Log # M-313A SP-20

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: May 23, 1986
In reply refer to: M-86-35 and -36

Keystone Shipping Company
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About 0324 on October 31, 1984, as the 660-foot-long United States-registered chemical tankship PUERTO RICAN, operated by the Keystone Shipping Company (Keystone), was preparing to disembark a pilot about 8 miles west of the Golden Gate Bridge, San Francisco, California, an explosion occurred in the vicinity of the vessel's center void (CV) space No. 6. The main deck over the void and adjacent wing tanks was lifted up, blown forward, and landed inverted over center cargo tank Nos. 4 and 5 and their adjacent wing tanks. An intense fire erupted and burned out of control for several hours. A few hours after the explosion, the vessel was towed farther offshore in an effort to avoid polluting the coastline if the vessel sank. Several days later the vessel broke in two while in heavy seas, and the stern section sank. The bow section remained afloat and was later towed to a shipyard. The pilot and one crewmember were injured, and one crewmember is missing and presumed dead. The PUERTO RICAN was valued at $35 million. 1/

On October 8, 1984, in Lake Charles, Louisiana, the PUERTO RICAN completed loading a 50 percent caustic soda solution into cargo tank Nos. 1C, 4CP, 4CS, 5CP, 5CS, 7CP, and 7CS. An independent cargo surveyor gauged the tanks, and the ullages were witnessed by the second officer. At 2118 on October 8, 1984, the PUERTO RICAN departed Lake Charles for San Pedro, California, via the Panama Canal. At 1030 on October 21, 1984, the PUERTO RICAN docked at the GATX terminal in San Pedro.

Shortly before noon on October 21, 1984, an independent cargo surveyor gauged the cargo tanks prior to discharging, and the 12-4 third officer recorded the ullages. None of the ullages recorded was compared at that time to the ullages taken at the loading port in Lake Charles. The crew decided from which tanks caustic soda would be pumped to transfer the scheduled amount of caustic soda to the GATX terminal, and at 1320 the discharge of caustic soda from the PUERTO RICAN was begun.

1/ For more detailed information read Marine Accident Report--"Explosion and Fire Onboard U.S. Chemical Tankship PUERTO RICAN in the Pacific Ocean near San Francisco, California, October 31, 1984" (NTSB/MAR-86/05).

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At 0400 on October 22 when the second officer assumed the watch, he was told by a GATX terminal employee that discharging of the scheduled amount of caustic soda would be completed about 0600. However, shortly before 0600 a terminal employee notified the second officer that about 3,000 more barrels of caustic soda were needed to complete the delivery. The second officer notified the chief officer of the request. For the first time, they compared the loading ullages recorded at Lake Charles with the predischarge ullages recorded at San Pedro. All of the loading and predischarge ullages were within acceptable industry tolerances except for those of center port (CP) tank No. 5. The loading ullage for tank No. 5CP was recorded as 13 feet 3 inches, while the predischarge ullage was recorded as 23 feet 1/2 inch. The ship's ullage tables indicate that an ullage difference of 9 feet 9 1/2 inches between 13 feet 3 inches and 23 feet 1/2 inch in tank 5CP is equivalent to 2,546 barrels. The surveyor checked the ullage on the receiving tank ashore and computed the amounts of cargo that had been discharged from the cargo tanks on the PUERTO RICAN. He concluded that the predischarge ullage of 23 feet 1/2 inch for tank No. 5CP was correct.

Concerned about the reported cargo shortage, the master, the chief officer, and the chief pumpman sounded all areas surrounding tank No. 5CP, with the exception of space No. 6CV, to determine if caustic soda had leaked from tank No. 5CP into those areas. The master testified that he had been told by a previous master that space No. 6CV had been sealed and inerted with nitrogen gas, so he looked for a sounding tube through which the space could be checked for liquid without opening a manhole cover and entering the space. Not finding any sounding tube for space No. 6CV, the master decided not to inspect the space. He decided to inspect tank No. 5CP later after the tank had been emptied of cargo and cleaned. Although the presence of caustic soda in space No. 6CV also could have been detected by activating the eductor system, the crew was not aware that the eductor system existed. While at sea, the master and chief officer inspected tank No. 5CP using bright portable lights; they did not find any fractures or holes.

On October 28, the PUERTO RICAN arrived at the Paktank Terminal in Richmond, California. A cargo of Alkane-60, an aromatic hydrocarbon, was loaded into tank Nos. 3S and 5CP. Tank No. 5CP was loaded to an ullage of 8 feet 4 inches.

A postaccident examination of the bulkhead between tank No. 5CP and space No. 6CV revealed a small hole between two fillet welds. The hole was at the 16-foot 6-inch level (32-feet 1 1/2-inch ullage) measured from the bottom of the tank and was obscured above, below, and in front by a horizontal stiffener plate and a gusset plate. Daylight entering tank No. 5CP facilitated locating the hole after the stern had broken away.

The hole in the bulkhead between tank No. 5CP and space No. 6CV was large enough so that the 2,546 barrels of caustic soda missing from tank No. 5CP could have leaked into space No. 6CV in the approximately 15 days the vessel traveled from Lake Charles to San Pedro. Calculations indicate that an estimated 1,100 barrels of Alkane-60 passed through the hole during the approximately 2.4 days from the time it was loaded in Richmond until the explosion.

Since space No. 6CV was not inerted, the tank could have been entered and inspected. If the crew had checked space No. 6CV, they would have discovered caustic soda. That discovery probably would have led to discovery and repair of the hole as well as removal of the caustic soda. With the hole repaired and the caustic soda removed from space No. 6CV, any part that the Alkane-60 may have played in the explosion would have been eliminated. If the master had required that space No. 6CV be inspected for the presence of caustic soda, the accident might have been prevented.

A safety consultant hired by Keystone conducted a safety inspection on board the PUERTO RICAN in August 1984. He testified that the station bill on the PUERTO RICAN, which the crew used for fire and boat drills, was an old-style station bill patterned after a Coast Guard CG-848 series form which was developed during the 1940's. He had recommended to Keystone, after observing firefighting drills on the PUERTO RICAN, that a team concept of firefighting would be a more effective method of firefighting. At the time of the explosion, the station bill had not been revised.

Coast Guard Navigation and Vessel Inspection Circular (NVIC) No. 7-82, entitled "Sample Format of Vessel or Facility Station Bill," issued on April 13, 1982, addresses problems in responding to fire, abandon ship, and other emergencies. The old station bill assigned each crewmember to specific firefighting stations, some of which might be unavailable or might not be needed to be manned, depending on the nature of the accident. Although implementation of the station bill as recommended by Coast Guard NVIC No. 7-82 probably would not have affected the outcome in this accident, this method of organizing firefighting, abandon ship, and emergency efforts is superior to that in the old station bill because the new pictorial format is easier to understand, and because a team concept assigns each department specific duties in addition to the specific assignments assigned to individuals. The team concept has the flexibility to address changing emergency conditions. The new station bill format is also better because a specific chain of command is designated within each department according to the crewmember's number on the station bill to prevent confusion as to who is in charge if a key person is unavailable.

Therefore, the National Transportation Safety Board recommends that the Keystone Shipping Company:

> Establish procedures to require the sounding or inspection of all underdeck spaces when ullage readings or other measurements indicate that cargo may have leaked from any tank. (Class II, Priority Action) (M-86-35)
>
> Revise station bills as recommended by United States Coast Guard Navigation and Vessel Inspection Circular No. 7-82. (Class II, Priority Action) (M-86-36)

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 recommendations in this letter. Please refer to Safety Recommendations M-86-35 and -36 in your reply.

GOLDMAN, Acting Chairman, and BURNETT, LAUBER, and NALL, Members, concurred in these recommendations.

By: Patricia A. Goldman
Acting Chairman