FIRE INVESTIGATION REPORT

Hospital Fire
Hyannis, Massachusetts
October 16, 1996

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ABSTRACT

Shortly before 11:16 a.m. on October 16, 1996, an accidental fire occurred at a hospital in Hyannis, Massachusetts. Sprinklers protecting a nurses’ lounge operated, controlling the fire while the nursing staff evacuated patients. Because the hospital staff members were able to evacuate patients from the wing of fire origin and care for their needs, responding fire fighters were able to concentrate on the suppression of the fire. Nine staff members and two patients sustained smoke-related injuries during the evacuation. There were no fatalities or fire fighter injuries.

The hospital had a fire protection program that brought together building construction, fire protection equipment, hospital staff, and local fire department resources. The building in which the fire occurred was constructed of noncombustible materials, and many areas in the building were protected by a partial automatic sprinkler system. In addition to the partial sprinkler system, smoke detection systems, a building-wide fire alarm system and manual fire alarm boxes were provided. The hospital administrators worked closely with the local fire department to prepare an extremely detailed disaster plan capable of handling a number of situations, including fire, that could affect the operation of the hospital. Fire department training personnel provided regularly scheduled instruction to hospital staff and administrators, and performed fire drills at the hospital. The fire department’s training personnel also instructed fire fighters in both the Hyannis Fire Department and Yarmouth Fire Department with respect to their response to the hospital.

The fire occurred in a nurses’ lounge when an unattended electric stove ignited a food tray left on the stove. Smoke from the fire area traveled through the building’s HVAC ducting and spread into one of the hospital’s medical units. When staff saw the smoke they began evacuating patients from the unit and called the fire department. The staff had relocated many patients in the wing of fire origin before fire fighters arrived. The sprinklers in the room of fire origin controlled the fire, and fire fighters extinguished spot fires that were shielded from the sprinkler discharge.

As soon as possible, maintenance staff began operations to minimize damage in areas not directly involved in the fire. One of their main concerns was controlling the sprinkler water that was flowing into operating rooms below the fire area. Once authorized by the fire department, Hospital staff attempted to shutdown the operating sprinklers. There was a slight delay in accomplishing this task because the valves to isolate the sprinklers in the fire area could not be readily located.

Based on the NFPA’s investigation and analysis of this fire, the following significant factors contributed to the successful outcome of this incident:

- Pre-fire planning and training of hospital staff
- Cooperation between the hospital’s administrators and staff and the Hyannis Fire Department before and during the incident
- Compartmentation afforded by noncombustible construction
- The presence of an automatic sprinkler system.
I. INTRODUCTION

The National Fire Protection Association (NFPA) investigated the hospital fire in Hyannis, Massachusetts to document and analyze significant factors that prevented the loss of life. The investigation was conducted by the NFPA as part of its ongoing program to investigate technically significant incidents. The NFPA’s Fire Investigations Department documents and analyzes incident details so that it may report lessons learned for life safety and property loss prevention purposes.

The NFPA became aware of the Hyannis fire on the day it occurred. Several days after the fire, Michael S. Isner, Senior Fire Investigator from NFPA’s Fire Investigations Department, and Burton Klein, Chief Health Care Fire Protection Engineer from NFPA’s General Engineering Department, traveled to Hyannis to perform an on-site study of this incident. Documentation from that day, on-site study, and subsequent analysis of the event were the basis for this report. Entry to the fire scene and data collection activities were made possible through the cooperation of the Hyannis Fire Department.

This report is another of the NFPA’s studies of fires having particularly important educational or technical interest. All information and details regarding fire safety conditions are based on the best available data and observations made during the on-site data collection phase and on any additional information provided during the report development process. It is not the NFPA’s intention that this report pass judgment on, or fix liability for, the loss of property resulting from the fire at the hospital in Hyannis. Rather, the NFPA intends that its report present the findings of its data collection and analysis effort and highlight factors that prevented the loss of life.

Current codes and standards were used as criteria for this analysis so that conditions at the hospital on the day of the fire could be compared with state-of-the-art fire protection practices. It is recognized, however, that these codes and standards may not have been in effect during construction or operation of the facility. The NFPA has not analyzed the hospital regarding its compliance with local codes and standards that were in existence when the facility was built or during its operation.

The cooperation and assistance of the Hyannis Fire Department and of the hospital’s administration are greatly appreciated.
II. BACKGROUND

Occupancy Classification
At the time of the incident, the hospital in Hyannis was a 258-bed facility licensed by the Commonwealth of Massachusetts. This hospital provided the community with a full spectrum of medical services and procedures, including general medical, surgical, and emergency room services. According to the 1994 edition of NFPA 101®, Life Safety Code®, the facility would be classified as an “existing health care facility”.

Applicable Codes and Enforcement
The City of Hyannis was enforcing 780 CMR (Code of Massachusetts Regulations), 5th edition. This document was the Massachusetts State Building Code and was effective on July 1, 1992. The code was based on the 1987 edition of the BOCA National Building Code. The Hyannis Fire Department was also enforcing 527 CMR, August 1994, which was the Massachusetts Board of Fire Prevention regulations. In 1976, when the building’s west wing (the area of fire origin) was built, the City of Hyannis was enforcing the earlier editions of 780 CMR, 527 CMR, and the Life Safety Code.

The hospital was accredited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), making it eligible to receive Medicare/Medicaid funds. JCAHO regularly surveyed the hospital, which also had to meet standards established by the U.S. Department of Health and Human Services, Health Care Finance Administration. The last JCAHO survey was performed in July 1996. JCAHO approved the hospital for accreditation with recommendations for improvement in certain areas. About 90 percent of JCAHO’s accreditation approvals come with recommendations for improvement, so their inclusion may be considered typical. In 1996, JCAHO based its fire safety inspection on the requirements of the 1991 edition of NFPA 101, Life Safety Code.

To assist the hospital pass the JCAHO surveys, the Hyannis Fire Department also inspected the hospital with respect to Life Safety Code. The Hyannis Fire Department used, as a standard practice, the edition of the Life Safety Code published after the edition being used by JCAHO. Therefore, the Hyannis Fire Department inspected the hospital in accordance to the 1994 edition of the Life Safety Code since JCAHO was using the 1991 edition of the Life Safety Code.

Even though NFPA 99, Standard for Health Care Facilities, had not been adopted by the City of Hyannis, the fire department used that document for guidance whenever possible.

The Hyannis Fire Department assisted the hospital in its hazard surveillance program by performing regular inspections. The fire department performed

1 Life Safety Code and 101 are registered trademarks of the National Fire Protection Association, Quincy, Massachusetts.
additional inspections during the hospital’s numerous construction projects. Fire suppression personnel in both the Hyannis Fire Department and the Yarmouth Fire Department (which is automatically called for mutual aid for alarms at the hospital) were familiar with the facility as a result of periodic training, pre-fire planning activities, and responses to alarm activations.

The Building

The hospital had been built in several phases (see Figure 1), so the design and construction details varied in different parts of the building. The oldest section was the east wing and was constructed in 1927.

The fire occurred on the top floor of the building’s three-story west wing, which was constructed in 1976. This wing was divided into the following four units:
• North Surgical unit — northwest corner
• Intensive Care Unit (ICU) — northeast corner
• Critical Care Unit (CCU) — southeast corner
• North Medical unit — southwest corner.

Two nurses’ stations and one lounge were used by nurses from all four units. One of the nurses’ stations was located in the North Medical unit and another was located in the North Surgical area. (See Figure 2.) The nurses’ lounge was across the corridor from the elevators in the center of the third floor.

The building had masonry exterior walls, gypsum wallboard interior walls, suspended ceiling assemblies with apparently noncombustible tiles, and concrete floor slabs. Fire department officials reported that the building was Type I (443) construction, according to the 1992 edition of NFPA 220, Standard on Types of Building Construction. This type of construction is consistent with regulations for existing health care occupancies found in the 1994 edition of NFPA 101, Life Safety Code.

All the wings in the building were divided by smoke barriers that extended from slab to slab. For example, the third floor of the west wing was divided into five smoke compartments (see Figure 2). Each of the four third-floor units, that is, North Medical, North Surgical, the CCU, and the ICU, were separate smoke compartments. The elevator lobby was the fifth smoke compartment. According to hospital and fire department officials, all penetrations where conduit, supply-air and return-air ductwork, and utilities passed through the smoke partitions were sealed against smoke movement.

The Nurses’ Lounge

The nurses’ lounge for the four third-floor units was approximately 20 ft (6 m) wide and 30 ft (9 m) long. Lounge was divided into a small locker room and a sitting area with a kitchenette by an interior partition that extended from slab to slab. This partition had two openings that allowed passage between the two areas. The

\[ ^1 \text{A Type I (443) structure will have a 4-hour fire rating for the exterior bearing walls (first digit); a 4-hour fire rating for structural frame or columns and girders supporting loads for more than one story (second digit); and a 3-hour fire rating for the story assembly (third digit).} \]
openings were the full height of the wall and had no doors. The sitting area had simple furnishings, including a wood table with two chairs, a vinyl-covered sofa and a wood end table. The kitchenette, which was located in one corner of the room, had a small sink, a two-burner electric stove, and a small refrigerator. The lounge had a fixed window that faced a small courtlike area in the center of the building.

**Heating, Ventilation, and Air Conditioning (HVAC)**

The HVAC system for the west wing was a central system capable of both heating and cooling. The air handling equipment was located in a second-floor mechanical
room directly below the third floor nurses’ lounge. A network of metal ducts carried both the supply air and return air to and from the mechanical room and distributed the conditioned air throughout the occupied spaces being serviced by the system.

A return air duct was located in the concealed space above the ceiling in the nurses’ lounge. This duct had two openings to collect air from the nurses’ lounge. According to fire department officials, fire dampers with fusible links were installed at locations where the duct passed through smoke partitions and fire walls. The duct between the nurses’ lounge and the North Medical unit nurses’ station had fire dampers but no smoke dampers.
Fire Suppression Equipment

The wing of fire origin was equipped with a wet-pipe sprinkler system designed by pipe schedule for ordinary hazard. The sprinklers were rated at 160°F (71°C). This was a partial sprinkler system protecting the corridors and several nonpatient rooms including the third-floor nurses' lounge in the west wing. The automatic sprinkler system was supervised and sent a signal directly to the Hyannis Fire Department. The sprinkler system was not equipped with a fire pump. A Massachusetts State licensed sprinkler installer maintained and repaired the building's sprinkler system and other fire protection equipment. In addition, the installer inspected the sprinkler system four times each year. The sprinkler system protecting the west wing had been inspected on schedule, and no discrepancies were noted during the last inspection in October 1996.

A standpipe system and portable fire extinguishers were also provided throughout the facility. The standpipes were Class III systems according to the 1993 edition of NFPA 14, Standard for the Installation of Standpipe and Hose Systems. One of the building's standpipes was located approximately 20 ft (6 m) from the room of fire origin. Portable dry chemical fire extinguishers and pressurized water extinguishers were provided at locations throughout the wing. The fire department reported that the fire extinguishers were situated so that travel distance to an extinguisher did not exceed 75 ft (22.9 m).

Fire Detection and Alarm Systems

The hospital was equipped with a multizone fire detection and alarm system. In the area of fire origin, the system's initiating devices were manual fire alarm boxes and ceiling-mounted, spot-type ionization smoke detectors. The manual fire alarm boxes were located by every stairway, and the smoke detectors were spaced approximately 30 ft (9 m) apart along the length of the corridor. Smoke detectors were also installed on each side of smoke barrier doors and at the nurses' station. There were no smoke detectors in patient rooms or in the nurses' lounge.

The manual fire alarm boxes and smoke detectors activated a building-wide fire alarm system and shut down the building's HVAC system. They also sent alarm signals to the Hyannis Fire Department and to the hospital's communication center, which is staffed 24 hours each day by the hospital's telephone operators.

In addition to the ceiling-mounted smoke detectors, there were smoke detectors in the HVAC system's supply-air and return-air ducts. These detectors were located near the HVAC equipment in the mechanical rooms. When the duct smoke detectors were activated, they shut down the HVAC system. Similar to the other smoke detectors in the facility, the duct smoke detectors also initiated the building-wide alarm system, sent a signal to the hospital's communication center, and sent a signal to the fire department.

NFPA 14 defines a Class III standpipe system as a system with 1 1/2-in. (38 mm) hose station (connection, hose and nozzle) for occupant use and 2 1/2-in. (65 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.
Means of Egress

Occupants of the North Medical unit and the other west-wing, third-floor medical units had access to three exits. The North Medical unit and the CCU occupants had access to Stairway G in the southeast corner of the CCU, the corridor leading to the main building and Stairway A in the northeast corner of the ICU. Stairways A and G provided direct access to the building’s exterior. The ICU occupants had access to Stairway A in the northeast corner of their compartment, the horizontal exit leading to the main building, and Stairway G in the CCU.

Disaster Plan

The hospital in Hyannis had a disaster plan for a variety of external and internal emergencies that could affect the safety of patients and staff or that could disrupt hospital activities. Some of the external emergencies addressed in the plan were long-term and short-term loss of electrical power, wind storms, hurricanes and snow storms. The internal emergencies addressed under the plan included security breaches, hazardous material spills, and fires. The hospital administration worked closely with the Hyannis Fire Department when they developed their plans for fire emergencies. The plans developed for the hospital’s response to fire emergencies were extended to cover the other emergencies addressed by the hospital’s disaster plan.

The joint Hyannis Fire Department and hospital fire emergency plan was modeled after the NFPA Life Safety Code egress requirements. The plan combined the building’s fire protection suppression features with building construction and layout assets, provisions for good communication, and highly trained hospital staff. The fire emergency plan was intended to maximize the protection to patients and other occupants and to minimize the effect that a fire emergency would have on hospital operations.

To ensure that the hospital’s built-in fire protection features were recognized and effectively used during an emergency by staff and fire fighters, detailed building plans were posted at key locations throughout the hospital. These plans were also included in an emergency response manual. The plans were color coded to show the divisions between the smoke compartments. The plans also showed and labeled key areas that would be used as staging areas for fire emergencies, for medical evaluation (triage), and for transferring patients to other facilities, if needed. During their fire safety training, staff were instructed to move patients two smoke compartments away from the area involved in the incident.

The hospital’s plan recognized that both the fire department and the hospital personnel would use incident management systems (IMS). Thus, it attempted to make the two systems complement each other. The plan also provided comprehensive information coordinating their mutual response to fire and other emergencies. The plan anticipated that the fire department’s incident commander (IC) would be working from a command post that would be selected by the IC. On the other hand, the hospital command staff would use a specific room that was designated and furnished

*According to Life Safety Code, the corridor to the main building would be classified as a horizontal exit.
to serve as their command post. The plan had provisions for moving the hospital’s command post to an alternate location in the event that the primary command post itself was involved in the emergency situation. In order to communicate with the hospital command staff, the fire department’s incident commander had full access to and used the hospital radio channels. In addition, both organizations understood that they could use runners to transfer information between the two command centers.

The hospital had a fire safety team consisting of the following members:
- Executive Vice President
- Vice President of Nursing
- Director of Plant and Engineering
- Maintenance Supervisor
- Maintenance Operator
- Any Available Housekeeping Staff
- Administrator on Call

During a fire emergency, the fire safety team members would meet with the hospital’s fire safety officer, who would assign tasks as needed. For example, team members could be assigned to specific exits, stairwells and entrances to the area affected by the incident. From these positions, team members would monitor evacuation activities, prevent nonessential personnel from entering the incident area, and perform other activities.

**Hospital Staff Training**

Following the development of the hospital’s comprehensive fire plan, the hospital administration and the fire safety team requested that the Hyannis Fire Department’s Fire Prevention Bureau conduct mandatory training for all hospital personnel. The primary purpose of the initial mandatory training was to introduce all hospital staff to the fire plan, which had been in place since April 1992. The training began in October 1992. During the initial training, 140 classes were provided to ensure that all staff had been trained. To date, over 400 staff training classes have been provided. The required training fulfilled one of the plan’s many objectives, namely, the provision of extensive training for all hospital personnel.

By having the Hyannis Fire Department provide all training regarding the fire plan, consistency was maintained between all training sessions. The hospital’s health education director kept records of all training so the training activities could be accurately monitored by the hospital. Following the completion of the initial training effort, fire department personnel also provided training sessions twice every month. One session discussed general fire safety and the hospital’s fire safety plan. The second session discussed evacuation activities. This reoccurring training was provided so all hospital staff could receive fire safety training every six months and all new employees could be introduced to the hospital’s fire safety plan.
The required fire safety training was complimented by fire drills. At least 12 fire drills are held in the hospital each year. The drills are scheduled so that each shift participated in four drills. Many of the staff who responded to the fire on October 16, 1996 had been involved in a fire drill held only two days before this incident. Evaluation forms completed after the drills showed that the staff generally had a good grasp of fire and evacuation procedures, even though minor fire safety problems had been noted.

**Building Occupants**

The west wing contained the hospital’s ICU, CCU, North Medical unit, and North Surgical unit. The patients in the ICU and CCU had serious illnesses, injuries, or other conditions requiring a high level of medical care. Many of the patients in both units were connected to various types of medical equipment, such as; intravenous lines, respirators, and cardiac monitors. Though no specific information was available about the patients in the North Medical and North Surgical units, most required different levels of staff assistance in order to move from their rooms.

At the time of the fire, 70 patients, 33 staff and three managers were assigned to the four west-wing units. The following table shows the number of patients, staff and managers that were in each unit:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Patients</th>
<th>Nurses</th>
<th>Nurse’s Aides</th>
<th>Clerk</th>
<th>Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Care</td>
<td>13</td>
<td>8</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Intensive Care</td>
<td>11</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>North Medical</td>
<td>19</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>North Surgical</td>
<td>27</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>70</strong></td>
<td><strong>26</strong></td>
<td><strong>4</strong></td>
<td><strong>3</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

**Hyannis Fire Department**

At the time of the fire, the Hyannis Fire Department protected a 9-square-mile (23.3-square-kilometer) community with a population of approximately 21,000. The department had 40 uniformed and nonuniformed personnel, a deputy chief officer, and the department chief. Nine paid fire fighters and fire officers were assigned to each shift. The daytime shift was 10 hours long and the nighttime shift was 14 hours long. Two lieutenants were assigned to the department’s Fire Prevention Bureau, and one person worked as the department’s mechanic. These three individuals and
the two chief officers worked during normal business hours. Fire suppression personnel responded to an average of 1500 fire-related and 3500 medical-related emergency calls a year, and fire prevention personnel performed more than 1000 inspections and trained more than 2000 people each year.

The department had 3 engines, 1 ladder truck, 2 light rescue vehicles and 1 heavy rescue truck. All of these vehicles were located in one fire station. When dispatched, the first engine and truck were staffed with one officer and two fire fighters on each vehicle. However, during normal business hours, the department’s fire prevention personnel, mechanic, and Emergency Medical Service (EMS) officer, if available, would become additional members of the fire crews.

The Hyannis Fire Department’s standard operating procedure for a response to the hospital required that both Hyannis Fire Department and Yarmouth Fire Department units be dispatched at the same time. The Hyannis fire fighters would respond to one of the hospital’s entrances, and the Yarmouth fire fighters would respond to the facility’s fire department connections in order to support the standpipe and sprinkler systems. When Hyannis fire fighters arrived at the entrance, they would look for security personnel or other hospital staff who would meet the fire fighters. The hospital’s security guard had been trained to meet the fire fighters, to provide information regarding the emergency and to serve as an escort through the complex.

Fire suppression personnel in the Hyannis and the Yarmouth Fire Departments received annual training regarding their response to the hospital. The training provided opportunities for suppression personnel to review the facility’s fire protection features, hazardous areas, operational strategies, and so forth.

In addition to the training, the fire fighters reinforced their knowledge of the hospital through visits to the facility. The fire fighters reported that they responded to the hospital several times each year for fire alarm system activations and other calls for assistance. Fire suppression personnel also visited the hospital during pre-fire planning activities.

Weather Conditions
On the morning of the fire, the weather was clear. There was a southwest wind with a speed of 5 to 10 mph (8 to 16 km/h). The outside air temperature was 60°F (15.5°C).
III. THE FIRE

Discovery and Occupant Activities

On the morning of Wednesday, October 16, 1996, hospital staff had been smelling an odor for approximately 30 to 45 minutes. Many of the hospital staff had attributed this odor to hot tar rooing work that was in progress on a nearby building. At one point, a maintenance worker investigated the smell, which seemed to be heaviest on the second floor near the mechanical room containing the west wing’s HVAC equipment. When the maintenance worker entered the room, he observed light, hazy smoke. He left the room and pulled a manual fire alarm box that initiated a building-wide fire alarm signal and automatically sent a signal to the fire department. After pulling the alarm, the maintenance person used a telephone to call the hospital’s operator and used his radio to call security and his supervisor.

In response to the call, the hospital operator announced “Code Red” over the facility’s public address system and in that announcement, the operator indicated the location of the “Code Red.” After making the in-house announcement, the operator called the Hyannis Fire Department. In response to the activated alarm, nursing staff on the third floor of the west wing began closing doors and preparing for a possible evacuation of those areas.

Shortly after the alarms operated, smoke began coming out of a HVAC register directly above the nurses’ station in the North Medical unit. When the nurses saw the smoke coming out of the register, they immediately began to evacuate patients in the area and moved them to the CCU. As conditions worsened, the staff decided to remove all patients from the CCU. Most patients were moved through the horizontal exit to the main building. These patients were evaluated in a triage area located in an elevator lobby and then sent to rooms in other units in the building. A few patients were moved to the ICU which was not evacuated during this fire. No one activated a second manual pull because the building alarm system was already operating.

When the fire alarms operated, the hospital’s fire response team responded to the area. Once they identified that there was an actual fire, the hospital’s administrators activated their disaster plan and opened their command post. Members of the fire safety team responded to the command post and began performing their assigned functions.

The staff operating in the command post coordinated a multitude of activities simultaneously. Among the actions taken, the Director of Emergency Services ensured that the communications systems were operational. Command staff followed the instructions in their emergency response manuals. Staff prepared a computer-generated list and performed a hospital-wide bed census, a standard practice for all “Code Red” responses. Other staff inventoried the number of available nursing staff and tracked the movement of patients being evacuated. Staff contacted other hospitals in the areas and determined the number of beds that were available at those facilities in the event that they were needed. Ambulances for patient transport were obtained and held in standby.

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In addition to the staff working in the command post, hospital staff who were assigned operational tasks performed their respective duties. The staff assigned to patient care evacuated patients. They also established a triage team to prioritize the evacuated patients according to their needs, and staff provided the necessary care once the patients were relocated. Security personnel and fire safety team members were gathered and used to establish perimeters so that nonessential personnel would not enter the fire area and that the activities inside that area could be controlled. In rooms outside the fire area, maintenance personnel initiated activities to control water runoff from the operating sprinkler systems and assisted fire department personnel as needed. Operations supervisory personnel maintained regular communications with command post staff to ensure that they were aware of the changing conditions. Runners were stationed at all patient care areas and at the command post. Clerical and maintenance staff were assigned to assist as needed. All nonessential hospital operations were suspended, making more medical personnel available if needed.

Once the Hyannis Fire Chief arrived on-scene and assumed overall command of the fireground, the hospital’s command post coordinated their activities through the fire chief.

Fire Department Notification and Response

The dispatch center for the Hyannis Fire Department received an automatic alarm from the hospital at 11:16 a.m. That alarm signal identified the building, but not the specific area in which the activated initiating device was located. The automatic alarm was followed by a telephone call from the hospital’s operator, who reported that the fire was in a second-floor mechanical room.

In response to the alarm activation, the Hyannis Fire Department dispatched an “All Call.” The “All Call” initiated a full response from the Hyannis Fire Department sending Engine 826 with its officer and two fire fighters and Ladder 829 with its officer, two fighters and the EMS officer acting as a fire fighter. In addition, Engine 822, Rescue 821, Rescue 828, the Hyannis Fire Chief (Car 801) and a deputy chief (Car 802) responded to the scene. The “All Call” also initiated an call back of off-duty Hyannis fire fighters and initiated an automatic mutual aid response from the Yarmouth Fire Department which dispatched Engine 42. According to the mutual aid agreement, the Yarmouth engine would connect to and supply the fire department connection for the building’s sprinkler and standpipe systems.

The Hyannis Fire Department companies carried detailed pre-fire plans showing the various zones in the hospital. Based on the information provided during their dispatch and the information provided in the pre-fire plans, the Engine 826 officer responded to the entrance located on the west side of the building. The fire chief arrived on the scene about this time also.

In accordance with the hospital emergency plan, security personnel met the Engine 826 officer at the entrance, but the fire fighters already knew the way to the second-

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5 The Hyannis Fire Department works closely with other fire departments in the county. As a result, it used a vehicle number system that was consistent with numbers for other fire department vehicles in the county.
floor mechanical room because they had responded to that room during many previous alarms. The Engine 826 officer got his portable radio and a flashlight, and the fire fighter got a halligan bar (a forcible entry tool), a flashlight, and a rope. These fire fighters and the fire chief went with the security guard to the reported fire area.

When the fire fighters and security guard arrived at the mechanical room, they found light, hazy smoke, similar to that created by a burning fluorescent light ballast, filling the room. Maintenance personnel were in the room attempting to determine the source of the smoke. After the maintenance personnel reported what they knew, the fire fighters joined in the search for the source of the smoke. At approximately that same time, the security person in the room received a report of smoke on the floor above. The fire chief sent the truck crew, who had already arrived on-scene and were waiting for an assignment, to the third floor to investigate this report.

Ladder 829's officer and fire fighter and the EMS officer entered the building through the entrance used by the Engine 826 crew. They took the elevator to the third floor. Upon entering that floor, they found smoke in the corridors and staff evacuating patients from the rooms in the North Medical unit. The Ladder 829 officer radioed the fire chief with his findings, and the chief immediately called the dispatch center ordering a second alarm. In response to this order, the Hyannis Fire Department dispatched Yarmouth Engine 43, and C.O.M.M. (Centerville, Osterville, Marstons Mills) Engine 304 to the scene. In addition, Barnstable Engine 205, West Barnstable Engine 296, and C.O.M.M. Engine 324 were sent to the Hyannis Fire Department so they could respond to any other alarms while the Hyannis units were committed to the hospital fire.

The Ladder 829 crew began looking for the source of the smoke and the fire fighters in the second-floor mechanical room left that room to go to the third floor.

The fire chief and Engine 826 crew used Stairway G to get to the third floor. As they left the stairway and entered the CCU, the corridor was clear of smoke. However, as soon as they passed through a set of closed cross-corridor fire doors that lead to the North Medical unit, the fire fighters observed smoke at the ceiling level. Looking toward the nurses' station, they saw extremely heavy smoke that appeared to be under pressure coming out of a ceiling-level HVAC register. Some maintenance staff members apparently were trying to take the register cover off in order to determine if the fire was in the duct.

Believing that the fire was in another location, the Engine 826 officer and fire fighter continued past the nurses' station desk to search for the fire, and the fire chief went on out to the balcony. As it turned out, the chief remained at this location and established his command post. (See Figure 3.) This location allowed the chief to observe interior and exterior fireground activities. In addition, he was able to maintain contact with the hospital command post. He used his radio primarily to communicate with his fire fighters and the hospital's command post. However, he occasionally used runners to transfer information.
From his position on the balcony, the chief radioed to Ladder 829 and told them to position the aerial bucket at the balcony and to bring two high-rise packs to the balcony. Since the aerial bucket was equipped with a pre-piped water supply and 2 1/2-in. (63.5-mm) connections, the fire fighters could use the aerial bucket as a standpipe system.

The Engine 826 officer and fire fighter separated so one could continue to search for the fire and the other could ensure the patient evacuation activities were progressing. As the Engine 826 officer approached the center of the building, he was met by a staff member coming out of the elevator lobby. The staff member told the officer that water was coming out from under the door to the nurses’ lounge. The
officer entered the elevator lobby and saw black, foul-smelling water coming out from under the nurses’ lounge door. In the officer’s experience, this water usually signified the operation of a sprinkler system. Without opening the door to the room, the officer radioed the chief and reported that he had located the fire. Wanting to get a hoseline in place before he entered the nurses’ lounge, the Engine 826 officer located other fire fighters and told them to bring a hoseline to his location.

The smoke condition in the North Medical unit had deteriorated to the point that the fire fighters in that area were using their self-contained breathing apparatus (SCBA) and the conditions in the elevator lobby were also deteriorating.

The Engine 826 fire fighter joined up with his officer. Two fire fighters from Ladder 829 connected an 1 3/4-in. (44-mm) hoseline to a standpipe near the elevator lobby and brought that hoseline to the Engine 826 officer’s position at the door to the nurses’ lounge. Other fire fighters from Ladder 829 connected a second 1 3/4-in. (44-mm) hoseline to the aerial bucket positioned at the third floor balcony and backed up the first line which had been advanced into the fire room.

When the attack crew opened the door to the nurses’ lounge, they found that the smoke had been driven completely to the floor causing zero visibility in the room. They felt no heat from the fire. Since they could see nothing, the fire fighters moved forward into the darkness and were soaked by the water from an activated sprinkler. They moved forward until they reached the window. At this location the fire fighters saw an orange glow from the fire immediately to their left and approximately 3 1/2 ft (0.9 m) above the floor. They discharged water and quickly extinguished the glow.

The light coming through the window made the fire fighters realize that they were by a large fixed window. Since it could not be opened, they broke it out. They then discharged their hose out the window in order to draw the smoke out of the room. When visibility improved, the fire fighters extinguished the remaining hot spots.

**Postsuppression Activities**

Once the fire chief was confident that the fire had been extinguished, he approved the shutdown of the sprinkler system in the fire area. However, the fire chief did not want the entire sprinkler system to be shut down. The hospital’s licensed sprinkler maintenance worker attempted to shut down the operating sprinklers using a sectional valve; however, it was not the correct valve for the fire area. The maintenance worker had to locate the proper sectional valve before he could shut down the operating sprinklers. This prolonged the period of time that sprinklers operated.

Water from the sprinkler system flowed to many areas on the third floor and drained through cracks, holes, and small voids, allowing it to drip into the operating rooms directly below the fire area. These rooms were not in use at the time of the fire. Maintenance and other hospital staff covered equipment in these areas and began
constructing dikes in third-floor areas to control the water flow. After the fire was extinguished, fire fighters assisted the hospital staff in controlling the flowing water.

**Casualties**

All 59 patients in the North Medical, North Surgical, and Critical Care units, and three patients in the Intensive Care unit were relocated. Four patients from the North Medical unit were moved to the hospital’s lobby; 13 were moved to floors where other patients were assigned and the last two North Medical unit patients were moved to an empty floor in the hospital’s south wing. All 27 patients assigned to the North Surgical unit were moved to locations throughout the hospital. Three of the Critical Care unit patients were moved to the Intensive Care Unit because there was space available in that area. The other 10 Critical Care unit patients were moved to the empty south-wing floor. Three of the Intensive Care patients were moved to the emergency room while the other eight Intensive Care unit patients remained in their rooms.

During the evacuation activities, two patients and nine hospital staff were injured as a result of their exposure to smoke. None of the injuries were serious. All of the injured patients and staff were treated at the hospital involved in the fire and released. No fire fighters were injured during this incident.

Only four patients were transported to other facilities by ambulance. One patient was transported to another hospital as a precautionary measure. The other three had been already scheduled for a transfer and were simply moved early.

**Damage**

Fire damage was limited to the corner of the nurses’ lounge where the kitchenette was located. Charred debris covered the top of the stove. A metal storage cabinet directly above the stove was damaged, and the contents of the cabinet were consumed.

Water from the operating sprinkler system leaked into the nine operating rooms located on the first floor below the nurses’ lounge. These rooms were inspected by fire department inspectors and the surgical manager after the fire. After being cleaned, four of the nine affected operating rooms were approved for use on the same day. The rest of the operating rooms were back in service the next day. Other rooms that sustained water damage included recovery rooms on the first floor and an administration area on the second floor. These rooms were back in service within two days of the fire.

The fire department estimated the property loss due to fire and water damage to be $100,000.
IV. ANALYSIS

Cause and Origin
Local and state fire investigators determined that the fire was accidental. The investigators found that one of the burner control knobs was in the “Hi” position. (See Photos 1 and 2.) They also found that the charred debris on top of the stove was the remnants of one fiberglass serving tray and paper products. The investigators concluded that the tray and other combustible material had been placed on the stove’s cooking surfaces. At some point, the electric stove was turned on and left unattended. When the cooking surfaces became hot, the combustible materials on the stovetop were ignited.

Fire Development
As the fire on the stove grew, it spread to combustible materials in a storage cabinet above the stove and became large enough to reach the suspended ceiling assembly. It then began to spread horizontally on the underside of the ceiling in the nurses’ lounge.

The growing fire activated two automatic sprinklers, and the operating sprinklers suppressed the majority of the fire. The sprinklers also contained the fire and kept it in the general area of the kitchenette until fire fighters entered the room. The fire fighters then completely extinguished the fire.

Photo 1: Point of fire origin, the stovetop in the third-floor nurses’ lounge.

Credit: Hyannis fire Department – Used with permission.
Smoke Spread

A return-air duct was the primary means for spreading the smoke generated in the nurses’ lounge to the North Medical unit. When the fire alarm system operated, the HVAC system shut down. Pressures created by the fire forced smoke through a register and into the return-air duct. The pressurized smoke, in turn, discharged out the return-air register above the North Medical nurses’ station. This smoke prompted the evacuation of the North Medical unit. Local investigators determined that the fire dampers installed in the duct between the nurses’ lounge and the nurses’ station did not operate because the fire had not generated sufficient heat to fuse the link holding the damper open.

Open doors were the second means for smoke spread from the fire area to other parts of the wing. The door to the nurses’ lounge was closed and kept the smoke in the nurses’ lounge until the fire fighters had to open it to start their fire suppression activities. Smoke filled the elevator lobby and spread through the doors on the east side and west side of the lobby because hoselines laid through these doorways held the doors open slightly. Smoke from the North Medical unit and the elevator lobby spread into the Critical Care and North Surgical units each time fire fighters passed through the doors as part of their operations and each time hospital staff opened the doors in order to evacuate patients.

As soon as they found the window in the nurses’ lounge, the fire fighters broke it out. This allowed some of the smoke to vent directly out of the building and reduced the amount of smoke that had to be exhausted out of the building during the post-fire overhaul operations.
Code Analysis

The 1992 edition of NFPA 1, *Fire Prevention Code*, the 1993 edition of NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*, the 1996 edition of NFPA 99, *Standard for Health Care Facilities*, and the 1994 edition of the NFPA 101, *Life Safety Code* were used as the basis for the comparison of the hospital in Hyannis with current NFPA codes. It was recognized, however, that these codes were not part of the legal requirements for this facility when it was built. The following discussion is not intended to be a complete description of all parts of the code that could be applied to this facility. The discussion does, however, highlight requirements that have particular relevance to this fire.

**NFPA 1, Fire Prevention Code**
NFPA 1 prescribes the minimum requirements necessary to establish a reasonable level of fire safety and property protection from hazards created by fire and explosion (1: 1-2.1). It covers construction, maintenance and property use aspects not covered in existing NFPA codes and standards. NFPA 1 also includes text extracted from other NFPA codes and standards in an effort to bring together information that is useful during field inspections (1: 1-2.2). For example, Section 1: 12-2 contains the operating features requirements that are cited in Chapter 31 of NFPA 101, *Life Safety Code*.

**NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems**
NFPA 90A requires that smoke dampers be installed at or adjacent to the point where air ducts pass through required smoke barriers (90A-3.3.5.1). Since the nurses’ lounge was considered to be in a separate smoke compartment, NFPA 90A would have required a smoke damper to protect the penetration in the wall separating the nurses’ lounge from the North Medical unit. Since no smoke damper had been installed at that point, smoke was able to spread from the fire area into the North Medical unit through the return air duct.

Had the nurses’ lounge been considered part of the smoke compartment that included the North Medical unit, then smoke dampers would not have been required by NFPA 90A (90A-3.3.5.1, Exception 3.)

**NFPA 99, Standard for Health Care Facilities**
Chapter 11 addresses health care emergency preparedness. Within its scope, the chapter establishes the minimum criteria for a health care facility’s disaster management program (99: 11-1). The chapter’s purpose is to provide a process that health care facilities can use for assessing, mitigating, preparing for, responding to, and recovering from, disasters (99: 11-3). The hospital in Hyannis followed NFPA 99 by establishing a disaster management program that would allow it to effectively handle a fire or other emergency situations affecting the facility.

*Section VII contains the full text of all code sections cited in this section.*
The hospital realized that the Hyannis Fire Department had information and experience regarding the management of fire and other emergencies. As a result, the hospital worked closely with Hyannis Fire Department while developing their disaster management system. This cooperative effort produced a disaster management system that was consistent with several NFPA 99 requirements.

As a result of its close working relationship with the hospital, the Hyannis Fire Department was keenly aware of that facility’s need for the continuity of operations of during emergencies (99: 11-4.1).

The hospital’s senior management recognized their responsibility for developing an effective program that would assure an effective response to emergencies affecting their facility. To ensure that a comprehensive disaster program was developed, senior managers appointed a disaster planning committee and gave them the authority for writing, implementing, exercising, and evaluating the disaster plan (11-4.2).

The disaster planning committee responded to their task by creating the disaster management program that was used during the October 16, 1996 fire. Since the disaster planning committee had worked closely with the fire department, their plan was modeled after the fire department’s incident command system (99: 11-4.3).

When the seriousness of the fire was realized, the hospital activated its disaster plan (99: 11-5.1). At the end of the incident when the decision to deactivate the plan was made, the hospital’s senior managers coordinated their activities with the fire department incident commander (99: 11-5.2).

The activation of the disaster plan brought together management and staff and allowed them to simultaneously allocate resources and personnel to the mitigation of the emergency situation while maintaining relatively normal operations in areas of the hospital that were unaffected by the fire. Maintenance personnel located sprinkler system controls for the fire fighters and serviced the system according to the direction of the fire fighters. Hospital personnel also assisted in overhaul activities outside the immediate fire area to help fire fighters minimize water damage (99: 11-5.3.2).

Hospital staff, normally responsible for patient care, were trained and assigned the task of patient care when the disaster plan was activated. During the fire, these staff members functioned as they had been trained. They evacuated patients, closely monitored their medical needs, and assured that patient records were properly managed during the evacuation (99: 11-5.3.4). The evacuation of any hospital unit can be a challenging task. The evacuation of a CCU is an even more difficult task because of the patients’ conditions and the level of medical care being provided. Still, no patients were injured as a result of the evacuation of the CCU, North Medical unit, or North Surgical unit. This was a direct result of the care that the hospital staff was able to provide under emergency conditions.
Like the maintenance and patient care staff, security and public affairs personnel had been trained with respect to their responsibilities when the disaster plan was activated. They performed as trained (99: 11-5.3.6 and 99: 11-5.3.7).

The previous discussion has mentioned the hospital’s and fire department’s joint program to educate the administrators and staff. Additionally, the hospital held regularly scheduled fire exit drills. Both of these activities are required by NFPA 99 (99: 11-5.3.8 and 99: 11-5.3.9). The successful outcome of the October 16, 1996 fire at the hospital in Hyannis can be partially attributed to extensive training and drills that occurred before the fire.

The Life Safety Code also has two chapters providing requirements specifically for health care facilities. Chapter 12 addresses new facilities, and Chapter 13 addresses existing facilities. Since the fire occurred in an area of the hospital that was approximately 20 years old, Chapter 13 requirements are discussed in this portion of the code analysis.

101: 13-1.1.3 Total Concept.

This section of the Life Safety Code requires that all health care facilities be designed, constructed, maintained, and operated to minimize the possibility of a fire emergency requiring the evacuation of occupants. Because the safety of health care occupants cannot be ensured adequately by dependence on evacuation of the building, their protection from fire shall be provided by appropriate arrangement of facilities, adequate staffing, and development of operating and maintenance procedures composed of the following:

(a) Design, construction, and compartmentation,

(b) Provision for detection, alarm, and extinguishment,

(c) Fire prevention and the planning, training, and drilling in programs for the isolation of fire, transfer of occupants to areas of refuge; or evacuation of the building.

The joint hospital and fire department disaster program for this hospital was consistent with the “total concept” in many ways. For example, each wing was divided into several smoke compartments. Every smoke compartment was clearly shown on building plans posted throughout the building and kept in the hospital’s command post. During fire evacuation training, staff were instructed to move patients two smoke compartments away from the involved area. Therefore, the hospital successfully combined construction, written material showing the building plan, and training to create an effective means for patient evacuation.
The *Life Safety Code* health care requirements are based on the assumption that staff is available in all patient-occupied areas to perform certain fire safety functions (101: 13-1.1.1.11). These functions include closing of corridor doors, operation of manual fire alarm devices, and rescue of patients. The trained staff successfully performed all the functions that were anticipated by the *Life Safety Code*.

**101: 13-2.2.5 Horizontal Exits**

Vertical evacuation of patients in a fire emergency can be a time consuming and difficult task. For this reason, horizontal exits can be a very useful component in the fire safety design of a health care facility. The *Life Safety Code* contains requirements intended to ensure that horizontal exits serve as a viable option for building occupants. Section 101: 13-2.2.5 includes the following requirements for horizontal exits:

- At least 30 net ft² (2.8 net m²) per patient shall be provided within the aggregated area of corridors, patient rooms, treatment rooms, lounge or dining areas, and other low hazard areas on each side of the horizontal exit.

- A door in a horizontal exit shall not be required to swing with egress travel.

- The total egress capacity of the other exits (stairs, ramps, doors leading outside the building) shall not be reduced below one-third that required for the entire area of the building.

- Door openings in horizontal exits shall be protected by a swinging door providing a minimum clear width of 32 in. (81 cm).

On the third floor the west wing was connected to the main building a corridor. Since this corridor provided access to the main building, there were many areas to which patients could be moved. The construction and design of the corridor and the protection for cross-corridor doors provided separation between the wing and the main building. As a result, the corridor in conjunction with the main building met the above listed requirements and the basic *Life Safety Code* requirements of 101: 5-2.4 and were considered to be a horizontal exit for the west wing. The exit proved to be extremely useful when the CCU, North Medical and the North Surgical units had to be evacuated.

**101: 13-2.4 Number of Exits**

Occupants of both the CCU and the ICU had access to three exits. For example, the CCU occupants had access to Stairway G in the southeast corner of that compartment, the horizontal exit leading to the main building and Stairway A in the northeast corner of the ICU. Therefore, the building satisfied the *Life Safety Code*’s requirement for at least two exits.
101: 13-2.6.2 Travel Distance

This section contains the following requirements for maximum travel distances:
- Between any room door and an exit 100 ft (30 m)
- Between any point in a room and an exit 150 ft (45 m)
- Between any point in a sleeping room and 50 ft (15 m) an exit access door in that room

Travel distances in the CCU and ICU did not exceed these values.

101: 13-3.4 Detection, Alarm, and Communication Systems

In order for health care staff to be able to effectively respond to a fire emergency, they must be notified that a situation exists. The Life Safety Code requires a fire alarm system for that purpose in health care occupancies (101: 13-3.4.1).

The hospital had a fire alarm system that was initiated by manual fire alarm boxes, smoke detectors, and sprinkler systems (101: 13-3.4.2). When activated, the alarm system automatically sounded a building-wide alarm (101: 13-3.4.3.1) and automatically sent an alarm signal to the fire department (101: 13-3.4.3.2).

101: 13-3.4.5 Detection.

The Life Safety Code requires smoke detectors in the corridors of limited care facilities. These are the only existing health care facilities that are currently required to have an automatic smoke detection system. As a result, the corridor smoke detection system in this hospital exceeded the Life Safety Code requirements.

In this fire scenario, the extra protection afforded by the corridor smoke detection system did not affect the outcome of the incident. The maintenance person who investigated the smell of smoke initiated the alarm before any smoke detector activated. In retrospect, a smoke detector in the nurses’ lounge would have had a significant effect on the outcome of this fire, because it would have detected the fire and initiated the building’s fire alarm much earlier in the sequence of events.

101: 13-3.5 Extinguishment Requirements.

Since the three-story west wing was an existing structure of Type I (443) construction, the Life Safety Code would not require an automatic sprinkler system. Therefore, the automatic sprinkler system, like the corridor smoke detection system, exceeded the Life Safety Code requirements. Unlike the corridor smoke detection system, the automatic sprinkler system had a significant effect on the fire growth and development. Once activated, the automatic sprinkler system extinguished most of the fire and kept the remaining fire contained until fire fighters were able to completely extinguish it. Since other combustible materials were present in the nurses’ lounge, the fire would have continued to grow had it not been controlled by the operating sprinklers. Since the fire would have been much larger at the time that

7 The Life Safety Code requires automatic sprinklers for new and some existing health care occupancies.
fire fighters arrived, their suppression operation would have been more difficult and the fire damage to the building would have been more extensive.

The building had been provided with portable fire extinguishers, which was consistent with Paragraph 101: 13-3.5.7. Fire extinguishers played no role in this scenario because fire fighters were already on the scene when the location of the fire was identified, and they used their hoselines to attack the fire.

Chapter 31 Operating Features

Since the Life Safety Code bases its requirements on the assumption that health care staff is available in all patient occupied areas and that the staff will perform certain fire safety functions, it provides requirements regarding those functions in Chapter 31. Section 101: 31-4.1.1 requires a plan for the protection of all persons in the event of fire and for their evacuation from the building. The section continues by stating that all employees shall be periodically instructed and kept informed with respect to their duties under the plan. Section 101: 31-4.1.2 requires quarterly fire exit drills to maintain health care staff proficiency with respect to emergency response on all shifts. Similarly, Section 101: 31-4.1.3 requires that employees of health care facilities to be instructed in life safety procedures and devices to assure familiarity with them.

The Life Safety Code recognizes that the proper protection of patients requires the prompt and effective actions of health care personnel (101: 31-4.2.1). As a result, it establishes procedures that need to be followed during a fire emergency. The basic response required of staff includes the following:

- The removal of all occupants directly involved with the fire emergency
- The transmission of an appropriate fire alarm signal to warn other building occupants
- The confinement of the effects of the fire by closing doors to isolate the fire area
- The execution of those evacuation duties as detailed in the facility fire safety plan

The Life Safety Code also requires that such procedures be documented in a written fire safety plan (101: 31-4.2.2). Since effective staff response to a fire emergency is essential in a health care facility, Paragraph 101: 31-4.2.3 specifically requires that all facility personnel be instructed in the use of, and response to, fire alarms.

The hospital and the Hyannis fire department worked together to develop, implement, and maintain a disaster response program that included the hospital’s response to fire emergencies. This extensive and organized program was supported by
detailed written policies and procedures. Additionally, all staff members were regularly trained with respect to the plan; the plan was practiced during fire exit drills and implemented to an appropriate degree during all emergencies. The joint hospital and fire department disaster program was consistent with the NFPA requirements. As a result, the program assured that the hospital staff members were well trained and prepared them to successfully perform all the functions anticipated by the *Life Safety Code*. 
V. DISCUSSION

Over the years, NFPA has investigated several hospital fires that have killed patients and have caused heavy damage to the facilities. Some or all of the following factors have contributed to the loss of life in these incidents:

- The lack of automatic sprinklers
- The lack of staff training
- The lack of effective staff response
- Open doors
- Room contents creating a significant fuel load

The October 16, 1996 fire in the Hyannis hospital differed from the other fires in that the factors cited in the other fires were not present in this facility and, therefore, did not affect this fire’s outcome. More importantly, the Hyannis fire was different because there were no deaths.

Many positive aspects of the fire safety program at the hospital in Hyannis came together and contributed to the successful outcome of this incident. The hospital trained all staff members, from administrators to volunteers, trained with respect to their roles during a fire and other emergencies. The hospital worked closely with the local fire department to develop and implement a comprehensive disaster plan. The highly trained hospital staff and comprehensive fire safety programs were complemented by a building constructed with noncombustible materials and protected by a partial automatic sprinkler system. On October 16, 1996, at 11:16 a.m., all of these provisions passed the ultimate test.

The combined Hyannis hospital and the Hyannis Fire Department fire safety program incorporated features and procedures required by NFPA codes and standards. This approach clearly contributed to the positive outcome.

The hospital also had fire safety features, mainly automatic sprinklers, which were not required by NFPA codes and standards for an existing facility, but would have been required for a new facility. In the Hyannis fire, the automatic sprinkler system was one of many fire safety features that contributed to the positive outcome. In other fire scenarios, automatic sprinklers could have had a decisive effect on the incident outcome. Following the five-fatality hospital fire in Petersburg, Virginia, on December 31, 1994, the Commonwealth of Virginia determined that automatic sprinklers would have had a significant effect on that fire. In response to their findings, the Commonwealth of Virginia adopted legislation requiring automatic sprinkler protection in all new and existing hospitals.

Based on the NFPA's investigation and analysis of this fire, the following significant factors contributed to the successful outcome of this incident:

- Pre-fire planning and training of hospital staff
- Cooperation between the hospital's administrators and staff and the Hyannis Fire Department before and during the incident
- Compartmentation afforded by noncombustible construction
- The presence of an automatic sprinkler system.
VI. ADDITIONAL NFPA INFORMATION

Since 1949, NFPA has prepared 25 reports or articles as a result of NFPA investigations of other hospital fires. The following is a list of those reports and articles:

NFPA Fire Investigation Reports

• Petersburg, VA, five fatalities, December 31, 1994

• Brooklyn, NY, three fatalities, September 1, 1993

• Weymouth, MA, sprinkler success, January 24, 1993

• St. Jerome, ON, five fatalities, January 29, 1989

• Kansas City, MO, two fatalities, December 30, 1986

• Winston-Salem, NC, evacuation, August 12, 1984

• New Orleans, LA, evacuation, July 4, 1979

• Philadelphia, PA, two fatalities, August 10, 1977

• Washington, DC, staff actions, January 10, 1977

• Montreal, Quebec, evacuation, November 27, 1976

• Osceola, MO, eight fatalities, December 3, 1974

Fire Journal and NFPA Quarterly Articles


VII. NFPA CODE SECTIONS

The following is the complete text of NFPA code sections and paragraphs that are relevant to this incident:


1-2 Purpose

1: 1-2.1 The intent of this Code is to prescribe minimum requirements necessary to establish a reasonable level of fire safety and property protection from the hazards created by fire and explosion. The scope covers the construction, maintenance, and use of property to the extent that such is not covered by existing NFPA codes and standards. When other codes and standards are applicable to the scope of this standard they are referenced herein.

1: 1-2.2 This Code is partially comprised of text extracted from NFPA codes and standards in an effort to bring together information useful during field inspections.

Chapter 12 Health Care Occupancies

Section 12-2 Operating Features

1: 12-2.1.1 The administration of every hospital, nursing home, and limited care facility shall have in effect and available to all supervisory personnel written copies of a plan for the protection of all persons in the event of fire and for their evacuation from the building when necessary. All employees shall be periodically instructed and kept informed with respect to their duties under the plan. A copy of the plan shall be readily available at all times in the telephone operator’s position or at the security center. The provisions of 12-2.1.3 to 12-2.2.3 inclusive shall apply. (*101*: 31-4.1.1)

1: 12-2.1.2 Fire exit drills in health care occupancies shall include the transmission of a fire alarm signal and simulation of emergency fire conditions except that the movement of infirm or bedridden patients to safe areas or to the exterior of the building is not required. Drills shall be conducted quarterly on each shift to familiarize facility personnel (nurses, interns, maintenance engineers, and administrative staff) with signals and emergency action required under varied conditions. At least twelve drills shall be held every year. When drills are conducted between 9:00 p.m. (2100 hours) and 6:00 a.m. (0600 hours), a coded announcement may be used instead of audible alarms. (*101*: 31-4.1.2)

1: 12-2.1.3 Employees of health care facilities shall be instructed in life safety procedures and devices. (*101*: 31-4.1.3)
1: 12-2.2 Procedure in Case of Fire.

1: 12-2.2.1 For health care occupancies, the proper protection of patients requires the prompt and effective actions of health care personnel. The basic response required of staff shall include the removal of all occupants directly involved with the fire emergency, transmission of an appropriate fire alarm signal to warn other building occupants, confinement of the effects of the fire by closing doors to isolate the fire area, and the execution of those evacuation duties as detailed in the facility fire safety plan. (101: 31-4.2.1)

1: 12-2.2.2 A written facility fire safety plan shall provide for:

(a) Use of alarms

(b) Transmission of alarm to fire department

(c) Response to alarms

(d) Isolation of fire

(e) Evacuation of area

(f) Preparation of building for evacuation

(g) Extinguishment of fire. (101: 31-4.2.2)

1: 12-2.2.3 All facility personnel shall be instructed in the use of and response to fire alarms; and, in addition, they shall be instructed in the use of the code phrase to ensure transmission of an alarm under the following conditions:

(a) When the individual who discovers a fire must immediately go to the aid of an endangered person.

(b) During a malfunction of the building fire alarm system. Personnel hearing the code announced shall first activate the building fire alarm using the nearest manual alarm station and shall then immediately execute their duties as outlined in the fire safety plan. (101: 31-4.2.3)


90A-3.5 Smoke Barriers

90A-3-3.5.1 Smoke dampers shall be installed at or adjacent to the point where air ducts pass through required smoke barriers, but in no case shall a smoke damper be installed more than 2 ft (0.6 m) from the barrier or after the first air duct inlet or outlet, whichever is closer to the smoke barrier.
Exception No. 1: Smoke dampers shall not be required on air systems other than where necessary for the proper function of that system where the system is designed specifically to:
(a) Function as an engineered smoke-control system, including the provision of continuous air movement with the air-handling system; or
(b) Provide air to other areas of the building during a fire emergency; or
(c) Provide pressure differentials during a fire emergency.

Exception No. 2: Smoke dampers shall not be required to be located within a prescribed distance of a smoke barrier where isolation smoke dampers are used in air-handling equipment. (See 2-3.9.2.)

Exception No. 3: Smoke dampers shall not be required where the air inlet or outlet openings in ducts are limited to a single smoke compartment.

Exception No. 4: Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

Exception No. 5: Smoke dampers shall not be required in health care occupancies where exempted by NFPA 101®, Life Safety Code®.


Chapter 11, Health Care Emergency Preparedness

99: 11-1 Scope.

This chapter establishes minimum criteria for health care facility disaster management in the development of a program for effective disaster preparedness, mitigation, response, and recovery.

NOTE: Since no single model of a disaster plan is feasible for every health care facility, this chapter is intended to provide criteria in the preparation and implementation of an individual plan. The principles involved are universally applicable; the implementation needs to be tailored to the specific facility.

99: 11-2 Purpose.

The purpose of this chapter is to provide those with the responsibility for disaster management planning in health care facilities with a process to assess, mitigate, prepare for, respond to, and recover from, disasters. This chapter is intended to aid in meeting requirements for having a disaster management plan.

99: 11-4 Responsibilities.

99: 11-4.1 Authority Having Jurisdiction (AHJ).
The AHJ shall be cognizant of the requirements of a health care facility with respect to its uniqueness for continued operation of the facility in an emergency.

99: 11-4.2 Senior Management.

It shall be the responsibility of the senior management to provide its staff with plans necessary to respond to a disaster, as appropriate. Senior management shall appoint a disaster planning committee with the authority for writing, implementing, exercising, and evaluating the disaster plan.

99: 11-4.3 Disaster Planning Committee.

The disaster planning committee shall have the responsibility for the overall disaster planning within the facility, under the supervision of designated leadership.

The disaster planning committee shall model the disaster plan on the incident command system (ICS).

99: 11-5 General Requirements.

99: 11-5.1 When a facility declares itself in a disaster mode, or when the authority having jurisdiction (AHJ) declares a state of disaster exists, the disaster plan shall be activated.

99: 11-5.2 The decision to activate the disaster declaration shall be made by the highest responsible authority within the facility as specified in the disaster plan, or his or her designee. The decision to terminate shall be made in coordination with the authority having jurisdiction and other civil or military authorities involved.

99: 11-5.3.2 Continuity of Essential Building Systems. When designated by the disaster management plan to provide continuous service in a disaster, health care facilities shall establish contingency plans for the continuity of essential building systems, as applicable:

(a) Electricity
(b) Water
(c) Ventilation
(d) Fire protection systems
(e) Fuel sources
(f) Medical gas and vacuum systems (if applicable)

99: 11-5.3.4 Patient Management. Plans shall include provisions for management of patients, particularly with respect to clinical and administrative issues.
Security. Security plans shall be developed that address facility access, crowd control, security staff needs, and traffic control.

Public Affairs.

Health care facilities shall have a designated media spokesperson to facilitate news releases.

An area shall be designated where media representatives can be assembled, and which will not interfere with the operations of the health care facility.

Staff Education. Each health care facility shall implement an educational program. This program shall include the concept of the incident command system, component of the disaster plan, and each staff member's duties and responsibilities.

Each educational program shall take place at the time of hire or assignment, and annually thereafter, as required.

Drills. Each organizational entity shall implement one or more specific responses of the disaster plan at least semi-annually. At least one semi-annual drill shall rehearse mass casualty response for health care facilities with emergency services, disaster receiving stations, or both.


Chapter 5 Means of Egress

Horizontal Exits.

Application. Horizontal exits shall be permitted to be substituted for other exits to the extent that the total egress capacity of the other exits (stairs, ramps, doors leading outside the building) will not be reduced below half that required for the entire area of the building or connected buildings if no horizontal exits existed.

Exception: In health care occupancies as provided in Chapters 12 and 13, and in detention and correctional occupancies as provided in Chapters 14 and 15.

Fire Compartments.

Every fire compartment for which credit is allowed in connection with a horizontal exit shall have, in addition to the horizontal exit or exits, at least one stairway or doorway leading outside or other exit that is not a horizontal exit. Any fire compartment not having a stairway or doorway leading outside shall be considered as part of an adjoining compartment with stairway.
Exception: In detention and correctional occupancies as provided in Chapters 14 and 15.

101: 5-2.4.2.2 Every horizontal exit for which credit is given shall be arranged so that there are continuously available paths of travel leading from each side of the exit to stairways or other means of egress leading to outside the building.

101: 5-2.4.2.3 Whenever either side of the horizontal exit is occupied, the doors used in connection with the horizontal exit shall be unlocked from the egress side.

Exception: In health care occupancies as provided in Chapters 12 and 13, and in detention and correctional occupancies as provided in Chapters 14 and 15.

101: 5-2.4.2.4 The floor area on either side of a horizontal exit shall be sufficient to hold the occupants of both floor areas, allowing not less than 3 sq ft (0.28 sq m) clear floor area per person.

Exception: Special floor area requirements in health care occupancies as provided in Chapters 12 and 13, and in detention and correctional occupancies as provided in Chapters 14 and 15.

101: 5-2.4.3 Walls for Horizontal Exits.

101: 5-2.4.3.1 Fire barriers separating buildings or areas between which there are horizontal exits shall be an assembly of noncombustible or limited-combustible material having a 2-hour fire resistance rating. They shall provide a separation continuous to ground. (See also 6-2.3.)

Exception No. 1: Where a fire barrier is used to provide a horizontal exit in any story of a building, such fire barrier shall not be required on other stories under the following conditions:

(a) The stories on which the fire barrier is omitted shall be separated from the story with the horizontal exit by construction having a fire resistance rating at least equal to that of the horizontal exit fire barrier.

(b) Vertical openings between the story with the horizontal exit and the open fire area story shall be enclosed with construction having a fire resistance rating at least equal to that of the horizontal exit fire barrier.

(c) All required exits, other than horizontal exits, shall discharge directly to the outside.

101: 5-2.4.3.2 Where fire barriers serving horizontal exits terminate at outside walls and the outside walls for a distance of 10 ft (3 m) on each side of the horizontal exit are at an angle of less than 180 degrees, the outside walls shall be 1-hour fire resistance rated fire barriers with 3/4-hour fire protection rated opening protectives for a distance of 10 ft (3 m) on each side of the horizontal exit.
Exception: Existing horizontal exits.

101: 5-2.4.3.3 Fire barriers forming horizontal exits shall not be penetrated by ducts.

Exception No. 1: Existing penetrations protected by approved and listed fire dampers.

Exception No. 2: In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 7-7.

Exception No. 3: Duct penetrations in detention and correctional occupancies as allowed by Chapters 14 and 15 that are protected by combination fire dampers/smoke leakage-rated dampers that meet the smoke damper actuation requirements of 6-3.5.

101: 5-2.4.3.4 Any opening in such fire barriers, whether or not such opening serves as an exit, shall be protected as provided in 6-2.3.5.

101: 5-2.4.3.5 Doors in horizontal exits shall comply with 5-2.1.4.

Exception: Sliding doors in industrial occupancies as provided in Chapter 28, and in storage occupancies as provided in Chapter 29.

101: 5-2.4.3.6 Where swinging fire doors are used in horizontal exits, they shall comply with the following:

(a) They shall swing in the direction of egress travel, and

(b) Where a horizontal exit serves areas on both sides of a fire barrier, there shall be adjacent openings with swinging doors, opening in opposite directions, with signs on each side of the fire barrier indicating the door that swings with the travel from that side, or

Exception to (b): Sleeping room areas in detention and correctional occupancies shall be exempt from the sign requirement.

(c) They shall be of any other approved arrangement provided that doors always swing with any possible egress travel.

Exception No. 1: Horizontal exit door swing in existing health care occupancies as provided in Chapter 13, and existing detention and correctional occupancies as provided in Chapter 15.

Exception No. 2: Horizontal exit doors in corridors less than 6 ft (183 cm) wide in existing buildings.
101:5-2.4.3.7 Doors in horizontal exits shall be designed and installed to minimize air leakage.

101: 5-2.4.3.8 All fire doors in horizontal exits shall be self-closing or automatic-closing in accordance with 5-2.1.8. Horizontal exit doors located across a corridor shall be automatic-closing in accordance with 5-2.1.8.

Exception: Where approved by the authority having jurisdiction, existing doors in horizontal exits shall be permitted to be self-closing.

Chapter 13, Existing Health Care Occupancies

101: 13-1.1.1 General

101: 13-1.1.1.1 The requirements of this chapter apply to existing buildings or portions thereof currently occupied as health care occupancies. (See also 12-1.1.1.1.)

Exception: Facilities where the authority having jurisdiction has determined equivalent safety has been provided in accordance with Section 1-5.

101: 13-1.1.1.11 The requirements of this chapter are based on the assumption that staff is available in all patient occupied areas to perform certain fire safety functions as required in other paragraphs of this chapter and Chapter 31.

101: 13-1.1.3 Total Concept. All health care facilities shall be designed, constructed, maintained, and operated to minimize the possibility of a fire emergency requiring the evacuation of occupants. Because the safety of health care occupants cannot be ensured adequately by dependence on evacuation of the building, their protection from fire shall be provided by appropriate arrangement of facilities, adequate staffing, and development of operating and maintenance procedures composed of the following:

(a) Design, construction, and compartmentation; and

(b) Provision for detection, alarm, and extinguishment; and

(c) Fire prevention and the planning, training, and drilling in programs for the isolation of fire, transfer of occupants to areas of refuge, or evacuation of the building.

101: 13-2.2.5 Horizontal Exits

101: 13-2.2.5 Horizontal Exits. Horizontal exits complying with 5-2.4 and the modifications that follow shall be permitted:

(a) At least 30 net sq ft (2.8 net sq m) per patient in a hospital or nursing home or 15 net sq ft (1.4 net sq m) per resident in a limited care facility shall be provided within the aggregated area of corridors, patient rooms, treatment rooms, lounge or
dining areas, and other low hazard areas on each side of the horizontal exit. On stories not housing bed or litter patients, at least 6 net sq ft (0.56 net sq m) per occupant shall be provided on each side of the horizontal exit for the total number of occupants in adjoining compartments.

(b) A door in a horizontal exit shall not be required to swing with egress travel as specified in 5-2.4.3.6.

(c) The total egress capacity of the other exits (stairs, ramps, doors leading outside the building) shall not be reduced below one third that required for the entire area of the building.

(d) Door openings in horizontal exits shall be protected by a swinging door providing a minimum clear width of 32 in. (81 cm) or a horizontal sliding door complying with 5-2.1.14 and providing a minimum clear width of 32 in. (81 cm).

Exception to (d): Existing 34-in. (86-cm) swinging doors.

101: 13-2.4 Number of Exits

101: 13-2.4.1 At least two exits of the types described in 13-2.2.2 through 13-2.2.8, remotely located from each other, shall be provided for each floor or fire section of the building.

101: 13-2.4.2 At least one exit from each floor or fire section shall be one of the following:

(a) A door leading directly outside the building, or

(b) A stair, or

(c) A smokeproof enclosure, or

(d) A ramp, or

(e) An exit passageway.

Any fire section not meeting these requirements shall be considered part of an adjoining zone. Egress shall not require return through the zone of fire origin.

101: 13-2.4.3 At least two exits of the types described in 13-2.2.2 through 13-2.2.8 shall be accessible from each smoke compartment. Egress shall be permitted through adjacent compartment(s), but shall not require return through the compartment of fire origin.
101: 13-2.6.2 Travel Distance

101: 13-2.6.2 Travel Distance.

(a) The travel distance between any room door required as an exit access and an exit shall not exceed 100 ft (30 m); and

(b) The travel distance between any point in a room and an exit shall not exceed 150 ft (45 m); and

Exception to (a) and (b): The maximum permitted travel distance in (a) or (b) above shall be increased by 50 ft (15 m) in buildings protected throughout by an approved, supervised automatic sprinkler system.

(c) The travel distance between any point in a health care sleeping room and an exit access door in that room shall not exceed 50 ft (15 m); and

(d) The travel distance between any point in a suite of sleeping rooms as permitted by 13-2.5 and an exit access door of that suite shall not exceed 100 ft (30 m) and shall meet the requirements of (b) above.

101: 13-3.4 Detection, Alarm and Communication Systems

101: 13-3.4.1 General. Health care occupancies shall be provided with a fire alarm system in accordance with Section 7-6.

101: 13-3.4.2 Initiation. Initiation of the required fire alarm systems shall be by manual means in accordance with 7-6.2 and by means of any required detection devices or detection systems.

Exception No. 1: Fire alarm pull stations in patient sleeping areas shall not be required at exits if located at all nurses’ control stations or other continuously attended staff location, provided such pull stations are visible and continuously accessible and that travel distances required by 7-6.2.4 are not exceeded.

Exception No. 2: Fixed extinguishing systems protecting commercial cooking equipment in kitchens that are protected by a complete automatic sprinkler system need not initiate the fire alarm system.

101: 13-3.4.3 Notification.

101: 13-3.4.3.1 Occupant Notification. Occupant notification shall be accomplished automatically in accordance with 7-6.3. Presignal systems shall be prohibited.

Exception No. 1: In lieu of audible alarm signals, visible alarm-indicating appliances shall be permitted to be used in critical care areas.
Exception No. 2: Where visual devices have been installed in patient sleeping areas in place of the audible alarm, they shall be permitted to be accepted by the authority having jurisdiction.

101: 13-3.4.3.2 Emergency Forces Notification. Fire department notification shall be accomplished in accordance with 7-6.4.

Exception: Smoke detection devices or smoke detection systems equipped with reconfirmation features need not automatically notify the fire department unless the alarm condition is reconfirmed after a maximum 120-second time period.

Chapter 31 Operating Features

101: 31-4.1 Attendants, Evacuation Plan, Fire Exit Drills

101: 31-4.1.1 The administration of every hospital, nursing home, and limited care facility shall have, in effect and available to all supervisory personnel, written copies of a plan for the protection of all persons in the event of fire and for their evacuation to areas of refuge and for evacuation from the building when necessary. All employees shall be periodically instructed and kept informed with respect to their duties under the plan. A copy of the plan shall be readily available at all times in the telephone operator’s position or at the security center.

The provisions of 31-4.1.2 to 31-4.2.3 inclusive shall apply.

101: 31-4.1.2 Fire exit drills in health care occupancies shall include the transmission of a fire alarm signal and simulation of emergency fire conditions. Drills shall be conducted quarterly on each shift to familiarize facility personnel (nurses, interns, maintenance engineers, and administrative staff) with signals and emergency action required under varied conditions. When drills are conducted between 9:00 p.m. (2100 hours) and 6:00 a.m. (0600 hours), a coded announcement shall be permitted to be used instead of audible alarms.

Exception: The movement of infirm or bedridden patients to safe areas or to the exterior of the building shall not be required.

101: 31-4.1.3 Employees of health care facilities shall be instructed in life safety procedures and devices.

101: 31-4.2 Procedure in Case of Fire.

101: 31-4.2.1 For health care occupancies, the proper protection of patients shall require the prompt and effective response of health care personnel. The basic response required of staff shall include the removal of all occupants directly involved with the fire emergency, transmission of an appropriate fire alarm signal to warn other building occupants, confinement of the effects of the fire by closing doors to isolate the fire area, and the execution of those evacuation duties as detailed in the
facility’s fire safety plan. (See Appendix A for a more detailed suggested emergency plan.)

101:31-4.2.2 A written facility fire safety plan shall provide for:
(a) Use of alarms.
(b) Transmission of alarm to fire department.
(c) Response to alarms.
(d) Isolation of fire.
(e) Evacuation of area.
(f) Preparation of building for evacuation.
(g) Extinguishment of fire.

101: 31-4.2.3 All facility personnel shall be instructed in the use of and response to fire alarms, and, in addition, they shall be instructed in the use of the code phrase to ensure transmission of an alarm under the following conditions:
(a) When the individual who discovers a fire must immediately go to the aid of an endangered person.
(b) During a malfunction of the building fire alarm system.

Personnel hearing the code announced shall first activate the building fire alarm using the nearest manual alarm station and then shall execute immediately their duties as outlined in the fire safety plan.