



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: November 16, 1987

In reply refer to: M-87-84 through -89

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Commandant
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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.

Once the flooding was discovered, the 28-inch-diameter discharge valves on the forward and aft main seawater circulating pumps were closed manually by order of the chief engineer. The closure of the pump discharge valves isolated the engineroom from two of the three main seawater circulating system sea connections and eliminated two possible sources of the flooding. At the same time, the chief engineer should have directed someone to close the 36-inch-diameter main seawater overboard discharge valve to completely isolate the main seawater circulating system and the engineroom from the sea. Instead, the chief engineer directed the first assistant engineer to open the emergency bilge pump valves so that the emergency bilge pump could be started. Seawater continued to back-flow through the open main seawater overboard discharge valve and through the main condenser to the ruptured expansion joint. The chief engineer should have known that sudden and rapid flooding of the engineroom is normally the result of one of two possibilities: a breach of the hull in the engineroom area or a failure in the main seawater circulating system. Isolating the main seawater circulating system from the sea by closing the main sea valves would have indicated to the chief engineer which problem existed. The chief engineer should have instructed someone to close the valves in the main seawater circulating system because it was the most likely method of controlling the seawater flooding in the engineroom. If all three valves had been closed immediately, the flooding in the engineroom would have ceased, precluding additional damage to the engineroom equipment.

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 engineroom 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 engineroom 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 the U.S Coast Guard (Coast Guard) should require reach rods on valves in vital ships 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 Coast Guard marine inspectors and an American Bureau of Shipping (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 Coast Guard should prohibit repairs to nonmetallic expansion joints installed in vital ship systems.

There is no evidence that the Coast Guard or the ABS, while conducting inspections and surveys during the period from November 1979 to April 1982, detected the deterioration of the forward and aft main seawater circulating pump discharge expansion joints.

At present, the ABS requires an internal and an external survey of expansion joints in the main seawater circulating system every 2 1/2 years during the mandatory ABS drydocking survey. The Coast Guard should have a similar mandatory requirement for those U.S. flag vessels not classed with ABS. Additionally, the Coast Guard should revise its drydock inspection booklet to include a check-off item for the external and internal inspections of expansion joints installed in the main seawater circulating system.

Both the ship engineering personnel and the Trinidad port engineers were aware of the deteriorated condition of the expansion joints, but they failed to relay this information to the Coast Guard as required in the Laws Governing Marine Inspection. Furthermore, one would expect that the chief engineers' and port engineers' descriptions of the deteriorated condition of the forward and aft main seawater circulating pump discharge expansion joints in their reports to Trinidad Corporation would have excluded

any decision to repair the expansion joints. Nevertheless, Trinidad had the forward main seawater circulating pump discharge expansion joint repaired and reinstalled in the main seawater circulating system without requesting the approval or reporting the repair to the Coast Guard as required by Federal regulations.

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 U.S. Coast Guard:

Require that expansion joints in the main seawater circulating system be replaced at least once every 10 years, and require that the date of manufacture and the serial number be clearly and indelibly affixed to the nonmetallic expansion joint. (Class II, Priority Action) (M-87-84)

Require a complete internal and external examination of nonmetallic expansion joints installed in the main seawater circulating system during drydock inspections. (Class II, Priority Action) (M-87-85)

Require on vessels of 500 gross tons and more that multiple bilge high level sensors be installed in various locations in the engineroom bilge to provide the redundant coverage necessary to detect flooding at an early stage. (Class II, Priority Action) (M-87-86)

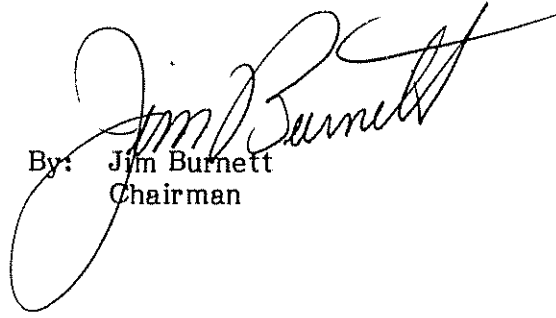
Require on vessels of 500 gross tons and more that reach rods for remote manual control of valves be installed in the vital main seawater circulating system and the emergency bilge pumping system. (Class II, Priority Action) (M-87-87)

Revise the Drydock Inspection Booklet to include a check-off for external and internal inspections of nonmetallic expansion joints in the main seawater circulating system. (Class II, Priority Action) (M-87-88)

Establish regulatory requirements which prohibit major repairs to nonmetallic expansion joints installed in the main seawater circulating system. (Class II, Priority Action) (M-87-89)

Also, the Safety Board issued Safety Recommendations M-87-90 through -93 to the American Bureau of Shipping and M-87-94 to the Sun Refining and Marketing Company.

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

A large, stylized handwritten signature in black ink, appearing to read "Jim Burnett". The signature is written in a cursive, flowing style with a large initial "J".

By: Jim Burnett
Chairman