



National Transportation Safety Board

Washington, D. C. 20594

Safety Recommendation

Date: April 29, 1992

In Reply Refer To: M-92-9 through -19

Admiral J. William Kime
Commandant
U.S. Coast Guard
Washington D.C. 20593-0001

On February 20, 1990, the reflagged 760-foot-long U.S. tank ship SURF CITY, loaded with naphtha and automotive diesel oil, departed Kuwait en route to discharge ports in southern Europe. At 1012 on February 22, the master and the chief mate were standing at the No. 4 starboard water ballast tank access trunk when an explosion occurred in the tank. The tank and area aft to the deckhouse on the starboard side were immediately engulfed in flames. The crew abandoned ship in the port lifeboat and were rescued by the U.S. Navy guided missile frigate USS SIMPSON (FFG-56) at 1053. U.S. naval vessels recovered the master's remains but the chief mate is missing and presumed dead. The fire burned for 2 weeks and 196,985 barrels of the 606,215 barrels of cargo were lost. The value of the loaded cargo was \$12.88 million and its salvaged value was \$6.5 million. The vessel, valued at \$30 million before the accident was sold in its damaged condition for \$4.85 million. The damage loss resulting from this accident totaled \$31.53 million.¹

The Safety Board determined from postaccident inspection and analysis that the accident resulted from a deflagration in the No. 4S ballast tank. To determine the conditions present on the SURF CITY that resulted in the explosion, Safety Board investigators focused on the source of the flammable vapors in the ballast tank, sources that could have ignited the vapors, and the ballast tank entry procedures that the master and the chief mate followed.

On the morning of this accident, the chief mate indicated to his watchstanders that he intended to check out the inoperable draft sensors in the bottom of ballast tanks Nos. 4P and 4S. The chief mate directed two ABs to install air blowers on the tank openings. When he tasked the seamen to install the ventilators, the chief mate did not advise them to follow any special precautions or be alert for the smell of

¹For more detailed information, read Marine Accident Report--"Explosion and Fire on the U.S. Tank ship SURF CITY Persian Gulf, February 22, 1990." (NTSB/MAR-92/02).

fumes. Neither the chief mate nor the master was on the main deck during the tank opening operations and they did not oversee the ventilation of the ballast tanks.

Title 46 Code of Federal Regulations at 35.30-10 requires that the "senior member of the crew on duty" shall be present when cargo tank hatches, ullage holes, or Butterworth plates are opened or remain open without flame screens, unless the cargo tank is gas free. Ballast tanks, cofferdams, or voids are not designated to carry cargo and therefore are not included in the regulation. Thus, the chief mate and the master were not required to be on deck when the crewmembers opened the deck fittings to the Nos. 4S and 4P ballast tanks before ventilating the tanks. Had the chief mate been on deck and present at the No. 4S ballast tank when the Butterworth plates and hatch were opened, he may have been alerted earlier that naphtha fumes were in the tank. Therefore, the Safety Board believes that general safety rules should be revised to require that the senior member of the crew be present when any hatch or Butterworth plate on any enclosed space within the cargo block is opened.

The Kuwait Oil Tanker Company Safety Manual used by the SURF CITY's personnel discusses oxygen deficiency and toxic vapors but does not state that a person should test for an explosive atmosphere before entering or ventilating a space. Another reference used by the tank vessel personnel, the ISGOTT guide discusses gas tests before entry; it also identifies what levels are safe for entry but does not provide any guidance about when to ventilate or not to ventilate a confined space. As this accident demonstrates, these guides would be more useful if both stated clearly and emphatically that prior to entry or ventilation, one should always consider any tank potentially hazardous and test it first for explosive levels and then for oxygen levels. They should also specify what to do, including contacting company management before ventilating, if a tank is found to contain explosive vapors. The guides should also include the rationale for the above procedures.

Conventional means of publicizing safety issues, such as articles in the Coast Guard's bimonthly publication, "Proceedings of the Marine Safety Council," reach a limited audience and do not have a sustained impact over time. Providing guidelines to shipboard personnel in a pamphlet could be ineffective because the booklet could be misplaced. Even though the Coast Guard regulations incorporate National Fire Protection Association (NFPA) Standard No. 306 for pier-side repairs or inspection work, the Safety Board believes that procedures for tank entry should be included in the tank vessel regulations. The regulation should also contain a requirement for the senior responsible officer to make an entry in the vessel's log or other record stating that tests for explosive and oxygen levels have been performed and that rescue equipment and team are in place before tank entry is attempted. Moreover, the regulations should contain guidelines to follow in the event cargo vapors are found in noncargo tanks.

Current U.S. and international regulations mandate an inert gas system for cargo and slop tanks only. To date, segregated ballast tanks, cofferdams, and voids are not subject to the same requirements because they do not carry cargo. However, because segregated ballast tanks border cargo tanks, a fracture resulting from corrosion, stress, or fatigue could provide a path for flammable cargo to enter the ballast tank and create an explosive atmosphere.

A tank ship with volatile cargo in its ballast tanks constitutes a very dangerous threat to its crew, other nearby vessels and structures, and the environment. The

crew has very few options for removing the threat. If the tank atmosphere is uniformly below the LEL and leakage into the tank remains very small, then continuous ventilation may be sufficient to keep it safe. If the tank atmosphere is flammable or above the UEL, any attempt to ventilate the tank will be very dangerous because the air injected into the tank will bring the over rich hydrocarbon/air mixture into the explosive range.

Because undetected failures in tank boundaries can permit leakage of volatile cargo into adjacent ballast tanks within the cargo block or into areas that are served by ballast piping that passes through cargo tanks, such ballast tanks should be protected by the inert gas system. Installation of the required inert gas system for the cargo tanks is a major construction cost in building a tankship. Inclusion of ballast tanks in the inert gas system is inexpensive because it requires only the addition of a limited amount of branch line piping and valves. Therefore, expansion of the inert gas system to include the ballast tanks would have minimal economic impact on the vessel owner or operator. The Safety Board believes that the Coast Guard should revise the inert gas regulations to include ballast tanks located within the cargo block. Further, the Safety Board believes that risk to the crew, the vessel, and the environment also exists on tank ships internationally and that the Coast Guard should encourage the International Maritime Organization to include ballast tanks in the inert gas system on tank ships.

As on other tank ships, the SURF CITY's ballast piping was routed through the center cargo tanks, and branch pipe lines extended to port and starboard into the ballast tanks. In the cargo tanks, cargo surrounded the ballast pipe line, which was subject to cargo head pressure. A failure in the ballast pipe line can also provide a path for cargo entry into the ballast tanks. The Safety Board believes that Coast Guard and international regulations should prohibit the routing of ballast piping through cargo tanks and cargo piping through ballast tanks.

Crewmembers testified that the conflagration was beyond the ability of the fire main/foam system to control. Whether any firefighting attempts by crewmembers would have succeeded is doubtful, considering the rapidly deteriorating survival conditions on deck. Nonetheless, the primary problem in this accident was that the crew could not operate the tank ship's main deck firefighting system because they could not reach the monitors to activate them.

Specifically, the port and starboard fire monitors on the tank top above the port and starboard slop tanks were in a position of risk, subject to damage and heat exposure from an explosion or fire in the area of the after cargo and fuel oil tanks. Had remote controls (open/close valves) been located in the fire control room to supply foam and water to individual fire foam monitors on deck, the crew could have attacked the fire from a protected position. Fire monitors aft and above the cargo block could have provided the crew with a means to fight the fire and could have allowed the crew to cool the cargo tank tops on the port side and thereby reduce cargo vapors which were feeding the fire. The fire in this accident was too intense for the crew to fight; however, on a smaller fire, remote operation of the fire monitors could be helpful in controlling a fire, preventing further damage, and providing protection to the crew.

Based on a review of the circumstances in this accident, the Safety Board believes that fire control systems on tankships carrying volatile cargoes should incorporate the following elements:

- o Individual control valves in the protected fire control room to supply and control water and foam for each fire foam monitor.
- o A fire foam monitor on an elevated platform aft of the cargo block on both sides of the vessel.

The crew had to abandon the tank ship in a traditional open lifeboat and were exposed to burning cargo, which was being released in the tank ship's wake. As a result, seven crewmembers suffered radiant heat burns due to lack of thermal protection. When the lifeboat's propulsion system became partially disabled by a steel gripe cable wound around the propeller shaft, exposure time to the burning cargo was increased.

On November 10, 1977, as a result of its investigation of the collision of the U.S. tank ship EDGAR M. QUEENY and the Liberian tank ship CORINTHOS,² the Safety Board issued the following recommendation to the Coast Guard:

M-77-35

Develop and promulgate specifications for an enclosed fire safe, self-contained lifeboat for installation aboard oceangoing vessels of 10,000 or more deadweight tons.

On April 13, 1978, the Coast Guard responded that they agreed with the recommendation and were proceeding with action to achieve such an objective. The Coast Guard's action resulted in the 1983 amendments to the 1974 SOLAS Convention. The Safety Board found this action "acceptable" toward fulfilling Safety Recommendation M-77-35, but the recommendation was never officially closed. The Safety Board now classifies Safety Recommendation M-77-35 as "Closed--Acceptable Action" based on the 1983 amendments to SOLAS '74.

Under the 1983 amendments to the 1974 SOLAS Convention, Chapter III, Regulations 46-1 and 48-1.2 and .4, totally enclosed lifeboats are mandatory on tank ships constructed on or after July 1, 1986, and must be capable of being launched without anyone having to leave the lifeboat. Additionally, under the 1983 amendments to Chapter III, Regulation 41-6.7, "All lifeboats shall be designed with due regard to the safety of persons in the water and to the possibility of damage to the propulsion system by floating debris." The Safety Board notes that under SOLAS '74, as amended, the SURF CITY'S lifeboats were not required to be enclosed or to have propulsion system protection because the SURF CITY was built in 1981 and therefore was not subject to the latest SOLAS lifeboat requirements.

If the boatswain had not remained on the burning tanker and lowered the lifeboat, there would have been no safe means for the craft to enter the water. Because the vessel was built before July 1, 1986, it was not required to have lifeboats that could be launched or lowered from within the craft. The boatswain was apparently injured while attempting to abandon ship after the lifeboat was waterborne. The Safety Board believes that all tank ships, regardless of the date of construction, should be equipped with covered lifeboats that are capable of being

²"SS EDGAR M. QUEENY - S/T CORINTHOS, Collision at Marcus Hook, Pennsylvania on 31 January 1975 with Loss of Life" (USCG/NTSB MAR-77-2(J)).

lowered to the water from within the craft and without the need for an individual to risk personal harm by remaining on board the ship to actuate the lowering mechanism.

Events that occurred during the lifeboat deployment following the SURF CITY explosion and fire suggest that crewmembers would not have been injured had the lifeboat met those requirements. In view of the large number of tank ships currently equipped with open lifeboats, the risks to crewmembers during an evacuation from a burning tank ship will be present until all tank ships are provided with covered lifeboats. This accident suggests that the International Maritime Organization and the Coast Guard need to develop a lifeboat retrofit or replacement program for tank vessels that were built before July 1, 1986, so that older tank ships will have lifeboats that meet current international standards.

Therefore, the National Transportation Safety Board recommends that the U.S. Coast Guard:

Require guidance for crewmembers to use before ventilating or entering cargo tanks, ballast tanks, cofferdams, and voids immediately adjacent to the cargo block on tank vessels. (Class II, Priority Action) (M-92-9)

Amend Title 46 Code of Federal Regulations Section 35.30-10, "Cargo tank hatches, ullage holes, and Butterworth plates," to include ballast tanks, cofferdams, and voids in addition to cargo tanks. (Class II, Priority Action)(M-92-10)

Require that the fire control system on each tank vessel have individual controls in the protected fire control room to supply and control water and foam to each fire foam monitor. (Class II, Priority Action) (M-92-11)

Determine the best location, set standards, and implement requirements for port and starboard fire foam monitors aft of the cargo block on tank vessels. (Class II, Priority Action) (M-92-12)

Amend Title 46 Code of Federal Regulations to prohibit on tank ships the routing of ballast piping through cargo tanks and cargo piping through ballast tanks. (Class II, Priority Action) (M-92-13)

Propose that the International Maritime Organization revise SOLAS '74, as amended, to prohibit the routing of ballast piping through the cargo tanks and cargo piping through the ballast tanks on tank ships. (Class II, Priority Action) (M-92-14)

Revise Title 46 Code of Federal Regulations Section 32.53-5, "Inert Gas System Operation," to require that ballast tanks located within the cargo block on tank ships be included in the Inert Gas System. (Class II, Priority Action) (M-92-15)

Propose that the International Maritime Organization revise SOLAS '74, as amended, to require that ballast tanks located within the cargo block be included in the Inert Gas System. (Class II, Priority Action) (M-92-16)

For tank ships built before July 1, 1986, develop a lifeboat retrofit or replacement program to require that lifeboats be totally enclosed, have propeller guards, and be launchable from within the craft. (Class II, Priority Action) (M-92-17)

Propose that the International Maritime Organization develop a lifeboat retrofit or replacement program for tank vessels built before July 1, 1986, requiring that lifeboats be totally enclosed, have propeller guards, and be launchable from within the craft. (Class II, Priority Action) (M-92-18)

Disseminate to all Coast Guard marine safety units information about the nature and circumstances of this accident so that they can identify similar safety hazards on other tank vessels. (Class II, Priority Action) (M-92-19)

Also, the Safety Board issued Safety Recommendation M-92-20 to the International Chamber of Shipping; Safety Recommendation M-92-21 to the International Association of Classification Societies; and Safety Recommendations M-92-22 through -24 to the Gleneagle Ship Management Company.

COUGHLIN, Acting Chairman, and LAUBER, HART, HAMMERSCHMIDT, and KOLSTAD, Members, concurred in these recommendations.


By: Susan M. Coughlin
Acting Chairman