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Ray M-285

**NATIONAL TRANSPORTATION SAFETY BOARD**  
WASHINGTON, D.C.

ISSUED: August 21, 1985

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Forwarded to:

Admiral James S. Gracey  
Commandant  
U.S. Coast Guard  
Washington, D.C. 20593

SAFETY RECOMMENDATION(S)

M-85-51 through -55

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On February 26, 1984, the 661-foot-long U.S. tankship SS AMERICAN EAGLE was en route in ballast from Savannah, Georgia, to Orange, Texas. Three crewmembers were cleaning and gas freeing the vessel's forward cargo tanks and the cargo tanks' heating coils. About 1045, an explosion occurred in one of the forward cargo tanks. Three of the vessel's thirty crewmembers died as a result of the explosion. On the following day, the vessel sank in the Gulf of Mexico about 130 nautical miles south-southwest of New Orleans, Louisiana, while awaiting a salvage tug. Two crewmembers died and two others are missing and presumed dead as a result of the vessel's sinking. The AMERICAN EAGLE was valued at \$7,500,000. 1/

Shortly before the explosion, the boatswain, the pumpman, and the chief mate were working on the forward deck near the No. 3 center tank using handtools and an air-mover ventilator. In these circumstances, several possible ignition sources suggest themselves, such as a lighted match or cigarette, a spark caused by striking a metal tool against a metal object, or an electrostatic discharge caused by the operation of the air-mover ventilator with steam. Since the Coast Guard regulation regarding smoking on deck had been strictly enforced and observed on the AMERICAN EAGLE, and since these men had not been seen smoking on deck previously, it is not likely that one of them attempted to light or smoke a cigarette on deck. The master was on the deck near the Nos. 5 and 6 tanks at the time of the explosion, but he did not smoke. Although it is possible that a spark could have been caused by the use of a metal tool, such as the one seen in the chief mate's pocket earlier on February 26, it is unlikely because he was not hammering or chipping with his tool and a forceful impact would have been required to produce a spark. Since he was not seen near any of the tank openings, it is unlikely that his tool was dropped into a tank. Therefore, the most likely source of ignition was the operation of the air-mover ventilator at the No 3. center tank.

1/ For more detailed information, read Marine Accident Report—"Explosion and Sinking of the United States Tankship SS AMERICAN EAGLE, Gulf of Mexico, February 26 and 27, 1984" (NTSB/MAR-85/06).

During the testing of the air-mover ventilator, a consultant hired by the owners of the AMERICAN EAGLE noted that large amounts of condensate accumulated on the inner surfaces of the air-mover ventilator and the plastic sleeve. The individual droplets on the air-mover ventilator and on the sleeve were observed to merge together and flow toward the bottom of the sleeve. Since the plastic sleeve was a non-conductor, it would accumulate static charge whether or not the air-mover ventilator was grounded. As the droplets flowed along the inner surface of the plastic sleeve and combined into small streams, the water surface would have been accumulating electrostatic charge from the inner surface of the sleeve. Although the plastic sleeve could not accumulate sufficient surface charge to spark directly to the tank structure, the charge induced on the inner surface of the sleeve would be transferred continuously to the flowing water which would accumulate more and more charge as it moved along the length of the sleeve. Past research has shown that water slugs can accumulate sufficient surface charge to cause an incendive spark when they pass close to grounded protrusions in a cargo tank, such as stiffeners or web frames. The plastic sleeve extended almost to the bottom of the cargo tank, so numerous slugs of charged condensate would have been falling from the end of the plastic sleeve toward the bottom of the tank and easily could have approached a structural member within the spark gap distance and could have caused an incendive spark. The Safety Board believes this to be the most likely mechanism for ignition of the flammable vapors in the No. 3 center cargo tank.

The Tanker Safety Guide, the International Safety Guide for Oil Tankers and Terminals (ISGOTT), and A Manual for the Safe Handling of Flammable and Combustible Liquids and Other Hazardous Products (CG-174) contain precautions to be followed during tank washing and gas freeing aboard tankships. The Tanker Safety Guide and the ISGOTT specifically identify the electrostatic discharge hazards involved in injecting steam into a non-gas free atmosphere. The master was not aware, and the chief mate apparently was not aware or did not consider the electrostatic discharge hazard when deciding to use steam to operate the air-mover ventilator in tanks that were not gas free. The published precautions and recommendations concerning the use of steam should have been practiced aboard the AMERICAN EAGLE, and the master and chief mate should have been aware of the electrostatic discharge hazards. If the master and the chief mate had been required to review periodically the available safety publications, they would have been aware of the danger of injecting steam into a flammable atmosphere, and the accident might have been prevented.

CG-174, A Manual for the Safe Handling of Flammable and Combustible Liquids and Other Hazardous Products, recommends procedures to follow to eliminate possible ignition sources, including those from static buildup. However, the manual does not address specifically the electrostatic discharge hazard involved with the injection of steam into a flammable atmosphere. Since the manual is used by persons preparing for tankerman certification and for license examination and as a primary source of guidance regarding safe operating procedures for tank vessels, it should contain detailed discussions dealing with the generation of static electricity and the hazards of electrostatic discharges. The fact that the injection of steam into a tank can cause electrical potentials much higher, and therefore of greater electrostatic hazard, than generally associated with tank washing where water is injected into the tank also should be discussed. Additionally, there would be more widespread understanding of this subject among operating personnel if appropriate questions were included in the examinations for tankermen and licensed officers.

The air-mover ventilator is advertised by the Mine Safety Appliances Company (MSA) to be suitable "for use in potentially explosive atmospheres, when properly grounded." The master, the chief mate, and the port engineer relied on this advertisement when they concluded that the air-mover ventilator was safe to use for ventilating non-gas free tanks. However, MSA had conducted no tests to ascertain whether electrostatic discharge hazards were associated with the use of the air-mover ventilator. The circumstances of this accident show that it poses a significant hazard. The Safety Board believes that the advertisement for the air-mover ventilator in the Mariner's Annual was misleading.

While the label on the device directs the user to ground it, it does not point out that steam passing through the air-mover ventilator will become electrostatically charged whether the device is grounded or not. Thus, the possibility of an electrostatic discharge would still exist. If the MSA advertisement for the air-mover ventilator had indicated the possibility of an incendive electrostatic discharge, the master, the chief mate, and the port engineer might have evaluated the use of the air-mover ventilator more thoroughly. Had the master and chief mate realized the electrostatic discharge hazard involved, they might have followed normal practice and used only Coppus blowers to ventilate the tanks, steam would not have been injected into the tanks, and the accident might have been prevented.

No visible reason for the lifeboat's failure to lower was noticed by the crew. Because of the urgency to abandon ship, no effort was made to check inaccessible locations, such as the areas inside the winch housing. The lifeboat could not have been lowered if the chain connecting the winch motor and the wire rope drum had parted and had jammed the drum. This would have allowed the hand flywheel to turn independently of the wire rope drum, but the failure would not have been readily detectable because the chain and the wire rope drum were encased.

The lifeboat also might fail to lower if a wire rope fall came out of the groove in its sheave and became jammed between the sheave and the davit. This is unlikely, however, because davits are designed to operate properly even if the vessel has a list or severe trim, and because the load on the fall tends to maintain them in the sheave. Since other modes of failure, such as a jammed brake, would have prevented the hand flywheel from turning, the Safety Board believes that the most likely mode of failure involved the parting of the chain and the jamming of the wire rope drum. If the lifeboat had lowered properly, the crewmembers might not have jumped into the water, and additional lives might have been saved.

Since the PROTEUS 2 flares which the crew attempted to fire had manufacturing dates of 1980 and 1982, it is obvious that both flares without safety cotter pins and flares with safety cotter pins were aboard the AMERICAN EAGLE. The PROTEUS 2 and the modified PROTEUS 2 flares looked alike with the exception of the tape and the label covering the cotter pin. Therefore, if the numbered instructions were read and followed to fire a flare without a safety cotter pin, the operator might not realize that a cotter pin had to be removed before turning the grip. The separate cotter pin label did not specify when in the firing process the cotter pin should be removed, and if the cotter pin was not removed before turning the grip, it would prevent the grip from being turned or pulled easily. Since the master did not notice a cotter pin on any of the flares, and since several crewmembers had difficulty turning and pulling the grip, they apparently were not aware of the cotter pin and the need to remove it before turning the grip.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the U.S. Coast Guard:

Develop specific safety precautions for the use of air-mover ventilators in potentially combustible atmospheres and disseminate this information to tankship owners and operators and to deck and engineering officers. (Class II, Priority Action) (M-85-51)

Amend the next edition of the Coast Guard publication CG-174, A Manual for the Safe Handling of Flammable and Combustible Liquids and Other Hazardous Products, to include discussions of the generation of static electricity, the hazards involved in electrostatic discharges, and the danger associated with the injection of steam into non-gas free cargo tanks. (Class II, Priority Action) (M-85-52)

Include questions on electrostatic discharges and the danger associated with the injection of steam into non-gas free cargo tanks in tankerman and licensed officers' examinations. (Class II, Priority Action) (M-85-53)

Notify the owners of the two remaining vessels which have Welin G-55P gravity davits and H-55A davit winches of the circumstances involving the failure of the AMERICAN EAGLE's aft starboard lifeboat to lower completely to the water. Require that the wire rope drum drive chains on those vessels be inspected monthly. (Class II, Priority Action) (M-85-54)

Publish a safety warning to inform users of Kilgore PROTEUS 2 hand-held parachute flares manufactured after March 1981 that a safety cotter pin must be removed before turning the grip to fire the flare. (Class II, Priority Action) (M-85-55)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in these recommendations.

By:   
Jim Burnett  
Chairman