



# National Transportation Safety Board

Washington, D. C. 20594

## Safety Recommendation

---

**Date:** April 29, 1992

**In Reply Refer To:** M-92-22 through -24

Mr. E. J. Miller  
President  
Gleneagle Ship Management Company, Inc.  
6220 Westpark, Suite 225  
Houston, Texas 77057

---

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.<sup>1</sup>

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

---

<sup>1</sup>For 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.

According to eyewitness accounts, the actions of the master and the chief mate indicate that they probably first became aware of the contamination in the 4S ballast tank when they initially looked into the tank. Although the master and the chief mate recognized that the tank atmosphere was not safe for entry without a breathing apparatus, witnesses did not see anyone test the tank atmosphere for flammability or safe levels of oxygen. After one descent into the tank, the chief mate returned to the deck. He and the master then removed the fans and used mirror(s) to reflect sunlight into the tank in an apparent attempt to locate the naphtha leak.

The Kuwait Oil Tanker Company (KOTC) Safety Manual at Chapter 7.1 provides guidance for preparing a tank for entry, but neither the master nor the chief mate adhered to these procedures. Testimony indicates that the actions of chief mate and the master fostered a casual attitude during the tank opening and ventilation operations. For example, the work party testified that while the two fans on the starboard ballast tank were connected using an electrically bonded rubber hose, one of the two air ventilators on the port ballast tank was connected using two coupled hoses that were not electrically bonded. The work party also stated that they did not use a continuity meter to test any of the blowers or hose arrangements for proper grounding. The work party reportedly told the chief mate about the ungrounded hose, but the chief mate took no exception.

The KOTC safety manual also 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 International Safety Guide for Oil Tankers and Terminals, 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.

The naphtha leak into the No. 4S ballast tank began sometime between February 18 and 22, 1990, after the liquid hydrocarbon was loaded into cargo tanks Nos. 5S, 5C, and 6C and/or during the tank ship's passage through the Persian Gulf. Enough naphtha leaked into the starboard ballast tank so that when the vapors mixed with air injected by the Dasic Jetfan ventilation fans, the naphtha atmosphere reached the explosive range.

Naphtha could only have entered the No. 4S ballast tank as a result of either a failure in the ballast system piping or a failure in a ballast tank bulkhead. Postaccident examinations conducted by the Coast Guard revealed that the weld around the ballast pipe penetration into the No. 4S ballast tank, the ballast piping, and the branch valve was tight; no evidence of naphtha was present. Thus, the ballast system piping did not provide a path for naphtha leakage into the tank.

The Safety Board also considered fractures resulting from metal fatigue, stress concentrations, corrosion, and laterally symmetrical damage in the Nos. 4P and 4S tanks as a source of naphtha entry into the ballast tank.

The operation of tank ships in general, including the SURF CITY, generally subjects the cargo block to certain stresses. The motions of the tank ship, in bending and in torsion in a seaway (working), and the tank ship's operational voyage cycle of half the trip in ballast (without cargo) and half the trip in cargo (without ballast) place the steel structure of the cargo block in a constant cycle of alternating loads. This operational cycle of repeated opposing loads and stresses, together with stresses caused by the repeated flexing of the steel structure can lead to fatigue fractures in the bulkheads and the structural strength members within the tanks.

Testimony indicated that in the SURF CITY, working appears to have had the greatest effect in the Nos. 4P and 4S ballast tanks. The conditions of bulkhead and structural strength members in the Nos. 4P and 4S ballast tanks, as reported by Coast Guard inspectors and the ABS surveyor before the accident, indicate that the aft area of the ballast tanks was an area of stress concentration within the cargo block. The Coast Guard hull inspector testified that the fractures he found in the transverse web frames, longitudinal stiffeners, and the upper horizontal girders were stress fractures.

When the former chief mate inspected the SURF CITY's ballast tanks in January 1990, he reported numerous new stress fractures, some along previous weld repairs, in the girders, frames, and stiffeners in the Nos. 4P and 4S ballast tanks. These new fractures had occurred less than 1 year following the previous ballast tank inspections and shipyard repairs in February 1989. He also found a previously unreported bulkhead patch in the No. 4S ballast tank on the aft transverse bulkhead in an area corresponding to the bulkhead fracture found in the No. 4P ballast tank. The testimony and reports from the previous chief mate, the ABs, and the Coast Guard indicate that the type and locations of fracturing found in the No. 4P ballast tank were laterally symmetrical to those found in the No. 4S ballast tank.

The facts concerning the material condition of the tanks, the location of the stress concentration, and the observations of the Coast Guard inspector who found the same condition on "all four of the 81,000 ton [dwt] vessels" (SURF CITY, CHESAPEAKE CITY, OCEAN CITY and SEA ISLE CITY) justify the conclusion that Gleneagle Ship Management Company, operator of the SURF CITY, should monitor the stress levels with strain gauges and determine their impact on the cargo block on the three 81,000 dwt tank ships still in service. Gleneagle should also conduct a detailed assessment of the material condition of the cargo block on board the tank ships CHESAPEAKE CITY, OCEAN CITY, and SEA ISLE CITY to determine the adequacy of cargo block design and implement any repairs or alterations necessary to improve the structural integrity of the cargo block to reduce the stress and the frequency of tank fractures.

Therefore, the National Transportation Safety Board recommends that the Gleneagle Ship Management Company:

Revise the "Kuwait Oil Tanker Company Safety Manual" and relevant safety procedures on all your tank ships to explicitly require that all ballast tanks, cofferdams, and voids located in or immediately adjacent to the cargo block be tested before tank entry for explosive levels and for oxygen levels to determine the

condition of the tank atmosphere and procedures to follow before ventilating the tank. (Class II, Priority Action) (M-92-22)

Disseminate to all company tank ship officers information about the nature and circumstances of this accident in order to alert them to potential safety hazards of ventilating ballast tanks. (Class II, Priority Action) (M-92-23)

Develop and implement a program to monitor the stress levels in the cargo block on the CHESAPEAKE CITY, OCEAN CITY, and SEA ISLE CITY; to analyze the information obtained; and to implement any repairs or alterations necessary to improve the structural integrity of the cargo block. (Class II, Priority Action) (M-92-24)

Also, the Safety Board issued Safety Recommendations M-92-9 through -19 to the U.S. Coast Guard; Safety Recommendation M-92-20 to the International Chamber of Shipping; and Safety Recommendation M-92-21 to the Association of Classification Societies.

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



By: Susan M. Coughlin  
Acting Chairman