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Cruise Ship Fires

One of the greatest threats to cruise ship safety is fire at sea

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In This Issue

Cruise ship travel remains one of the most popular forms of transportation. However, with newer and bigger passenger ships being built, some, which may carry 5,000 passengers, the potential for disaster is high; and one of the greatest threats to cruise ship safety is a fire at sea.

Cruise ship lines are taking this threat seriously. According to the International Council of Cruise Lines (ICCL), the average ICCL cruise ship, which weighs approximately 86,000 gross registered tons (78,017 metric tons), has five firefighting teams on board, more than 170 trained personnel to support the firefighting teams, and approximately 20 crew members with advanced firefighting training. The typical U.S. town fire department usually has an average of six firefighters per station.

The average ICCL ship also has more than 6 miles (9 kilometers) of firefighting hose, more than 16 miles (25 kilometers) of sprinkler piping, and more than 5,000 sprinklers, covering every cabin and room. There are also more than 500 fire extinguishers aboard; more than 4,000 smoke detectors; local alarms that sound in all cabins; more than 400 fire stations or hydrants; and enough lifeboats and life rafts for everyone aboard.

However, fires can still happen. Most recently, a discarded cigarette butt caused the 90-minute fire that charred one side of the cruise ship Star Princess in March 2006 and led to the death of a passenger, the British safety agency investigating the incident reported in October 2006.

In its final report, Britain's Marine Accident Investigations Branch (MAIB) reported that the fire spread quickly because of its location -- on a balcony where plastic partitions fed the flames. The incident revealed a blind spot in the maritime industry's longstanding fire code regulations, which do not apply to balconies. The agency did not recommend cruise ships ban or regulate smoking, but instead focused on removing from balcony areas any materials that could burn.

The 3 a.m. fire on Star Princess, en route from Grand Cayman to Montego Bay, Jamaica, injured 13 passengers and generated clouds of thick smoke. According to the marine agency report, passenger Richard Liffridge, 72, died from smoke inhalation.

Star Princess is registered in Bermuda, a British overseas territory, Princess Lines responded to the fire with the replacement of combustible furniture, floor tiles, and privacy dividers on outside verandas, more specialized training for crews, and new fire detection and suppression systems on balconies.

The fire took about 20 minutes to get started, and within another six minutes had spread from one deck to three, and across the length of three of the ship's seven fire zones -- subdivisions designed to contain shipboard fires. The heat shattered glass in stateroom balcony doors, but fire suppression systems stopped the blaze from moving inside. In all, 79 cabins were destroyed and another 218 had some fire, smoke or water damage.

Since the Star Princess fire, cruise companies have replaced as many as 80,000 plastic balcony dividers, which industry officials now acknowledge pose greater risks than previously thought.
The affected cruise lines include large operators such as Royal Caribbean Cruises Ltd., Carnival Corp.'s Carnival Cruise Lines, Princess Cruises and Holland America Line units, and Walt Disney Company's Disney Cruise Line. The lines fixed a total of 36 ships. The 2,600-passenger Star

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Cruise Ship Fires Continued

Princess, for example, returned to service in May, 2006, with aluminum balcony partitions.

NFPA codes and standards apply to cruise ships as well as numerous other marine vessels. Chief among those codes and standards is NFPA 301, Code for Safety to Life from Fire on Merchant Vessels, which applies to cruise ships.

NFPA 301, however, is rarely followed on cruise ships because most cruise ships are non-U.S. flagged ships and they follow the International Maritime Organization's (IMO) SOLAS (International Convention for Safety of Life at Sea) regulations, which supercede NFPA 301.

The SOLAS Convention addresses a wide range of measures to enhance vessel safety including: standards for ship design and construction, stability, fire protection, lifesaving, communications, navigation, safety management and certification.

Recent SOLAS amendments enacted in 1992 called for comprehensive fire safety improvements on all passenger vessels. These amendments, which apply to both new and existing passenger vessels, require vessels to upgrade fire protection and lifesaving equipment, and install low-level lighting, smoke detectors, and automatic sprinklers.

Ships operating from U.S. ports are also subject to U.S. federal and state regulations. The U.S. Coast Guard inspects all ships sailing out of U.S. ports four times a year. The ICCL sets guidelines and mandatory standards for cruise companies seeking or maintaining membership in the association. These standards meet or exceed international and U.S. laws and regulations that apply to cruise ships.

NFPA 301 is currently in the revision cycle and NFPA members will vote on it in June at the World Safety Conference & Exposition in Boston, Massachusetts.

Coast Guard request

NFPA 301 was developed in the mid-1990s at the request of the United States Coast Guard, which was looking for a way to regulate the growing casino-boat industry.

In 1993, the Coast Guard approached the NFPA Standards Council with a request to form a new Technical Committee that would develop a consensus standard on fire protection of merchant vessels, similar in format to NFPA 101®, Life Safety Code®. The basis for this request was a Coast Guard initiative known as Maritime Regulatory Reform. One aspect of maritime regulatory reform involves greater use of industry standards in lieu of detailed design requirements contained in the Code of Federal Regulations.

In 1994, NFPA established the Technical Committee on Merchant Vessels to develop criteria for protecting human life, property and the marine environment from fires aboard merchant vessels.

The initial approach advocated by the Coast Guard was to develop a standard that was applicable to passenger vessels only and to add requirements for different vessel types in future editions. However, the Technical Committee agreed that it would not take much more effort to draft a standard that was applicable to passenger vessels, cargo vessels, and tank vessels. Towing vessels were added to this list in anticipation of a federal law mandating fire protection upgrades.

According to Guy R. Colonna, Assistant Vice President of Fire Protection Applications and Chemical Engineering, the U.S. Coast Guard needed NFPA's assistance because of the rise in casino boats. These types of vessels are licensed by the Coast Guard. Nearly every port area in the United States has these floating gaming establishments. In addition, these ports became home to dinner cruises and other small passenger industry activities.

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NFPA 301 was seen as a way to supplement the Coast Guards regulations. In the case of casino boats, most ports required the ships to "get underway" before any gambling could take place.

By shifting development and maintenance of regulations to standards-making organizations, the regulators (in this case the Coast Guard) are assured of dynamic standards that are regularly updated. The marine industry benefits through increased input into the rules it must subsequently follow. Similar efforts to add marine-specific criteria to existing NFPA fire protection system standards, such as automatic sprinklers, water mist extinguishing systems, foam, carbon dioxide, and clean agent alternatives to halons, have been completed.

NFPA 301 provides minimum requirements for the design, operation, and maintenance of merchant vessels for safety to life from fire and similar emergencies. The document establishes occupancy classifications and then provides requirements for design and construction, access and egress, and fire protection. The document applies to passenger vessels, towing vessels, and cargo vessels. Chapter 20, Passenger Vessels, applies to all vessels that carry more than 12 passengers. Portions of vessels that are primarily intended for another service that also carry passengers (i.e., a cargo vessel with passenger accommodations for more than 12 people) shall comply with this chapter.

Specific requirements are based upon vessel category and defined according to the number of passengers, specifically: 20.1.3.1 Group I Passenger Vessels. Passenger vessels that operate with more than 3,000 day passengers or carry more than 300 overnight passengers shall be categorized as Group I.

20.1.3.2 Group II and III Passenger Vessels. Passenger vessels that operate with more than 150 day-passengers or carry more than 49 overnight passengers shall be categorized as Group II and III.

20.1.3.3 Group IV Passenger Vessels. Passenger vessels that operate with no more than 150 day passengers or carry no more than 49 overnight passengers shall be categorized as Group IV.

20.1.3.4 Group V Passenger Vessels. High-speed passenger vessels that operate with no more than 450 day passengers no further than 4 hours from a harbor of safe refuge shall be categorized as Group V.

The structure of NFPA 301 is similar to NFPA 101. This was done by design, says Colonna. Because cruise ships and other marine vessels contain a variety of occupancy types, the code outlines requirements by occupancy including: mercantile, industrial, assembly, and health care. It also contains means of egress requirements similar to those outlined in *Life Safety Code*.

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What's New From Tyco Fire & Building Products?

Tyco Fire & Building Products has had several new product releases over the past quarter. In case you missed it, here were some of the highlights:

DPV-1
Tyco Fire & Building Products has expanded its existing DPV-1 Dry Pipe Valve family for dry systems to include the 2 ½ and 3-inch sizes. The family of products now ranges from 2 ½ through 6-inches.

Domestic Short Pattern Fittings Now Available
Tyco Fire & Building Products is pleased to announce the addition of their Domestic Figure 510S 90° Cast Elbow and Figure 519S Cast Tee to their Grinnell brand of Grooved Fire Products. Available in sizes 2" to 8", these products are UL/ULC listed and FM approved.

Manufactured in the company's facility in Anniston, Alabama, both products are backed by the industry leading 10 Year Limited Warranty.

Tyco Offers Only FM Approved Package of Residential Sprinklers
Tyco Fire & Building Products recently announced the introduction of the Series LFII 5.8 K-factor (TY4334) horizontal sidewall residential sprinkler. The new LFII 5.8 K-Factor sprinkler is a decorative, fast response, frangible bulb sprinklers designed for use in residential occupancies such as apartments, dormitories and hotels (greater than four stories). When used with the previously announced LFII 6.9 K-factor (TY4234) pendent sprinklers, Tyco Fire & Building Products now offers the only FM Approved package of residential sprinklers optimized specifically for NFPA 13 residential occupancies.

Designed for applications where higher flow demands are required for residential portions of any occupancy per NFPA 13, the large orifice sprinklers provide the required water discharge at lower pressure, enabling the use of smaller pipe sizes. In addition to being FM Approved, they are also UL and C-UL Listed.

FIRES IN THE NEWS

Residential Fire Sprinkler Success Stories

Pittsburg, Pa. Fire Chief: Sprinklers Saved Lives in Senior Housing Fire
5/16/7 - According to television news station CBS-5, the sprinkler system at a Pittsburg, Pa. senior housing facility "saved a lot of lives" during a two-alarm fire the evening of May 11, according to Contra Costa County Fire Protection District Battalion Chief Mark McCullah. The fire began in a female resident's top-floor apartment in a four-story apartment building at the retirement facility, and immediately prompted the building sprinkler system to go on containing the flames, according to McCullah. "There's no doubt that saved a lot of lives," McCullah said.

Reprinted from AFSA Web Site

Fire in dormitory room extinguished by sprinkler

NEBRASKA — A sprinkler extinguished a fire in a school dormitory; however, two students suffered smoke inhalation injuries when they tried to fight the fire using portable fire extinguishers.

The fire occurred in a three-story, 75-room dormitory. It was constructed of concrete block walls with concrete floors, and had a roof covered with tar and gravel. A wet-pipe sprinkler system provided full coverage and was operational at the time of the fire. A fire detection system provided coverage in the hallways only and notification to the school's public safety center. There were no local smoke alarms or detectors in the individual rooms. At the time of the fire the building was operating.

A burning candle on a shelf radiating heat or direct flame ignited stored papers and books. Flaming debris fell to a countertop below and ignited other combustibles. An occupant investigating the odor of smoke opened the door to the room, as heat and smoke escaped and triggered the fire detection system.

Occupants first used a portable fire extinguisher on the flames; however, it malfunctioned, releasing only air and no agent. A second extinguisher was used, just as the sprinkler fused and extinguished the flames.

Two male students, both 20, suffered smoke inhalation injuries. Damage to the building was estimated at $75,000 and lost contents were estimated at $75,000. The fire department found that an exterior water motor gong for the sprinkler did not work and the room to the sprinkler valve was not marked and locked. A delay in controlling water from the sprinkler occurred, as firefighters could not locate the sprinkler room nor did the system include an exterior post indicator valve to shut down the system. A lack of smoke detectors extending the detection system into the sleeping rooms is being evaluated with the school.

Reprinted from NFPA Journal

Cruise Ship Fires Continued

The code underwent a complete revision in 2001. This revision incorporates changes, to the testing requirements for interior finishes, deck coverings, mattresses and bedding, and electrical cable. The code expands the vessels covered to include ocean-going towing vessels as part of the cargo vessel requirements in Chapter 18. In the passenger vessel chapter, the code has redefined the classification criteria for vessel categories. One outcome of this change is an attempt to modify the requirements for sprinkler protection on certain classes of passenger vessels so that the requirements more closely match existing Coast Guard requirements in order to encourage use of the code as an alternative to Coast Guard prescriptive regulations.

First-hand account
Colonna has first-hand knowledge of the effectiveness of the code because of his involvement in NFPA's 1998 cruise ship fire investigation.

According to the investigation by Colonna and NFPA's Senior Fire Investigator Robert Duval, on July 20, 1998, a fire occurred on the passenger cruise ship Ecstasy as the ship was beginning a four-day trip to Cozumel , Mexico , from the Port of Miami, Florida. This fire resulted in injuries to 60 people, including both passengers and crewmembers. At the time of the incident, the ship was carrying 2,557 passengers and 920 crewmembers.

The fire on the cruise ship Ecstasy resulted from an unsupervised cutting and welding operation and failure to follow established "hot work" guidelines.

Due to the prompt actions of the on-board fire brigade and the structural fire protection features of the vessel's construction, the fire damage was limited to the aft mooring deck and adjacent vertical spaces. Due to the presence of the main vertical zone barrier, the fire did not spread beyond MVZ 1, limiting horizontal damage to that zone. Main vertical zones act as fire walls as they do in structures on land, compartmenting a fire to limit damage and allowing automatic suppression or manual fire fighting to control and extinguish the fire.

The activation of automatic sprinklers in the adjoining corridors, passenger accommodations, and common areas also assisted in limiting fire damage and controlling the spread of fire.

Additional resources can be miles and therefore hours, away. The ship's design and the tactics used by the brigade isolate the fire to allow for the extinguishment by automatic suppression and/or manual means such as extinguishers and hoselines.

Vessels are constructed with features that are designed to confine the fire within a compartment or a MVZ, allowing the fire brigade to control the fire within this limited area. SOLAS regulations outline these construction features.

NFPA 301 takes the same approach to fire and life safety aboard merchant vessels as that derived from SOLAS requirements.

NFPA 301 was developed following the premise that through a combination of methods, both passive and active, a fire will be limited to the space or deck of origin.

"The Ecstasy fire highlighted the value of this approach. Even though the fire occurred shortly after the vessel got under way and the vessel was still close to port, the additional response assistance that was provided only augmented the fire protection; it was not essential to the safety of the vessel or the passengers. NFPA 301 also limits the use of combustible finishes and the installation of fire detection and alarm systems throughout the vessel to protect accommodation, service, and storage spaces," the investigation states.

Importance of sprinklers
In August 1984, a fire broke out aboard the Scandinavian Sun that resulted in the deaths of 2 passengers and injured 57 passengers. The fast-spreading fire forced many of the passengers, who were disembarking the ship at the Port of Miami, to remain onboard until the fire was extinguished. According to NFPA's investigation of the fire, the fire was discovered just after docking, and it originated in the auxiliary engine room. The cause of the fire was the ignition of atomized lubricating oil leaking from a diesel engine driving one of the ship's generators. The fire spread vertically six decks above the machine room through a ladder accessway and through an open passageway and watertight doors.

According to NFPA's findings, the following are considered major factors contributing to the loss of life in this fire:

The failure to extinguish the fire in its incipient stage by either automatic or manual means;

The rapid and intense flash fire resulting from the ignition of a combustible lubricating oil;

The rapid horizontal and vertical spread of products of combustion throughout the ship caused mainly by open fire doors;

The presence of combustible interior finish materials in passageways and in the stair tower.

In their analysis of the fire, NFPA investigators noted "Although the fire was seen by engineering staff at the point of ignition, efforts of the staff to control or extinguish the fire in the early moments of the fire were ineffective. Considering the intensity of the fire at this stage of its growth, an automatic fire suppression system such as automatic sprinklers would likely have been the only effective means to control the fire."

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