

**ADMINISTRATIVE REPORT
PUBLIC HEALTH SERVICE/CDC/NIOSH/DSR
FACE 97-04**

DATE: May 9, 1997

TO: Director, National Institute for Occupational Safety and Health

FROM: Division of Safety Research, NIOSH

SUBJECT: Floor Collapse in a Single Family Dwelling Fire Claims the Life of One Fire Fighter and Injures Another - Kentucky

SUMMARY

On February 17, 1997, two male fire fighters (the victim and injured) were part of a fire company that responded to a single family dwelling fire. When the fire company arrived at the fire scene, the District Major reported heavy smoke emitting from the roof area of the dwelling. The victim and injured pulled two water hoses from their assigned engine and proceeded toward the dwelling. After knocking down a ceiling fire, they entered the dwelling through the front door and both immediately fell through the floor into the basement area. One fire fighter was seriously injured while the victim died from asphyxiation. NIOSH investigators concluded that, to prevent similar occurrences, employers should:

- o *ensure that fire command always maintains close accountability for all personnel at the fire scene*
- o *ensure at least four fire fighters be on the scene before initiating interior fire fighting operations at a working structural fire*
- o *ensure that fire fighters who enter hazardous areas, e.g., burning or suspected unsafe structures, be equipped with two-way communications with incident command.*

INTRODUCTION

On February 17, 1997, two male fire fighters (the victim and injured), ages 29- and 31-years-old, respectively, entered a single family dwelling that had heavy smoke emitting from the roof area

and from around the door and window openings. The two fire fighters entered the house through the front door and both immediately fell through the floor into the basement area. One fire fighter was seriously injured while the victim died from asphyxiation. On March 10, 1997, the International Association of Fire Fighters (IAFF) requested that NIOSH provide technical assistance in reviewing the circumstances surrounding the fatality and serious injury. On April 15, 1997, the Chief of Trauma Investigations Section and a Safety Specialist traveled to Kentucky to conduct an investigation of this incident. Meetings were conducted with Kentucky OSHA personnel, including the OSHA compliance officer assigned to the case, fire department officers, the IAFF union representative, and the State Fire Marshal. Copies of photographs of the incident site, transcription of dispatch tapes and taped police interviews were obtained, and a site visit was conducted.

The fire department involved in the incident serves a population of 240,000 in a geographic area of 280 square miles. The fire department is comprised of approximately 430 employees, of whom 360 are fire fighters. The fire department provides all new fire fighters with the basic 16-week recruit training at the fire department training center. The department also requires 100 hours of additional on-the-job training for each fire fighter each year. The required training is designed to cover fire department operation, e.g., ladder training, aerial operations, hose training, and breathing apparatus. Recertification training is conducted at the training center on an annual basis. The fire department's written standard operating procedures manual was reviewed and appeared to be complete. The victim and injured had 7 and 4 years fire fighting experience, respectively.

Although two fire companies were involved in this incident, only those directly involved up to the time of the fatal incident are mentioned in this report. The figure shows all companies responding to this incident.

INVESTIGATION

On February 17, 1997, at 0009 hours, a fire call came into the 911 dispatcher from the occupant of a private residence adjacent to the incident site. The site of the incident, a one-story single family residence measuring 28 feet by 28 feet, was located in a residential neighborhood. Most of the homes in the area were one-story frame and vinyl/aluminum sided structures and mobile homes, with the exception of the residence involved in the incident. The roof had been constructed of wood framing, sheeting, and shingles, while the exterior walls of the residence had been constructed of concrete block. The residence had a full basement about 8½-feet high; access to the basement was gained through either an interior stairway or an exterior doorway which was located on the back side

of the residence. The call was immediately directed to the fire station serving the district of the city where the fire was located. The District Major-204, Engine-11, Engine-6, Emergency Medical Service-EC6, and Aerial-4 were ordered to respond. Altogether, 5 pieces of equipment and 16 personnel arrived at the fire scene between 0013 and 0014 hours. The District Major was first on the scene at 0013 hours and assumed command. All the remaining vehicles and crews arrived seconds after the District Major.

When the District Major pulled up near the front of the residence where the incident occurred, he reported heavy smoke emitting from the structure. He then asked a small group of spectators standing on the street, whether anyone might be in the house. A spectator responded that they didn't think anyone lived there. He then ordered fire fighters from Engine 11 to pull two 1³/₄-inch water lines and approach the front door area. After the lines had been pulled and moved to the door area, it was discovered that the pressure relief valve on the Engine 11 water pump was sticking and could not sustain adequate water pressure. In the interim, a fire fighter attempted to open the front door, but found it was locked. He kicked open the door which allowed considerable amounts of heavy black smoke and heat to emit from the door opening. He was ordered to close the door and pull two lines from Engine 6. Also, fire fighters from Aerial 4 had started a generator and illuminated the area, then carried two positive pressure ventilation (PPV) fans to the front of the residence. The PPV fans were started, but their use was restricted until charged lines were brought to the front door area. Other fire fighters had pulled exposure lines and were fighting fires on the opposite side of the structure and protecting an adjacent residence.

While the District Major was working with the engineer from Engine 11 to get the pump on Engine 11 functioning, he called for Engine 6 to pull two water lines. Two fire fighters (the victim and injured) pulled two lines from Engine 6 and proceeded to the front door of the residence. Air-flow from the PPV fans was initiated and aimed toward the door opening. The two fire fighters from Engine 6 donned their self-contained breathing apparatus (SCBAs) and knocked down the fire in the ceiling area of the structure before making entry. Unknown to the fire fighters, three separate fires were burning in the basement, one fire directly below the entry of the front door. Shortly thereafter (about 2 to 3 minutes after donning their SCBAs) the two fire fighters entered the house through the front door to attack the interior fire, and immediately fell through the floor into the basement area. Approximately 8 minutes had elapsed and the District Major said "let's ease off this thing for a minute," (pull back and regroup), and then realized two fire fighters were missing. A lieutenant, after being advised of the problem, crawled along the ground and discovered hose lines going into the front doorway and down into the basement area. A light from a flashlight was seen in the smoke/darkness

coming from the basement, and the lieutenant stuck his right hand into the floor opening which was grabbed by one of the fire fighters (injured). At about the same time, fire fighters on the outside of the house lowered a 14 foot ladder through the front doorway into the basement; the ladder brushed up against the injured fire fighter and he grabbed it. The injured was pulled/lifted from the basement area with the aid of the ladder. The injured fire fighter, after being extracted from the basement, advised others that the other fire fighter was still in the basement. Numerous search and rescue efforts were made through the hole in the floor and from the back door to the basement. The victim was eventually located and removed from the basement area, and vital signs were checked at 0118 hours, approximately 53 minutes after the victim and injured were discovered missing. The injured fire fighter reported that both he and the victim sprayed water on one another trying to stay cool. It was also reported that the injured fire fighter had manually activated his personal alert safety system (PASS) device. However, due to the noise of the engines, pumps, and PPV fans, no one heard the alarm. Approximately 8 to 10 minutes after entering the structure, both fire fighters' SCBAs ran out of air and they tried to breathe entrained air from the water spray from their lines.

The following time line has been developed from fire and EMS dispatch sheets, and personal and taped interviews of fire personnel:

February 17, 1997, (minutes have been rounded off to the full minute)

0009	Call received at fire station
0013	District Major-204 arrives at fire scene
0014	Engine-11, Engine-6, EMS-EC-6, and Aerial-4 arrive at the fire scene
0015-0017	Victim and injured pull two lines from Engine-6, move to front door area and put on SCBAs, and fight ceiling fire
0017	Victim and injured fall into basement area
0025	Victim and injured discovered missing
0040	EC-6 departs fire scene with injured
0118	EC-5 departs fire scene with victim

CAUSE OF DEATH

Preliminary cause of death was listed by the medical examiner as asphyxiation due to smoke inhalation.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Fire departments should ensure that fire command always maintains close accountability for all personnel at

the fire scene.

Discussion: Accountability for all fire fighters at a fire scene is paramount, and one of the fire command's most important duties. The District Major was directing his attention towards the various aspects of the total operation and had ordered the two fire fighters to enter the structure, but not advance too far; however, he was not aware of exactly when the fire fighters entered the structure.

Recommendation #2: Fire departments should ensure at least four fire fighters be on the scene before initiating interior fire fighting operations at a working structural fire.

Discussion: When the District Major arrived at the scene he took command and directed the operations. Personnel from the Engines and Aerial Truck were performing duties as directed, or as standard operating procedures directed. Although there were approximately 16 fire fighters on the scene, no one actually witnessed the two fire fighters (victim and injured) enter the burning structure or fall through the floor, and about 8 minutes elapsed before they were discovered missing. The National Fire Protection Association (NFPA) and the Occupational Safety and Health Administration (OSHA) recommend that four persons (two in and two out), each with protective clothing and respiratory protection, is the minimum number essential for the safety of those performing work inside a burning structure. The team members should be in communication with each other through visual, audible, or electronic means to coordinate all activities, and determine if emergency rescue is needed.

Recommendation #3: Fire departments should ensure that fire fighters who enter hazardous areas, e.g., burning or suspected unsafe structures, be equipped with two-way communications with incident command.

Discussion: When the two fire fighters entered the burning residence and fell through the floor, the noise from the fire fighting operations (pumps, engines, PPV fans, etc.) obscured the calls for help and the audible signal from the PASS device. If the fire fighters had a portable radio, then incident command may have been able to determine sooner that the two fire fighters were trapped in the basement of the burning structure.

References:

1. Morris, Gary P., Brunacini, Nick., Whaley, Wynn; Fireground Accountability: The Phoenix System, Fire Engineering, Vol. 147, No. 4, April, 1994.

2. National Fire Protection Association. NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, National Fire Protection Association, Quincy, MA.
3. National Fire Protection Association. NFPA 1561, Standard on Fire Department Incident Management System, National Fire Protection Association, Quincy, MA.
4. 29 Code of Federal Regulations 1910.120, Hazardous Waste Operations and Emergency Response.
5. U.S. Department of Labor, Occupational Safety and Health Administration Compliance Memorandum to Regional Administrators and State Designees, May 1, 1995.

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Fatality Assessment and Control Evaluation (FACE) Project

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), performs Fatality Assessment and Control Evaluation (FACE) investigations when a participating State reports an occupational fatality and requests technical assistance. The goal of these evaluations is to prevent fatal work injuries in the future by studying the working environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

States participating in this study: North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia.

Additional information regarding this report is available from:

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FACE 97-04