



## FIRE AT THE MGM GRAND HOTEL

**A November 21, 1980, fire at the MGM Grand Hotel in Las Vegas** claimed 85 lives, injured about 600 people, and caused more than \$30 million damage to the 23-story high-rise. The MGM Grand was the worst hotel fire in the United States since 119 people died in the 1946 fire in Atlanta's Winecoff Hotel and was the first of a series of major hotel fires in the early 1980s.

The hotel included a ground-level complex with a Casino, restaurants (including The Deli at the Casino's east end), convention facilities, jai alai fronton, and a mercantile complex.<sup>1</sup> The low-rise portion of the hotel, of protected and unprotected noncombustible construction, was partially sprinklered. The 21-story high-rise tower rested above the Casino level and was of fire-resistant construction.

Approximately 3,400 guests were registered in the hotel at the time of the fire, many of them on pre-Thanksgiving vacations. As usual at 7:00 am, most of the guests were still in their rooms. The restaurants were only lightly occupied, the casinos were nearly empty, and most of the function rooms and nightclub areas were closed.

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This article is based on material about the MGM Grand Hotel fire previously published by the NFPA. For a more detailed analysis of the MGM Grand Hotel fire, see "Fire at the MGM Grand: A Preliminary Report," *FIRE JOURNAL*, Vol. 75, No. 2 (March 1981), pp. 33-36; "Fire at the MGM Grand," *FIRE JOURNAL*, Vol. 76, No. 1 (January 1982), pp. 19-37; *Investigation Report on the MGM Grand Hotel Fire, Las Vegas, Nevada, November 21, 1980* by Richard Best, NFPA Senior Fire Analysis Specialist, and David P. Demers, Consultant to the NFPA, NFPA No. LS-4 (Boston: NFPA, 1982); "Human Behavior in the MGM Grand Hotel Fire," *FIRE JOURNAL*, Vol. 76, No. 2 (March 1982), pp. 37-48; and *An Examination and Analysis of the Dynamics of the Human Behavior in the MGM Grand Hotel Fire, Clark County, Nevada, on November 21, 1980* by Dr. John L. Bryan, Professor and Chairman of the Department of Fire Protection Engineering at the University of Maryland, for the NFPA, NFPA No. LS-5 (Boston: NFPA, 1982).

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<sup>1</sup> The MGM Grand Hotel is a 23-story structure, comprised of the Arcade and Casino levels and the 21-story guest tower. The hotel numbering system, however, included 26 levels.

### The Fire

At approximately 7:10 am, an employee discovered the fire in a serving station in The Deli, the restaurant located at the east end of the ground-level Casino. A second employee saw smoke coming from The Deli area and saw the south wall of The Deli burst into flames. A chef, cooking bacon when a waitress told him of the fire, alerted the hotel telephone operator.

At 7:16 am, the consolidated alarm office that serves the city of Las Vegas, Clark County, and North Las Vegas received a telephone call reporting the fire. The Clark County Fire Department dispatched the normal first-alarm assignment for a hotel occupancy (4 engines, 1 ladder, 1 hosewagon, and 1 rescue unit, a battalion chief, and 23 fire fighters). Follow-up alarms were dispatched almost immediately. A total of 544 fire fighters from surrounding areas responded to the fire, which was controlled by approximately 8:30 am.<sup>2</sup> Another 2½ hours were required to evacuate survivors.

The Clark County Fire Department reported the most probable source of ignition as heat produced by an electrical short circuit (ground fault) of an ungrounded electrical circuit conductor to a flexible metal conduit.

The fire probably smoldered for some time in a combustible concealed space on the west side of a pie case in The Deli serving station before breaking out of the concealed space shortly after 7:00 am.

Smoke is believed to have moved originally from the serving station through an air-transfer grill, located in the ceiling of the service station, to a return-air plenum. Flames began to spread on lightweight fuels and combustible interior finish, and the fire spread from the serving station to The Deli and other combustibles. The fire and flame front moved through The Deli and accelerated throughout the Casino.

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<sup>2</sup> See the January 1982 issue of *Fire Service Today* for details of fire-fighting operations.



Sprinklers, doors, and fire venting stopped the fire from spreading into the east side of the Casino. However, the fire in the unsprinklered west end of the Casino blew out the doors. By 7:25 am, the porte cochere (canopy) was fully involved.

As the fire grew in The Deli and the Casino, smoke and heat spread through the plenum above the ceilings, causing the suspended ceiling system between the Casino and the security walkway system to fail.

Unprotected vertical openings (seismic joints, interior stairways and smokeproof stair enclosures, toilet exhaust shafts, and pipe chases and other building service penetrations) and vertical openings with enclosure deficiencies allowed smoke and heat to reach the high-rise tower. Passenger elevator hoistways were a major avenue for smoke and heat spread.

Heat and smoke moved to a plenum area above the twenty-sixth floor ceiling, where the unprotected vertical openings ended. From this plenum, smoke continued its spread to the mechanical penthouse on the roof. Some smoke and heat spread through cable slots at the top of the passenger elevator hoistways and penetrated the interior of the mechanical penthouse.

The air-handling units supplying conditioned air from the penthouse shafts to the corridors in the high-rise tower continued to operate during the fire. Consequently, smoke-laden air from the mechanical penthouse was carried through filters and pumped back through the shafts to the corridors outside guest rooms. Additional smoke, traveling vertically through some toilet ventilation systems, overpowered the systems' exhaust capacity and leaked into bathrooms.

Major factors in the fire were identified as:

- Rapid fire and smoke development on the Casino level;
- Lack of fire extinguishment during the incipient stage of the fire;
- Substandard enclosure of interior stairs, smokeproof towers, and exit passageways;
- Distribution of smoke throughout the high-rise tower by HVAC equipment; and
- Smoke spread through the elevator hoistways to the high-rise tower.

#### The Casualties

Eighty-five people (78 hotel guests and seven employees) died as a result of the fire. Bodies of 83 victims were located on the day of the fire; the 84th victim was discovered the next day and the 85th victim died weeks later.

The locations of 79 of the 84 victims who died the day of the fire have been documented. Sixty-one of the bodies were located in the high-rise tower, while 18 victims were on the Casino level.

The Clark County Coroner determined that all of the 61 victims in the high-rise tower died of asphyxiation

caused by carbon monoxide inhalation. Twenty-five of these victims were found in rooms, 22 in corridors, 9 in stairways, and five in elevators. The twentieth and twenty-third floors had the largest concentration of victims (14 each).

Fourteen of the 18 victims located on the Casino level died of smoke and carbon monoxide inhalation. Three died from the effects of burns and the inhalation of smoke and carbon monoxide, while one victim died of a skull fracture. Six of the Casino-level victims (including three who had sustained massive burns) were found near the Registration Desk. Four more victims were in the Ritz Room, five were in elevators, and two in the Casino-level elevator lobby. One victim was found outside, after jumping or falling from the high-rise tower.

Approximately 600 people were injured, transported from the hotel, and treated in local hospitals. Of the 600 injured, 318 were admitted to hospitals and 282 were released after treatment in hospital emergency rooms.

#### The Survivors

Of the approximately 3,400 guests registered at the hotel at the time of the fire, more than 2,700 escaped without injury. In an effort to discover their life-saving

View of north face of hotel shows aerial ladder and construction hoist used to rescue some occupants. All but the lowest (fifth floor) guest-room floors are shown.

*Las Vegas Sun*







Four victims died in this high-rise tower elevator that was stopped at the twentieth floor. The pillow was used to mark a victim's location. NFPA

actions during the fire, the NFPA sent questionnaires to 1,960 survivors.<sup>3</sup>

Of those sent questionnaires, 554 people or roughly 28 percent responded. Respondents' ages ranged from 20 to 84 years; approximately 60 percent were male and 40 percent female.

The largest number of people in the study population (240 or 43.3 percent) evacuated successfully. Another 206 people or 37.2 percent attempted to evacuate, but were forced to return to their rooms or to seek refuge elsewhere. Another 107 people (19.3 percent) remained in their rooms throughout the fire; the action of one

<sup>3</sup> Guests known to have been registered with those who died and guests with foreign addresses were not sent questionnaires.



Two victims were found near the windows in this twenty-first floor room that was adjacent to the elevator lobbies. Note light smoke deposits on beds where pillows and bedding were removed. NFPA

respondent was undetermined. Guest behavior was primarily cooperative and altruistic.

#### Damage

Fire damage, other than that caused by smoke, included major damage to the Main Casino, lobby areas, the registration area, and the west end of the Hall of Mirrors. The Deli, Orleans Coffee House, the Cafe Gigi, the Parisian Bar, the Cub Bar, the gift shop, and other areas at the top of the escalator, the Casino-level elevators, and the elevator lobby were severely damaged. A clear distinction between damaged and undamaged areas corresponded with the line between unsprinklered and sprinklered areas.

Above the Casino level, however, there was little evidence of a major fire. Corridors and rooms in the high-rise tower were generally free of smoke or soot deposits. Deposits, if any, were located in the bathrooms. The operation of HVAC equipment during the fire apparently accounted for the lack of visible evidence of smoke particles.

Estimates of property damage range from \$30 million to \$50 million. △

#### ASTM SCHEDULES SYMPOSIUM

The American Society of Testing and Materials (ASTM) will hold a Symposium on Temperature Effects on Concrete in Kansas City, Missouri, on June 22, 1983. Fire exposure will be among the heat sources discussed. For further information, contact: Pamela Whiteaker, ASTM, 1916 Race Street, Philadelphia, PA 19103.