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National Transportation Safety Board

Washington, D. C. 20594

Safety Recommendation

Date: April 29, 1992

In Reply Refer To: M-92-21

Mr. R. A. Belik
Chairman
International Association of
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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 salved 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.

[1]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).

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 case of 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.

Undetected failures in tank boundaries that permit leakage of volatile cargo into adjacent ballast tanks, cofferdams, or voids within the cargo block constitute a very dangerous threat to the crew, other nearby vessels and structures, and the environment. For this reason, the Safety Board believes that the lessons to be learned from the SURF CITY accident extend to international operations.

Therefore, the National Transportation Safety Board recommends that the International Association of Classification Societies:

> Review the circumstances of this accident as it relates to stress and its effects on the structural integrity of the cargo block on tank vessels and disseminate this information to your member societies. (Class II, Priority Action) (M-92-21)

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 Recommendations M-92-22 through -24 to the Gleneagle Ship Management Company.

COUGHLIN, Acting Chairman, and LAUBER, HART, HAMMERSCHMIDT, and KOLSTAD, Members, concurred in this recommendation.

By: Susan M. Coughlin
Acting Chairman