Twelve Die In Fire at Westchase Hilton Hotel
Houston, Texas

On March 6, 1982, an early-morning fire in the Westchase Hilton Hotel in Houston, Texas, resulted in the deaths of 12 hotel guests and serious injury to three others. The fire, which was reported to the Houston Fire Department at 2:25 am, occurred in a guest room located on the fourth floor of the hotel's 13-story, high-rise tower. The fire mainly involved the contents of one guest room, and exposed the fourth-floor corridor to severe heat and smoke conditions. Due to the building configuration, the fire was also able to extend horizontally to two adjoining rooms on the fourth floor. In addition, there was minor vertical exterior fire extension to three guest rooms on the fifth floor. Smoke spread throughout the fire floor and, in varying degrees, to all levels of the building.

All of the fatalities were occupants of the fourth floor, the floor of fire origin. Nine persons from two separate families occupying three fourth-floor rooms were among the 12 fatalities. Another occupant of the fourth floor died while attempting to escape and was found in the smoke-filled fourth-floor exit corridor. Two other fourth-floor occupants, rescued from the building by fire department personnel, died after hospitalization.

The following are considered to be major factors contributing to the loss of life in this fire:

- Lack of detection and extinguishment of the fire in the incipient stage.
- The guest-room door of the room of origin did not close completely, contributing to the severe heat and smoke exposure to the fourth-floor corridor and other guest rooms.
- The lack of an evacuation alarm in the early stages of the fire to alert guests on the fire floor.

BACKGROUND

The Building

The Westchase Hilton Hotel opened for business in late 1980. The complex was built to the requirements of the City of Houston Building Code in existence when the building permit was issued in September 1979. A Certificate of Occupancy for the hotel was issued on November 24, 1980.

The hotel complex consisted of three separate areas of varying heights and construction (see Figure 1). A one-story lobby building located to the north was of noncombustible construction with a sloping glass wall and roof facade. The building contained the lobby, registration area, and administrative offices of the hotel.
A one-story meeting and restaurant building to the east was also of noncombustible construction. This building contained a restaurant, lounge, kitchen, banquet and meeting rooms, and ancillary service areas.

A 64-foot-by-234-foot, 13-story high-rise tower contained 306 guest rooms, with a typical floor containing 24 rooms. The tower structure was of fire-resistive, reinforced-concrete construction. The exterior walls of the high-rise tower were of tempered glass in aluminum floor-to-ceiling frames. Aluminum plates were placed in the horizontal space between the exterior building skin and the reinforced concrete floor slabs. The void spaces between the aluminum plates, floor slabs, and exterior window lights were filled with mineral fiber thermal insulation.

Corridor and room partitions consisted of ½-inch gypsum wallboard on both sides of steel studs. Corridor walls had an additional layer of ½-inch gypsum wallboard on the corridor side of the wall to achieve a one-hour fire-resistive rating. Spaces between the studs were filled with cellulose insulation for sound attenuation.

Guest-room corridor doors were 1½-inch solid-core doors with a plastic laminate surface in steel frames. Doors were provided with two spring-hinge closers located near the top and bottom of the door. The center hinge was not spring-loaded. The latching mechanism provided positive latching of the door. In addition, the doors were equipped with dead-bolt locks. A ½-inch-by-½-inch sponge neoprene seal was provided on the door jambs to limit air infiltration.

Wall finish for guest rooms was a vinyl wall covering consisting mainly of polyvinylchloride with loose fibers of cotton, rayon, and a trace of polyester bonded on the back. An adhesive was used to attach the wall covering to the gypsum wallboard. The ceiling finish in guest rooms and exit access corridors consisted of textured stucco finish applied directly to the underside of the reinforced-concrete floor slabs. The concrete slab, floor, and ceiling assemblies for the high-rise were determined to have a two-hour fire-resistive rating.

Guest-room carpeting consisted of a short, cut-loop nylon pile with a polyurethane padding bonded to a secondary backing of jute fibers.

Room draperies were of woven cotton fabric. The lining attached to the draperies was a polyester-cotton blend faced with vinyl polymer coating. The sheer drapery was a polyester fabric.¹

In the guest-room tower, corridor walls were covered with vinyl wall coverings, and the corridor floors were carpeted; however, the composition of the carpeting was not determined.

Exits for guest-room floors were provided by enclosed stairways located at the ends of the 182-foot central corridor. The stairways were designed to have a two-hour fire-resistive rating, as were other vertical shafts. The east stairway, closest to the room of fire origin, was a smokeproof tower with a pressurized stairway. The west stairway was not pressurized. Both stairways discharged directly to the exterior of the building. Each doorway to the stairways was provided with one ½-hour, B-labeled door with self-closing device. Exit stairway locations were indicated by illuminated directional exit signs placed at the junction of the corridor and a small foyer. Within this small foyer area were exit stairway and

storage-room doors, similar in appearance, but lacking additional markings to distinguish the exit.

The smokeproof stairway was pressurized by means of a roof-mounted fan unit rated at 4,000 cfm. The vestibule between the guest-room tower corridor and the stairway was provided with an additional supply of outside air by a 3,110 cfm rated supply fan, and air was removed by a 5,570 cfm exhaust fan. The vestibules in the vicinity of the fire floor were provided with 280 cfm of supply air, and air was removed at 475 cfm. Stairway pressurization and vestibule supply and exhaust fans were activated through the alarm panel by operation of the fire alarm system.

The heating, ventilation, and air-conditioning (HVAC) system for the high-rise residential guest-room tower included individually controlled fan-coil units located in each guest room in an area above bathroom suspended ceilings. The units were supplied with outside make-up air through ducts located in common bathroom walls between adjacent guest rooms. The supply ducts terminated in a plenum area located behind the fan-coil units. Return air from the guest rooms passed through grills to the fan-coil unit plenum areas.

Guest-Room Contents

The furnishings found in Room 404, the room of fire origin, were typical of the furnishings of rooms in the hotel's residential tower. However, the number of furnishings and the amount of fire loading varied with the size and configuration of each guest room. Room 404 and similarly arranged rooms included two double beds with spring mattresses and box springs, wall-mounted headboards, two upholstered chairs, a small round table, a nightstand, a large upright cabinet containing a color television set, and a wall-mounted desk/dresser assembly with chair.

Fire Protection Systems

The hotel was provided with a fire alarm system that had a presignal feature. The system was not directly connected to the fire department or to a central station. In the residential tower, the system was arranged with three manual pull stations located on each guest-room floor in the vicinity of the stairways and near the elevators. Audible and visual evacuation alarm devices were provided in the vicinity of each pull station. The alerting devices were horn/strobe light units.

Activation of either a manual pull station or a corridor smoke detector (see discussion later) produced an alarm at the annunciator panel with a visual zone display located near the registration desk. The presignal feature for the alarm system was set for three minutes to allow time for investigation of the alarm source. At the end of the three-minute presignal cycle, the system was designed to sound an evacuation alarm in a fire zone that consisted of the floor of activation, plus the floor above and the floor below. The system was designed so that subsequent activation of either corridor smoke detectors or manual pull stations on a separate zone would indicate the zone at the annunciator panel, and if the presignal was completed, would sound evacuation alarms within that zone. A key-operated switch that was provided at the annunciator panel could sound a general evacuation alarm for the entire building.

In addition to the evacuation alarm functions, the alarm system was designed to shut down the corridor heating, ventilation, and air-conditioning (HVAC) system, return elevators to the first-floor lobby area, and activate the east stairway pressurization and vestibule exhaust systems.

A single photoelectric-type smoke detector connected to the fire alarm system was located in the exit-access corridor on each floor, in the immediate vicinity of the passenger elevators. The purpose of this detector was to return and lock-out elevators at the lobby floor after sensing smoke in the elevator lobby area, but it did not provide full exit-corridor coverage.

Each guest room was provided with a single-station, battery-operated, ionization-type smoke detector. These detectors were not connected to the fire alarm system. The single-station detectors had been placed in each guest room after the hotel was in operation, to meet requirements of a Houston ordinance requiring a smoke detector in each residential unit subject to rental.

The guest-room tower was equipped with a standpipe system that provided fire department valve connections at the floor landings in each of the tower's exit stairways. In addition, hose cabinets with 1½-inch hose lines, primarily designed for occupant use, were provided at each end of the corridor in the vicinity of the exit stairway doors. The standpipe system was provided with a 750-gpm fire pump and a 2,500-gallon reserve water supply.

The building was not fully protected by automatic sprinklers; however, partial sprinkler protection was installed in linen chutes. A waterflow alarm device connected to the fire alarm system was provided on the sprinkler supply piping from the standpipe riser. Sprinklers were located on alternate odd-numbered floors.

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2: A single-station residential-type smoke detector provided within a hotel guest room will only provide significant protection (warning) to the occupants of that room from fires occurring within their own room. This detector is not provided for or intended to give protection (warning) to a room occupant from a fire occurring in another room or part of the hotel. Protection of occupants from fires occurring in common areas or contaminating escape routes can only be provided by fire detection systems located in such areas. Richard W. Bukowski, "Analysis of Single-Station Smoke Detectors from the Westchase Hilton Hotel Fire of March 6, 1982," Center for Fire Research, National Bureau of Standards, Letter Report dated July 20, 1982.
Hotel Emergency Procedures and Training

The Westchase Hilton Hotel had a firesafety plan, entitled Emergency Procedures, which designated hotel staff members to specific fire emergency functions and outlined the actions of each staff member in the event of a fire emergency within the hotel complex. An approved fire emergency plan for all hotels is required by the Houston Fire Marshal’s office. A basic outline of a fire emergency plan was provided in the fire inspection documents presented to the hotel at the time of occupancy. However, the Emergency Procedures developed by the hotel from the outline had not been given final acceptance by the Houston Fire Marshal’s office.

The Emergency Procedures document designated hotel staff members to investigate a source of the alarm, form evacuation teams, notify guests, determine evacuation routes, and form the fire brigade. The document also specified actions to be taken by front desk personnel and hotel operator in an alarm or emergency situation. A Firesafety Director, Assistant Firesafety Director, Fire Brigade Chief, Firesafety Trainer, and Night Firesafety Director were assigned by management, and their duties were outlined in the document.

The Houston Fire Department indicated that approximately 35 members of the staff had received firesafety training in four sessions prior to the opening of the hotel. The level and extent of firesafety training for staff in the emergency plan and fire emergency actions after the hotel’s opening and for new employees was not determined by the NFPA.

In addition, the Houston Fire Department had a prefire plan for the Westchase Hotel, using as a basis their standard high-rise building prefire plan.

Occupancy Status

At the time of the fire, approximately 200 guests occupied some 150 of the 306 rooms in the hotel. Many of the occupants were members of one family and family friends staying at the hotel to attend a wedding on Saturday morning.

At the time of the fire, most occupants were asleep in their rooms. However, several guests were entering the hotel to check in after night travel or were returning to the hotel following the 2:00 am closing of restaurants, lounges, and clubs in the Houston area.

THE FIRE

Investigators from the Houston Arson Bureau have determined that the cause of the fire was accidental. The investigation concluded that a cigarette caused ignition of one of the two upholstered chairs in Room 404. (See Figure 2.) Statements from a witness initially placed an incipient fire in the vicinity of the bed nearest the window and the adjacent upholstered chair.

Figure 2.

Figure 2. Floor plan - guest - room tower
The actual fire-ignition scenario has not been determined; however, through interviews and fire ignition tests conducted by the Consumer Product Safety Commission (CPSC), a most probable ignition scenario was determined. Investigators determined that the two guests who had obtained Room 404 for the evening had been smoking throughout the evening. At approximately 10:30 pm, one of the guests left the hotel to meet his date and did not return until approximately 2:20 am. The remaining guest stayed in the room with his date, who had arrived earlier in the evening. The latter guest’s date left the hotel at approximately 12:45 am (leaving the guest behind), and later reported to investigators that there were no indications of a fire within the room at the time of her departure. (For additional details see the Analysis Section of this report.) Investigators believe that a lighted cigarette apparently fell onto or into the crevices of the upholstered chair some time during the evening and initiated a smoldering fire in the chair. The remaining guest apparently was unaware of the developing fire.

Early Indications of Fire Conditions

There were early indications of fire within the building before the fire department was notified. An occupant of the tenth floor, whose room was located directly above the room of fire origin, returned to the hotel minutes before 2:00 am. He apparently smelled a slight odor of smoke as he entered his room. The smell was so faint that he dismissed it, turned on the television, and got ready for bed. His next recollection of the events was hearing sirens when fire department personnel arrived at the hotel.

Discovery and Alarm

One of the first notifications of fire conditions that was made was a telephone call from an eighth-floor guest in Room 304, the first occupied room located directly over the room of origin, reporting smoke in her room.

This guest had returned to her room at approximately 2:10 am. When she opened the door, she found the room filled with smoke. She propped open the door to clear the smoke and began to check the room for its source. Unable to locate a source, she telephoned the hotel operator and reported the smoke in her room. At about the same time, an alarm signal from the single eighth-floor corridor smoke detector was transmitted to the annunciator panel located adjacent to the front desk. Soon after the guest hung up the phone, a hotel security guard walked into her room, apparently directed there by the front desk operator following alarm system conditions. Upon examination of the source of the smoke, the guard stated that it was entering the room through the ventilation system.

The occupant reportedly asked the guard if they should inform other guests, to which the guard stated, “No, not yet.” The guard then reentered the corridor to search for the source of the smoke. The occupant apparently decided to leave the building. She packed her belongings and entered the corridor, when she noted an increase in the concentration of smoke. She stopped at the outside window located in the corridor near the elevators and again called the hotel operator.

After informing the hotel operator of the smoke conditions in the corridor, she asked the operator, “Shouldn’t the operator be informing other guests?” The occupant was reportedly told, “No, wait until the fire department gets there.”

Continuing her evacuation, the guest pushed the elevator call buttons, to which there was no response. She then began to walk toward an exit. As she did, a man who was walking from the direction of the exiting told her not to go that way, because the exit was locked. She then turned and walked toward the second exit, and left the building.

The first person known to have discovered the fire on the fourth floor was one of the male occupants of Room 404, who was returning to the hotel with his date. Entering the hotel at approximately 2:20 am, they attempted to use the passenger elevators, which were inoperable. They noted later to investigators that they found the elevator doors in the open position and the elevators would not respond to their activation of the floor buttons. Apparently familiar with the building, the couple walked to the east end of the corridor and took the service elevator to the fourth floor. As the doors opened, the couple observed a haze of smoke in the corridor.

The occupant used his key to unlock the door to Room 404. On opening the door to the room, he found it filled with smoke from the fire, which he later described to investigators as a red glow in the vicinity of the bed closest to the window. Entering the room, he attempted to extinguish the fire by beating it with what he thought to be a pillow. This action apparently increased the volume and intensity of the fire. (After seeing the fire, his date apparently took the service elevator back to the ground floor. She reportedly went to the registration desk to notify the hotel staff of the fire.) Meanwhile, the returning occupant of Room 404, unable to control the growth of the fire, abandoned his attempt to extinguish it. He then searched for and ultimately located his semiconscious roommate on the floor at the end of the bed closest to the corridor door, and pulled him into the corridor. He assisted his roommate down the corridor to the west stairway. Leaving the roommates in the stair-

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See Analysis section of this report for additional details.

(Continued on page 20)
way, he reportedly returned to the room to search for his roommate's date. He did not know at the time that his roommate's date had left earlier.

Unable to locate his roommate's date in the room, which by this time was heavily charged with heat and smoke, the guest returned to the west stairway to assist his roommate from the building.

After the occupant left the room (and possibly during his efforts to rescue his roommate and extinguish the fire), the guest-room door apparently remained in a partially open position. Both occupants escaped safely from the building.

**Fire Department Actions**

Station 69, the closest first-alarm fire company, is located 1 1/2 road miles from the Westchase Hilton Hotel. At 2:25:13 am, the fire department dispatcher received a call from the hotel desk clerk reporting a fire of an unknown type. After some discussion with the desk clerk, the dispatch of the first-alarm assignment was begun at 2:27:38 am.

**Fire Damage**

The fire was confined to the room of origin and a portion of the corridor in the immediate vicinity of the room of origin. Because of the sawtooth configuration of the exterior wall, the fire was also able to extend horizontally to expose Rooms 403 and 405, which were adjacent to the room of origin. The fire was also able to extend vertically through the exterior windows broken by the intense heat to a fifth-floor guest room directly above the room of origin. However, fire damage to these rooms was relatively minor.

There was severe fire damage in the room of origin, with almost total consumption of bedding materials, wall and floor coverings, and room furniture. Although there was damage along the entire length of the fourth-floor exit-access corridor, most of the damage was confined to a segment of corridor wall and floor coverings in the immediate vicinity of the room of origin.

There was no structural damage to the building.

**Casualties**

All of the fatalities were occupants of the fire floor. A family of four and a family of five were found in Rooms 407 and 411; guest-room doors to both were now closed. One victim was found in the corridor outside Room 413. In addition, five occupants on the fire floor were hospitalized; four in critical condition, and one in serious condition. Two of the injured died soon after the fire. (See Table 1.) Fire fighters found the injured behind closed doors in guest rooms and in the fourth-floor exit-access corridor.

The victims ranged in age from 2 years old to 67 years old; seven females and five males were among the victims. As reported by the Harris County Medical Examiner, carbon monoxide saturation levels of the victims ranged from 18 percent to 58 percent. The Medical Examiner attributed eight of the deaths to "asphyxia due to the soot and carbon monoxide." Two of the deaths were reported as caused by "asphyxia due to soot, carbon monoxide, and cyanide inhalation." All but one of the two victims were found by fire fighters behind closed guest-room doors. Autopsy reports indicated that in some cases, soot caused almost complete obstruction of the lung's air passages.

Investigators noted varying degrees of soot deposits in the fourth-floor guest rooms. Investigators could not determine conclusively whether any of the victims found in these rooms had opened guest-room doors to examine conditions in the exit-access corridor, or had attempted escape and then returned to their rooms. However, bodies of four victims in Room 411 were found clustered at the entry door. Many of the survivors indicated that one of their first actions had been to examine the condition of the corridors.

There were several indications of movement in the fourth-floor corridor. The occupant of Room 402 was found in the corridor outside Room 413. One victim may have explored escape routes and then returned to the guest room. A 62-year-old grandmother registered in Room 413 was found with family members in Room 411 and may have relocated to Room 411 during the fire.
Two survivors (in addition to the occupants of Room 404) successfully used the corridor to escape, and two others were rescued from the corridor by fire fighters.

ANALYSIS

Fire Development and Smoke Spread

As determined by the Houston Fire Department, the probable cause of the fire was an accidental cigarette ignition of an upholstered chair located in the vicinity of the south window wall of Room 404.

According to ease-of-ignition tests conducted by the Consumer Product Safety Commission (CPSC), the upholstered chair most likely had smoldered for approximately an hour or more before erupting into open flame. The cigarette could have been dropped by one of the occupants between 12:45 am and 1:00 am, prior to first indications of the smell of smoke at approximately 2:00 am. Witness statements and physical evidence corroborate the laboratory finding.

Prior to discovery of the fire, smoke from the fire in Room 404 was able to ascend vertically to other floors. An occupant of the tenth floor (Room 1005) smelled smoke at approximately 2:00 am. Another occupant on the eighth floor (Room 804 — the first occupied room above room of fire origin) found smoke in her room at approximately 2:10 am. The avenue of smoke spread, resulting in these early indications, was most likely through the bathroom vent system or smoke migration through the fan coil unit plenum to a vertical pipe chase in the common wall between the bathrooms of Room 404 and 405.

At approximately 2:20 am, the occupant of Room 404 and his guest returned and unlocked the entry door; he noted a haze of smoke in the corridor. After leaving the room (and possibly during the occupant’s efforts to rescue his roommate and extinguish the fire), the guest-room door apparently remained in a partially open position, most likely because the carpeting interfered with the door’s movement. (Occupants of the room stated that throughout the course of the evening, the door had to be pushed closed; otherwise, it remained open from 6 to 18

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**Table 1. Casualty Information**

<table>
<thead>
<tr>
<th>Victim Location</th>
<th>Age</th>
<th>Sex</th>
<th>Percent of Carbon Monoxide Saturation Level</th>
<th>Cyanide Level in Parts Per Million</th>
<th>Cause of Death</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridor</td>
<td>26</td>
<td>F</td>
<td>47</td>
<td>0.22</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td>Attempted escape; found in corridor by Room 413; 9 percent burns on body</td>
</tr>
<tr>
<td>407</td>
<td>36</td>
<td>M</td>
<td>52</td>
<td>0.75</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td></td>
</tr>
<tr>
<td>407</td>
<td>30</td>
<td>F</td>
<td>58</td>
<td>0.75</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td></td>
</tr>
<tr>
<td>407</td>
<td>4½</td>
<td>M</td>
<td>30</td>
<td>8.00</td>
<td>Asphyxia due to soot, carbon monoxide and cyanide inhalation</td>
<td></td>
</tr>
<tr>
<td>407</td>
<td>4</td>
<td>M</td>
<td>45</td>
<td>10.00</td>
<td>Asphyxia due to soot, carbon monoxide and cyanide inhalation</td>
<td></td>
</tr>
<tr>
<td>411</td>
<td>46</td>
<td>M</td>
<td>32</td>
<td>0.65</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td></td>
</tr>
<tr>
<td>411</td>
<td>37</td>
<td>F</td>
<td>39</td>
<td>0.50</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td></td>
</tr>
<tr>
<td>411</td>
<td>19</td>
<td>F</td>
<td>44</td>
<td>0.50</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td></td>
</tr>
<tr>
<td>411</td>
<td>15</td>
<td>F</td>
<td>37</td>
<td>0.70</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td></td>
</tr>
<tr>
<td>411</td>
<td>62</td>
<td>F</td>
<td>18</td>
<td>0.73</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td>Registered in Room 413; found with family members in Room 411</td>
</tr>
<tr>
<td>411</td>
<td>30</td>
<td>M</td>
<td>Anoxic encephalomalacia due to smoke and carbon monoxide inhalation</td>
<td>0.50</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td>Rescued from room by fire department; died 3/12/82</td>
</tr>
<tr>
<td>415</td>
<td>67</td>
<td>F</td>
<td>Respiratory failure due to smoke inhalation complicated by organizing pulmonary fibrosis</td>
<td>0.73</td>
<td>Asphyxia due to soot and carbon monoxide</td>
<td>Rescued from room by fire department; died 4/14/82</td>
</tr>
</tbody>
</table>

* Data in this table are from Harris County Medical Examiner Autopsy Reports and fatalities from the Westchase Hilton Hotel fire except guest room and victim location data verified by NFPA.
inches.) Between initial discovery of the fire and his return to search for his roommate’s date, the occupant found that fire conditions had worsened to the extent that he could not reenter the room.

Once the upholstered chair had erupted into open flames, the fire most likely grew rapidly, extending to the table, bed mattress, box springs, and bedding materials located close to the chair, and ultimately full room involvement occurred. As the fire grew in intensity, smoke and heat entered the fourth-floor corridor through the partially open door, leading to a rapid deterioration of tenable conditions in the corridor. Flames impinged directly on the doors of Room 403 (next to the room of origin) and Rooms 407 and 408, directly across the corridor from Room 404.

Flame spread in the corridor was limited to the vicinity of the room of origin. However, smoke and heat conditions were evident the entire length of the corridor. Interviews of fourth-floor survivors conducted by Houston investigators indicated that smoke conditions were so severe that they had to feel their way, touching the corridor walls in order to reach an exit.

Once smoke entered the fourth-floor corridor, the primary avenues of smoke spread to upper floors included elevator shafts and the corridor HVAC system. Occupants of upper floors noted that smoke was emanating from elevator shafts into exit-access corridors.

Evidence of smoke spread in fourth-floor guest rooms was not uniform, and soot deposits varied. Smoke was reported to have spread into several guest rooms through doors opened by guests to examine conditions in the corridor. Evidence of smoke penetration around guest-room doors was also noted by investigators, and at least one witness reported smoke entering under a guest-room door.

At some time before the arrival of the fire department, the door to the fourth-floor west stairway reportedly had been propped open with a chair. This condition allowed smoke to penetrate the stairway and to migrate vertically to upper levels. The smoke prevented the use of this exit stairway as a means of escape for some of the occupants on upper floors. Smoke was also reported within the east pressurized stairway. The smoke most likely migrated into this stairway during fire department operations.

Also prior to fire department arrival at 2:31 am, the intense heat in the room of origin broke out the window glass in the south wall. The fire vented, allowing flame, heat, and smoke to extend up the exterior of the south facade of the building, exposing and causing minor damage to Room 504. The venting process, however, most likely reduced the amount of smoke and heat entering the interior spaces of the building.

Re-creation of People Movement and Actions Taken

At the time of the fire, nearly 200 guests were registered at the hotel. Guests had been assigned rooms on 12 of the 13 floors of the high-rise tower. On the fourth floor, 15 of the 24 rooms were occupied by 32 guests. See Table 2 for details of fourth-floor occupant actions.

Some of the surviving occupants of the fourth floor were awakened by running, yelling, or loud noises of the guests in the fourth-floor corridor or in other rooms. Many reported that they investigated the corridor for the source of the disruption.

A few fourth-floor occupants who became aware of the fire early in the incident were able to exit from their rooms to the stairways and escape. Others entered the smoke-filled corridor and were able to narrow an escape as conditions deteriorated, or were rescued by fire fighters from the corridor (two were found unconscious). The majority who became aware of the fire later found that smoke and heat conditions in the corridor precluded escape by this means, and were trapped in their rooms. These occupants either were overcome by products of combustion or were rescued over ladders or removed from their rooms by fire department personnel. Some of them took actions within their rooms to survive (i.e., placed wet towels around smoke entry points, alerted the fire department of their presence, etc.) while they awaited rescue.

<table>
<thead>
<tr>
<th>Table 2. Summary of Fourth-Floor Occupant Fatalities and Survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escaped through corridor and down stairways without fire department assistance</td>
</tr>
<tr>
<td>Survivors rescued by fire department</td>
</tr>
<tr>
<td>Rescued from rooms by ladder</td>
</tr>
<tr>
<td>Rescued from rooms through corridor and down stairways</td>
</tr>
<tr>
<td>Rescued from corridor and down stairways</td>
</tr>
<tr>
<td>Fatalities</td>
</tr>
<tr>
<td>Victims located in rooms</td>
</tr>
<tr>
<td>Occupants rescued from rooms and died later</td>
</tr>
<tr>
<td>Victim located in corridor</td>
</tr>
<tr>
<td>Total fourth-floor occupants:</td>
</tr>
</tbody>
</table>

* Includes two occupants of Room 404 and their guest.
** Includes only those occupants whose actions or survival disposition were documented. One occupant was registered but was not on the fire floor at the time of the fire. The location and actions of another occupant were undetermined.

Several occupants on the fourth and other floors attempted to break the tempered glass windows with varying degrees of success. Occupants stated that they had kicked at the windows, or threw chairs or other objects against them. These efforts to break the glass panels are thought to have caused the “rumbling” and “crashing” noises heard by other occupants that indicated something unusual was happening in the hotel.

Like many of the fourth-floor occupants, other guests of the hotel that night stated that they became aware of
the fire through means other than the fire alarm system (i.e., noises in corridors, noises in guest rooms, etc.) or the individual room smoke detector units. Due to lack of early notification, many occupants were awakened to find that smoke had spread into hotel corridors or exit stairways, which precluded their use for escape.

Successful escape efforts of occupants depended on several factors:
- The time frame within the fire scenario in which they became aware of fire conditions and attempted to initiate their escape;
- The floor on which they were located;
- The escape route they attempted to use; i.e., stairways, etc.
- Instructions given by hotel staff to occupants who had called the front desk; and
- Occupants being located by fire fighters and assisted/removed from the hotel.

The initial course of action of many occupants was to call the hotel operator or the front desk to either ascertain what was going on in the hotel, or to seek guidance and direction as to what they should do. This indicated an inherent reliance of the hotel guests on the hotel management to instruct them on what to do in a fire emergency. Depending upon their location in relation to the fire and the time at which they called, occupants received a variety of directions from the hotel staff. Some occupants on the fourth floor apparently were given instructions to enter the hotel corridor and were directed to turn and move in the direction of an exit stairway. Although given those directions, some of the occupants of the fire floor found that conditions had deteriorated to such an extent that they could not safely enter the fourth-floor corridor.

Some of the occupants on upper floors elected to attempt to escape rather than remain in rooms that were becoming filled with smoke. Several occupants who elected to remain in their rooms reported taking several actions. They included blocking doors and vents with wet towels and other materials, shutting off heating, ventilation, and air-conditioning systems in the room, lying on the floor, crawling below levels of smoke, turning on room lights to indicate their location to rescue personnel on the exterior of the building, and notifying other family members within the hotel. Many occupants indicated that, upon leaving their rooms, they attempted to notify other guests by yelling and knocking or beating on doors as they moved toward exit stairways. One occupant of the sixth floor called the fire department directly and asked what he should do. He received instructions from the fire department dispatcher that he should not escape via the corridor, and should not attempt to break out the window. The occupant followed these instructions. The fire department command post was notified and fire fighters made their way to the sixth floor to rescue the individual and his family.

Occupants located during search-and-rescue activities were either led down corridors and stairways in small groups by fire fighters or, in a few cases, they were taken out of the building over aerial or ground ladders. Occupants attempting to escape from hotel floors on their own indicated for the most part that they knew they should not use hotel elevators as a means of escape. However, some occupants indicated that when they found one or both of the hotel stairways filled with smoke, they did use the service elevator as a means of escape.

Occupants in several of the rooms on upper floors of the hotel were not aware of the fire until fire fighters opened their room doors and awakened the still sleeping occupants during search operations.

Performance of Fire Detection and Alarm System

The first notification of fire conditions that the hotel staff received was the telephone call from a guest who reported smoke in her eighth-floor room — four floors directly above the fire. About the same time, the annunciator panel received an alarm signal from the eighth floor. The fire alarm system would then initiate the 3-minute presignal function which, if not cancelled, would result in evacuation alarms sounding on the fire floor, the floor above, and the floor below.

Many of the hotel's occupants indicated that either they did not hear evacuation alarms or only heard the alarm sounding for short periods of time. Houston Fire Department investigators determined that the desk clerk on duty repeatedly activated the annunciator panel's bell silence and reset switches. This action silenced the annunciator panel alarm and, during the early stages of the fire, apparently resulted in the reported lack of evacuation alarm activation in the high-rise tower.

A postfire survey of the hotel's fire alarm system indicated additional system impairments or malfunctions that may have contributed to a lack of evacuation alarm activation or other system performance problems. These conditions included:
- The single photoelectric smoke detector centrally located in the elevator lobby of the fourth-floor corridor may have been inoperative prior to the fire (specific impairment details were not available to the NFPA).
- Multiple-alarm zone activation would cause the AC alarm system power supply circuit breaker to trip within 20 to 30 seconds, followed by a DC circuit breaker that would trip in 20 to 30 seconds. These actions made the alarm system inoperative and prevented the sounding of alarms throughout the building.

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5 Although functional fire alarm system tests were witnessed by an NFPA specialist a few weeks after the fire, the findings were neither independently verified by the NFPA nor has the NFPA reviewed the complete findings of the survey. The operational status of the fire alarm system and photoelectric smoke detectors immediately following the fire was not determined by the NFPA and/or the Houston Fire Department.

(Continued on page 54)
The malfunction of the system and power supply interruption would allow the HVAC system and the east stairway pressurization system to return to their normal nonemergency operational status. However, the elevators would have had to be reset manually with a key.

- The smoke detector located in the return-air duct of the tower HVAC system was incorrectly matched with the other components of the fire alarm system and would not have activated.

Other NFPA observations that were made concerning the fire alarm system were:

1. There were no instructions at the panel to indicate the operation and control of the switches such as the normal sequence of silencing alarm and resetting the panel.
2. There was a nameplate adjacent to the switches advising the operator to notify the fire department prior to silencing the alarm. However, the plate was difficult to read since it was close to the floor.
3. The zone light indications shining through slots in the panel were poorly identified as to what zones or section of the building the light represented.
4. During functional system tests, there was difficulty in hearing evacuation alarms in some guest rooms within the building.

If the observed alarm system power supply malfunctions occurred during the incident, intermittent operation of the corridor HVAC system and east stairway pressurization system would have occurred. It is known from interview data that elevators were returned to the lobby level; however, the data were insufficient to determine the operational status of the HVAC systems during the incident.

**Guest-Room Smoke Detectors**

The guest-room smoke detectors were the single-station, battery-operated ionization type. These detectors were designed only to provide warning to the occupants of the room of fires within their room. The detectors were not provided or intended to give warning to a room occupant of a fire occurring in another room or part of the hotel. Adequate alerting of occupants to fires that are occurring in common areas or contaminating escape routes of such occupancies can only be provided by fire detection and alarm systems located in all areas.\(^6\)

Many hotel occupants reported that the single-station, battery-powered detectors did not sound, even though smoke conditions were obvious by sight and smell in their rooms. However, laboratory examination of a sample of detectors by the Center for Fire Research, National Bureau of Standards, indicated there was no malfunction of the individual guest-room detectors tested. The reported lack of activation of these devices in some cases may have resulted due to the following conditions:

- **Cold Smoke Effect.** The essential feature of smoke is its instability. As smoke travels away from a fire, and ages, the smoke particles in a cloud collide with one another and cluster. This process goes on continuously until the number of particles has been considerably diminished and the average size largely increased.

Since the response of an ionization smoke detector is dependent on the particle concentration and size, some of the guest rooms might not have had a sufficient concentration of this aged smoke to operate the smoke detectors in the guest rooms.\(^7\)

- **Location of Smoke Detectors.** Some smoke detectors were located in the small foyer area between the fan coil unit return air grill and the room corridor doors. Smoke entering through the cracks around the door and the door frame was most likely drawn across the foyer into the fan coil unit air-return vent located in the partition between the bathroom and the room foyer, and was circulated throughout the room.

**Summary and Major Contributing Factors**

The fire at the Westchase Hilton, like other recent severe hotel fires, was in a modern, recently completed...
(or expanded) fire-resistive structure with a number of built-in fire protection features. Yet 12 out of 30 occupants (40 percent) on the fire floor were fatalities. Nine of the 12 victims were found in guest rooms. One fatality was found in the exit-access corridor. Two guests were rescued from their individual rooms by fire fighters, but later died from smoke inhalation injuries. The successful interior and exterior rescues of 13 occupants of the fourth floor by fire department personnel are considered to have been significant in reducing the possible number of fatalities and/or injuries.

The severe heat and smoke exposure to the fire floor resulted after a combination of events and factors, documented in this report, allowed the room of origin in this nonsprinklered building to reach full fire involvement. Ignition most likely occurred when a lighted cigarette was dropped onto an upholstered chair in a fourth-floor guest room; the occupant was not aware of the condition or was not able to take actions such as notifying others.

The initial notification to the hotel staff was from a guest in Room 304 reporting a smoke condition and, subsequently, the activation of the eighth-floor smoke detector at approximately 2:10 am. The initial notification from the eighth floor may have diverted attention from the fire floor, thus delaying discovery of the actual location. The actual location was discovered and reported at approximately 2:20 am when an occupant of the room of origin returned to his room.

The fire was able to develop in the room of origin, consuming combustible contents and exposing the fourth-floor corridor to severe heat and smoke through the partially open guest-room door. Full room involvement was reached sometime prior to fire department arrival at 2:31 am.

As the fire grew in intensity and exposed the exit-access corridor, conditions in the corridor deteriorated rapidly. In addition to the two occupants and their guest from the room of origin, only two other guests (a couple in Room 409) were able to successfully evacuate on their own from their room using the corridor, and their escape was barely achieved. Notification was not soon enough for the majority of fourth-floor guests to use the exit-access corridor.

Of the 22 guests who stayed in their fourth-floor rooms, eight were successfully rescued over ladders. These guests were in two separate rooms and had broken their windows to notify the fire department of their presence. Three other guests were rescued from their rooms by fire department personnel and taken down the stairways. Nine fatalities were found in two guest rooms, behind closed doors. Two occupants in separate rooms were rescued, but later died. The delay in notification of guests and lack of extinguishment of the fire in the incipient stage greatly affected the potential for survival.

It is not known whether the guest-room doors (other than the room of origin) remained closed throughout the incident; however, there was considerable movement in the corridor due to escape attempts, and doors may have been opened to assess conditions or to attempt escape. Soot deposits indicated that smoke had migrated into guest rooms where fatalities occurred. The amount of soot, however, varied from room to room throughout the fire floor.

Based on the NFPA investigative study, the following are considered to be major factors contributing to the loss of life in this fire:

- **1) Lack of detection and extinguishment of the fire in the incipient stage.**

  A severe threat to life safety resulted from the guestroom fire that involved combustible contents in this nonsprinklered hotel. The life safety record in such facilities protected by complete automatic sprinkler systems is excellent. An automatic sprinkler system could have extinguished the fire and also provided an alarm for notification of hotel management and guests. Automatic notification of the fire department would have allowed the fire department to respond to the hotel to assist guests and hotel management.

- **2) The guest-room door of the room of origin did not close completely, contributing to the severe heat and smoke exposure to the fourth-floor corridor and other guest rooms.**

  The door, although equipped with self-closing hardware, did not close completely. This condition increased the severity of heat and smoke exposure in the corridor and greatly reduced the chances of survival on the fire floor. Smoke also spread from the fourth floor to other floors through elevator shafts and the corridor HVAC system. The door installation and maintenance details were not available to the NFPA. It appears that the carpet may have interfered with the door swing. A closed door throughout the fire could have reduced or delayed heat and smoke spread to the corridor.

- **3) The lack of an evacuation alarm in the early stages of the fire to alert guests on the fire floor.**

  Proper staff action was essential in order to continue the emergency procedures that should have been initiated following notification and the automatic activation of the fire alarm system. This did not occur, and resulted in evacuation alarms not sounding or being heard. Fourth-floor guests became aware of the fire by other means, and only a few were able to successfully evacuate the building on their own. Those who were forced to remain in their rooms because of severe corridor conditions faced a serious threat to their safety. The initial notification from the eighth floor caused by smoke migration may have diverted attention from the fire floor, de-
laying discovery and the alerting of fourth-floor guests. There was insufficient data to determine the effect of possible fire alarm system impairments or malfunction on evacuation alarm performance during the fire.

The following are considered significant additional findings of the NFPA investigative study:

1) In addition to the lack of evacuation alarm activation in the high-rise tower, there was a delay in notifying the fire department. Full room involvement in fire and the severe exposure to fourth-floor occupants occurred prior to fire department arrival at 2:31 am. Water was applied to the fire in Room 404 at approximately 2:38 am, some 28 minutes after initial notification to hotel staff. There were several successful rescues of fourth-floor occupants even with the delayed alarm. Earlier notification of the fire department could have helped to achieve earlier control of the fire and might have reduced casualties.

2) Interviews conducted by fire investigators plus follow-up surveys of survivors of the fire indicated that several people were confused by the exit markings or by the similarity of exit doors and adjacent storage room doors. The directional exit signs within the exit foyers at the ends of the hotel corridors indicated that the exit path from this point would be perpendicular to the exit access corridor. Some of the occupants moved toward the locked storage room doors and away from the exits.

3) Interviews conducted by Houston investigators and questionnaire responses received by the NFPA from victims of the fire repeatedly indicated the lack of audible fire alarms from the individual battery-operated room smoke detectors. However, laboratory examination of the detectors by the Center for Fire Research, National Bureau of Standards, indicated there was no malfunction of the ionization-type smoke detectors tested. NFPA specialists believe that the cold smoke phenomenon and placement of the detectors in relationship to the room's return-air grill may have delayed the detectors' response.

The cooperation of V. E. Rogers, Chief of the Houston Fire Department, is acknowledged. The assistance and cooperation of Edie Corral, Fire Marshal, District Chief J. F. Schindewolf and Lt. Troy Lewis, Fire Marshal's Office; Leonard Mikeska, Chief Investigator, and B. W. Emmors, W. E. Sammons, and J. E. Thornton, Investigators of the Arson Bureau, and District Chief Robert L. Pockett are greatly appreciated.

The assistance of Charles Zimmerman and James K. Lathrop of NFPA's Engineering Division is acknowledged. Special thanks go to Mary Rynisha, Project Secretary, for her efforts in the preparation of this report.

NFPA Standards Council Meeting (continued from page 33)

Responsibility for life safety is with the Life Safety Code Committee. If it is felt that there are special needs for non-nuclear power generating plants, these should be discussed with the Life Safety Code Committee to determine whether or not these special needs should be handled in NFPA 101, the Life Safety Code, or in proposed NFPA 850.

In reviewing the Committee report further, the Council noted that there are other provisions in the proposed Standard that need to be coordinated with other committees (e.g., Fire Tests, Fire Doors, etc.). The Council, thus, urges that such coordination be achieved before the Committee submits its Technical Committee Documentation (TCD) for publication.

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[Required by Section 3503, Title 39, United States Code]

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PAMELA POWELL