

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

4-139

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Forwarded to:

Admiral John B. Hayes
Commandant
U.S. Coast Guard
Washington, D.C. 20593

SAFETY RECOMMENDATION(S)

M-80-102 through -114

On the afternoon of March 30, 1979, a fire erupted in the crew galley onboard the Italian passenger ship ANGELINA LAURO while it was berthed starboard side to the West India Company dock in Charlotte Amalie Harbor, St. Thomas, U.S. Virgin Islands. The fire was initially fought by the ship's crew, but shoreside assistance was requested and the local fire department responded. The fire spread from the crew galley to an adjacent dining room. Heavy smoke severely impeded firefighting efforts aboard the ship and eventually forced the crew to leave the ship. Firefighting efforts continued to be directed against the external surfaces of the vessel, but the fire raged out of control throughout the interior spaces until the fire burned itself out 4 days later. The ANGELINA LAURO was almost destroyed. Two persons received minor injuries. 1/

The fire started in an unattended tilting skillet in the crew galley when cooking oil was overheated and was ignited. The skillet was routinely used by the ship's cooks to deep-fry food. The fire then spread into the grease vapor exhaust hood and duct system, which was laden with a grease film. The fire dampers in the duct were ineffective in stopping the fire's spread, and the fiberglass insulation on the duct burned. As a result, in less than 30 minutes, the fire spread from the main vertical zone (MVZ) in which it started into a dining room in an adjacent MVZ when combustible materials ignited near the red-hot duct in the space between the overhead ceiling and deck above.

The long horizontal run of this exhaust duct as it passed through the dining room both enhanced the grease film buildup and exposed the duct to more combustible materials. Proper cleaning of this duct was beyond the capability of the crew since it would have required that it be either completely dismantled or steam-cleaned with special equipment. Although testimony indicated that this duct had been cleaned when the ship was last in dry dock, the duct was not examined by the Coast Guard or any other examining authority to insure that it was cleaned and reassembled properly.

1/ For more detailed information read "Marine Accident Report—Fire Onboard the Italian Passenger Ship ANGELINA LAURO, Charlotte Amalie Harbor, St. Thomas, U.S. Virgin Islands, March 30, 1979" (NTSB-MAR-80-16).

In its analysis, the Safety Board concluded that automatic fire dampers may not be an effective means of preventing fire spread in grease vapor exhaust ducts. The exhaust duct was required by the Fire Safety Standards of 1966 to have "efficient insulation" where it passed through accommodations spaces. However, the insulation on the duct was destroyed by heat, which caused the combustible materials in the overhead space of the dining room to be directly exposed to the red-hot surface of the duct. Subsequent laboratory analysis of the insulation residue indicated that it was a fiberglass composition, which is normally held together by combustible resin binder and which is not suitable for high temperature applications. The National Fire Protection Association (NFPA) requires exhaust ducts serving hoods over cooking equipment to have duct enclosures with a fire resistance rating of over 2 hours when the structure is over four stories high and requires ducts and hoods to be protected by fire extinguishing equipment unless an approved grease extractor serves the cooking equipment. The Safety Board concludes that grease vapor exhaust ducts should be adequately insulated where they pass through spaces containing combustible materials on passenger ships and that ducts and hoods should be fitted with an automatic fire extinguishing system unless an approved grease extractor serves the cooking equipment.

Examination and testing of the skillet after the fire indicated that it lacked overheat protection and that it could heat cooking oils and fats to their autogenous ignition temperature. Reliable overheat protection is essential to the safe use of cooking appliances that can heat a large quantity of cooking oil or fats. Water sprinkler systems, as installed on the ANGELINA LAURO, do not provide effective fire extinguishing for grease fires because water droplets contacting the hot grease would cause explosive splattering of grease and possibly the rapid spread of the fire. The manually operated steam smothering system was not used because of the delayed discovery of the fire and because the firefighters did not know the system existed. Ships that use combustible materials in their internal construction are especially vulnerable to the hazards of a fire that could originate in cooking equipment. The Safety Board is concerned that similar dangers may exist on other passenger ships operating under the Coast Guard's control verification program. Therefore, the Safety Board concludes that cooking equipment on such passenger vessels operating from U.S. ports should be protected by reliable overheat protection and an adequate automatic fire extinguishing system.

The sprinkler system on the ANGELINA LAURO did not automatically alarm the pilothouse of a fire in zone 21, which served the crew galley, until the fire had been burning for about 30 minutes and had spread into an adjoining MVZ. This demonstrates a serious shortcoming of Method II structural fire protection, which, because of the strong reliance upon the sprinkler system to detect a fire and alert firefighters, allows combustible materials to be used in the ship's internal construction. It is well known that prompt detection in the early stages of a fire is most important. However, the sprinklers in the crew galley were not located close enough to the skillet fire to provide prompt detection since most of the flame was venting into the exhaust hood. In the dining room, the sprinklers were located below the overhead space and were unable to provide timely detection of a fire in the upper space. No alternate means of detection was provided for the overhead space even though the Fire Safety Standards of 1966 require a fire detection system for locations that are not considered accessible to the patrol system. Evidently, the Italian classification authority considered the space between the ceiling and overhead of the dining room accessible to a fire detection patrol, and the Coast Guard agreed with that interpretation. The Safety Board believes that a fire in this overhead space could remain hidden from a patrol too long to insure timely detection and, therefore, the Safety Board does not agree with the interpretation that this space was accessible to the patrol.

The ANGELINA LAURO was required to maintain an efficient patrol system to promptly detect the outbreak of fire. Over 30 minutes after smoke had been seen in several locations on the ship and after reports of smoke and fire had been made to the officer on watch, the firefighter conducting the patrol reported that everything was normal. The Coast Guard requires U.S. passenger vessels on international voyages to comply with comprehensive regulations regarding supervised patrols. The regulations include specifications regarding the frequency of patrols, provisions of clocks, and the wearing of a distinctive uniform. For vessels constructed with combustible materials prior to May 26, 1965, a supervised patrol is required to completely cover all parts of the vessel accessible to passengers or crew at least once every 20 minutes. If the patrol firefighter had been required to check the crew galley, which is recognized as a fire hazard area, every 20 minutes, he probably would have observed and reported the smoke coming from the skillet before the oil erupted into fire. The Safety Board believes that all passenger vessels carrying U.S. citizens from U.S. ports, except those essentially complying with Method I structural fire protection standards, should provide more frequent, supervised patrols similar to those imposed by the Coast Guard on U.S. passenger vessels which were constructed with combustible materials prior to May 26, 1965.

The sprinkler fire detection system does not respond until heat generated by the fire raises the temperature at the sprinkler to about 165° F, and the timeliness of detection is very dependent upon the location of the fire relative to the sprinkler. Another shortcoming of sprinkler detection is that smoke can build up enough to seriously hamper firefighting efforts, as it did here, before the sprinkler alarm sounds. Smoke detectors could have provided earlier warning. Therefore, the Safety Board concludes that, in addition to more stringent patrol requirements, a means of fire detection that is more sensitive than a sprinkler system is necessary in passenger ships constructed with combustible materials.

The sprinkler system installed below the suspended overhead could not extinguish a fire in the overhead. The NFPA "Fire Protection Handbook" states, "Sprinklers should be installed in spaces above ceilings because fire may spread in these spaces shielded by construction from sprinklers in the main area. Sprinklers may be omitted where construction is noncombustible. . . ." A sprinkler system installed in the overhead space of the dining room with special consideration given to ignition sources, such as the grease vapor exhaust duct, would have slowed the spread of fire while firefighters were responding.

For reasons never determined, the flow control valves serving the sprinklers in the dining room and crew galley were only partially opened; only one of the eight flow control valves examined was fully opened. The failure to insure that the sprinkler flow control valves were fully open seriously impaired the ANGELINA LAURO's fire protection capability against a fire below the overhead. As a deterrent to the closing of sprinkler valves, the Coast Guard should make unannounced visits to foreign passenger vessels to check the readiness of sprinkler systems.

Because of the discretion permitted by the words "reasonable and practicable" in the Fire Safety Standards of 1966, the construction of the ANGELINA LAURO's internal divisions was largely of combustible materials. Consequently, fire protection depended very much on control of ignition sources, prompt fire detection, and effective fire extinguishing. However, even in these matters, the Fire Safety Standards of 1966 permitted further discretion as to whether the overhead space was accessible to the patrol system and by simply specifying "efficient insulation" for the exhaust duct and an

"efficient patrol system" for fire detection. The Safety Board concludes that too much discretion is allowed in conjunction with Method II structural fire protection to insure an adequate level of safety for vessels carrying large numbers of U.S. passengers.

In its control verification program, the Coast Guard reviews a vessel's plans and conducts a cursory examination of the vessel, but relies mostly on certification by the government of the ship's registry to insure compliance. Because of the wide discretion allowed by the Fire Safety Standards of 1966, the Coast Guard generally does little more than verify that the ship is constructed according to the fire protection plans already approved by the government of registry. The adequacy of fire protection provisions, such as sprinkler and fire detection systems and galley exhaust duct insulation, appears not to be questioned, probably because the standards are not sufficiently specific to definitely determine compliance. The Safety Board is concerned because the safety of thousands of passengers, most of them U.S. citizens, depends upon the adequacy of the Fire Safety Standards of 1966 as well as the Coast Guard's interpretation of these standards. For example, over 500,000 cruise ship passengers visit St. Thomas each year. The Safety Board believes that the Coast Guard's control verification and examination program does not provide adequate assurance that the fire protection safeguards of foreign passenger vessels that embark U.S. citizens at U.S. ports are reasonably comparable to those required of U.S. vessels.

No ship's officer immediately assumed overall control of the firefighting activities or set up a command center where he could receive reports about the fire, plan a firefighting strategy for the situation, and direct a coordinated shipboard firefighting effort. The Safety Board concludes that effective control and coordination of the shipboard firefighting was never established.

The failure of a senior officer to immediately assume command led to other serious omissions. Most serious among these was the lack of consideration given to passenger safety. About 1555, smoke was observed coming from passenger cabins near the foyer and smoke was heavy enough to cause disorientation to some crewmembers. Yet, it was not until 1615, when the staff captain ordered the general alarm sounded, that any consideration was given to the welfare of passengers, except possibly for isolated efforts by crewmembers who acted on their own. This delayed consideration for passenger welfare was contrary to proper response in firefighting where the hazards to life should always be the earliest and primary consideration.

The failure to promptly and systematically evacuate passengers led to a second serious omission: the failure to immediately close all firescreen doors. The firescreen doors on the ANGELINA LAURO could have been selectively released from the pilothouse. Concern expressed by ship's officers that passengers could be injured or trapped if the doors were released remotely is either unfounded or indicates improper fitting of these doors, since the Fire Safety Standards of 1966 and the Italian classification authority regulations require that the doors should close slowly and that a person should be able to open the doors with little force. Because of testimony that the closure features of these doors could threaten passenger safety, the Safety Board concludes that the Coast Guard should examine the closure features of remotely actuated doors on all foreign passenger vessels under its control verification program.

Smoke was probably the most serious impediment to firefighting and provided a real test of the skill of shipboard firefighters. The smoke impaired breathing and visibility and became so thick that firefighters could not see the fire or their surroundings. Successful firefighting of the dining room fire should have been accomplished as a coordinated team effort in which some firefighters would open up the ceiling space and vent the smoke from the dining room while hose teams directed water on the fire. Such effective firefighting under the adverse smoke conditions would have required considerable leadership and skill which would normally be acquired through specialized training at an approved marine firefighting school by senior ship's officers and the ship's firefighters and through firefighting team practice. However, none of the ship's senior deck officers who should have directed the firefighting efforts had received formal training in shipboard firefighting, and drills generally involved little more than mustering crewmembers who donned equipment and laid out hoselines. Therefore, the Safety Board concludes that the ship's officers and crew were not adequately trained to fight the type of fire which developed on the ANGELINA LAURO. Because the potential for loss of life on passenger ships of Method II construction is so great, the Safety Board believes that the senior officers on foreign passenger vessels embarking U.S. passengers in U.S. ports should be required to attend an approved practical firefighting school. Further, the Coast Guard should develop and enforce more stringent standards for fire drills on passenger vessels to provide a more realistic demonstration of shipboard firefighting capability.

It is fortunate that the ANGELINA LAURO was in port and alongside a dock when the fire started, so that most of its passengers were ashore. However, when the local firefighters arrived onscene, they were not able to either assist the ship's crew or to organize an effective firefighting effort because they were unfamiliar with the ship, its crew, and its fire protection method, and had difficulty communicating with crewmembers due to language differences. Consequently, they were not able to analyze the fire and plan a firefighting strategy. As a result, the Virgin Islands firechief ordered the ship to be abandoned by all, including the ship's crew. However, because the ship's crew had not mustered an effective firefighting effort and were already abandoning the ship, the firechief's evacuation order did not have a significant effect on the fire and may have prevented loss of life.

As additional Federal and local officials arrived onscene, confusion, rather than effective coordination, developed. Various parties expressed concerns about the danger of explosion, fire spreading to the port, pollution of the harbor, and spread of fire to port buildings. However, they lacked the information and expertise to properly evaluate the situation. Plans and information regarding the ship's general arrangement, fire protection features, and stability were not available. As a result of this lack of coordination and information, an effective firefighting strategy involving local assistance never developed. Rather, all efforts were directed toward applying more water on the ship; this water had virtually no effect on the fire and nearly caused the ship to capsize.

The section of the Virgin Islands Emergency Operations and Disaster Control Plan describing procedures to be followed in the event of a ship fire at the West India Company facility was not comprehensive enough to be an effective prefire planning document, and supervisory firefighters of the Virgin Islands fire department lacked training in marine firefighting. Firefighter training and a more comprehensive prefire contingency plan are needed. The emergency plan should include firefighting assistance to passenger ships which frequently anchor in the harbor of Charlotte Amalie.

Therefore, the National Transportation Safety Board recommends that the U.S. Coast Guard:

Examine all passenger vessels operating under its control verification program to insure that cooking appliances that can heat more than a thin film of oil have reliable overheat protection. (Class II, Priority Action) (M-80-102)

Examine passenger vessels operating under its control verification program which contain combustible materials in their construction to insure that grease vapor exhaust ducts are insulated to provide, at least, "Class A-60" fire resistance when subjected to a Standard Fire Test. (Class II, Priority Action) (M-80-103)

Require vessel operators to provide proof of periodic cleaning of the interior of grease vapor exhaust ducts on passenger vessels operating under its control verification program. (Class II, Priority Action) (M-80-104)

Examine passenger vessels operating under its control verification program to insure that firescreen doors that can be closed by remote means cannot injure or trap passengers when closed remotely. (Class II, Priority Action) (M-80-105)

Conduct unannounced boardings of passenger vessels operating under its control verification program to insure that sprinkler system control valves are immediately ready to deliver their maximum flow of water. (Class II, Priority Action) (M-80-106)

Develop and implement more stringent requirements for conducting fire drills on passenger vessels operating under its control verification program to determine the crew's familiarity with shipboard fire protection features and their firefighting preparedness. (Class II, Priority Action) (M-80-107)

Require that passenger vessels operating under its control verification program which contain combustible materials in their construction increase the frequency and coverage of fire detection patrols, particularly for spaces constructed with combustible materials and for spaces, such as galleys, having a high risk of fire. (Class II, Priority Action) (M-80-108)

Require that passenger vessels operating under its control verification program which contain combustible materials in their construction install, in all ship spaces including overheads that are not easily accessible for visual observation, an improved means of automatic fire and smoke detection that will insure faster detection than the present temperature-sensitive sprinklers. (Class II, Priority Action) (M-80-109)

Inform the masters and operators of all passenger vessels operating under its control verification program, by appropriate published means, of the deficiencies discovered in this accident and of corrective actions which the Coast Guard recommends. (Class II, Priority Action) (M-80-110)

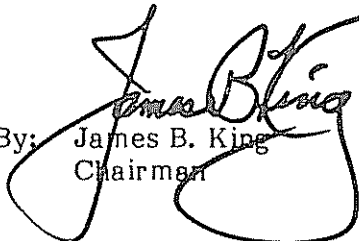
Urge the operators and owners of passenger vessels operating under its control verification program to install an automatic fire extinguishing system to extinguish fires in grease vapor exhaust hoods and ducts, unless an approved grease extractor serves the cooking equipment, and in cooking appliances that can heat more than a thin film of grease or oil. (Class II, Priority Action) (M-80-111)

Urge the operators and owners of passenger vessels operating under its control verification program to install suitable automatic fire extinguishing systems in all overhead and other hidden spaces constructed with combustible materials. (Class II, Priority Action) (M-80-112)

Urge the operators and owners of passenger vessels operating under its control verification program to train all senior officers including safety officers at an approved practical firefighting school. (Class II, Priority Action) (M-80-113)

In conjunction with the Federal Emergency Management Agency, assist the Virgin Islands Government in revising its contingency plan to include more comprehensive provisions for rendering firefighting services to vessels calling at its ports, including vessels at anchor in the harbor of Charlotte Amalie. (Class II, Priority Action) (M-80-114)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and GOLDMAN, Members, concurred in these recommendations. BURSLEY, Member, did not participate.

By:  James B. King
Chairman