SP-20
Log M-286

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

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Forwarded to:

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SAFETY RECOMMENDATION(S)

M-85-56

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).

The operation of the air-mover ventilator caused steam to be injected into the No. 3 center cargo tank, and whether or not the air-mover ventilator was properly grounded, the steam passing through the device would have become electrostatically charged. A charged steam cloud or mist in a cargo tank containing flammable vapors does present the possibility of an incendive spark when an ungrounded object closely approaches the tank structure after passing through and acquiring a charge from the steam cloud or mist. Such an object would have to pass between regions of high and low field strength and would have to approach the tank structure within the spark gap distance. Typically, the ungrounded object could be a sounding tape, a sampling bottle, a falling tool, or a falling Butterworth machine. Since the No. 3 center tank no longer contained cargo and had been washed previously, it is not likely that a sounding tape, a sampling bottle, or a Butterworth machine was lowered or dropped into the tank. Again, since no work involving handtools was being done near the tank openings, it is doubtful that a tool was dropped into the tank, and no other object can be identified as possibly having been dropped into the tank. Therefore, the explosion in the No. 3 center tank probably did not result from an incendive spark between a charged falling object and the tank structure.

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 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.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the Mine Safety Appliances Company:

> Revise current advertisements, data sheets, and warning labels for the air-mover ventilator to include a warning regarding the hazards associated with an incendive electrostatic discharge when the air-mover ventilator is powered by steam. (Class II, Priority Action) (M-85-56)

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 recommendation in this letter.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in this recommendation.

By: Jim Burnett
Chairman