Fire Investigation Summary

Bulk Retail Store Fire

Tempe, Arizona
March 19, 1998

NFPA investigated a fire that occurred in an occupied bulk retail store. This incendiary fire involved Group A plastics and resulted in 67 sprinkler heads activating before it was brought under control by the fire department. There were several significant factors involved in this incident including draft curtains, ceiling vents and sprinkler density.

National Fire Protection Association
Fire Investigations Department

A fire occurred in an occupied bulk retail store in Tempe, Arizona on Thursday, March 19, 1998, at approximately 4:00 p.m. At the time of the fire 110 people were estimated to be in the store. There were no injuries or fatalities as a result of this fire.

The building in which the fire occurred was a sprinklered, bulk retail store that sold general home improvement merchandise. The building was constructed in 1988.

Investigators from the Tempe Fire Department determined that the area of origin was in a rack that contained lawn furniture seat cushions. The cause was determined to be incendiary and was started by someone using a point-and-click type of lighter to ignite the seat cushions.

According to eyewitness testimony, when the fire was first observed it was located approximately chest height on one side of a 12 ft (3.7 m) high double-row rack. There was an additional 3 ft (0.9 m) of storage on the top level that created a total height of 15 ft (4.6 m). The size of the fire at that time was characterized as being as big as a computer monitor. Within a very short time, the fire had extended vertically along both the outside face of the rack and within the flue longitudinal space the full height of the rack.

A series of telephone calls were made to the Phoenix Fire Department Alarm Room, which dispatches for the Tempe Fire Department. One of the first calls was by an off-duty Phoenix fire fighter, who suggested that an immediate first alarm assignment be dispatched because of the severity of the fire. Other calls also reported a serious fire.

The first company to arrive was Phoenix Engine 38, which was located 1.2 miles (1.9 km) away. As soon as they left the station they could see a large column of smoke coming from the area. Upon arrival, they immediately made entry in through the northeast door, advancing a handline. They reported that smoke had filled the building from floor to ceiling and that visibility was zero. The sprinklers had activated by this time, and the fire fighters were inundated with water as they made entry, advancing with an 1-3/4 in. hose line. The officer reported that they had to climb over debris in the aisles to reach the seat of the fires. Not until they came up to the fire was it visible, due to the heavy smoke conditions.

A ladder company was assigned to ventilate the roof. When they reached the area over the fire, they reported that one skylight had burned through and that three automatic roof vents had opened. They proceeded to open approximately 42 more, either by popping them open with an axe or sawing through the fiberglass panels.

Eventually, 66 sprinklers were activated over an area of 5,082 ft^2 (472 m^2). Fire damage from flame impingement was limited to 1,500 ft^2 (139 m^2). The fire destroyed product in the rack of origin for a length of 32 ft (10 m) and for the full height of the rack. It also spread to the other side of the double-row rack, destroying product over a length of 32 ft and for the full height of the rack.

The fire spread across a 10 ft (3 m) aisle and ignited the commodity being stored on the shelves in that rack. This commodity was comprised of barbecue gas grill products wrapped in plastic or cardboard material.

The fire impinged directly on the combustible roof trusses and the combustible roof panels. Two trusses and a number of roof panels had to be replaced following the fire. A third truss had to be repaired.

The building in which the fire occurred was a one-story, reinforced masonry structure measuring 400 ft x 250 ft (122 m x 76 m) and ranged from 24 ft to 29 ft (7.3 m to 8.8 m) high. This resulted in an area of 100,000 ft^2 (9,290 m^2). The roof was supported by lightweight, parallel chord, wood trusses measuring 4 ft (1.2 m) deep. The trusses were comprised of 2 in. x 4 in. wood members joined by metal gusset plates. The roof assembly consisted of 4 ft x 8 ft (1.2 m x 2.4 m) panels constructed of 1/2 in. (13 mm) plywood resting on 2 in. x 6 in. wooden supports.

The building was equipped with three ceiling level, wet sprinkler systems. The systems were designed to provide water at a density of 0.495 gpm/ft^2 over 2,000 ft2 (20.2 (L/min)/m^2 over 185.8 m^2) and were designed to protect a Class IV commodity for a maximum storage height of 20 ft (6 m). The maximum

number of sprinklers that it was designed for was 29 sprinklers operating simultaneously. The upright sprinklers were equipped with 286° F (141° C) fusible elements and with 17/32 in. (13 mm) diameter orifices. The building was divided into three zones, and was supplied with water through an 8 in. (203 mm) municipal connection. The control valves and flow switches were supervised by the building fire alarm system. The only in-rack sprinkler system was located in a section of the paint aisle that was not affected by the fire.

A series of draft curtains were located throughout the building. They were constructed of sheet metal and measured 78 in. (2,000 mm) in depth. One draft curtain was located directly over the aisle where the fire occurred.

There were a total of 93 skylights and 29 automatic, thermal activated roof vents, each measuring 4 ft x 8 ft (1.2 m by 2.4 m). The roof vents were equipped with 165° F (74° C) fusible links.

The rack in the area of origin measured 12 ft high (3.7 m), 32 ft long (9.8 m) and 2.5 ft deep (0.76 m). An additional 3 ft (0.9 m) of storage on the top level of the rack resulted in a total storage height of 15 ft (4.6 m). Immediately adjacent to this rack was another rack measuring 4.5 ft (1.4 m) deep. The two racks were separated by a longitudinal flue space, creating a double-row rack configuration.

The double-row racks were separated by a longitudinal flue space which varied in measurement from approximately 0 to 6 in. (0 mm to 150 mm). The transverse flue spaces measured three in. in width and were spaced approximately 8 ft (2.4 m) apart. Due to the damage in the area of origin, it was not possible to determine if the longitudinal flue spaces were blocked by product or kept open. However, it was observed throughout the store that it was very common to have the longitudinal flue space obstructed by product. There did not appear to be any provisions made to keep this from occurring.

Shelving was a combination of either solid sheets of plywood that measured 4 ft x 8 ft (1.2 m x 2.4 m) by 3/4 in. (19 mm) thick, or 2 in. x 6 in. wooden slats that were installed next to each other, creating a solid shelf without spacing between the individual slats.

The area where the fire occurred contained merchandise such as seat cushions, patio umbrellas, and plastic lawn chairs. Merchandise at the lower levels was either loosely packed or within cartons that had been opened to allow customer access to the product. Merchandise on the upper levels was on pallets that had been shrink-wrapped around four sides. The product on the adjacent rack was comprised of grass trimmers, plastic gasoline cans and other outdoor-related products. Much of the material would be classified as a Group A plastic, both expanded and unexpanded, as defined by NFPA 231C, *Standard for Rack Storage of Materials.*

During the investigation, it was noticed that the foil facing on the roof-level fiberglass insulation (also known as reflective insulation) had become dislodged. In some areas, this foil was either draped over sprinklers or hanging in such a way as to obstruct the flow of water from the sprinkler.

Based on the NFPA's investigation and analysis of this fire, the following significant factors were considered as having contributed to the loss of property in this incident:

- Fire ignition through arson
- Ceiling sprinkler density
- Flue spaces
- Draft curtains
- Fusible links on the ceiling vents
- Obstructed sprinkler spray patterns

This is the third fire that NFPA has investigated in a bulk retail building in three years. The other two, one in Quincy, Massachusetts, and the other in Albany, Georgia, involved pool chemicals, which greatly accelerated the fire. In this case, however, the fire was fueled by conventional fuel loads, and overwhelmed the inadequately designed sprinkler system, destroying 96 linear ft (29 m) of racks and product, and causing six million dollars in damage.

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The National Fire Protection Association's Fire Investigations Department documents some of the most significant fires and incidents throughout the world. The objective of these investigations is to determine what lessons can be learned from these incidents. This information is then made available to the fire safety community to be used in developing future codes and standards. A complete listing of reports is available, either upon request or can be viewed on our web page.

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- **Quincy, MA Bulk Retail Store Fire**
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