

107# M-333A



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: November 16 1987

In reply refer to: M-87-90 through -93

Mr. William N. Johnston
Chairman and President
American Bureau of Shipping
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About 0115 on May 9, 1986, seawater was discovered flooding the engineroom of the U.S. flag tankship PRINCE WILLIAM SOUND, which was in the Pacific Ocean about 80 nautical miles west-southwest of Puerto Vallarta, Mexico. The vessel was en route from Valdez, Alaska, to Puerto Armuelles, Panama, with a cargo of 876,000 barrels (36,120,000 gallons) of Alaskan North Slope crude oil. The water level rose rapidly, and by the time the crew discovered the flooding, the electric motor drives of the bilge pumps and the sea valves were submerged before the pumps could be started or the valves closed electrically. The crew dived into the flooding engineroom and succeeded in manually closing all but one of the main sea valves. The flooding stabilized about the 61-foot level (above the keel) of the engineroom. The vessel subsequently was towed to Long Beach, California, where the engineroom was completely dewatered. Damage to the vessel was estimated to be \$12 million. There were no injuries or fatalities.

The failure of the main condensate pumps allowed the condensate level to fall in the boiler feedwater heater and to rise in the main condenser which actuated alarms for each unit, the first indication of a problem in the engineroom. However, there was no indication that the flooding of the lower engineroom caused the main condensate pump to shut down. Consequently, while the engineering watch and the chief engineer were taking corrective actions to keep the steam plant functioning, no one was aware that seawater was flooding into the lower engineroom. Both the first and second alarms were indicative of steam system engineering problems that could be solved by the operation of a condensate pump.

The chief engineer's concerns at the time were to maintain vacuum in the main condenser, to keep feedwater (condensate) in the boilers, and to keep the steam turbine electric generators operating. Had the chief engineer directed someone to investigate the reason the bilge alarm activated, the engineroom flooding may have been discovered in sufficient time to permit the closure of the sea valves electrically, using the controls at the main console. Clearly, the single bilge high level alarm sensor at one end of a 95-foot-long engineroom bilge did not provide any redundancy to alert the engineering watch early of the flooding condition. Therefore, the Safety Board believes there should be a requirement for multiple bilge high level alarm sensors installed in various locations in engineroom bilges.

1/ For more detailed information, read Marine Accident Report—"Engineroom Flooding of the U.S. Tankship PRINCE WILLIAM SOUND near Puerto Vallarta, Mexico, May 9, 1986" (NTSB/MAR-87/07).

When the crew attempted to manually close the 36-inch-diameter main seawater circulating system overboard discharge valve, they were able to close only 75 percent of the overboard valve opening before the rising seawater level in the engine room forced them to abandon their task. Had the valves in the main seawater circulating system been equipped with reach rods, the valves could have been closed from a higher, safer platform level. The time-consuming effort expended in diving into the flooding engine room and closing the main seawater overboard discharge valve could have been avoided if reach rods had been installed. The level of damage to the vessel would have been reduced and the risk of injury or death by drowning could have been avoided. Therefore, the Safety Board believes that the American Bureau of Shipping (ABS) should require reach rods on valves in vital ship systems, such as the main seawater circulating system and the emergency bilge pumping system.

While the vessel was drydocked, in Nagasaki, Japan, from September to November 1984, two U.S. Coast Guard (Coast Guard) marine inspectors and an ABS surveyor inspected all the expansion joints in the main seawater circulating pipelines. Both main seawater circulating pumps were removed for overhaul, and the main condenser access was opened which allowed an internal, as well as an external, examination of the two main seawater circulating pump discharge expansion joints. The joints were found to be in satisfactory condition and replacement was not recommended. In fact, from the time of the repair of the expansion joint until the postaccident survey, no one who examined the expansion joints, including the Coast Guard inspectors, the ABS surveyors, the Sun port engineer, and the engineers on board the vessel, were aware of or recognized that the forward expansion joint had been repaired.

The vulcanized repair made to the forward main seawater circulating pump discharge expansion joint covered the original expansion joint material. This repair concealed the deteriorated condition of the underlying original expansion joint from the view of marine inspectors, surveyors, port engineers, and the ship engineers. Goodall Rubber Company does not recommend repairs to expansion joints that exceed one ply in depth. The company does market an expansion joint repair kit; however, repairs are confined to minor repairs to blemishes on the outer cover surface. Therefore, the Safety Board believes that the ABS should prohibit repairs to nonmetallic expansion joints installed in vital ship systems.

Although the Safety Board cannot determine the precise reason for the failure of the expansion joint, it is clear that the expansion joint should have been replaced and not repaired. Clearly these joints should be (as they are required to be) inspected periodically and replaced when their condition warrants replacement. However, the Safety Board believes that there should be a limit to the length of time they are allowed to remain in service even if there has been no apparent deterioration. Although data are not available to determine systematically the safe service life of nonmetallic expansion joints, representatives of the Coast Guard and the ABS have indicated to Safety Board investigators that a 10-year period is reasonable. A 10-year expansion joint replacement interval coincides with the current ABS required drydock survey schedule and the proposed Coast Guard drydock inspection schedule. Therefore, the Safety Board believes that a 10-year limit should be placed on the service life of nonmetallic expansion joints installed in vital ship systems.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the American Bureau of Shipping:

Require that expansion joints in the main seawater circulating system be replaced at least once every 10 years, and require the date of manufacture and serial number be clearly and indelibly affixed to the nonmetallic expansion joint. (Class II, Priority Action) (M-87-90)

Require on vessels of 500 gross tons and more the installation of multiple bilge high level sensors in the engineroom bilge to provide the redundant coverage necessary to detect flooding at an early stage. (Class II, Priority Action) (M-87-91)

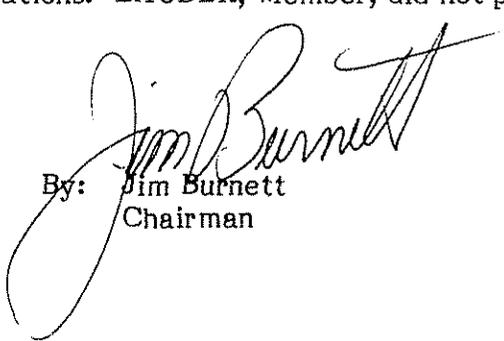
Establish rules which prohibit major repairs to nonmetallic expansion joints installed in the main seawater circulating system. (Class II, Priority Action) (M-87-92)

Require on vessels of 500 gross tons and more that reach rods for remote manual control of valves be installed in the vital main seawater circulating system and the emergency bilge pumping system. (Class II, Priority Action) (M-87-93)

Also, the Safety Board issued Safety Recommendations M-87-84 through -89 to the U.S. Coast Guard and M-87-94 to the Sun Refining and Marketing Company.

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 recommendations in this letter. Please refer to Safety Recommendations M-87-90 through -93 in your reply.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and NALL and KOLSTAD, Members, concurred in these recommendations. LAUBER, Member, did not participate.

By: 
Chairman