

log# P-307A

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D. C. 20594



Safety Recommendation

Date: December 15, 1993

In Reply Refer To: P-93-10 through -14

Mr. Robert Sachse
MAPCO Natural Gas Liquids, Inc.
1800 South Baltimore Avenue
Tulsa, Oklahoma 74119

On April 7, 1992, an uncontrolled release of highly volatile liquids (HVLs) from a salt dome storage cavern in the Seminole Pipeline System near Brenham, Texas, formed a large, heavier-than-air gas cloud that exploded. Three people died from injuries sustained either from the blast or in the fire. An additional 21 people were treated for injuries at area hospitals. Damage from the accident exceeded \$9 million.¹

The Safety Board determined that this accident could have been avoided had MAPCO Natural Gas Liquids, Inc. (MAPCO), done a comprehensive safety analysis of the Seminole pipeline system, including Brenham station, in order to identify potential points of failure and product release. Certain system components at both the dispatch center and the accident site did not allow dispatchers to readily identify an abnormal operating condition or to determine the scope of the problem. The Board also found that the Brenham station emergency shut-down system lacked fail-safe features.

When the Brenham station was constructed, no industry or government standards existed that described the type or design of equipment needed to provide a specified level of safety control. An executive officer and former chief engineer for the company said that MAPCO engineers designed the station, including the configuration of the station's cavern safety system and selected equipment, after reviewing the practices of other companies that were operating caverns at the time. He characterized Brenham's cavern safety system as "state of the art at the

¹For more detailed information, read Pipeline Accident Report--*Highly Volatile Liquids Release From Underground Storage Cavern and Explosion, MAPCO Natural Gas Liquids, Inc., Brenham, Texas, April 7, 1992* (NTSB/PAR-93/01).

time it was installed and now" and added that other Seminole cavern storage facilities had comparable safety systems.

Following the accident, a MAPCO team looked at the design of the Brenham station and reconstructed its underground storage safety control system, which is now considerably more complex and extensive. However, the team redesigned the system without using safety analyses to identify and document potential failures, to assess the likelihood of their occurrence, and to assess the feasibility of modifications that could eliminate or minimize potential failures. The Safety Board believes that without such an analysis, the ability of the control system to protect public safety is unknown. According to a MAPCO spokesperson, the company is currently performing safety analyses and will correct any identified deficiencies before returning the storage system to service.

MAPCO indicated that when the design of the Brenham control system has been analyzed and accepted, the company intends to use the Brenham system as its standard for reviewing and improving all other company cavern storage control systems. The company has already begun buying and installing equipment to initiate improvements at other caverns in its pipeline system based on the proposed Brenham design.

During its investigation, the Safety Board determined that communication among the principals in this accident was ineffective. During an emergency, effective communication, coordination, and task allocation is paramount. Failure in any of these areas can result in people becoming overwhelmed by an influx of information, as the dispatcher was in this accident. To avoid the possibility of an employee being overloaded, distribution of emergency response actions would facilitate communication and strategic planning among employees responding to a crisis. In this accident, effective allocation of responsibilities among other dispatch employees would have reduced the "chaotic" environment experienced by the dispatcher and allowed him to efficiently execute required tasks, such as notifying the local emergency response agencies.

Deficiencies in communications among employees resulted in a series of other failures in this accident. For instance, two employees approaching the station from the north did not initially communicate their location and observations to the dispatcher. When the first employee on-scene, who was unaware of any other personnel in the area, learned that a schoolbus was headed toward the area, he left his position, where he should have been establishing a roadblock, and at risk to his own life, ran to intercept the bus. Shortly after that, a woman drove her car through the point where a blockade was inadequately established into the gas-filled area and possibly ignited the products. The Safety Board concludes that the lack of communication adversely affected coordination among employees, increased the risk to initial responders, and ultimately contributed to the failure of employees to establish roadblocks that would have prevented the public from driving into the area of potential harm.

The Safety Board further examined the effect of inadequate communication on the dispatcher, who reported that the first technician on-scene at Brenham station did not indicate the magnitude of the gas release. The failure of the first responder on scene and the dispatcher to exchange vital information compounded the problems in this accident. The technician told the dispatcher that "gas was in the station yard," but did not indicate either the magnitude of the

release or that it was not confined to the immediate station area. The dispatcher failed to ask for any details regarding the release. Because he did not have a complete understanding of the situation, the dispatcher did not immediately contact the local emergency response agencies and company management. The Safety Board believes that had MAPCO provided the dispatcher with procedures for eliciting relevant product release information from on-site personnel, he would have become aware of the situation at the Brenham station and could have taken appropriate emergency response actions.

In this accident, if public safety officials had been quickly notified of the abnormal conditions, they could have prepared to evacuate people from the area of potential harm until the cause of the alarm had been verified. Although the dispatcher's actions were in accordance with MAPCO procedures, the time wasted while he waited for the responding technician at Brenham station to verify that a release had occurred negated any opportunity for community response personnel to establish site security and control, to evacuate, or to plan for fire fighting.

The Safety Board believes that this accident also demonstrates that MAPCO needs to reconsider its policies about evacuation. A review of the employee operating manual shows that despite the extremely hazardous properties of HVLs, employee guidelines do not list evacuation as a precautionary measure to take prior to controlling a leak, but only as the final step to take after all attempts to control the release have failed. MAPCO's emergency procedures are primarily designed for small releases when the responder (technician) has time to receive a call-out, proceed to the scene, determine the reason for the alarm, and notify the dispatcher. With small releases, responders usually have sufficient time to secure the area, warn area residents, and set up blockades. The Safety Board believes that MAPCO should work with representatives from emergency response agencies for Washington County to develop disaster plans for Brenham Station that identify conditions that warrant an evacuation, that identify the extent of the area to be evacuated, and that include procedures for carrying out an evacuation.

The Safety Board believes that number and type of employee errors that occurred in this accident suggest that MAPCO needs to further evaluate the effectiveness of its training program. MAPCO has a multifaceted training program that has numerous courses covering many important issues. However, the Board found that the company frequently did not provide written operational procedures for employees to follow. Moreover, in this accident, employees failed to adhere to specified procedures for normal and emergency operations. These errors occurred during product measurement (calculation of the HVL flow into and out of the cavern), communication (failure to relay information describing the extent of the gas release and failure of employees to identify their location around the cavern), supervision (failure to effectively check employees' measurements for accuracy), and other operations (improper inspection of the cavern valve, failure to establish adequate roadblocks, and the technician's failure to respond promptly to a HAZGAS alarm).

From interviews, the Safety Board determined that MAPCO does not routinely administer written tests after safety instruction. The Safety Board believes that to help ensure that employees are mastering the course work and to afford supervisors and training evaluators the capability to determine the effectiveness of their training, employees need to be formally tested.

The Safety Board also found that MAPCO does not always provide opportunities for trainees to apply what they have learned. The company does not conduct emergency drills in which employees can perform safety-critical operations to demonstrate their knowledge of emergency techniques. The Safety Board believes a program of emergency procedure training is not adequate unless employees have the opportunity to practice their skills during a simulated emergency situation and receive feedback on their performances. Management must also be sensitive to the need for recurrent training because the infrequency of performing emergency response activities being trained makes it important to ensure that knowledge and skills are maintained with refresher training.

Following the accident, MAPCO provided the Safety Board with a description of its revised ongoing education and training program. Two employees from the environmental and safety department are now assigned full-time to regularly review, update, and expand MAPCO's existing program and to work with different company committees to recommend new training or modify existing training. The training department evaluates new programs in response to regulatory, technical, or operational changes. The Safety Board believes that in formulating lesson plans for its in-house schools, MAPCO needs to include testing in its safety seminars and emergency drills or simulations as part of its training program.

Therefore, the National Transportation Safety Board made the following safety recommendations to MAPCO Natural Gas Liquids, Inc.:

Perform safety analyses of the safety control systems for each of your underground storage systems and, based on those analyses, modify the control systems to provide an adequate level of safety for the public and employees. (Class II, Priority Action) (P-93-10)

Develop and implement training and procedures that focus on identifying and distributing emergency-response tasks, establishing communication, and coordinating on-scene personnel for all employees who respond to abnormal and emergency situations. (Class II, Priority Action) (P-93-11)

Develop procedures for dispatchers and on-scene employees to follow when gathering product-release information during an emergency to help ensure that employees promptly disseminate essential information to company and community officials responsible for emergency response actions. (Class II, Priority Action) (P-93-12)

Incorporate testing and practice drills or other emergency-procedure exercises into your employee training program so that managers can evaluate the effectiveness of the emergency response training. (Class II, Priority Action) (P-93-13)

In cooperation with Washington County, develop disaster plans for Brenham Station that identify conditions that warrant an evacuation, that identify the extent of the area to be evacuated, and that include procedures for carrying out an evacuation. (Class II, Priority Action) (P-93-14)

Also, the Safety Board issued Safety Recommendations P-93-09 to the Research and Special Programs Administration; P-93-15 and -16 to Washington County; P-93-17 to the Texas Department of Public Safety; P-93-18 through -20 to the American Petroleum Institute; P-93-21 and -22 to the American Gas Association; and P-93-23 to the International Association of Fire Chiefs. The Safety Board is also reiterating Safety Recommendation I-88-1 to the Department of Transportation. If you need additional information, you may call (202) 382-0672.

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-93-10 through -14 in your reply.

Chairman, VOGT, Vice Chairman, COUGHLIN, Members, LAUBER and HAMMERSCHMIDT concurred in these recommendations. Member HART did not participate.



By: Carl W. Vogt
Chairman

