

TRAINING PAYS OFF IN TWO PENNSYLVANIA HOSPITAL FIRES

JAMES K. LATHROP

TWO FIRES IN 1977 — one in a Pittsburgh hospital and the other in a Philadelphia hospital — demonstrated the benefits of training a hospital staff for fire emergencies. The first fire occurred in the 22-story Allegheny General Hospital in Pittsburgh. An estimated 165 patients were evacuated to lower floors. No fatalities or serious injuries were reported.

The second fire occurred in the 130-year-old St. Joseph's Hospital in Philadelphia. The fire, which began on the second-floor west wing of this ordinary-construction building, spread through walls and floors to the third and fourth floors. There was heavy smoke in the west wing and smoke evident in the east wing. As a result, it was necessary to evacuate all 171 patients in the hospital. This was accomplished in 20 minutes by members of the fire department, hospital staff, police, and neighbors while other fire department personnel contained and extinguished the fire. No fatalities occurred that could be attributed to the fire.

ALLEGHENY GENERAL HOSPITAL FIRE April 10, 1977

Background

The Allegheny General Hospital was built in 1932, with later additions and renovations. Primarily of fire-resistant construction, it had a capacity of 676 beds. Because of its configuration, almost every floor up to the eighth floor was a different size. From the eighth to the sixteenth story (there was no thirteenth floor), the floors were almost identical. The sixteenth story was the highest patient-room floor. From there, a small tower that housed offices and mechanical rooms continued up to the twenty-second floor.

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When the hospital was originally built, it was powered by its own direct-current (DC) electrical supply. The present switchgear room was then the DC power-supply room. All power for the hospital originated from that point. When the hospital later switched over to commercial alternating-current (AC) power, only certain equipment (three low-lift elevators, one high-rise elevator, some pumps, and ventilation fans) remained powered by direct current. At that time, the function of the room changed considerably; it was used for routing control wires for the emergency 110-volt circuits, for housing some emergency switchover equipment, and as a DC-wire terminus point.

The building was heated from a central power house by means of radiators. All floors below the eighth floor were air conditioned; power was supplied by the 440-volt service that came up the mechanical tower. The fifth floor was an exception; it had a separate power source for the air conditioning. There was no air conditioning from

Allegheny General Hospital. NFPA



the ninth floor up, and all ventilation was provided by windows and by a corridor-and-bathroom ventilation system with fans in the upper mechanical rooms. These fans were run by means of the DC circuits.

Because of the age and design of the building, a new hospital was being built in stages, so that the same site could be used while the old building was gradually torn down. Local civic organizations, however, had considerably delayed the new construction. The hospital group responsible for firesafety, including the hospital's fire marshal and its fire inspector, a vice-president, and the head of safety and security, recognized the firesafety problems in the existing structure. Therefore, the fire marshal instituted a rigorous firesafety campaign that included fire prevention education, use of fire-fighting equipment, patient evacuation, and other basic operations.

For the most part, the hospital was not sprinklered. Some high-hazard areas were protected by automatic sprinklers, and the waterflow alarm was connected to the fire department by means of a master box. Fire-alarm pull boxes were provided throughout the building, along with portable fire extinguishers. Smoke detection equipment was provided in some areas, but the equipment sounded only local alarms.

As in many hospitals, especially older ones, storage was a major problem. When a large quantity of disposable linens had to be stored, the use of the large switchgear room, which had ample empty space, was suggested. The request was denied, and the door that led directly from the room into the hospital was sealed with gypsumboard. Nevertheless, the linens were placed in the room by personnel who entered the sealed room by going outside, into the old boiler house, and then into the switchgear room.

The Fire

Sometime before 6:00 am on Easter morning, April 10, 1977, a fire started in the disposable linens stored in the basement switchgear room. At 6:09 am, the computerized air-handling equipment started indicating abnormal conditions (most likely because the control wires were channeled through the fire room). Unfortunately, the room where the print-out equipment was located was not constantly manned, and these abnormal readings resulted in no action being taken.

At 6:45 am, several events occurred: 1) the switchboard operator received a call on the emergency line from the third-floor kitchen reporting smoke in the elevator, 2) a smoke detector (location not determined) sounded at her panel, and 3) the sprinkler waterflow activated (because control wires were channeled through the fire room). The waterflow alarm automatically tripped the city master alarm box, and the alarm was received at Pittsburgh Fire Alarm at 6:47 am. The hospi-

tal's switchboard operator called the fire department and relayed the information that she had received from the kitchen.

Fire-Fighting Operations

When fire fighters arrived on the scene, smoke was evident in the hospital, and crews went to the third floor. It was determined that the fire was not on the third floor and that finding its origin was going to be difficult. A second alarm was struck. Total equipment and personnel on the scene at this point consisted of six engines, one elevating platform, two trucks, one squad, one salvage squad, one battalion chief, and one deputy chief, with a total of approximately 48 men.

Smoke was observed coming from the ground-floor area (one floor below the first floor, aboveground in front and below grade in the rear). Smoke was continuing to build up. An unusual amount of smoke was issuing from an electric ceiling junction/pull box cover. The cover was removed, and large quantities of smoke were observed coming from conduits on the east side of the box.

At approximately 7:38 am, fire fighters checked out the old boiler-house area. At this time, the fire in the switchgear room was discovered, and water was applied at approximately 7:45 am.

Evacuation of Patients

Shortly after 7:00 am, the hospital's management notified staff members on each floor to prepare to evacuate patients. Smoke was starting to build up on upper floors, and was evident on lower floors. Between 7:20 am and 7:30 am, the decision to evacuate was made, and evacuation of patients from the upper floors began. By 8:20 am, approximately 158 patients on the tenth through the sixteenth floors had been evacuated down stairways by hospital staff members. At that time, the decision was made to stop the evacuation, because the smoke was dissipating.

No problems were reported in the evacuation of the patients; many of them were ambulatory and were simply escorted down the stairways.

Fire Origin and Smoke Spread

The fire, which apparently was of incendiary origin, burned for a considerable time before it was discovered. As well as can be determined, power failures occurred simultaneously with discovery of the fire. One possible theory is that the failure of the ventilation fans allowed the smoke to build up; this would account for the fact

that discovery was reported simultaneously from many points in the building.

The smoke spread from the basement switchgear room to the base of the tower through electrical conduits, most of which were empty. The smoke entered the conduits through a junction/pull box cover that had been removed in the switchgear room, then exited through a junction/pull box in the ground floor of the tower. From there, the smoke traveled rapidly by stack effect to and up the elevator shafts in the tower building. The sixteenth floor received additional smoke because the elevator door had been propped open on that floor, allowing smoke to escape at higher rates there than on other floors.

Electrical Failures

Due to the fire in the switchgear room, numerous electrical feeders were lost. All DC circuits in the building lost energy because the terminus point for the DC power was located in the switchgear room. When the building had been converted to AC, rectifiers had been installed to provide power for equipment that was left on DC; these were connected to the terminus point of the DC lines in the switchgear room. The DC panels in the room were completely destroyed by the fire.

There was also loss of all the 110-volt branch circuits from the third floor down through the subbasement, which resulted in no lights at all in that area. This failure

was caused by the fact that the transfer for these circuits from emergency power to normal power was located in the switchgear room.

Some of the fire alarm wires were lost because the wires were routed through the room of fire origin.

All heavy equipment such as elevators, pumps, air compressors, and fans were out of service because both DC and 440-volt AC electrical power were disrupted by the fire.

Approximately 60 percent of the emergency power lines went through the switchgear room; therefore, if the upper floors had required emergency power, they would not have been able to receive it. Although on the upper floors the automatic switchover from normal power to emergency power was made on each floor, there would have been no power fed to the switchgear from the emergency generator because the lines were destroyed by the fire.

Two of the 13 operating rooms lost power because these rooms were supplied by 440-volt service that was transformed to 110 volt for use in the surgical area. The 440-volt service was destroyed by the fire.

Analysis

This fire demonstrates the effect that a fire can have on a large hospital even if the fire itself is contained to one room in a remote location. The benefits of a comprehensive staff training program were evident in the smooth,

How Allegheny General Hospital Trained Employees in Firesafety

LAWRENCE D. SUKAY

In recent years, many hospitals across the country have recognized the need for a comprehensive firesafety program to effectively prepare their staff for a fire emergency.

Allegheny General Hospital in Pittsburgh realized this need in 1975 and instituted a rigorous firesafety program to include fire prevention education, use of fire-fighting equipment, patient evacuation, and other basic operations.

The first of many features was an in-house fire inspection of all buildings. Floor by floor, room by room, all areas were checked for fire hazards. An

inspection report was submitted to management indicating the location of the hazard, type of hazard, and the suggested corrective action to be taken. Fire hazards indicating an immediate threat to life were handled in a different manner to expedite their corrective action.

Upon completion of Priority I — locating and identifying hazards and starting corrective action to eliminate them — all efforts were turned to Priority II, the training of hospital staff in the proper and safe use of fire-fighting equipment. During the month of July 1975, 64 fire-training classes were held. The purpose of the program was to introduce the staff to the equipment, with

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orderly evacuation. However, it must be pointed out that this incident was vastly different from previously reported fires that started in patient rooms or on patient room floors. In situations such as the hospital fire in Osceola, Missouri, on December 3, 1974,¹ it is very likely that smoke may prevent evacuation within minutes after the start of the fire.

The spread of smoke by way of the electrical conduit and the stack effect demonstrates the need to keep all box covers in place at all times. (Missing box covers was the number one OSHA citation nationwide in 1977.) In this case, while the contractor had the covers off, unused conduit could easily have been plugged, thus preventing the spread of smoke into the main hospital. Likewise, removal of the box cover in the hospital ground-floor added to the severe smoke flow upwards in the hospital.

¹ "In Osceola, A Matter of Contents — Hospital Fire Kills Seven," FIRE JOURNAL, Vol. 69, No. 3 (May 1975), p. 20.

Quick action by a hospital air engineer in opening vents in the top of the tower helped reduce smoke on the upper patient floors.

Switchgear rooms are often not sprinklered even though they are, unfortunately, frequently used for combustible storage. In this incident, if the area had been sprinklered, detection would not have been delayed as long and the electrical equipment might not have been destroyed. Wet equipment could have been restored much faster than the burned equipment that resulted from this fire.

Another problem was the central location of several vital electrical systems. This fire demonstrated the reason why Article 517-65 (Health Care Facilities) of the NFPA's *National Electrical Code* requires that "all equipment shall be located to minimize the hazards that might cause complete failure of the equipment such as flood, fires and icing."

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How Allegheny General Hospital Trained Employees in Firesafety (continued from page 27)

hands-on training. Approximately 20 to 30 employees attended each class. First they were shown a film entitled *RX for Fires*, which was followed by a short discussion concerning the film and evacuation of patients. Then all participants went outside where they were shown the several types of extinguishers currently used in the hospital and told how to activate and how to use them. After this, they were shown the proper method to extinguish a fire. A 5-foot-by-2-foot-by-3-inch pan, used for instructional purposes, was then filled with a flammable liquid, which was ignited; two employees then extinguished the rather large fire. While instructors stressed the proper use of the extinguisher, examples of what could happen if the extinguisher was used improperly were demonstrated — for example, using a pressurized water extinguisher on a flammable liquid. The last part of the class focused on the use of fire hose. A hose from a hose rack inside the hospital was pulled to the outside and charged. After instructors explained and demonstrated the operation of the fire hose, all class members were given an opportunity to use it.

In all, over 1,500 employees attended the fire-training classes during the month. To assure maximum attendance, classes were scheduled at several key times to permit staff on all shifts to attend. For those who worked part-time or on weekends, classes were also held on Saturday nights at 12:30, 2:30, and 4:30 pm.

These classes formed the groundwork for the hospital's training programs. When it was finally decided that the major portion of the hospital's

staff had been adequately trained in the use of its fire equipment, attention then was focused on the men of the Pittsburgh Fire Department who would have to enter the 22-story, five-building complex and extinguish any fires.

On September 17, 1975, the first of four familiarization tours was conducted for the first-alarm companies that would respond to the hospital's fire alarms. During the tour, the companies were shown areas of the hospital that could be potential problems. Since the hospital is heavily involved with research on and treatment of cancer, a mini-class on radiation safety was given to the men, explaining the potential problems that could be encountered in the nuclear medicine area. In addition to touring the building's interior, the fire department's elevating-platform and truck companies that normally respond on the first alarm also used the equipment available at several key points around the hospital. As a result of these drills, the fire fighters had a basic idea of the layout of the hospital, which proved very beneficial during the fire on April 10, 1977.

In the spring of 1976, Harry A. Pate of McGrath and Pate Associates, a nationally recognized hospital firesafety specialist, conducted a seminar on patient evacuation and fire control at the hospital. From this seminar, a program was developed and tailored to hospital needs.

The following June, the first of 40 classes on patient evacuation was held, following the same basic style as the fire-equipment classes. Groups of

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How Allegheny General Hospital Trained Employees in Firesafety *(continued from page 28)*

25 employees attended classes that covered extinguishing fires with readily available materials, fire equipment in the hospital, and patient evacuation. Four basic patient "carries" and two "assists" were demonstrated; all of them were used in the 1977 fire.

Problems now existed regarding firesafety training of newer employees. Those who had started to work at the hospital a week after the last summer class finished had received no in-depth fire training . . . only new-employee orientation, which consisted of a film and a short talk on the procedure to follow on discovering a fire. With the help of the Director of Nursing and the Assistant Director of Nursing in charge of Inservice Education, monthly fire-training classes were arranged that enabled the hospital to train staff members as soon as they started to work. The fire-equipment class and the evacuation class were combined into a single two-hour class. At present, a new employee in the hospital is taught, by his or her third week, the proper procedure to follow when discovering a fire, with emphasis on removing any patient, visitor, or employee who is in immediate danger. The staff member is taught that once the area is cleared of victims, the door leading into the fire room should be pulled shut. If the fire is so hot that the door cannot be pulled shut, the staff member is instructed to leave it, but to close all doors to other patient rooms. During the class, various employees participate in extinguishing fires ranging from small container fires to controlled fires in a bed by using either a fire extinguisher, blanket, or newspaper. Although extinguishment is demonstrated first, students are instructed that evacuation has top priority in a fire emergency. They are shown how to coordinate these two activities. With the help of audio/visual aids, employees are also shown the proper methods for removing patients from any affected areas.

Every year, during the Christmas holidays, several floors in the hospital are closed down as a result of a decrease in the number of patients. While the floors are unoccupied, they are utilized for fire-evacuation training classes, which serve as a refresher course for those who have attended the previous classes. The main idea behind these classes, however, is to allow the staff to perform evacuation in a patient-care unit, instead of in a classroom. In addition to training the staff members who would discover a fire, a back-up crew of men was trained to handle larger fires that could

not be handled by the nursing staff. This Special Response Squad, comprised of Security personnel, met for eight consecutive weeks. During this time, numerous fire-related subjects were covered, including the chemistry of fire, fire tactics, use of fire-fighting equipment, simple hose evolutions, rescue techniques for nonambulatory patients, extinguishment of car fires, and the use of the breathing apparatus that is maintained in the hospital's Security office. Several recent fatal fires in patient units of other hospitals have indicated that the tremendous volume of smoke produced in the first few minutes of a fire may be fatal to patients with a cardiac condition or lung disorder. Therefore, it becomes necessary for staff members wearing breathing apparatus to enter their area, if those patients are to survive.

On April 10, 1977, the two years of intense training of the hospital's staff paid off. At 6:45 am, a fire on the ground floor sent large volumes of smoke to the upper patient floors. In the early stages of the fire, the nursing staff stuffed wet towels at the base of the patients' doors and opened the windows to the rooms, as previously trained. At approximately 7:05 am, the Associate Director of Nursing went to the upper nursing floors, where he found conditions to be untenable. The smoke on the sixteenth floor was so thick that there was visibility only for a few feet near the floor. About 7:20 am, the decision was made to start evacuating patients. Those on the sixteenth floor were moved first, due to smoke conditions and the fact that most of the hospital's critical patients were located on this floor. Evacuation was performed floor by floor. All ambulatory patients (approximately 60 percent of the total number) were gathered in the stairwell and escorted down the stairs at one time, so that one nurse could head the group and a second nurse could bring up the rear. In all, six floors were evacuated. All patients were taken to the fifth floor because it was the only floor that did not contain any smoke. Patients who could not be moved a great distance were wrapped in blankets and placed in a stairwell that was clear of smoke. One patient on the sixteenth floor could not be moved at all due to his medical problems; he was accompanied by a nurse and sealed in his room. In all, 165 patients were evacuated in some manner. Approximately 95 percent had to be evacuated down ten flights of stairs. At 8:20 am, the smoke started to clear and the decision was made to stop the evacuation at the tenth floor.

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ST. JOSEPH'S HOSPITAL FIRE
August 10, 1977

Background

St. Joseph's Hospital was built in 1847 of brick-and-wood-joist construction. There were many newer wings and additions; however, since the fire occurred in the original section, which was the main part of the hospital, this report will consider that section only. The hospital was considered a general acute-care hospital and received accreditation from the Joint Commission on Accreditation of Hospitals, most recently in 1976. The building was four stories high and consisted essentially of two wings — the east and west wings.

The hospital was heated by low-pressure steam radiators, and with some exceptions, the building was not air conditioned. Near the area of fire origin, there was a ceiling air-conditioning system that cooled approximately ten rooms on the south side of the corridor by way of ductwork. The system had no automatic shut-down.

The original open, main, central stairway had been enclosed a number of years earlier with a wood and wire-glass partition. Although this partition would not have received any significant fire-resistance rating, it would have prevented smoke spread up the central stairway. The partition was arranged so that you could not travel the length of the stairway without entering each floor individually. In addition, there was an exit tower at the end of each wing (see Figure 1).

The hospital was equipped with a manual fire-alarm system that sounded at the 24-hour switchboard and automatically summoned the fire department. There was no evacuation alarm. The hospital staff was notified over a loudspeaker system, using a code word and a coded

location. In addition, there were standpipes for occupant and fire department use, as well as the normal complement of fire extinguishers. There were no automatic detection or suppression systems.

Over the last few years, the hospital had undergone a number of renovations that included the installation of suspended ceilings in some areas, plus the installation of some plywood wall paneling and vinyl wall covering.

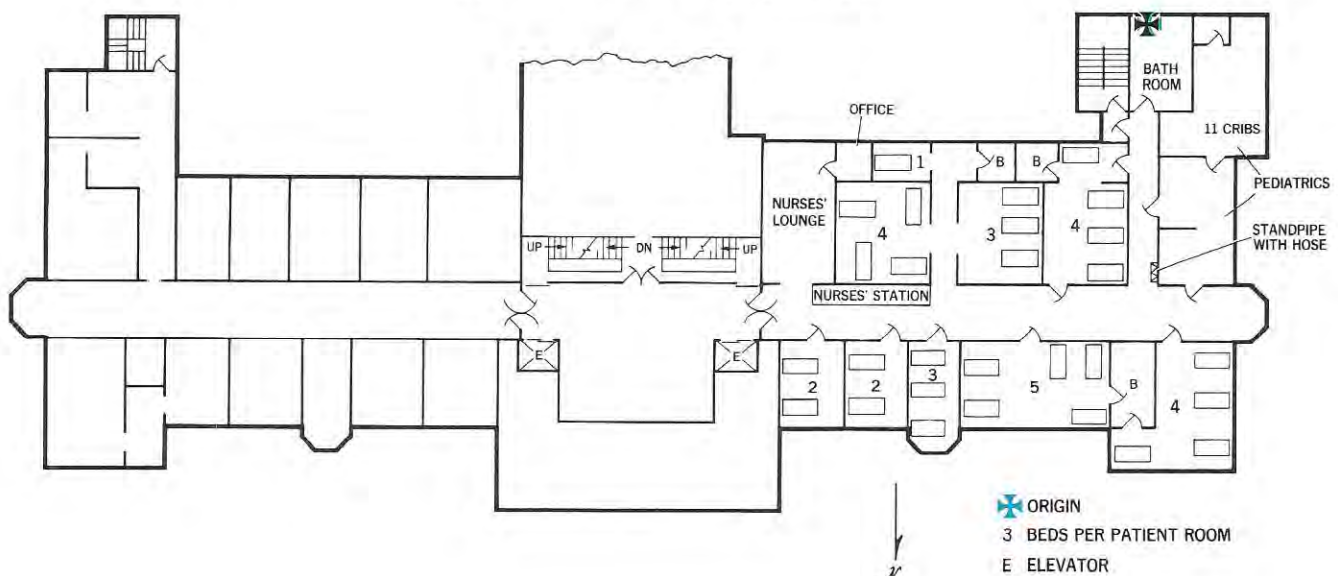
All new personnel were informed of the hospital's fire-safety program through an employee manual, plus a one-hour training session with slides produced in the hospital. In addition, each shift attended an annual fire-safety training session, approximately three hours long, conducted by the Philadelphia Fire Department's two-man hospital team. During the session, patient "carries" were demonstrated, films on hospital firesafety were shown, and a discussion of hospital safety was conducted. One of these fire department training sessions was held in July 1977, the month before the fire.

The hospital held a fire drill on each shift every month. During the drill, a code word for fire was announced over the loudspeaker system, and the staff closed patient room doors. Ambulatory patients in the area of the coded emergency were moved; critical and severely ill patients were not.

The Fire

At approximately 8:45 pm on August 10, 1977, a hospital employee discovered a fire in a second-floor bathroom. A pull station in the hospital was activated. The alarm was automatically transmitted to the fire department and was received there at 8:48 pm. Four engines, two ladder trucks, two battalion chiefs, a deputy

Figure 1. Second floor of St. Joseph's Hospital.





Area of fire origin in bathroom. Fire started under counter, between window and sink. NFPA



View of bathroom from north-south corridor. Area of origin is at far end of room at left of window. NFPA

chief, an assistant chief, and a rescue squad were dispatched to the scene with a complement of approximately 42 men. The first engine, which was two blocks away, arrived on the scene and reported fire showing from a second-floor window. At 8:52 pm, a second alarm was struck, followed by a third at 8:57 pm and a fourth at 9:04 pm. This provided approximately 17 engines, five ladder trucks, five battalion chiefs, a deputy chief, an assistant chief, two chemical and air units, and numerous other upper-level fire officials. In addition, 11 fire department rescue squads were on the scene, giving a total manpower of about 165 fire fighters and 22 emergency medical technicians. There were also approximately 15 police department emergency patrol wagons present, with about 30 men.

Looking west down main east-west corridor. Note damage where north-south corridor connects with the east-west corridor near left center of photo. NFPA



Looking north from area of origin down north-south corridor toward main corridor. Note the ceiling construction. NFPA

Hospital employees had already started to remove patients from the second-floor west wing, where the fire had started. Fire fighters, police, hospital personnel, and neighbors continued to evacuate all 171 patients in the hospital at the time of the fire, and since the safety of the building could not be ensured, all of the patients were evacuated from the building to a church across the street and to other hospitals. The entire hospital was evacuated in 20 minutes. It should be noted that very few of the patients in this hospital were able to move without help.

The fire was declared under control at 9:42 pm. Five fire fighters received minor injuries, and a number of patients suffered from minor cases of smoke inhalation. There were no fatalities attributable to the fire.

Analysis

The fire, which had started in a second-floor bathroom, spread to two other stories because of the type of construction of the building. Once a fire spreads into the combustible concealed spaces of a building of ordinary or wood-frame construction, it is very difficult to stop; in this case, it was controlled only by the diligent efforts of the Philadelphia Fire Department. As fire fighters opened up more and more walls and ceilings, they found more fires behind them. Because of this, patients could not be safely kept in the building and therefore all had to

be evacuated. It is for this reason that NFPA 101, the *Life Safety Code*, does not allow buildings of ordinary construction to be used as health care facilities if they are over two stories in height, and those under two stories in height must be protected by automatic extinguishing equipment. This is the reason why the hospital management planned a new facility at the present site. The intricacies of receiving approval for the work as required in Section 1122 of the Social Security Amendments of 1972 have delayed the project for years. Those amendments include provision for construction or renovation of facilities receiving Medicare and Medicaid funds.

The successful evacuation of immediately-endangered patients by the hospital staff before the arrival of fire fighters was attributed to training provided by the fire department hospital team and in-house drills. △

This report is based on investigations conducted by the NFPA Fire Analysis Department. In the Pittsburgh incident, the assistance of Chief Thomas Kennelly and Battalion Chief Henry Didek of the Pittsburgh Fire Department; Robert E. Taylor, P.E., Republic Steel Corp.; Rene E. Hauser, P.E., Vice-President, Barry Quinones, Head of Safety and Security, and Lawrence Sukay, Fire Marshal, all of the Allegheny General Hospital, is acknowledged and appreciated.

In the Philadelphia incident, the author appreciates and acknowledges the assistance of Commissioner Joseph Rizzo, Deputy Chief Edward Stevens, Jr., Battalion Chief James E. Meskill, Captain Joseph Worton, Captain Charles LePre, and Lt. Joseph O'Drain of the Philadelphia Fire Department; and Sister Mary Anita, Administrator, St. Joseph's Hospital.

How Allegheny General Hospital Trained Employees in Firesafety *(continued from page 29)*

Evacuation was performed only by hospital staff. The Pittsburgh Fire Department was unable to assist them because of a manpower shortage and problems in locating the fire. It is estimated that approximately 70 to 85 nursing personnel were involved in the evacuation of the patients. Fortunately, the fire occurred during the change of a shift, thus adding an additional 47 trained personnel from the night shift to aid in the evacuation.

Many lessons have been learned as a result of the fire. The most significant, however, is the fact

that training a hospital staff will pay off in a fire situation. Smooth, orderly evacuation and fire control will only be achieved by a continuing, comprehensive fire-training program. Most important, there must be total administrative backing for the training program, as was the case at Allegheny Hospital. It is senseless for a skilled medical staff to spend time restoring patients back to health, only to lose them as a result of the staff's ineffectiveness in, and lack of knowledge of, basic firesafety procedures. △