A fire occurred in the high-rise Tae Yon Kak Hotel building in downtown Seoul, Korea, during midmorning of Christmas Day 1971. The final death toll of employees, office workers, and guests was 163. Sixty others were injured. Involving LP-Gas, the rapidly developing fire spread through a second-floor coffee shop and the hotel lobby and cut off escape by way of the single open hotel stairway, which discharged occupants into the lobby. The open stairway and other vertical shafts communicated toxic gases, heat, and smoke through the building. Combustible interior finish contributed to the fire spread. Over 100 occupants escaped over sheet ropes, jumped safely from lower floors, or were rescued by fire fighters over an aerial ladder. Six occupants were rescued from the roof by helicopters. Others trapped beyond the reach of rescuers below faced a dilemma. Eventually 38 people jumped to their death and 121 others perished in the building. Two fell while being rescued by helicopters, and two who were hospitalized died of their injuries.

Left: Fire fighters at the rear of the building rescued up to 50 hotel guests and employees from lower floors.

In order to report to its members the lessons of this large-loss-of-life fire, the NFPA sent the author on a fact-finding mission to Seoul. At the time of his visit a government investigation was still in progress, and a report was not available. The arrest of several people for negligence in the loss and national security precautions made it difficult to obtain some of the technical information normally documented. The author was fortunate to be allowed on the hotel premises for a quick-look survey of the fire scene. For this courtesy he acknowledges the cooperation of the Seoul Bureau of Metropolitan Police.

Personnel from the following Korean and United States agencies extended assistance without which this report would not have been possible: The Vice-Mayor’s Office, Seoul City; the Fire Protection Section, Seoul Bureau of Metropolitan Police; the Chung Bu District Headquarters, Seoul Metropolitan Fire Services; the Chief Officers and Staff, Eighth Army Fire Department, Yong San, Seoul; the United States Embassy, Seoul; Techtronics, Inc., Seoul Office; and Caltex-Honam Oil Corporation, Seoul Office.

All the photos except the large one on pages 8–9 are by the Korea Times.
BACKGROUND

Seoul, Korea, is a thriving, modern city with a population of over 5.5 million, which has more than doubled in the last decade. This rapid growth is evident in the high-rise building construction that continually alters the skyline. At present Seoul has over 90 high-rise buildings. In design, construction, and occupancy the modern Tae Yon Kak building was typical of tall buildings in Seoul. Only 18 months old, it was a recent addition to the downtown area, located on Toegye-Ro, one of Seoul’s busiest highways.

The 21-story-and-basement building was vertically divided into two occupancies by masonry walls. Business firms occupied office space from the second to the twentieth floor in the west half of the building (see Figure 1). The hotel portion to the east contained 223 guest rooms from the sixth to the twentieth floor. On every other floor level a swinging steel door through the eight-inch concrete-block division walls provided access from the office section to the hotel (see Figure 2). On the second floor there were glass doors between
the office lobby and the hotel lobby (see Figure 3). A
driving garage was located in the basement. The
boiler and mechanical equipment rooms were located at
intermediate-basement (first-floor) level; a bank,
offices, shops, the office lobby, the hotel lobby, and
and a coffee shop were located on the second floor. On
the hotel side, two restaurants, a bar and grill, and a cock-
tail lounge were located on the third floor. On the
fourth floor there were banquet rooms, a ballroom shop,
a barber shop, and the hotel manager’s office. A me-
chanical equipment room for the central heating and
air-conditioning system was located on the fifth floor,
as was a telephone equipment room. Guest rooms began
on the sixth floor. A night club and lounge occupied
most of the twenty-first floor. The fourteenth and
twenty-first floors and a twenty-second-floor penthouse
contained additional mechanical equipment rooms.

THE BUILDING

The building was L-shaped, 160 feet on the front
(south) and 140 feet on the east (see Figure 2). A 35-
by-70-foot seven-story section was located at the rear.
The construction consisted of reinforced concrete col-
umns, beams, and floor slabs. The nonbearing exterior
walls were constructed of concrete block and veneer.
The interior walls between rooms and between rooms
and corridors and other division walls ran from the floor
to the underside of the slab above. The construction was
eight-inch concrete block with 8-inch concrete plaster
applied to both sides. The doors to hotel guest rooms
in corridor walls were solid wood. The partitions in
offices were wood paneling on wood frame.

Throughout the building plywood-on-wood-frame
ceilings were dropped below floor slabs. There were
horizontal openings above the dropped ceiling in the
walls between guest rooms and the corridor. On those
floors where there were metal doors the division wall
between the office and hotel sections ran from the floor
to the dropped ceiling. An opening for utilities was pro-
vided above the ceiling.

The vertical central heating, air-conditioning, and
utility shafts were enclosed with concrete-block and
concrete plaster walls. Metal access doors to the shafts
were installed at openings on floor levels. The central
heating and air-conditioning ducts and utility piping
were located above the dropped ceilings.

The floors in the lobby, restaurant, hotel corridor,
and guest rooms were carpeted. The wall finish was rice
paper and rice straw in most areas of the building, with
wood paneling in the lobby, restaurant, and office areas.
Throughout the building the ceiling finish was rice
paper.

The building was served by two interior stairways,
one in the office portion and one on the hotel side of
the building. Stairs were also installed for access to
the roof from the Sky Lounge. Office employees re-
portedly had access to the hotel stairs through the metal

The point of origin is to the top left of this photo of the coffee
shop. The ruptured LP-Gas cylinder is in the foreground lean-
ing against the burned counter frame. The LP-Gas stove is at
the left of the cylinder shell.
door in the division wall on every other floor. Reportedly there were exit signs installed in the office section to indicate the egress route through the access door. Because of the locking arrangement, hotel guests had access only to the hotel stairs. The office stairs, which ran from the basement to the twentieth floor, were enclosed in concrete-block and cement plaster walls. Rolling steel doors were installed at floor openings. Running from the basement to the twenty-first floor, the hotel stairs were also enclosed with concrete block and concrete plaster. The stairs were open at the lobby level and on the three floors directly above. Hollow-core wood doors with closers were installed at the openings on the remaining floors. Occupants descending either stairway normally left it at the lobby level. Egress from the lobby level was through three separate 36-inch-leaf double doors (see Figure 3). Stairs descended to street level at each location.

Of the eight elevators installed in the building, four were located in the office portion. Three of the office elevators ran from the basement to the twentieth floor. One express elevator ran from the lobby, with stops beginning on the thirteenth floor and continuing on each level to the twentieth floor. Three guest elevators and one employee elevator served the hotel side. All four of those elevators ran from the basement to the twenty-first floor. All the elevator shafts were enclosed with concrete-block and concrete plaster walls. Metal doors were installed at the openings. On each floor the call buttons were the mechanical contact type.

Standpipes with 2½-inch connections and hose were installed in both the office and hotel occupancies. The hose cabinets were located adjacent to the stairs in the office portion and in the corridor on the hotel side. A hose cabinet with 1½-inch hose and hose connection was adjacent to the stairs at each floor level on the hotel side. The standpipe systems were reportedly supplied by an electric-drive fire pump located in the basement and a storage tank at twenty-second-floor level. The building was equipped with an automatic fire alarm system arranged to sound evacuation alarms in both office and hotel occupancies. The system was not connected to the Fire Department. The sleeping compartment of each guest room in the hotel portion had fixed-temperature heat detectors. In both occupancies manual pull stations were located at each floor level throughout the building. An open-head, manually operated sprinkler system was installed in the basement parking garage.

A manually started emergency generator in the intermediate basement was arranged to supply power to the fire pump, the elevators, some lighting circuits, and exit signs.
THE FIRE

Officials estimate that there were approximately 200 hotel guests and 70 hotel employees in the hotel portion of the building before the fire, which occurred just after 10:00 am. As it was Christmas morning, many guests were still in bed or were just getting up. There were no guests in the lobby or coffee shop. The employees expected a busy day. Although the business offices were closed, about 15 employees of various firms were in the office portion of the building.

Although exact details on the fire cause are not known, a fire involving LP-Gas started in the coffee shop adjacent to the hotel lobby (see Figure 3). LP-Gas was used to supply a two-burner stove located on a counter. A length of wire braid-reinforced flexible plastic hose was used to supply the stove from a 20-kilogram (44-pound) cylinder. A short length of soft rubber hose and clamps were also used in the connection. A regulator was connected to the cylinder valve outlet. Each burner had a manual shutoff valve, but neither burner was equipped with a pilot. The morning of the fire a spare 20-kilogram LP-Gas cylinder was located beside the cylinder connected to the stove.

The investigation is not complete at this writing, and there is speculation that the spare cylinder failed first, releasing its contents, which were quickly ignited, or that a serious leak or opening of the relief valve caused fire, with subsequent failure of the cylinder from flame contact. In either event, the spare cylinder body was found separated from the bottom. It had moved approximately six feet toward the counter (see the photo on page 7). The force of the container rupture had moved the counter outward.

Three waitresses died in the coffee shop. One of them had been standing behind the counter near the cylinders. The other two had been sitting in chairs toward the west wall. They died in their seats. A hostess who had been standing on the opposite side of the counter from the cylinders was seriously burned over the upper half of her body. She was able to run toward the elevators, where other employees rescued her. The reservations, cashier, and front desk clerks had all been at their counters. All three escaped. The reservations clerk was burned on his face. Three employees near the front vestibule escaped without injury.

Fed by the LP-Gas, the fire immediately engulfed the coffee shop, spread throughout the lobby over combustible interior finish, and cut off escape down the

Far left: View from the southwest  HONAM OIL CORPORATION
Above left: Six persons were rescued by helicopters from the roof.
Left: Driven by desperation, many jumped to certain death, a few with mattresses in a futile attempt to cushion the impact.
hotel stairs. Smoke and toxic gases filled the building as the fire raced up the unenclosed stairway to involve the third and fourth floors. Ducts were open to vertical heating and air-conditioning shafts at the third-floor slab. Thus the vertical shafts also spread smoke and heat through the office and hotel portions of the building.

ESCAPES AND RESCUES

An office worker had arrived at approximately 10:00 am and entered the office lobby from the front. He had to duck under an exterior rolling steel door located at the main entrance. He entered an office elevator on the right side of the lobby and pushed the sixth-floor button. For some unknown reason, the elevator stopped at the fourth floor. As he stepped out he saw smoke in the lobby. Realizing there must be a fire in the building, he ran down the office stairway, but he could not exit at the office lobby floor because the rolling steel door in the stairway at that level was closed. He ran back to the fourth floor, took the elevator to the lobby, and ran outside and to the rear of the building, where he soon observed fire on the first three floors. About the time the fire-fighting units arrived he also saw fire on the twenty-first floor.

A workman papering a wall on the third floor of the office portion heard what he thought was an explosion outside the building. He kept on working until he noticed smoke coming from an air-conditioning vent in the room. When he tried to leave the area he found heavy smoke in the stairway. He then ran to a window, jumped to a canopy at the second-floor level, and was rescued unharmed.

Other office employees on upper floors were not so fortunate. On man apparently went from the sixth floor up to the nineteenth floor, where he joined two other members of his firm. All three men were trapped and died on the nineteenth floor. Another employee ran down the stairs from the eighteenth floor to the eleventh floor. Apparently smoke and heat prevented him from going any farther on the stairs. He then jumped from a window, and survived — only to die of his injuries later at a hospital.

Hotel guests were aroused by the smell of smoke and by employees warning them of fire. Many tried to leave the building, only to find corridors and the stairway charged with smoke and heat. Some on lower floors were able to jump to safety, climb down sheet ropes, or wait at windows for rescue. A few were rescued from the roof by helicopters. Others, particularly those on upper floors, faced little hope of survival.

A hotel employee on the seventh floor became aware of the fire when he smelled smoke in the corridor. After attempting to rouse guests on that floor by pounding on room doors, he ran up the stairs to the eighth floor. Apparently he was one of those rescued by ladder from the roof of the seven-story section at the rear. Up to 50 employees and guests may have been rescued at the rear of the building from the lower eight stories.

A telephone operator was at the switchboard on the fifth floor when smoke began to fill the room. She was able to go to a window and jump uninjured to the roof of an adjacent four-story building on the east side of the hotel. On that side of the building an unknown number of people saved themselves in the same manner. Others died from their falls or received serious injuries.

Guests on various floors made sheet ropes and made their way down the east wall of the hotel. Two guests on the eighth floor escaped in this manner. When he smelled smoke in the corridor one guest on the thirteenth floor made a rope from two bed sheets in his room and clambered down to the fourteenth floor. Entering a room on that floor, he lowered his rope to reach the next floor. By repeating the procedure he eventually reached the seventh floor. Fire fighters and police fired a lifeline to him and he reached a point of safety.

Several people made their way to the Sky Lounge to await rescue by fire fighters — a vain hope. As conditions in the lounge became untenable, several persons were overcome and perished. Unofficial sources indicate 23 victims were later found on this floor. Eight made their way to the roof over a vertical ladder (a means of escape probably known only to employees). A door at the head of a stairway leading to the roof may have been locked, preventing escape by many of those trapped in the lounge. Republic of Korea (ROK) Army helicopters were able to pick up those on the roof with rescue lines. Unfortunately, two of those people fell before reaching safety on the roof of a nearby high-rise building.

Those not fortunate enough to reach lower floors faced a hopeless situation. Driven by desperation, many jumped to certain death, a few with mattresses in futile attempts to cushion the impact. The front and rear streets and the roofs of adjacent buildings were littered with broken bodies.

FIRE-FIGHTING

The Seoul city Fire Service, a section of the Bureau of Metropolitan Police, is also responsible to the Bureau of National Police, Fire Protection Section. The city is divided into four fire-fighting districts, including the downtown Chung Bu District, where the Tae Yon Kak building is located. Each district is commanded by a chief officer and has a headquarters fire station. The city is covered by 24 organized substations or fire companies, and the four headquarters stations, located in
Right: The fire spread first through lower floors and the twenty-first floor. The middle floors became involved in the afternoon. Streams from the 100-foot aerial and from elevated platforms were directed at the fire showing at the front of the building.

Bottom right: On the east of the building some hotel guests escaped over sheet ropes. Others fell to their deaths.

21 separate fire stations. Each district operates its own fire alarm office and radio communications center. The pumping apparatus consists of war surplus and 500-gpm Japanese pumpers supplied by 1,000-gallon tank trucks. Hydrants are few in the city, and most fire-fighting is done by pumper-tanker operations. The city’s ladder equipment consists of one 31-meter (101-foot) rear-mounted aerial and three 15-meter (49-foot) elevated platforms. The Chung Bu District headquarters was seven-tenths of a mile from the Tae Yon Kak Hotel; so the response after the alarm is assumed to have been reasonably prompt.

The Chung Bu fire alarm headquarters received the alarm by telephone at 10:17 am. As the fire became visible to those outside the hotel, headquarters was swamped with calls.

First-arriving fire fighters found fire showing on the lower three floors and heavy smoke billowing from floors above. Fire soon showed from the twenty-first floor. First the aerial was used to rescue guests and employees from the roof of the seven-story section and the lower eight floors of the building. Then the aerial and the three elevated platforms were used at the front of the building to play streams up to the eleventh story, in an attempt to control the fire on the lower floors. The water supply was limited, and most of the streams (approximately 200 to 240 gpm each) were supplied by tank trucks. An unconfirmed report indicated one hydrant may have been used in the vicinity of the hotel. Because of the extensive fire involvement on the lower floors, all fire-fighting and rescue work was external. Eight helicopters from the ROK Army and the United States military forces arrived within one hour of the initial alarm. ROK Army helicopters successfully performed the roof rescues. Rescue from windows by helicopters with rescue lines was attempted, but none was successful, because of the crowded air space, poor visibility, and danger from thermal updrafts.

By 12:00 noon there were approximately 40 pieces of apparatus on the scene. Korea President Park, Chung Hee ordered mobilization of all available National Police forces to assist at the fire. Eventually 530 fire fighters, 750 police, 115 ROK Army personnel and 30 medical personnel were used in the emergency operations. United States Eighth Army fire fighters and pumper-tanker apparatus, called to assist, took part in operations throughout the day. An estimated force of 200 police were used to control a spectator crowd of
thousands who blocked streets in the immediate area of the hotel.

A dramatic attempt was made to rescue a Nationalist Chinese diplomat who resided on the eleventh floor. His room faced the front of the hotel. Around 12:30 pm he appeared at the window wrapped in a blanket, calmly surveying his situation. Fire fighters concentrated their streams around his room to hold back fire that was gradually spreading in that direction. The diplomat was the focal point of attention for spectators at the scene. Local television stations broadcast the fire live, and many TV viewers called in with rescue ideas. ROK Army personnel made a futile attempt to fire a rescue line to the diplomat's room. Later he was no longer seen at his window; he had apparently collapsed. Fire fighters making entry into the building around 8:00 pm found him still alive. He was transported to a hospital, where he succumbed to respiratory complications on January 6. No one else was found alive in the building.

Although the fire was declared under control after 5:30 pm, the heat retained by the building prevented fire fighters from making their way beyond the seventh floor. A more intensive search for victims, lasting 18 hours, began around 8:00 pm. The bodies were recovered and transported to morgues in the city. Of the total of 163 victims, 121 bodies were recovered from the building. Thirty-eight died at the scene from jumps, two fell to their death from helicopters, and two died at hospitals from their injuries.

Ninety-six of the victims were male, 67 female. By nationality, 147 of the victims were Korean; ten, Japanese; three, Chinese; and one each, American, Indian, and Turkish.

Photographs and descriptions of personal belongings were posted to assist the public in the identification process. Seventeen bodies remained unidentified.

**DISCUSSION**

Government investigation reports with findings were not available to the NFPA at the time of the author's visit to Korea. Certain observations concerning fire development and spread were collected through interviews of witnesses and after a quick-look survey of the fire scene.

Regardless of the exact sequence of the events that caused the fire, it is obvious that the involvement of the hotel lobby area was very rapid. Both interior stairs discharged occupants at the lobby level and not to a place of safety. Escape down the hotel stairs was immediately cut off. Witnesses interviewed did not confirm that fire evacuation alarms sounded. The elevators on both the office and hotel sides operated for a brief time before power failures. There were no confirmed successful escapes by occupants using hotel elevators. Three victims were found in a hotel elevator at third-floor level.

The stairways and vertical air-handling shafts were constructed so that they communicated smoke and fire gases through the hotel. The hotel stairway appeared to be the principal means of fire spread to the first five floors above the hotel lobby. Combustible interior finish contributed to fire spread in all areas. Total burnout

(Continued on page 16)
individuals in all the areas requiring expertise. When one notes further that the Sears Roebuck Catalog lists approximately 3,000 consumer products, it is obvious that the expense to the taxpayer would become exceedingly burdensome, if not prohibitive, if the Government had the burden of producing standards.

To the extent that they can favorably influence safety, standards for consumer products developed under the voluntary standards system appear to hold significant advantages over Government-developed standards.

The voluntary standards system I have described provides the necessary safeguards to assure protection of the public. Use of voluntary standards by responsible Government agencies could provide the maximum cost-effective product safety program, which both consumers and taxpayers have every right to expect from industry and government.

Tae Yon Kak Hotel Fire, Seoul, Korea (continued from page 12)

of the restaurant, the kitchen, the corridor, and most of the guest rooms was noted on these floors. The combustible construction, finish materials, and furnishings were mostly consumed.

The vertical heating and air-conditioning shafts spread fire to the top floors. Burn patterns on the eighth floor and on floors above indicate that the fire traveled up heating and air-conditioning shafts and spread through ductwork to individual floor levels above the combustible dropped ceilings. On those upper hotel floors there was less fire damage evident in the corridors. Portions of dropped ceilings were charred but still in place. Wall finish showed smoke stain and evidence of heat, but some lower areas of walls had not been charred. Corridor and room carpeting (material not identified) showed significant burning only after other finish materials had become involved. Some rooms were burned out; others showed only heavy smoke damage, particularly if the room doors had been kept closed.

Most floor areas of the office portion were totally burned out, because of the open areas and the fire loading. As in the case of the hotel section, combustible interior finish contributed to fire spread in all areas. Combustible ceilings, partitions, and furnishings were consumed. Early in the fire witnesses noted fire involving the twenty-first-floor Sky Lounge area. Lower floors (the eighteenth, nineteenth, and twentieth) on the office side became involved progressively in a downward direction. At the same time the fire progressed upward floor by floor from the fourth-floor level. The middle floors did not become involved until the afternoon. Again, the significant spread was through vertical shafts and ductwork, although there appeared to be some fire spread through windows on the lower floors on the west side of the building. The office stairway showed only some smoke and heat damage, with little charring of wood handrails. The stairway rolling steel door was apparently closed at lobby level. Openings in division walls above the dropped ceilings permitted horizontal fire spread between the office and hotel occupancies.

Apparently the building remained structurally sound following total burnout of most areas. Some superficial spalling of columns, beams, and floor slabs was evident. Only one significant crack in a column located on the eighteenth floor of the office side was noted. Some interior concrete-block partition walls had failed and collapsed.

The press described the Tae Yon Kak Hotel fire as the most disastrous hotel occupancy fire since the 1946 Winecoff Hotel fire in Atlanta, Georgia, which claimed 119 lives. The design features of both high-rise buildings that were responsible for loss of life are remarkably similar. Both buildings were constructed of noncombustible materials but contained combustible interior finish. The Winecoff and the hotel portion of the Tae Yon Kak had a single open stairway. In both cases egress down the stairs was cut off by fire that developed on lower floors. The same dilemma faced occupants trapped on upper floors; as the NFPA report on the Hotel Winecoff noted: “The position was hopeless for the occupants except for the possibility of rescue through the exterior windows.”

Had the Tae Yon Kak fire occurred on a normal working day, with the business offices open, many more people would have been exposed, and the appalling death toll would have been even higher.

---