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# National Transportation Safety Board

Washington, D.C. 20594  
**Safety Recommendation**

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**Date:** May 15, 1987

**In reply refer to:** H-87-25

Ms. M. Cynthia Douglass  
Administrator  
Research and Special Programs  
Administration  
Department of Transportation  
400 Seventh Street, S. W.  
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About 12:40 p.m., e.d.t., on September 6, 1985, a 1982 GMC 2-axle truck fitted with a 1973 MC-331 cargo tank overturned while traveling southbound on the Capital Beltway, I-95, near Largo, Maryland. The 2,500-gallon capacity cargo tank contained about 1,375 gallons of propane. The Poist Gas Company truck was traveling between 50 and 55 mph when, according to the driver, the steering wheel started shaking violently and "flew out of my hands." The driver stated that he took his foot off the accelerator but did not brake because he believed that one of the vehicle's tires was experiencing a blow out. The truck veered across the right paved shoulder of the highway and onto a grass shoulder. It then traveled 300 feet down the grass shoulder until the driver steered the truck back to the left to avoid hitting a tree. The truck clipped the north end of a guardrail when it reentered the paved shoulder of the highway as the driver tried to regain control of the truck. The truck then traveled 510 feet down the paved shoulder and the right travel lane of the highway before rotating clockwise about 80° and overturning on its left side. The vehicle continued to rotate another 100° as it slid 400 feet down the highway on its left side. The truck came to rest facing north (180° opposite its original direction of travel) with the top of the cargo tank parallel with and against the guardrail. At the time of the accident the roadway was dry and the weather was clear. 1/

The cargo tank, manufactured by the Petroleum Tank Company of Kenly, North Carolina in 1973, was built to a design pressure of 250 psig. Although the 2,500-gallon cargo tank had been used primarily for local delivery service, the cargo tank had been manufactured to the same U.S. Department of Transportation (DOT) construction requirements as much larger over-the-road cargo tanks. It was equipped with safety valves (manufactured by the RegO Company of Chicago, Illinois) similar to those on larger cargo tanks. The State of Maryland, where this cargo tank was being operated, like many other States, had adopted DOT's construction, testing, and repair requirements for cargo tanks used in the transportation of propane and other hazardous materials within its borders.

1/ For more detailed information, read--Highway Accident/Incident Summary Report "Overturn and Fire Involving Truck-cargo Tank Transporting Propane, Largo, Maryland, on September 6, 1985" (NTSB/HAR-87/01/SUM).

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During the accident, the cargo tank liquid propane discharge pipe broke at a joint between the internal shut off valve and the propane delivery meter. Liquid propane in that line was released and ignited. The fire consumed flexible connectors (hoses) installed in the liquid propane return line, the propane vapor return line, and the liquid propane discharge line. Those lines were connected to three openings in the cargo tank, which was equipped with separate safety valves designed to prevent or control the unintentional flow of propane from the cargo tank. The three valves (an internal shut off valve, an excess flow check valve, and a back pressure check valve) were removed from the cargo tank after the accident for examination and laboratory testing by the Safety Board.

The internal shut off valve was installed at the liquid propane discharge opening on the bottom of the cargo tank. Examination of the 13-year-old valve after the accident disclosed that a synthetic rubber disc mounted in the piston assembly was hardened, partially disintegrated, and contained gaps up to 6/32-inch wide. The synthetic rubber disc is designed to seat against the body of the valve when the piston is in the closed position to prevent the flow of propane from the cargo tank to the discharge pipe. Tests conducted on the internal shut off valve after the accident measured a liquid propane flow rate through the valve in the closed position at 13.31 gallons per minute (GPM). In addition to the deteriorated disc, the O-shaped synthetic rubber seals (O-rings) in the valve were also hardened, one O-ring had split, and a synthetic rubber seal in the valve's packing nut assembly had deteriorated severely. While some hardening of the synthetic rubber components may have occurred as a result of heat exposure during the incident, accident photographs showed that there was no direct flame impingement on the internal shut off valve. Further, photographic evidence indicated that the valve's synthetic rubber seat disc failed to prevent the flow of propane from the cargo tank during the early phases of the incident, before the cargo tank was heated by the fire.

The excess flow check valve was installed at the propane vapor return opening in the rear head of the cargo tank. It also allowed propane to escape from the cargo tank during the incident. However, this valve is designed to control the rate of flow of propane from the cargo tank in the event of a complete break in the vapor return line and to allow pressure equalization between the cargo tank and lines outside of the cargo tank during normal operating conditions. It is not designed to completely stop the escape of propane in the closed position.

The excess flow check valve closed properly during laboratory tests conducted on the valve following the accident. However, laboratory examination of the valve disclosed no evidence indicating whether the valve was opened or closed during the incident. No obstructive foreign matter was found in the valve during its inspection after the incident, and no restriction was found in the vapor return line to indicate that the flow rate was reduced to less than a rate necessary to shut the valve. Also, it could not be determined if an angle valve, located between the excess flow valve and the vapor return line, was fully opened at the time of the accident. If the angle valve had not been fully opened, the flow rate through the excess flow valve may not have been sufficient to close it. Photographs taken during the incident indicate that a significant amount of propane flowed through the vapor return opening and that the excess flow valve may not have closed.

The back pressure check valve, which was installed at the liquid propane return opening, was also removed from the cargo tank following the accident and laboratory tested. A test of this valve indicated that it had functioned properly and that it had not allowed any significant amount of propane to flow from the cargo tank during the accident.

The Poist Gas Company did not have records to demonstrate when the cargo tank's safety valves were last inspected or tested; however, a company official believes that the valves were tested in 1982 when the cargo tank was attached to the truck. All piping, valves, and fittings on MC-330, MC-331, and MC-338 cargo tanks must be pressure tested and proved free from leaks after installation (49 CFR 173.33(f)(5)). However, while those cargo tanks must be hydraulically or pneumatically pressure tested periodically, internal shut-off valves, excess flow check valves, and back pressure check valves are not required to be tested periodically to identify unsatisfactory valve performance. <sup>2/</sup> To reduce the risk of safety valve failures during accidents, carriers should frequently test the operating condition of all cargo tank safety valves.

A RegO Company safety warning bulletin on LP-Gas excess flow check valves warns that all RegO products are mechanical devices that will eventually become inoperative due to wear, contaminants, corrosion, and aging of components made of materials such as metal and rubber. The bulletin also warns that environment and conditions of use will determine the safe service life of the products, that periodic testing at least once a year is essential, and that because the valves have a long and proven record of quality and service, LP-Gas dealers may forget the hazards that can occur when valves are used beyond their safe service life. A similar safety warning bulletin should be issued for the internal shut off valves, and users of the valves should be urged to test them periodically to determine if the seals properly seat.

The National LP-Gas Association (NLPGA) has also issued several advisory safety bulletins to promote safe operating practices. NLPGA Safety Bulletin 112-71 suggests that excess flow check valves and shut off valves be checked monthly by blowing out the pressure downstream of the valves and checking for proper operation of the valves, including seat seals on shut off valves. In addition to safety advisories, the NLPGA has prepared check lists to help carriers establish safe operating procedures and attain compliance with DOT safety requirements. Further, the National Fire Protection Association's Standard for the Storage and Handling of Liquefied Petroleum Gases, 1983, NFPA 58 (an American National Standard) specifically requires all LP-Gas cargo vehicles to comply with DOT requirements. Because many carriers, States, and safety organizations rely on DOT regulations to help assure the safe transportation of hazardous materials in cargo tanks, the DOT regulations should require frequent testing of all cargo tank safety valves to determine if the valves operate properly and prohibit the use of cargo tanks equipped with improperly operating safety valves.

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

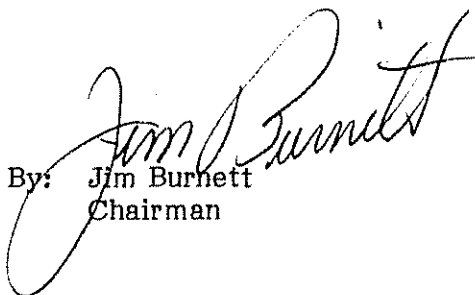
Require that all cargo tank safety valves be periodically tested to determine the operating condition of the valves, and prohibit the use of cargo tanks equipped with safety valves that are not determined to be operating properly. (Class II, Priority Action) (H-87-25)

Also as a result of its investigation, the National Transportation Safety Board issued Safety Recommendations H-87-22 to the Poist Gas Company, H-87-23 to the RegO Company, and H-87-24 to the National LP-Gas Association.

<sup>2/</sup> While these safety valves are not subject to periodic retest requirements, spring loaded safety relief devices (pressure relief valves) on cargo tanks other than MC-330, MC-331, and MC-338 cargo tanks must be removed periodically and tested (49 CFR 177.824(b)).

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 actions taken as a result of its safety recommendations and would appreciate a response from you regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation(s) H-87-25 in your reply.

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

  
By: Jim Burnett  
Chairman