near the village. Because the valve at CR 43 must be manually operated, it would take more than an hour for an employee from the closest attended facility to arrive at this location to close it. The TEPPCO needs to modify the mainline valves near populated areas and remote- or automatic-operated valves should be installed to enable the rapid isolation of any failure in those sections.

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.

Additionally, procedure No. 270 required that each region provide information to government agencies, excavators, and the public on recognizing an emergency condition that may involve a hazardous liquid (HL) pipeline and reporting it to the TEPPCO. The information distributed at least annually by the TEPPCO personnel included emergency telephone numbers, pocket calendars with emergency notification instructions, maps of the general location of TEPPCO's pipeline facilities in the region, and data sheets for the various liquids transported in the region.

The TEPCCO information to educate the public about how to recognize and report leaks and the protective actions to take was provided only 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 CPD 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 TEPCCO 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 Liquefied Petroleum Gas Pipelines: An Evaluation of Present Levels and Proposals for Change," 24 percent of the fatalities and 7 percent of the injuries caused by releases from liquefied petroleum gas pipelines occurred between 1/8 and 1 mile of the pipeline. This accident again demonstrates the need to provide essential hazard recognition and response information to persons most likely to be harmed by a release of HVL from pipelines. The Safety Board urges the TEPCCO to extend its emergency preparedness liaison program to all community response agencies adjacent to its pipelines and its public education program to persons who reside at elevations lower than and within 1 mile of its pipelines.

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

Develop and conduct employee training and testing programs to annually qualify employees to perform each responsibility assigned to them. (Class II, Priority Action) (P-91-5)

Develop explicit procedures on the physical movement of pipelines containing highly volatile liquids to require that, before movement, analyses be conducted to determine:

- o the extent to which the pipe may be safely moved, the specific procedures required for the safe movement of the pipe, and
- o the actions to be taken for protection of the public.

Require that all employees be briefed on the work to be performed before work is begun. (Class II, Priority Action) (P-91-6)

Use only qualified employees to move pressurized liquid pipelines. (Class II, Priority Action) (P-91-7)

Install, at intervals sufficient to rapidly stop the flow of product in the event of a rupture, remote- and automatic-operated valves (including check valves) on pipeline segments that pass through or are adjacent to populated areas. (Class II, Priority Action) (P-91-8)

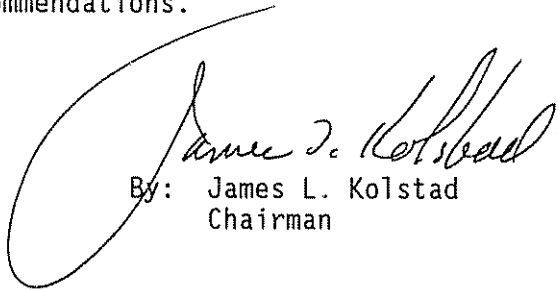
Extend your emergency preparedness liaison program to include all community response agencies adjacent to your pipelines. (Class II, Priority Action) (P-91-9)

Extend your public education program on recognizing and responding to highly volatile liquid pipeline emergencies to include all persons who reside at elevations lower than and within 1 mile of your pipelines. (Class II, Priority Action) (P-91-10)

Also, the Safety Board issued Safety Recommendations P-91-1 through -4 and reiterated P-84-26 and P-87-2 and -22 to the Research and Special Programs Administration of the U.S. Department of Transportation and issued P-91-11 to the American Petroleum Institute, the Interstate Natural Gas Association of America, and the American Gas Association.

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 action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations P-91-5 through -10 in your reply.

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



By: James L. Kolstad  
Chairman