

SUPERMARKET FIRE PHOENIX, ARIZONA

MARCH 14, 2001



FIRE INVESTIGATIONS

NATIONAL FIRE PROTECTION ASSOCIATION

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Supermarket Fire

Phoenix, Arizona

March 14, 2001

1 Fire Fighter Fatality

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ABSTRACT

On March 14, 2001, at approximately 4:54 p.m., a debris fire at the rear of a shopping plaza was reported to the Phoenix Fire Department. The fire would spread into the shopping plaza and result in the death of a fire fighter and in injuries to several others.

The fire began in a pile of debris adjacent to a compactor unit in the rear of a supermarket. The supermarket was located in a shopping plaza containing several retail occupancies. The fire spread into the attic and roof spaces of the supermarket, eventually spreading throughout the store. The store was occupied at the time the fire was discovered.

A short time after the Phoenix Fire Alarm Office received notification of the fire by phone, Phoenix Fire Department units in the area reported seeing smoke in the area of 35th Avenue and McDowell Road. Engine 24 was dispatched to the area. Battalion Chief 3 also responded to the scene. [Engine 14, the unit that is normally closest to the reported address, was returning to their quarters from the repair shop with only a driver (Engineer).] The first arriving units reported smoke showing from the rear of the hardware store at that address. Further investigation showed that the burning debris was on a dock to the rear of the supermarket.

As personnel from Engine 24 begin to extinguish the exterior fire, fire fighters from Engine 14, which had since responded with a full crew, began to check for extension in adjacent occupancies. Engine 24's crew forced entry into the rear of the store and found that the fire had spread into the combustible roof and attic space/storage area.

As Engine 14's crew (Captain and three fire fighters) moved into the front of the supermarket, they reported to the incident commander a smoke condition at the ceiling level. Engine 14 then returned to the interior of the store with a hoseline and began to search for the seat of the fire near the southeast portion of the store. Engine 3 and Rescue 3 had also advanced a hoseline into the southeast corner of the store.

Visibility was reported to be worsening as Engine 14 advanced their hoseline. One fire fighter from Engine 14 then reported his low-air alarm was sounding, and he was exiting the building. The Captain of Engine 14 directed the fire fighters to exit the building as a team. At this point, another of Engine 14's crew low-air alarm was sounding. During the crew's exit, two fire fighters and the Captain lost contact with the hoseline. The Captain was able to again gain contact with the hoseline and exit the building. Outside he met with one of Engine 14's fire fighters, who informed him that the other two members of the crew had not exited. It was at this point that the first distress call was heard from one of the lost fire fighters.

The Engine 14 Captain informed other crews of the situation and instructed them to follow the hoseline that Engine 14 had used in order to attempt to find the lost fire

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fighters. The Captain and remaining Engine 14 fire fighter refilled their air cylinders and also re-entered the building.

The Captain and two fire fighters from Engine 21 located one of the lost fire fighters during their search. However, they lost contact with him after attempting to lead him out of the building on the hoseline. The other lost fire fighter was able to exit on his own after following the sound of voices in the southeast storage room of the store.

Several Rapid Intervention Crews (RICs) were sent to search for the remaining missing fire fighter, as conditions within the store worsened. Eventually the missing fire fighter was located, unconscious in the meat preparation portion of the store. Removal of the fire fighter was difficult due to his size and the obstructions located in the storage room and in the path to the exit. His removal required several additional crews. He was eventually removed through the storage room in the southeast corner of the store. He was transported to the hospital where he was pronounced dead.

This fire investigation report reviews the available facts concerning this incident and discusses them in relation to the following significant topics as they are relevant to fighting fires in larger commercial structures:

- Risk Management
- Incident Management
- Personnel Accountability
- Rapid Intervention Crews
- Pre-Fire Planning

CONTENTS

	<u>Page</u>
I. Introduction	4
II. Background	
o Occupancy Classification	6
o Building Details	6
o Fire Department	9
o Weather	9
III. The Fire	
o Operations	10
o Casualties	14
o Damage	14
IV. Time Line	18
V. Analysis	
o Origin and Cause	22
o Fire Growth and Spread	22
o Fire Department Operations	23
VI. Summary	33
VII. NFPA Documents	34
VIII. Appendix	35
Abstracts of NFPA Fire Investigation Reports:	
• Lake Worth, TX, Church Fire	
• Keokuk, IA, Residential Fire	
• Marks, MS, Commercial Building Fire	
• Chesapeake, VA, Commercial Building Fire	

I. INTRODUCTION

NFPA investigated the Phoenix, Arizona supermarket fire in order to document and analyze significant factors that may have contributed to the fire fighter fatality as well as significant factors that may have prevented or minimized further injury, loss of life or property damage.

The study was conducted by NFPA as part of an ongoing program to investigate technically significant incidents. NFPA's Fire Investigations Department documents and analyzes incident details so that it can report lessons learned and thus prevent future life and property loss.

NFPA became aware of the Phoenix fire the day it occurred. NFPA Senior Fire Investigator Robert Duval and Senior Fire Service Specialist Stephen Foley traveled to Phoenix to meet with the investigators, fire officers, and fire fighters of Phoenix, to view the scene, interview participants, and perform an on-site study of the incident. The information gathered during the on-site activities and subsequent analysis of that information is the basis for this report. Entry to the fire scene was made through the cooperation of the Phoenix Fire Department.

This report is another of NFPA's studies of fires having particularly important educational or technical interest. It is a project of NFPA's Fire Investigations staff intended as an aid to researchers, safety specialists, and to the codes and standards development activities conducted by NFPA and other organizations. The opinions expressed and conclusions drawn are those of the NFPA staff who prepared this report and do not, therefore, necessarily represent the official position of NFPA or of the NFPA Technical Committees that develop NFPA codes and standards. (See NFPA Regulations Governing Committee Projects at 6-1.1.)

All information and details regarding the fire safety conditions gathered in this report are based on the best available data and observations made during the on-site data collection phase and on any additional information provided during the report development process. It should be remembered that the ability of NFPA Fire Investigations staff to collect all relevant facts and draw definitive conclusions may be limited by a variety of factors, including available time and access. It is not the authors' intention to comprehensively document this fire incident for all purposes. The purpose of the report is not to pass judgment on or fix liability for the loss of life and property resulting from the fire. Rather, the report's purpose is to identify factors that may have contributed to the loss of life and property and to provide analysis that may serve to better the understanding of how to prevent these losses in the future. The report also identifies factors that functioned well and served to prevent or minimize potential losses.

Current codes and standards were used as criteria for this analysis so that conditions at the scene of the fire could be compared with state-of-the-art fire protection practices. It is recognized, however, that these codes and standards may not have

been in effect during the construction and operation of the buildings. NFPA has not analyzed the building in Phoenix regarding its compliance with the local codes and standards in existence when the buildings were constructed and during their operation.

The cooperation of the Phoenix Fire Department and the Phoenix Fire Department Fire Investigative Unit is greatly appreciated. The writer would also like to extend his appreciation to Chief Alan Brunacini, Captain Todd Harms, Deputy Chief Ronald Dykes and Kevin Roche of the Phoenix Fire Department for their assistance during the on-scene portion of the investigation and in preparing this report.

II. BACKGROUND

Occupancy Classification

The building involved in this incident would be classified as existing mercantile occupancy (Chapter 37, NFPA 101[®], *Life Safety Code*[®], 2000 edition, Chapter 26, NFPA 5000 *Building Construction and Safety Code*, 2002 edition, and Chapter 8–12, NFPA 1, *Fire Prevention Code*, 2000 edition).

Building Details

The supermarket where the fire occurred was part of a shopping plaza that contained several different occupancies, including but not limited to, a hardware store, a clothing store, a barber shop, and a bakery. The plaza was located on the southwest corner of the intersection of 35th Avenue and McDowell Road. The plaza was arranged with store entrances along the north and east sides of the building. The plaza was arranged with two sections. The east side of the plaza contained the supermarket, hardware store, barbershop, and clothing store. The west portion of the plaza contained the bakery and several smaller retail occupancies. (See Figure 1)

The supermarket was the largest of the occupancies in the plaza, measuring approximately 24,360 ft² (2263 m²). The supermarket was arranged in an “L” shape, with the main sales floor of the store measuring 135 ft × 124 ft (41 m × 38 m) and the storage room measuring 72 ft × 40 ft (22 m × 12 m). A partial office and equipment mezzanine was located over the storage room and over the south edge of the sales floor (15 ft × 124 ft and 72 ft × 40 ft) (4.5 m × 38 m and 22 m × 12 m).

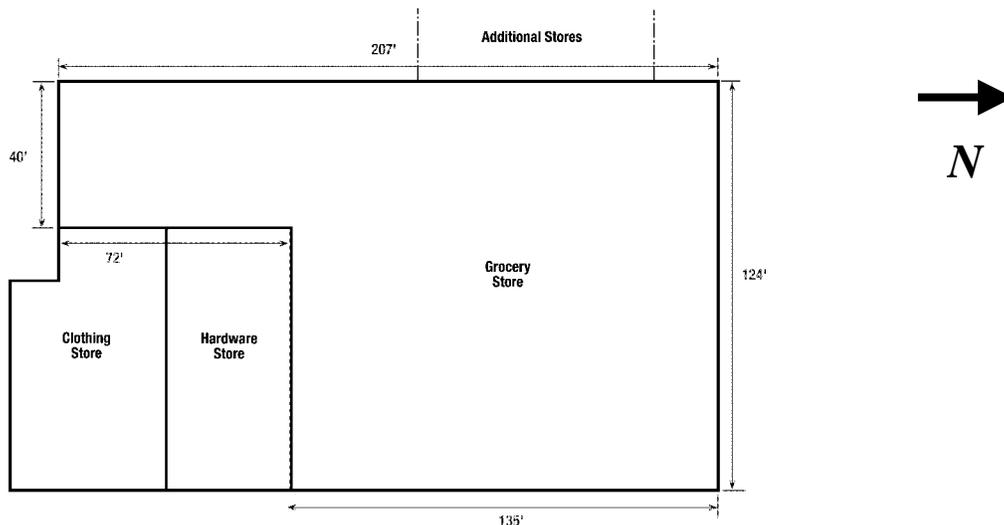


Figure 1- Building Dimensions

The building was constructed in 1956. The walls of the supermarket were unreinforced concrete block. The roof system of the supermarket consisted of approximately ½ in. (1.27 cm) thick wood panels on open web steel trusses on steel beams on steel pipe columns [6 in. (15.24 cm) diameter]. The roof covering consisted of layers of mopped asphalt on the wood panels. There were no columns installed in the southwest storage room (72 ft x 40 ft) (22 m x 12 m). The trusses in this area ran from the east to the west wall (40 ft) (12 m).

The suspended ceiling in the main portion of the store was installed on the bottom cord of the steel truss via a framework of 2 in. x 4 in. (5 cm x 10 cm) members. This ceiling created a 4 ft high attic space over the majority of the supermarket. A concrete wall separated the main sales floor of the supermarket from the southeast storage area. This wall contained an open space approximately 20 ft (6.1 m) wide, beginning on the west wall of the storage room, near the meat preparation area. There were additional openings in this wall measuring 3 ft x 3 ft (0.9 m x 0.9 m) near the ceiling level.

The barbershop (615 ft²) (57 m²) was actually located within the footprint of the supermarket. The hardware and clothing stores completed the east portion of the plaza. These two stores were separated from the southwestern portion of the supermarket by an unreinforced concrete block wall. The roof height was approximately 8 ft to 10 ft (2.4 m to 3 m) lower in these stores than in the supermarket.

The east wall of the supermarket was arranged with 22 ft (6.7 m) high glass in aluminum frame panels. Plywood panels covered the glass panels at the 8 ft (2.4 m) level to the ceiling inside the store. The customer entrance was located on this side of the store through two 3 ft x 6 ft (0.9 m x 1.8 m) doors.

The south wall of the supermarket contained a loading dock area. This area was arranged with a personnel door (3 ft x 6 ft) (0.9 m x 1.8 m) and a roll-up door (12 ft wide x 8 ft high) (3.6 m x 2.4 m). The dock was approximately 2 ft (0.6 m) high and 3 ft (0.9 m) wide and ran the entire length of the southeast wing of the store. Two trash containers and a compactor unit were located adjacent to the dock area. At the time of the fire, this area also contained several bales of corrugated cardboard.

Access to the southwest portion of the supermarket was through an alleyway approximately 20 ft (6.1 m) wide. A pair of utility poles containing a bank of three transformers was located in the center of the alley, approximately parallel with the southeast wall of the clothing store. Electrical power of the shopping plaza was supplied from this point.

The interior of the supermarket was arranged with a main sales floor with storage areas in the southwest wing of the building. The sales floor was arranged with shelves and aisles running east - west in the southern half of the area. Refrigerated produce and meat display coolers were located along the south and west walls of the sales floor. Produce display bins were located adjacent to the south wall of the sales

area. Adjacent to the produce bins were the frozen food coolers and displays. The eastern portion of the sales floor consisted of the checkout counters and other service areas. (See Figure 2.)

The meat freezer and the dairy cooler were located adjacent to the meat preparation room, in the southwest corner of the sales floor, extending into the storage room. The dairy cooler was accessible to customers from the sales floor. The meat freezer was accessible only through the meat preparation room and from the storage area. An access passage was provided from the meat preparation room into the storage in the southeast corner of the room. This passage was equipped with a swinging door to maintain temperatures in the rooms. The access to the meat freezer from the meat preparation room was equipped with heavy plastic curtains.

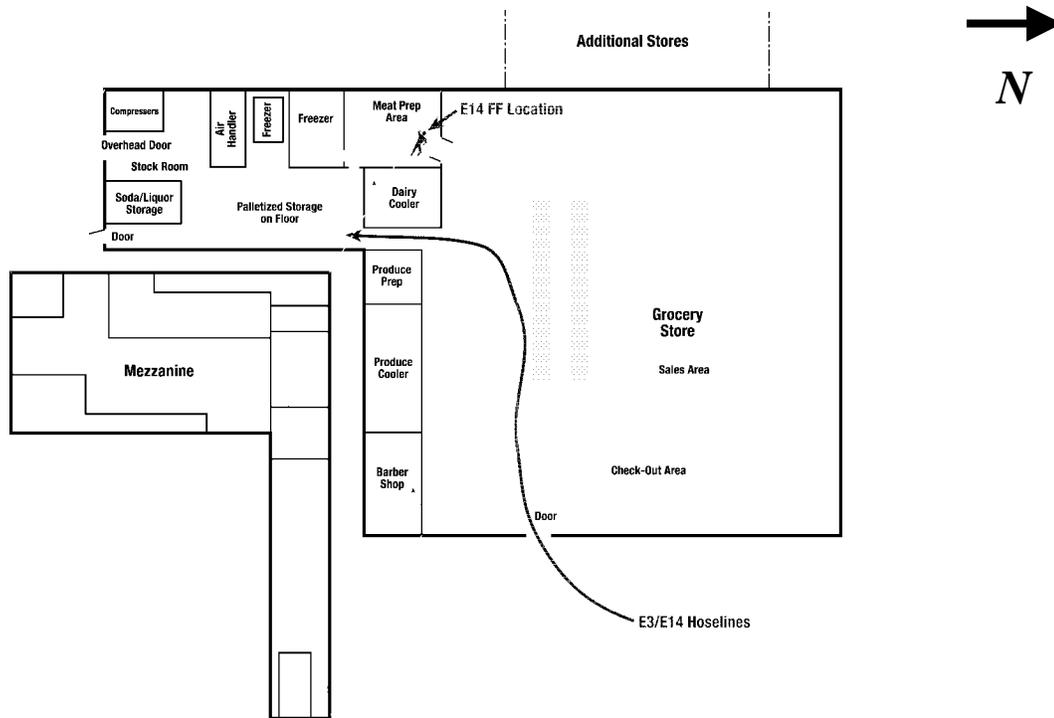


Figure 2 – Store Layout

Employee access to the sales floor from the storage areas was through a corridor located between the dairy cooler and the main produce cooler. This corridor was equipped with the heavy plastic curtains as well. The stairs to access the office mezzanine were located in the corridor, along with an approximately 15 ft × 15 ft (4.6 m × 4.6 m) area used for produce preparation.

The remainder of the storage room contained a cage for liquor and soda storage, located between the personnel and the roll-up doors, palletized storage of merchandise, compressor equipment, and air-handling equipment. The mezzanine level above the storage room was utilized for storage of fixtures and seasonal items.

The remainder of the mezzanine level contained the store office and the employees' lounge.

The shopping plaza did not contain automatic sprinkler protection or a fire detection system.

Fire Department

The Phoenix Fire Department is a career department comprised of 1,309 uniformed and 304 civilian personnel. The department provides services to 1.3 million residents of Phoenix. The response area consists of 478 square miles (1238 km²).

The fire department staffs 53 engine companies; 13 ladder companies; 29 ambulances (ALS/BLS); 7 battalion command units; and 8 hazardous material, command, and support units; with 356 fire fighters on duty each shift.

In 2001 the Phoenix Fire Department responded to a total of 133,458 emergency incidents. Of these incidents, 104,032 were medical emergencies and 16,442 were fire-related emergencies. The remainder of the incidents consisted of hazardous materials, technical rescue, and other requests for assistance.

The Phoenix Fire Department Alarm Room (dispatch center) provides dispatch and communication service for 19 fire agencies in the area surrounding the city.¹

Weather

Observations for National Weather Service at Phoenix Sky Harbor Airport for the time of the fire:

Temperature - 75°, Relative Humidity 28%, and Dew Point 38°

The average wind speed was 6.4 mph. The highest wind speed was west at 17 mph and the highest gust speed was west at 21 mph.

¹ Final Report – Southwest Supermarket Fire, Phoenix Fire Department, March 12, 2002
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III. THE INCIDENT

Operations

On March 14, 2001, a report of a debris fire in the rear of the hardware store and supermarket in the shopping plaza at 35th Avenue and McDowell Road was phoned into the Phoenix Fire Department. Phoenix Engine 24 was dispatched at 4:54 p.m. (The Phoenix Engine Company that is located closest to the address, Engine 14, was out of service for maintenance at the time of the call.) As the initial call was being received, Phoenix Fire Department units in the area began to contact the fire alarm office to ask about a possible fire in the area. Among these units was the Battalion Chief for that district, Battalion Chief 3. He responded to the area as well. Based on the amount of smoke visible, the chief requested additional units dispatched to the scene [Engine 21, Ladder 24, and Rescue (Ambulance) 25].

Meanwhile, while en route back to Station 14, the Engineer of Engine 14 overheard the radio traffic reporting the fire and saw the smoke column. At that point the Engineer notified the station that she would be back momentarily. Once the engine arrived back at the station, the Captain notified the fire alarm office that the company was back in service and would respond to the incident. On board the engine were the Engineer, the Captain and two fire fighters.

Battalion 3 arrived at 5:00 p.m. and reported a working fire with smoke showing from the rear (southwest) of the plaza. Engine 3 and Utility 1 were then assigned to the alarm. Engine 24 arrived and connected to the hydrant adjacent to the alley on the southeast side of the plaza. E24 stopped at the corner of the clothing store. From this vantage, the fire was not visible, only smoke. As the crew advanced the hoseline down the alley, they encountered power lines arcing near the dock area in the rear of the hardware and clothing stores. The E24 crew, along with the two fire fighters from R25, advanced slowly toward the dock areas and saw the fire involving cardboard debris near the compactor unit. As the crew advanced toward the rear of the supermarket, they extinguished the debris fire and began to access the storage room. The crew forced the roll-up door and then opened the personnel door from the inside. E24 reported that it appeared that the fire had spread into the building. Smoke was seen issuing from the attic vents along the south wall of the plaza.

Ladder 24 was assigned to access the roof and attempt ventilation over the southwest portion of the plaza. L24 accessed first the lower roof and then the supermarket roof over the storage room via another ground ladder that they had brought up with them. The ladder company reported seeing smoke and fire from an air-conditioning unit in the center of the storage room roof. A ventilation hole was opened near the air-handling unit. The crew exited the roof, refilled their SCBA cylinders, and returned to the roof.

Engine 14 arrived on the scene at 5:01 p.m., parked the apparatus on 35th Avenue, and was assigned to check for fire extension in the hardware store portion of the plaza. Finding no extension into the hardware store, E14's crew was ordered to enter the east entrance of the supermarket to check for fire extension. The E14 Captain reported that smoke was visible approximately two feet down from the ceiling level and that light fixtures could still be seen illuminated at the ceiling. The E14 crew proceeded to the produce area of the sales floor and could see into the corridor leading to the storage room. At this point, the Captain reported a worsening smoke condition. The E14 crew exited the building to get a hoseline. They obtained a hoseline from Engine 3, which had just arrived on the east side of the supermarket. (See Figure 3.)

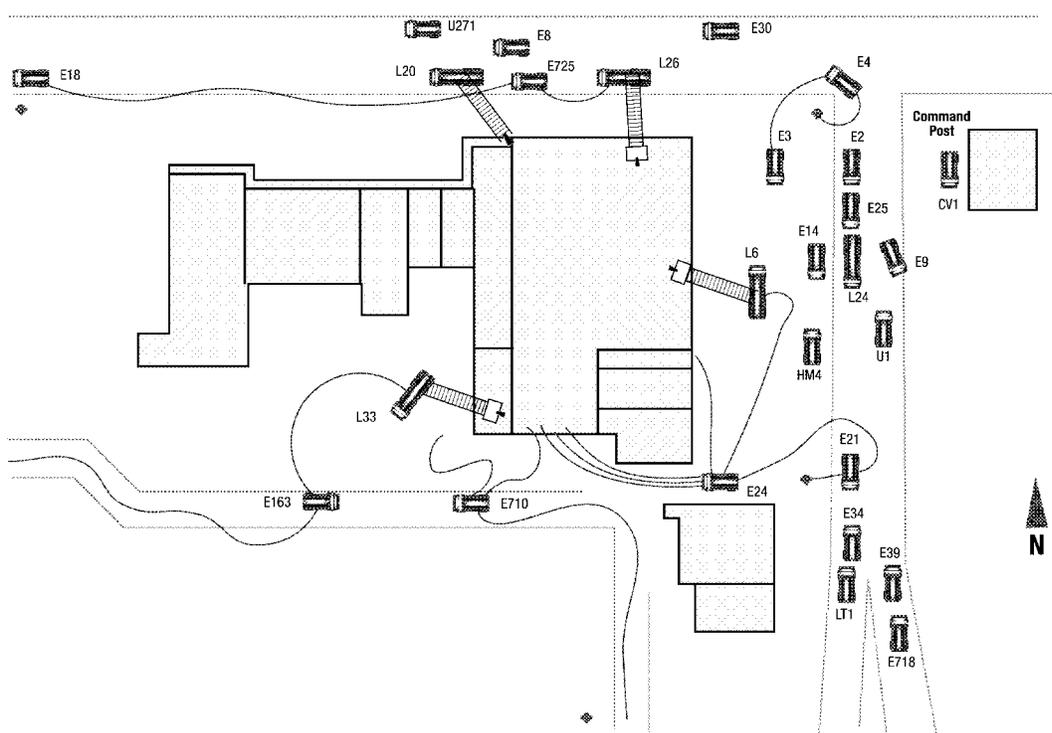


Figure 3 – Initial Fireground Operations

The E14 crew then advanced the hoseline into the building to the corridor leading to the storage room. At first the line did not have sufficient pressure. Kinks were removed from the hoseline, and the pressure improved. (The Captain reported that the line still contained two loops onto itself once it was advanced and the kinks were taken out.) The E14 crew began to apply water to a body of fire in the storage room from the area of the corridor off of the sale floor. The crews from Engine 3 and Rescue 3, which had advanced another line from their apparatus, met the E14 crew there. Crews then reported that the smoke and heat conditions were getting heavier, and E3 reported a working fire in the storage room at 5:11 p.m. Both lines were applying water into the storage room from the area of the corridor. Members of both crews were also pulling ceilings in the northern portion of the stock room and in the

corridor. At this point one of the E14 fire fighters reported that his low-air alarm was sounding and he was exiting the building. As the Captain gathered the E14 crew to exit, the other E14 fire fighter's low-air alarm began to sound.

As the crew began to exit, the Captain tripped, fell backwards, and lost contact with the remainder of the crew. Reportedly both of the fire fighters also lost their balance and lost contact with the hoseline and the other two E14 members. The E14 Captain gained contact with the Captain from E3, and began to exit the building. Outside he discovered that only the Engineer had exited. The two fire fighters were still inside the building. It was at this point (5:26 p.m.) that one of the disoriented fire fighters from E14 gave a "Mayday" call on the radio, reporting that he was low on air and in distress.

According to reports from one of the E14 fire fighters who were lost, the two fire fighters ended up in the meat preparation area, as they searched for an exit. While they were together, they transmitted additional distress calls. The two fire fighters eventually lost contact with one another in the meat preparation area of the store. While in the area of the meat preparation room, one of the fire fighters, now out of air, heard radios and the sound of the fire fighters searching. He followed the sounds and ran into a crew from E34. He reported to them that another fire fighter from E14 was still missing. The E34 crew removed him from the building through the storage room.

At the time of the first distress call (5:26 p.m.), BC3 assigned two RIC teams (Engine 18 and Ladder 9). These crews prepared to enter the now worsening conditions to search for the missing fire fighters.

Upon exiting the store and meeting with the E14 Engineer, the Captain from E14 briefed the Captain from E21 of the situation. The Captain from E21 and two fire fighters entered the building, following the hoseline that E14 had used. Once inside, they reported that the smoke had dropped to the floor level and was very heavy. After a short time searching, the E21 Captain ran into a fire fighter upright in the smoke. When he asked if he was the missing E14 fire fighter, the fire fighter appeared confused. The Captain instructed the fire fighter to get down on the hoseline and follow him and the other fire fighters out of the building. The E14 fire fighter got down with the crew from E21 for a short time before he suddenly stood up again and then walked back into the building. The E21 crew could not relocate him before their air supplies began to run out. They exited the building as their air supplies were exhausted.

The two RIC crews (E18 and L9) searched the sales floor of the store as well. These crews searched and assisted other searching fire fighters from the building as fire conditions began to worsen and eventually involve the entire sales floor area.

The crews from E3 and R3 had continued to battle the fire in the storage room from the area of the corridor leading from the sales floor as E14 exited the building. Members of the E3/R3 crew also began to run low on air and began to exit the

building. As two fire fighters from E3/R3 begin to exit the building, an R3 fire fighter reported hearing one of the missing fire fighters in their vicinity but could not readily locate him. Eventually, the R3 fire fighter located the missing fire fighter in the meat preparation room. At this point the E34 crew had already removed the other missing E14 fire fighter. The R3 fire fighter reported on the radio that he had located the missing E14 fire fighter and that they were in the southwest corner of the store. He reported that they were now both out of air and in distress. The time of this transmission is approximately 5:33 p.m.

While searching for a way out of the building, the R3 fire fighter encountered the heavy plastic curtains similar to those in the corridor from the sales floor to the storage room. At this point, he thought he was back at the corridor and began to search for the hoseline and the tools he left at that location, when he was actually at the entrance to the meat freezer in the back of the meat preparation room.

After approximately three minutes, a crew from Engine 25 located the two fire fighters in the meat preparation area (5:36 p.m.). The fire fighter from R3 managed to tell the E25 crew that he was with the missing E14 fire fighter before passing out. A portion of the crew removed the R3 fire fighter, while the Captain from E25 located the E14 fire fighter by following his then activated PASS device. The E14 fire fighter was unconscious and on the floor under a counter in the meat room. The E25 Captain transmitted that he had found the missing E14 fire fighter and needed assistance. The Captain attempted to move the downed E14 fire fighter but could not. He was then out of air. The Captain reported looking into the sales floor area of the store and seeing that it was fully involved in fire. While back in the meat preparation room, he ran into fire fighters from Engine 6. The E25 Captain informed the E6 fire fighters of the location of the downed E14 fire fighter and was then assisted from the building and transported to the hospital (5:49 p.m.).

The Captain and a fire fighter from E6 then located the downed E14 fire fighter and began to position him for removal from the meat room. These two fire fighters got the E14 fire fighter to a pallet in the storage room before other fire fighters relieved them at 5:52 p.m. Fire fighters from several companies assisted in the final push to remove the downed fire fighter. Safety Officers stationed at the overhead and personnel door in the southwest portion of the store constantly rotated personnel into the stock room to assist in the removal of the fire fighter. The E14 fire fighter was removed from the building, with great difficulty, over debris and other obstacles, through high heat and limited visibility, at 6:19 p.m.

Fire department paramedics immediately began resuscitation efforts once the fire fighter was brought outside. These efforts continued as he was transported to a nearby trauma center. The fire fighter was eventually pronounced dead at this trauma center without regaining consciousness.

The fire was brought under control at approximately 9:30 p.m.

Casualties

A fire fighter was killed while fighting this fire. The official cause of death was thermal burns and smoke inhalation. Several fire fighters were injured during the fire fighting and rescue efforts. Four fire fighters were transported to the hospital suffering from smoke inhalation.

Damage

The supermarket portion of the shopping center was destroyed in this fire. The surrounding occupancies suffered varying degrees of damage from heat, smoke, and water.



Photo No. 1 – Loading Dock of Supermarket near Point of Origin (NFPA)



Photo No. 2 – View of Stock Room from Loading Dock looking North (NFPA)



Photo No. 3 – Photo showing debris in stock room that fire fighters encountered while attempting to fight the fire and locate and remove the downed fire fighter (NFPA)



Photo No. 4 – View of meat preparation area looking south into the meat freezer. The downed fire fighter was located in this room when located by the R3 fire fighter. The R3 fire fighter was located in the meat freezer when located later by the E25 Captain. (NFPA)



Photo No. 5 – Stock Room in southwest corner of supermarket as seen from overhead door Note: Remaining portions of the partial mezzanine are indicated by arrow (NFPA)



Photo No. 6 – Aerial view of loading dock area showing the pole mounted electrical transformers. (NFPA)



Photo No. 7 – Aerial View of Southwest portion of the supermarket showing the wall separating the stock room from the sales floor and the meat preparation room (NFPA)

IV. TIME LINE

Actual Time	Elapsed Time	Activity
4:54 p.m.	0	Debris fire reported in rear of shopping plaza
4:54 p.m.	0	E24 dispatched
4:58 p.m.	4 minutes	BC 3 asks for additional units based on size-up/reports (exposures)
4:58 p.m.	4 minutes	L24, E21, R25, U1 added to the response
5:00 p.m.	6 minutes	E3 added as RIC
5:00 p.m.	6 minutes	E24 on scene—reports an outside debris fire
5:00 p.m.	6 minutes	BC 3 on scene
5:01 p.m.	7 minutes	E24 reports electrical arcing in rear of shopping center – utilities requested
5:02 p.m.	8 minutes	E14 (back in service) responds
5:03 p.m.	9 minutes	L24 on scene requested to check roof/attic for fire extension
5:05 p.m.	11 minutes	L24 reports smoke from roof vents
5:08 p.m.	14 minutes	E34, LT1, E18, L26, E25, E710, E725, BC1 added to assignment – balance of 1 st alarm assignment
5:11 p.m.	17 minutes	Power lines secured

Actual Time	Elapsed Time	Activity
5:11 p.m.	17 minutes	BC 3 reports a working fire inside the rear storage room of the supermarket
5:11 p.m.	17 minutes	E14 reports "All Clear" (occupants) in supermarket E14, E3, R3 advancing hand line to south store room through the store
5:12 p.m.	18 minutes	E24 reports they have gained access to the store room through roll-up door and request another hand line
5:15 p.m.	21 minutes	L24 reports ventilation complete over storeroom – "A lot of heat and smoke from vent hole."
5:18 p.m.	24 minutes	Heavy smoke reported at SW corner of supermarket
5:18 p.m.	24 minutes	Fire is reported coming from original vent hole in SW
5:21 p.m.	27 minutes	L9 added to assignment
5:21 p.m.	27 minutes	E24 reports, "No relief from smoke and heat from ventilation."
5:21 p.m.	27 minutes	Command Van (CV1) on scene
5:24 p.m.	30 minutes	BC3 indicates power in the plaza is secured and operation is still in "offensive mode"
5:25 p.m.	31 minutes	2 nd alarm requested

Actual Time	Elapsed Time	Activity
5:25 p.m.	31 minutes	E30, E1, E2, E6, L11, LT11, L20, LT20, BC5, E151, U17, BC2, BC4, BC6 assigned
5:26 p.m.	32 minutes	Emergency traffic from E14
5:27 p.m.	33 minutes	Confirmed FF lost (E14)
5:28 p.m.	34 minutes	Command assigns E18 and L9 as RIC
5:28 p.m.	34 minutes	E21 enters supermarket following E14's hoseline in an attempt to find lost FF's
5:29 p.m.	35 minutes	E14 FF reports he is down in "back corner" of building and out of air
5:30 p.m.	36 minutes	E34 reports finding one of the two lost FF's
5:33 p.m.	39 minutes	E3 reports finding 2 nd lost FF
5:34 p.m.	40 minutes	3 rd alarm requested
5:34 p.m.	40 minutes	E3 FF reports that he is with one lost E14 FF and is attempting to get out
5:36 p.m.	42 minutes	E25 Captain with lost E14 FF (other E14 FF removed from building by multiple units)
5:38 p.m.	44 minutes	Medical Sector setup (E30/E9)
5:39 p.m.	45 minutes	Command announces that fire will be fought defensively (once FF's evacuate the building)

Actual Time	Elapsed Time	Activity
5:40-42 p.m.	46-48 minutes	E4 with emergency traffic reporting FF down in SW corner of the building (E6 FF now with lost E14 FF)
5:40 p.m. (approximately)	46 minutes	4 th alarm sounded
5:42 p.m.	48 minutes	E3 FF removed from building – treated & transported
5:47 p.m.	53 minutes	E6 with lost E14 FF
5:49 p.m.	55 minutes	E25 Captain out of the building
5:52 p.m.	58 minutes	E6 in process of removing downed E14 FF- requests additional assistance
5:55-6:08 p.m.	61-74 minutes	Removal of E14 FF continues with multiple units assisting PAR taken of all units on scene
6:09 p.m.	75 minutes	Heavy fire reported in SW corner as removal efforts continue
6:10 p.m.	76 minutes	Efforts to remove downed E14 FF continue and have progressed to within 40 ft of doorway in SW corner
6:19 p.m.	85 minutes	Downed E14 FF removed to medical sector
6:23 p.m.	89 minutes	R25 transporting E14 FF to hospital

V. ANALYSIS

Origin and Cause

The Fire Investigations Unit of the Phoenix Fire Department has determined that this fire began in the discarded cardboard and other debris outside the southwest corner of the supermarket. The cause of the fire has not been determined as of this writing.

Fire Growth and Spread

The fire spread from the pile of combustible material outside the loading dock into the combustible roofing eave and roof deck in the southwest corner. The prevailing wind direction at the time the fire began was out of the southwest. This wind direction resulted in the fire being pushed toward the building and eventually into the building through combustible building materials and contents. The fire in the refuse eventually involved some plastic milk crates and other combustible materials on the loading dock that added to the fuel load for the fire.

As the fire began to gain a foothold in the building, it fed on the roof decking and combustible materials at or just below the roof level. Unknown to the fire fighters and officers at the time of the fire, there was a partial mezzanine constructed overhead in a portion of the perimeter of the stock room in the southwest corner of the store. The four ft wide mezzanine was formerly a conveyor for the meat preparation room and was constructed with a solid plywood floor and utilized as a storage area. The existence of this mezzanine structure may have led to difficulty in applying water from hose streams to the overhead fire in the stock room. Ventilation efforts over the stock room also had a limited effect on the lower levels of the stockroom because of this mezzanine and storage on the mezzanine.

The fire continued to spread rapidly in a northerly direction toward the area above the main sales floor of the store.

Fire fighters in the stock room area reported applying hose streams to the fire with little effect, while visibility began to deteriorate rapidly throughout the store. Fire fighters in the main portion of the store reported that upon their initial entry the smoke conditions were light and smoke was visible at the ceiling level and for a few feet below. Within minutes fire fighters reported a rapid loss of visibility with smoke pushing downward to within inches of the floor and a large increase in the level of heat at the floor level. Reports from the roof at this point indicated fire coming from the initial ventilation holes over the stock room area of the store. The smoke conditions outside the store were reportedly increasing rapidly at this point as well, indicating a rapidly spreading fire within the building.

Fire eventually consumed the roof structure and spread throughout the entire supermarket portion of the shopping center. Fire suppression effort prevented the fire from spreading into the surrounding occupancies. However, these stores did suffer heat, smoke, and water damage.

Fire Department Operations

What began as an outside debris fire in the rear of a shopping center escalated to a well-involved supermarket with several other exposures in a matter of minutes. This fire highlights many points about the difference between a fire in a residential structure and a commercial building. The majority of structural fires are fought in smaller residential structures. When fire fighters battle a fire in a much larger commercial building, many of the strategies and tactics involved in the residential fire have to be modified. With the magnitude of the incident growing as it did, several factors came into play during the course of this fire:

- Risk Management (including Size-up as a function of Risk Management)
- Incident Management (including Communications)
- Personnel Accountability
- Rapid Intervention Crews
- Pre-Fire Planning

Risk Management

Risk management plays an important role in managing a fireground operation. The incident commander must weigh the risk to the fire fighters against the objective and the benefits to be achieved, and fire fighters and officers must also manage risk by monitoring the conditions they are operating in.

Risk management on the fireground begins with the receipt of the alarm and continues until the incident is under control. The risks posed by the incident itself or by the actions taken by the responders to the incident must constantly be compared to the benefit to be derived by the actions taken. The information that the incident commander or any other responder uses to make a risk vs. benefit analysis must be complete and up-to-date. Conditions on a fireground change rapidly. What might have appeared to be a safe situation moments ago can turn deadly in seconds, giving the responders little or no time to react.

Being able to recognize signs of impending problems, such as collapse, backdraft, and flashover, comes with training and experience. Recognizing that a dangerous situation exists or is about to get worse can allow a fire fighter or incident

commander the time to react and remove themselves or other responders from danger.

Risk management (on a personal level) includes knowing your location within the building and monitoring your air supply accordingly. Large commercial buildings pose a difficult problem to fire fighters in regard to their self-contained breathing air supply and the time it may take to reach the fire or a point of rescue within the building, operate there, and then exit. Fire fighters and officers must constantly monitor their air supply as it relates to a safe time to exit the building. The point when the low-air alarm sounds on the breathing apparatus is not the time to consider the path and manner of exiting the hazardous environment.

Risk management during emergency operations is addressed in Section 8.2 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program* (2002 edition).

8.2 Risk Management During Emergency Operations.

8.2.1* The incident commander shall integrate risk management into the regular functions of incident command.

A.8.2.1 The incident commander has the ultimate responsibility for the safety of all fire department members operating at an incident and for any and all other persons whose safety is affected by fire department operations. Risk management provides a basis for the following:

- (1) Standard evaluation of the situation
- (2) Strategic decision making
- (3) Tactical planning
- (4) Plan evaluation and revision
- (5) Operational command and control

8.2.2* The concept of risk management shall be utilized on the basis of the following principles:

- (1) Activities that present a significant risk to the safety of members shall be limited to situations where there is a potential to save endangered lives.
- (2) Activities that are routinely employed to protect property shall be recognized as inherent risks to the safety of members, and actions shall be taken to reduce or avoid these risks.
- (3) No risk to the safety of members shall be acceptable when there is no possibility to save lives or property.

A.8.2.2 The risk to fire department members is the most important factor considered by the incident commander in determining the strategy that will be employed in each situation. The management of risk levels involves all of the following factors:

- (1) Routine evaluation of risk in all situations
- (2) Well-defined strategic options

- (3) Standard operating procedures
- (4) Effective training
- (5) Full protective clothing ensemble and equipment
- (6) Effective incident management and communications
- (7) Safety procedures and safety officers
- (8) Back-up crews for rapid intervention
- (9) Adequate resources
- (10) Rest and rehabilitation
- (11) Regular evaluation of changing conditions
- (12) Experience based on previous incidents and critiques

When considering risk management, fire departments should consider the following Rules of Engagement:

- (1) What is the survival profile of any victims in the involved compartment?
- (2) We WILL NOT risk our lives at all for a building or lives that are already lost.
- (3) We may only risk our lives a LITTLE, in a calculated manner, to save SAVABLE property.
- (4) We may risk our lives a lot, in a calculated manner, to save SAVABLE LIVES.

8.2.3* The incident commander shall evaluate the risk to members with respect to the purpose and potential results of their actions in each situation.

A.8.2.3 The acceptable level of risk is directly related to the potential to save lives or property. Where there is no potential to save lives, the risk to fire department members should be evaluated in proportion to the ability to save property of value. When there is no ability to save lives or property, there is no justification to expose fire department members to any avoidable risk, and defensive fire suppression operations are the appropriate strategy.

8.2.3.1 In situations where the risk to fire department members is excessive, as defined by 8.2.2, activities shall be limited to defensive operations.

8.2.4 Risk management principles shall be routinely employed by supervisory personnel at all levels of the incident management system to define the limits of acceptable and unacceptable positions and functions for all members at the incident scene.

8.2.5* At significant incidents and special operations incidents, the incident commander shall assign an incident safety officer that has the expertise to evaluate hazards and provide direction with respect to the overall safety of personnel.

A.8.2.5 An incident safety officer should be established at all major incidents and at any high-risk incidents. The incident safety officer should be assigned

to operate under the incident commander. Depending on the specific situation, this assignment could require one or more members. If the fire department's safety officer is not available or doesn't have the expertise necessary for the incident, the incident commander should assign one or more members that have the expertise to assume this responsibility. All members should be familiar with the basic duties and responsibilities of an incident safety officer.

Size-up

A tool to assist the incident commander as well as every fire fighter is a proper size-up. As a part of a risk management plan, the incident size-up also begins with the alarm and continues until units are released. Size-up is used to analyze risk and to gather information during the risk vs. benefit analysis. During a structural fire the overall situation is sized up as well as the structure or structures involved in the incident.

A thorough size-up of a building can reveal hidden dangers, such as concealed spaces, lightweight or deteriorated construction, or suddenly changing conditions that can trap fire fighters. In this incident, a fire beginning outside the building quickly began to involve the combustible roof system, spreading out of sight of the initial responding units. Also, the configuration of the building was not clear to the initial units. Although the building was thought to be mostly square in shape, it actually was shaped like the letter "L." The stock room where the fire spread first made up one leg of the "L."

The danger posed by not knowing the extent to which a fire is burning within a building in which fire fighters will be operating has been demonstrated numerous times in the past, often with tragic circumstances. In this case, a partial mezzanine in the stock room prevented fire fighters from seeing the extent of the fire spread over their heads in that area. Information from other sources (such as units operating on the roof and elsewhere within the building) eventually led incident commanders to believe that the fire was spreading rapidly northward and beyond the stock room area, causing the order to "go defensive" and to battle the fire from defensive position outside the building.

Size-up/risk management continues throughout the incident. Commanders right down to company officers and fire fighters must continue to size up the situation at their level and act upon what they see, hear, and otherwise experience.

Incident Management System

A key component of a comprehensive risk management plan on the fireground is the implementation of an incident management system (IMS). The Phoenix Fire Department has long been a leader in the establishment of IMS and in the everyday use of the system. With a well-established system of incident management in place,

the incident commander can receive information on conditions and activity in each area of the building and can then make decisions based on that information. With an IMS in place, the transfer of command can be made efficiently upon arrival and briefing of incoming officers. In the case of this incident, the initial incident commander E24 officer transferred command to the fire Battalion Chief (BC3) upon his arrival. As events escalated, the IC (incident commander) requested additional resources and filled in the various components of the IMS with arriving officers. Once the command post vehicle arrived (CV1), the command post was moved from the chief's vehicle to the enclosed space of the command post vehicle.

Safety officers were deployed throughout the incident scene and especially in the Southwest Sector (stock room area), where efforts to remove the trapped E14 fire fighter were centered. These Safety Officers monitored the companies entering the building, as well as the progress of the fire fighter's removal (rescue).

Communication is a major component in the IMS. This communication can be face-to-face or via radio or other means. There was a great deal of radio communications between the IC and units operating on the fireground. As in all major operations, some transmissions were covered by other radio traffic at certain times during the incident. The radios were used to transmit "Emergency Traffic" announcing a potential emergency or an urgent situation that had or was about to occur. A total of 12 "Mayday" fire fighter distress signals were broadcast via the radio as well.

NFPA 1561, *Standard on Emergency Services Incident Management System* (2002 edition), establishes minimum requirements for the development and implementation of an incident management system. Incident management systems, as designed, grow with the complexity of the incident. For smaller incidents, during which a limited number of units are operating, the incident commander can directly oversee each unit without difficulty. However, as the incident becomes more complex, the incident commander must delegate control of tasks or portions of the scene to other commanders so that the "span of control" is not exceeded. The span of control is the number of units reporting directly to a command officer. (A span of control of between three and seven is considered desirable.)

Some of the key points that the establishment of an incident management system assists in controlling include the aforementioned size-up of the incident and communications, as well as accountability of personnel operating on the fireground.

Accountability

A key component of an established incident management system (IMS) is an accountability system. Such a system provides a means to track and account for all personnel operating at the incident by function and location. In Phoenix such a system is called a Personnel Accountability Report or PAR. An accountability system allows for a rapid "head count" in the event of an emergency (e.g., collapse or explosion), or at a predetermined interval during the incident. Division, group, or

sector commands should track the personnel assigned in an area and the functions they are performing. Company or crew integrity is vital to maintaining accountability throughout an incident, large or small. Too many times fire fighters lose contact with those they are working with, and many times the result is tragic. All personnel operating at the emergency incident are responsible for their participation in the accountability system. The incident commander is responsible for the overall personnel accountability at each incident.

There are several accountability systems in use in the fire service today. The type of system instituted by an individual department should fit the operational procedures of the department. A system that functions well in a large urban department will not necessarily work for a small rural volunteer department. Some accountability systems include the use of tactical worksheets, riding lists, identification tags, or bar-code systems.

The Phoenix Fire Department uses an accountability system where each company officer tracks the personnel in his/her company. At an incident where multiple companies are operating, a Field Incident Technician or FIT (Chief's Aide) tracks the personnel on scene, by sector or other designation. In this incident, PAR reports were requested throughout the incident, and overall accountability was well tracked. However, individual company accountability was impaired in some cases by conditions that developed inside the structure. The initial impairment occurred when two fire fighters from E14 began to exit the building and became disoriented. The remaining two members of E14 exited the building believing that the other two fire fighters were ahead of them and were exiting as well. Once the Captain and Engineer from E14 exited the building, they realized that the two remaining members were missing. This accountability impairment resulted in the deployment of numerous Rapid Intervention Crews (RICs) to locate and remove the missing fire fighters.

During the numerous efforts to locate and remove the two E14 fire fighters, PARs were requested and taken by company officers, sector officers, and safety officers. When a company could not complete a PAR, the missing member or members were located rapidly. (Most were attempting to either locate or remove the second E14 fire fighter, and had broken away from their companies and were with the downed fire fighter.)

The establishment and use of accountability systems is addressed in Section 8.3 of NFPA 1500, *Standard on Fire Department Occupational Health and Safety* (2002 edition) and Section 4.7 and 4.8 of NFPA 1561, *Standard on Emergency Services Incident Management System* (2002 edition).

8.2 Personnel Accountability During Emergency Operations.

8.3.1* The fire department shall establish written standard operating procedures for a personnel accountability system that is in accordance with NFPA 1561, *Standard on Emergency Services Incident Management System*.

A.8.3.1 A standard system to account for the identity and assignment of each member could be relatively simple when all members arrive as assigned crews on fire apparatus. The identity of each crew member should at least be recorded in a standard manner on the vehicle, and each company officer is responsible for those members. In fire departments where members arrive in their own vehicles or assemble at the scene, a system is required to record the identity of each member arriving and to organize them into companies or groups with appropriate supervision. This requires a standard system of “reporting in” at the incident and becoming part of the organized system of operations.

8.3.2 The fire department shall consider local conditions and characteristics in establishing the requirements of the personnel accountability system.

8.3.3 It shall be the responsibility of all members operating at an emergency incident to actively participate in the personnel accountability system.

8.3.4 The incident commander shall maintain an awareness of the location and function of all companies or crews at the scene of the incident.

8.3.5 Officers assigned the responsibility for a specific tactical level management component at an incident shall directly supervise and account for the companies and/or crews operating in their specific area of responsibility.

8.3.6 Company officers shall maintain an ongoing awareness of the location and condition of all company members.

8.3.7 Where assigned as a company, members shall be responsible to remain under the supervision of their assigned company officer.

8.3.8 Members shall be responsible for following personnel accountability system procedures.

8.3.9 The personnel accountability system shall be used at all incidents.

8.3.10* The fire department shall develop the system components required to make the personnel accountability system effective.

A.8.3.10 There are many means of meeting these requirements. Some components can include tactical worksheets, command boards, apparatus riding lists, company personnel boards, electronic bar-coding systems, and so forth. These components can be used in conjunction with one another to facilitate the tracking of personnel by both location and function. The components of the personnel accountability system should be modular and expand with the size and complexity of the incident.

8.3.11* The standard operating procedures shall provide the use of additional accountability officers based on the size, complexity, or needs of the incident.

A.8.3.11 These accountability supervisors should work with the incident commander and tactical-level management component supervisor to assist in the ongoing tracking and accountability of members.

8.3.12 The incident commander and members who are assigned a supervisory responsibility for a tactical level management component that involves multiple companies or crews under their command shall have assigned a member(s) to facilitate the ongoing tracking and accountability of assigned companies and crews.

An established accountability system includes a method to track all of the fire fighters operating at an incident and their location and function. In the event of a collapse, explosion or other significant event the fire fighters can be rapidly located, and rescued if necessary.

Rapid Intervention for Rescue

The concept of rapid intervention for fire fighters in distress is a fairly new concept in its current form. In the past, there may not have been a formally established team of fire fighters assigned to stand by and await a potential rescue situation involving a trapped fire fighter or fire fighters. If a fire fighter became trapped or was missing, the incident commander usually assigned a company or companies or put together a team from personnel on the scene to complete the rescue. NFPA 1500 introduced a section on Rapid Intervention for Rescue of Members in the 1992 edition. The formation and implementation of Rapid Intervention Crews (RIC) is becoming a common practice in the fire service. The function is referred to alternatively as Rapid Intervention Teams (RIT) or Fire Fighter Assistance Safety (or Search) Teams (FAST), but the goal is the same: the location and rescue of trapped or incapacitated fire fighters.

As soon as fire fighters are committed to a hazardous situation (e.g., interior fire fighting), an RIC should be established. Initially, this crew can consist of two fire fighters (a standby team referred to above), but the crew should be expanded according to the complexity and the size of the incident. One or more crews can be deployed based on the incident commander's evaluation of the situation. The larger or more complex the building, the more additional RIC teams the incident commander should consider deploying.

The necessary equipment should be staged for use by the RIC. Such equipment includes forcible entry tools, lights, extra SCBA, hand tools, ropes and associated hardware, medical equipment, and extra protective equipment. Specialized equipment may be needed, depending on the situation encountered.

The RIC should be utilized only for rapid intervention duties and not for other routine fireground tasks. If the RIC is deployed for tasks other than fire fighter rescue, another RIC should be formed to take the place of the initial group.

One of the most important duties of a RIC is to monitor fireground conditions and hazards. In addition to their function as a rescue team, they can assist in making the fireground safer for companies operating at the incident. This can include placing additional ladders to provide alternate means of escape from upper floors for units operating inside a structure.

The establishment of Rapid Intervention Crews is addressed in Section 6.5 of NFPA 1500. The use of RICs during the incident is covered in NPFA 1521, *Standard for Fire Department Safety Officer* (2002 edition), and NFPA 1561.

Phoenix Fire Department dispatches additional companies as part of an alarm assignment to serve as RICs. In this incident, as soon as it was discovered that the fire involved a commercial structure and the alarm assignment was “filled out” with additional units, companies were added as RIC companies. During the course of the search for and recovery of the downed fire fighter, many companies were assigned RIC duties on a rotating basis by command and by Safety Sector Officers.

Pre-Planning

A pre-fire plan is another tool available to the fire fighter, company officer, and incident commander that allows them to “see the building” in a way that they cannot during a fire or other emergency. Having information on building construction and layout, fire protection features, hazards, and other details allows strategy and tactics to be formulated to allow for an increased chance for a successful outcome. The alternative is to guess as to these features with the information available. Often these assumptions are incorrect, based on incomplete or false information. If a plan is not available, additional time is required to gather the information available in a well-designed pre-fire plan.

NFPA 1620, *Recommended Practice for Pre-Incident Planning* (1998 edition) addresses pre-planning facilities and associated emergencies.

1-1 Scope.

1-1.1

This document is a recommended practice for evaluating the protection, construction, and operational features of specific occupancies to develop a pre-incident plan for responding to fires and other emergencies. The pre-incident plan should be used by responding personnel to manage fires and other emergencies in these facilities using the available resources.

The primary purpose of a pre-incident plan is to help responding personnel effectively manage emergencies with available resources. A pre-incident plan should not be confused with fire inspections, which monitor code compliance. Pre-incident planning involves evaluating the protection systems, building construction, contents, and operating procedures that can impact emergency operations.

1-1.2

Unlike fire prevention or fire safety inspections, pre-incident planning assumes that an incident will occur.

1-2 General.

1-2.1

A pre-incident plan is one of the most valuable tools available for aiding responding personnel in effectively controlling an emergency. Although there are many types of incidents that require emergency response, fires generally represent the most frequent challenge to emergency responders. Many of the recommendations in this document that relate to fires and fire protection features can be equally applicable to other types of incidents.

1-2.2

Pre-incident planning is a total concept based upon the following: awareness of the problem, management commitment, education, prevention, protection, and emergency organization. A thorough pre-incident plan involves information gathering, analysis, and dissemination; applying the “what-if-approach”; and planning reviewing, training, and evaluating. Pre-plans within a jurisdiction should be similar in style, procedures, and content to maximize effectiveness and to reduce the time required to familiarize responding forces with the plan.

A pre-fire plan was not available for the shopping plaza involved in this incident. E14 personnel were familiar with the plaza; however a formal pre-fire plan was not created.

VI. SUMMARY

What began as a fire outside a supermarket in a pile of debris ended tragically with the death of a fire fighter. This incident highlights many points about the difference between a fire in a residential structure and a commercial building. The majority of fires are fought in smaller residential structures. When fire fighters battle a fire in a much larger commercial building, many of the strategies and tactics involved in the residential fire have to be modified. These include Risk Management, Incident Management, Accountability, and Rapid Intervention and Pre-Fire Planning.

While the overall goals are the same (save lives and protect property), the manner in which the goals are achieved must be altered to fit the size of the incident. Incident commanders must look at the bigger picture; with life safety accounted for, can we save this building, or will the fire be fought defensively? Fire fighters must get out of the small fire mind-set and keep in mind that they can proceed much farther from a means of egress in a commercial building than in a single-family home.

A residential fire fought with a small number of companies requires a different size incident management system than does a large commercial fire. As a result, not only must the IMS expand with personnel and officers to fill the necessary command positions, but the accountability system must expand as well to be able to track the larger number of fire fighters being utilized. However, accountability at the company level remains the same no matter what size the incident.

Rapid Intervention Crews, while deployed at every fire, may have a much more daunting task when a fire fighter or fire fighters become lost or trapped in a commercial building. Crews should be trained for the extra hazards posed by the larger buildings. Additional crews should be deployed BEFORE a fire fighter(s) needs assistance.

A pre-fire plan provides a key tool to the company officer or incident commander. Having a plan to reference limits the guesswork and assumptions that need to be made on subjects such as building construction and layout, hazards, occupant load, fire protection feature, and the contents of the building.

The Phoenix Fire Department report on this incident addresses these topics and more as they strive to learn from this tragic incident and use the lessons learned to make their personnel safer.

VII. NFPA DOCUMENTS

NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, 2002 edition.

NFPA 1521, Standard for Fire Department Safety Officer, 2002 edition.

NFPA 1561, Standard on Emergency Services Incident Management System, 2002 edition.

NFPA 1620, Recommended Practice for Pre-Incident Planning, 1998 edition.

VIII. APPENDIX

Abstracts of NFPA Fire Investigation Reports:

Fire Investigation Summary Church Fire Lake Worth, Texas February 15, 1999

A fire in a single-story church building resulted in the deaths of three fire fighters after a collapse of the truss roof system.



The fire began in an adjacent storage shed and spread rapidly, driven by the wind, into the attic space of the church. The fire continued to spread rapidly through the concealed attic space.

While fire fighters simultaneously battled the fire from within the church and ventilated the attic space from above, the roof system collapsed. The sudden collapse trapped five fire fighters inside the building. The four fire fighters on the roof narrowly escaped.

Rescue attempts successfully removed two fire fighters from the building before conditions precluded any further attempts.

On February 15, 1999 at approximately 10:42 a.m., a fire occurred in a church in Lake Worth, Texas. The fire resulted in the deaths of three fire fighters when the wood truss roof collapsed only minutes after the arrival of the fire department.

The fire began in a storage shed adjacent to the northeast corner of the church building. A strong wind directed the flames on the east side of the church, eventually spreading the fire into the attic space of the church. As the pastor was cleaning up the church from the previous evening services, a teenage male came to the door of the church to report the fire to the pastor. The pastor went outside to investigate and there he saw the shed ablaze, and the flames impinging on the northeast corner of the church.

Just before the male reported the fire to the pastor, a police officer from the neighboring jurisdiction of Samson Park spotted the fire and reported it to his dispatcher. (The town line is immediately adjacent to the church's property.) The dispatcher notified the Samson Park Fire Department, thinking the fire was in that jurisdiction. At the same time, a water department employee from Lake Worth spotted the fire and reported it via radio to his supervisor, whom in turn reported it to

the Lake Worth Fire Department. With the dual notifications and with automatic aid a total of six fire departments responded to the reported fire.

The pastor reported hearing sirens as he returned to the building to report the fire.

The first arriving engine from Lake Worth (E210) was positioned in front of the church (Side A) on Roberts Cut-Off Road. The next arriving unit was an engine from Samson Park (E225) and was positioned on the Cowden Street (Side B), adjacent to the church (north). Two 1 ¾-in. (44-mm) handlines were deployed from both the Samson Park and Lake Worth engines. Both the lines from the Lake Worth engine were advanced into the church, while one line from Samson Park was also deployed into the church.

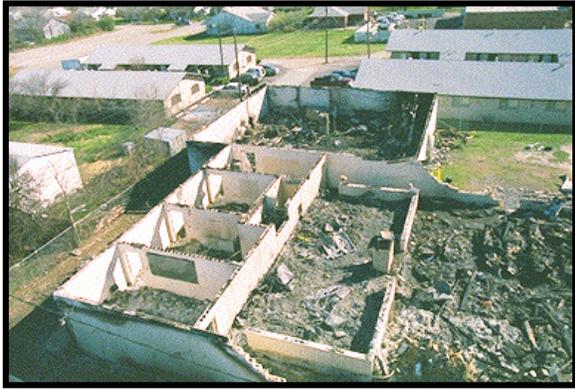
An aerial tower from the Saginaw Fire Department (T14) arrived and was set up on the northwest corner of the building to provide access to the roof for ventilation. River Oaks Fire Department E13 responded and supplied E210 with water from a near-by hydrant. The crew from E13 then responded to the building to assist in battling the fire.

Crews from Lake Worth and Samson Park had advanced into the east portion of the church from the front of the church, using the center aisle toward the rear of the altar area into the sanctuary in the southern corner. They had located a fire in the attic space and were attempting to extinguish it. Two fire fighters from River Oaks entered the building and joined the crew in the sanctuary. At this time, there were five fire fighters in this area: two from River Oaks, one from Samson Park, one from Lake Worth, and one from the Eagle Mountain Fire Department

Four fire fighters accessed the roof to begin ventilation operations. One fire fighter removed the covers from the roof monitor ventilation units and reported light smoke venting from the units at first. This smoke got heavier as minutes went by. Before rooftop ventilation could be completed, the roof structure collapsed, sending one fire fighter into the main hall of the church, and leaving another fire fighter hanging by his fingers at the edge of the collapsed portion of the roof. The remaining two fire fighters were on the only portion of the roof not to collapse. One fire fighter went to assist the fire fighter hanging by his fingers, and the three quickly exited the roof toward the tower ladder. The fire fighter who had fallen into the building was able to find the front door and exit with minor injuries.

The collapse trapped the five fire fighters in the interior of the building in the southeast corner of the church near the wall shared with the Fellowship Hall. An initial accountability check revealed that two fire fighters were trapped in the building. A rescue attempt was attempted through the Fellowship Hall, and as a fire fighter entered the hall he found a door near where the trapped fire fighters were believed to be located. He was able to remove two of the five fire fighters inside the building, but was unaware that there were additional fire fighters trapped inside.

Conditions deteriorated rapidly immediately following this rescue. A second more accurate accountability check was made, and it was realized that three fire fighters were still missing, two from River Oaks and one from Samson Park.



As the fire was being extinguished, the three fire fighters were found. Two were in a short corridor adjacent to the altar and the third was found in one of the offices on the east side.

State and local fire marshals have determined that the fire was incendiary in nature. No arrests have been made in this incident at the time of this report.

Based on the fire investigation and analysis, the NFPA has determined that the following significant factors may have contributed to the deaths of the three fire fighters:

- Lack of a proper building/incident size-up (risk vs. benefit analysis)
- Lack of compatible accountability systems among mutual aid department
- Absence of an established rapid intervention crew (RIC)
- Lack of use of Personal Alert Safety Systems (PASS)
- Lack of subdivision in combustible attic space

Fire Investigation Summary Residential Fire Keokuk, Iowa December 22, 1999



At approximately 8:24 a.m. on Wednesday, December 22, 1999, a fire was reported in a multi-family dwelling in Keokuk, Iowa. Several neighbors phoned the Keokuk 911 center to report smoke coming from a residence, and that a woman was outside screaming that there were children trapped inside.

At the time the fire was reported, the on-duty force from the Keokuk Fire Department (an assistant chief, a lieutenant, and three fire fighters) was completing operations at a motor vehicle accident at a major intersection, two miles northwest of the fire scene. The dispatcher notified the units of the fire and the report of people trapped. Both units at the accident (Rescue 3 and Aerial 2) responded from the scene of the motor vehicle accident. During the response, additional calls were made to the 911 Center reporting heavy smoke coming from the house.

One member of the on-duty force of five fire fighters was committed in assisting the EMS crew on the ambulance and was en route to the Keokuk hospital at the time of the report of the house fire.

The chief of the department became aware of the incident as he entered his office at the fire station. The chief responded from the fire station and went to the hospital to pick up the fire fighter that was with the ambulance crew.

Upon arrival at 8:28 a.m., the units found heavy smoke showing from a two-story multi-family dwelling on the northeast corner of a four-way intersection. A water supply was established from a hydrant one-block southwest of the scene. Rescue 3 (R3), a 1500-gpm engine, laid a 5 in. diameter supply line from the hydrant while the lieutenant stayed at the hydrant to connect the line and activate the hydrant. Aerial 2 (A2), with a 50-ft ladder and a 2000-gpm pump, continued to the scene.

The assistant chief requested six fire fighters be called back to duty as he arrived at the house in Aerial 2. As the two truck operators set up the apparatus, the assistant chief reportedly spoke to the female resident of the burning apartment. She reported that three of her children were still inside the apartment and that she tried but could not get them out. (She was able to exit the house via a second-floor window with her 4-year-old son, with the assistance of neighbors.) The assistant chief completed donning his protective clothing, including SCBA, and entered the right side apartment door.

The chief arrived not long after the assistant chief entered the building. The chief ordered the two apparatus operators into the building to assist the assistant chief with the search for the children. Shortly thereafter, a fire fighter passed a 22-month-old male out the front door of the apartment to a police officer, who began CPR. The officer with the infant was then taken to a police car and transported to the hospital, six blocks west of the scene. A second child, an unresponsive 22-month-old female, was then passed out the door to the fire chief. With no EMS units yet on the scene, the chief chose to take the infant to the hospital in another police car, with a police captain driving. The fire chief conducted CPR on the infant during the one-minute ride to the hospital emergency room. He quickly handed the infant over to the emergency room staff and returned to the fire scene.

In the meantime, the fire fighter that arrived with the fire chief stretched a 1 ½-in. hoseline to the front door of the fire apartment and returned to don her SCBA. When the hoseline was charged, she noticed that the hoseline had burned through while at the entrance to the apartment. The fire fighter reported that the first level of the apartment was engulfed in flames, visible from her vantage point at Aerial 2.

The location and condition of the fire fighters and the remaining child in the burning apartment was not known. The burned length of hose was removed, and the nozzle reconnected to the line as it was charged again. The fire fighter played a hose stream into the burning apartment. She was only able to advance 6-8 ft into the apartment before being driven back by the intense heat.

The first two of the “call-back” fire fighters arrived in Engine 6 (E6 - reserve unit). They were teamed with the lieutenant that was at the hydrant and had now walked



the one block to the scene. The three were ordered to search the adjoining apartment for a resident that supposedly was still inside. The search was completed with nothing found. (The occupant was at a local restaurant.)

Efforts continued to contact the three fire fighters that were in the fire apartment.

As additional call-back, fire

fighters arrived in Aerial 1 ([A1] 100 ft aerial unit with a 1500 gpm pump); they were ordered to begin to search for the missing fire fighters in the original fire apartment. As the fire was knocked back and a search could begin, fire fighters quickly found one fire fighter in the first floor room to the right of the main entrance corridor. He had perished.

The assistant chief's body was then found at the top of the stairs, not far from the body of the remaining child, a seven-year-old girl. The third fire fighter was found in the master bedroom to the right of the top of the stairs. All had perished.

The remaining fire was extinguished at approximately 1:30 p.m. Overhaul was conducted until 3:30 p.m. and at that point units were placed back in service.

On the basis of the fire investigation and analysis, the NFPA has determined that the following significant factors may have contributed to the deaths of the three fire fighters:

- Lack of a proper building/incident size-up (Risk vs. Benefit Analysis)
- Lack of an established Incident Management System
- Lack of an Accountability System
- Insufficient resources (such as personnel and equipment) to mount interior fire suppression and rescue activities
- Absence of an established Rapid Intervention Crew (RIC) and a lack of a standard operating procedure requiring a RIC

On the basis of the fire investigation and analysis, the NFPA has determined that the following significant factor may have contributed to the deaths of the three children:

- Lack of functioning smoke detectors within the apartment to provide early warning of a fire

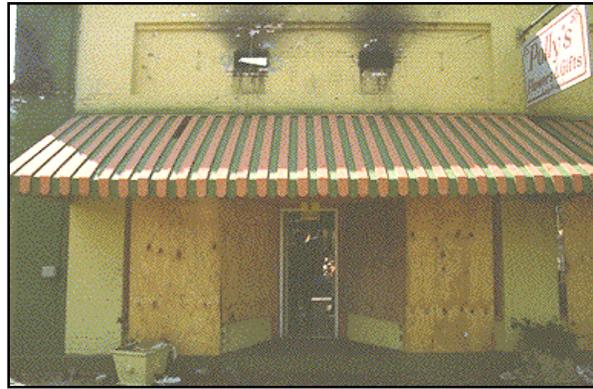
Fire Investigation Summary

Commercial Building Fire

Two Fire Fighter Fatalities

Marks, MS

August 29, 1998



At approximately 12:58 a.m. on Saturday, August 29, 1998, a fire was reported at the rear of the florist shop on Main Street in Marks, Mississippi. The fire reportedly began in a pile of cardboard and other combustible materials outside the rear of the florist shop. The fire then spread through the open eaves of a storage building behind the florist shop. The 20-ft \times 30-ft. (6.1-m \times 9.1-m) storage building was used to store floral packing and display materials and also contained a 6-ft \times 6-ft. (1.8-m \times 1.8-m) cooler unit. The building was connected to the main florist shop through a steel frame door. The florist shop was located in the middle of a block of buildings that contained a restaurant, a liquor store, dry cleaners, and a lounge. The block of buildings was approximately 140ft- (42.6 m) in length and 60 ft (18.3 m) deep.

Upon arrival of the first fire units, at 1:05 a.m. smoke and flame were showing from the eave line of the storage building. The fire department gained access to the storage building and began to extinguish the fire within the building. An additional hoseline was deployed to protect a youth club building located 15 ft (4.6 m) south of the fire building. The Marks fire chief requested mutual aid from the Lambert Fire Department at 1:09 a.m.

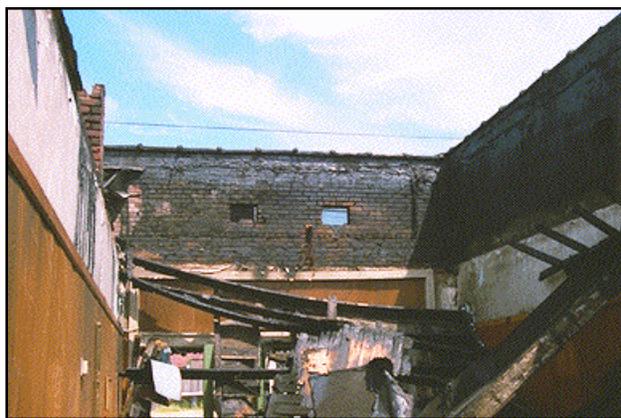
With the fire in the storage building extinguished, salvage and overhaul was begun in the storage building and the adjoining florist shop. When the Marks fire chief entered the florist shop with the owner at about 1:25 a.m., he reported light smoke in the building. Further investigation revealed smoke showing from the attic space of the florist shop. The chief then returned to the rear of the shop and ordered two Marks fire fighters to access the roof and check on conditions to determine if ventilation would be necessary.

The two Marks fire fighters placed a ground ladder at the rear of the liquor store and began to climb to the roof. One fire fighter was equipped with breathing apparatus and the other was not. As they reached the roof, smoke conditions worsened, and the fire fighter without breathing apparatus returned to the ground to find breathing apparatus to don. The fire fighter remaining on the roof then proceeded to walk over to the area of the florist shop. When he stepped from the roof of the restaurant onto the roof at the rear of the florist shop, at approximately 1:40 a.m., the weakened roof structure collapsed and he fell into the store, landing in the southeast storage room in the shop. No one on the fire ground witnessed his falling through the roof. His location was unknown to the others on the fireground.

At the front of the florist shop, with smoke conditions worsening, a hoseline was stretched from the Lambert engine that had been positioned at the front of the restaurant. Two fire fighters (one from Marks and the other from Lambert) donned breathing apparatus and prepared to enter the front of the shop at about 1:55 a.m. The Marks fire fighter had also participated in the attack on the fire in the storage building and was on his third air cylinder. Within seconds of the two fire fighters' entry into the building, witnesses on the outside reported seeing the hoseline "jump." Immediately following this, the Lambert fire fighter stumbled out of the door and onto the sidewalk, stating that the fire fighter from Marks was still in the building.

Fire fighters outside the shop, including the fire fighter who had just exited, entered the building and began searching for the Marks fire fighter lost near the front of the shop. Numerous attempts were made to locate the fire fighter. Rescue efforts were hampered due to a lack of full air cylinders at the scene. A police officer had been dispatched to travel approximately 20 miles (32.2 km) to Batesville to refill the cylinders already depleted. The hoseline that was used was located. The fire fighter, however, was not with the line. During the rescue attempts, the Marks fire chief was injured by broken glass in an effort to ventilate the florist shop.

Additional mutual aid was requested from the Batesville Fire Department at 2:03 a.m. Upon arrival of Batesville units at 2:25 a.m., fire fighters from Batesville began to assist in the search for the lost Marks fire fighter in the front of the florist shop. The injured Marks fire chief turned command of the scene over to the Batesville chief while he sought medical attention for his injuries. At this point, additional mutual aid was requested from surrounding communities to assist in the search for the missing fire fighter and for help in extinguishing the fire.



Batesville fire fighters located the missing Marks fire fighter during the second search of the store, after 3:00 a.m. His body was found under a pile of debris within 24ft (7.3 m) of the front entrance.

During the search efforts, the fire spread to the adjoining establishments. When the body of the fire fighter lost in the front of the florist shop was located and removed, the focus was again turned to extinguishment of the fire. At this point, it was determined that another fire fighter was missing, the Marks fire fighter who had gone to the roof in the rear of the block to ventilate. It was thought that he might be in the rear of the florist shop. Efforts were put forth to extinguish the fire in that and adjoining areas so that another search effort could be mounted.

The fire was under control at about 5:30 a.m., and the second missing fire fighter's body was found in a rear storage room of the florist shop around 6:00 a.m.

On the basis of the fire investigation and analysis, the NFPA has determined that the following significant factors directly contributed to the deaths of the two fire fighters:

- Lack of a fireground accountability system
- Ineffective use of an established incident management system (IMS)
- Failure to equip fire fighters with personal alert safety systems (PASS)
- Lack of knowledge of the construction features of the building and how these features would affect the spread of fire in the concealed spaces, including the attic
- Insufficient resources (personnel and equipment such as self-contained breathing apparatus [SCBA] and spare cylinders) to mount interior fire suppression and rescue activities.
- Absence of an established Rapid Intervention Crew (RIC) and the lack of a standard operating procedure requiring a RIC
- Lack of automatic sprinkler protection within the buildings

Fire Investigation Summary

Fire Fighter Fatalities

Auto Parts Store

Chesapeake, VA

March 18, 1996



At approximately 11:30 a.m. on Monday, March 18, 1996, fire fighters in Chesapeake, VA, responded to a fire in an auto parts store. No fire was visible from the exterior of the building when the fire fighters arrived. Two fire fighters entered the building and located a small fire at the rear of the store. The fire fighters extinguished the fire and began checking for fire extension. Approximately 20 minutes after their arrival, the roof of the building collapsed and the two fire fighters were trapped inside. The fire fighters both died of burns, with smoke inhalation being a contributory factor.

The building involved was approximately 12 years old. Two of the building's exterior bearing walls were constructed with unprotected steel frames and two were constructed with masonry block. Lightweight wood trusses with a clear span of 50 ft (15.2 m) supported the store's roof. Because the facility was an auto parts store, it contained a wide variety of combustible and noncombustible materials, flammable auto paints (liquid and aerosol), and other flammable and combustible liquids. Most packaging materials and some shelving materials were also combustible.



The fire occurred when a utility worker damaged the electrical service drop conductors on the outside of the store. Electrical arcing inside the store ignited fires that quickly involved the wood trusses supporting the roof and ignited a fire in the area of an electric hot water heater. Though some of the fire was visible to anyone in the occupied area of the building, much of the fire was hidden in the concealed space above the store's ceiling, and the fire was able to

spread in that area.

The fire fighters who died in this fire probably did not know that the building was constructed with lightweight wood roof trusses. Approximately seven minutes after they had arrived on the scene, the crew inside the building radioed their battalion

chief to report that they had found the fire. They asked for a second crew to come into the building and requested a pike pole. Approximately 13 minutes after this transmission, the roof collapsed, intensifying the fire and trapping the fire fighters inside the building. The trapped fire fighters radioed for assistance but, for an undetermined reason, the incident commander did not understand the transmission. Two other chief officers who were responding to the scene did hear the transmission and relayed the information to the on-scene commander. By the time the on-scene commander realized that fire fighters were possibly trapped inside the building, the fire had become too intense to attempt rescue operations.

On the basis of the NFPA's investigation and analysis of this fire, the following factors contributed significantly to the loss of the two Chesapeake fire fighters:

- The presence of lightweight wood roof trusses.
- Fire officers and fire fighters unaware that the roof of the Chesapeake auto parts store was constructed with lightweight wood trusses.
- The lack of a fire attack strategy that could minimize the risk to fire fighters while suppressing a fire involving lightweight wood trusses.
- The lack of automatic sprinklers.

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