



Death in the line of duty...

A summary of a NIOSH fire fighter fatality investigation

August 19, 2003

Structural Collapse at Residential Fire Claims Lives of Two Volunteer Fire Chiefs and One Career Fire Fighter - NJ

SUMMARY

On July 4, 2002, a 30-year-old male volunteer fire chief, a 40-year-old male volunteer deputy fire chief, and a 30-year-old male career fire fighter died when a residential structure collapsed, trapping them, along with four fire fighters and an officer who survived. At 0136 hours, a combination fire department and a mutual-aid volunteer fire department were dispatched to a structure fire. Local law enforcement radioed Central Dispatch reporting a fully involved structure with three children trapped on the second floor. The first officer on the scene assumed incident command and reported to Central Dispatch that the incident site was a three-story structure with fire showing and that people could be seen at the windows. *Note: The female resident (survivor) was the person seen in the window. The three children that were reported as being trapped did not survive and were later found in the debris.* Additional units were requested, including a mutual-aid ladder company from a career department. Crews were on the scene searching for occupants and fighting the fire for approximately 27 minutes when the building collapsed.

NIOSH investigators concluded that, to minimize the risk of similar incidents, fire departments should

- *ensure that the department's structural fire fighting standard operating guidelines (SOGs) are followed and refresher training is provided*
- *ensure that the Incident Commander (IC) formulates and establishes a strategic plan for offensive and defensive operations*
- *ensure that the incident commander (IC) continuously evaluates the risk versus gain during operations at an incident*
- *ensure that a separate Incident Safety Officer, independent from the Incident Commander, is appointed*
- *ensure that fire fighters conducting interior operations (e.g., search and rescue, initial attack, etc.) provide progress reports to the IC*
- *ensure that accountability for all personnel at the fire scene is maintained*
- *ensure that a Rapid Intervention Team (RIT) is established and in position*
- *ensure that the officer in charge of an incident recognize factors (e.g., structural defects, large body of fire in an old structure, etc.) when analyzing potential building collapse*
- *ensure, when feasible, that fire fighters should respond together, in one emergency vehicle, as a crew*

Additionally, municipalities should consider

- *establishing and maintaining regional mutual-aid radio channels to coordinate and communicate activities involving units from multiple jurisdictions*

INTRODUCTION

On July 4, 2002, a 30-year-old male volunteer fire chief (Victim #1), a 40-year-old male volunteer deputy fire chief (Victim #2), and a 30-year-old male career fire fighter (Victim #3) died when a residential structure collapsed, trapping them, along with four fire fighters and an officer who survived. The National Institute for Occupational Safety and Health (NIOSH) was notified of this incident by the U.S. Fire Administration (USFA) on July 12, 2002. On July 15, 2002, two Safety and Occupational Health Specialists conducted an initial meeting with representatives from the New Jersey Department of Labor, New Jersey Division of Fire Safety, New Jersey State Fireman's Mutual Benevolent Association, and the President of the Professional Fire Fighter's Association of New Jersey. On July 29, 2002, two Safety and Occupational Health Specialists and the Team Leader from the NIOSH Fire Fighter Fatality Investigation and Prevention Program investigated the incident. Meetings were conducted with the Chief and Battalion Chiefs from the combination fire department, the city attorney, and representatives from the New Jersey Department of Labor and the New Jersey Division of Fire Safety. Interviews were conducted with the career and volunteer Chiefs, officers, and fire fighters involved in this incident. The personal protective equipment, including the SCBAs of all three victims, were examined by the NIOSH team. The incident site was visited by the NIOSH team for orientation purposes only (the building debris and its contents had been removed before the NIOSH visit). The NIOSH team reviewed copies of the dispatch run sheet, dispatch radio transcriptions, autopsy reports, fire department SOGs, training records of the three victims, and witness statements.

Fire Departments Involved in the Incident.

The combination fire department, which was in charge of this incident, is comprised of 26 career fire fighters and 50 volunteer fire fighters. The department serves a population of approximately 12,000 residents in a geographic area of about 2.5 square miles.

The volunteer fire department, which provided mutual aid at this incident, is comprised of 55 volunteer fire fighters. The department serves a population of approximately 5,500 residents in a geographic area of about 1 square mile.

Training and Experience.

Victim #1 was a volunteer Chief who had approximately 17 years of experience with this volunteer fire department. He was certified Fire Fighter Level I & II, Fire Officer Level I, and as a Fire Service Instructor.

Victim #2 was a volunteer Deputy Chief who had approximately 23 years of experience with this volunteer fire department. He was certified Fire Fighter Level I & II, Fire Officer Level I, and as a Fire Service Instructor.

Victim #3 was a career fire fighter who had approximately 10 years of experience with this combination fire department. He was certified Fire Fighter Level I, Emergency Medical Technician, and as an Apparatus/Engine Operator.

Equipment and Personnel.

0136 Hours—Initial Dispatch (First Alarm)

Combination fire department apparatus and personnel: Engine 513 (Battalion Chief [BC #1] and a fire fighter), Ladder 514 (fire fighter), Squad 557 (two fire fighters), and IC 501 (Chief).

Mutual-aid volunteer fire department apparatus and personnel: Squirt 542 (Battalion Chief and four fire fighters), Engine 541 (Captain, Lieutenant, and two fire fighters), Engine 521 (Battalion Chief, Captain, and five fire fighters).

0140 Hours—Additional Units

Combination fire department apparatus and personnel: Headquarters recall (two Battalion Chiefs, one of which was BC #2 [second-floor search command], six fire fighters [including Victim #3] responded in their privately owned vehicles [POVs]).

Mutual-aid volunteer fire department apparatus and personnel: Rescue 455 (Chief [Victim #1] and five fire fighters).

Mutual-aid career fire department apparatus and personnel requested: Ladder 2 (Battalion Chief, Captain, and three fire fighters).

County Fire Marshal Office personnel: County Deputy Fire Marshal (Victim #2 who was also a Deputy Chief with the mutual-aid volunteer fire department).

Additional units and fire fighters were dispatched after the building collapsed at approximately 0206 hours.

Structure.

The incident site was a residential duplex (Unit #1 [exposure apartment] and Unit #2 [fire apartment]), twin frame, of balloon-frame construction that was built in approximately 1900. Each unit had approximately 2100 square feet of living space above ground (3 stories) and approximately 867 square feet below ground (basement). The two units contained similar floor plans. The first floor had, from front to back, two living rooms, a dining room, a kitchen, and a utility room all connected with a common hallway. A stairwell from the hallway led up to the second floor where there were three bedrooms and a bathroom. The first floor also had a second set of stairs in the rear of the dwellings that led to the second floor. A second stairwell led from the second floor to the third floor, where two rooms were located.

INVESTIGATION

On July 4, 2002, at 0136 hours, a combination fire department and a mutual-aid volunteer fire department were dispatched to a structure fire. At 0138 hours, Engine 513 reported to Central Dispatch that they were responding to the scene. Central Dispatch acknowledged and advised them that local law enforcement was on the scene reporting that the dwelling was fully involved with three children trapped on the second floor. Engine 513, Ladder 514, and Squad 557 arrived on the scene at approximately 0139 hours. The Battalion Chief (BC #1) from Engine 513 assumed command (Incident Commander [IC]) and reported to Central Dispatch that the incident involved a three-story structure with fire showing and that people could be seen at the windows. *Note: Unit #1 had no visible fire showing at this time. Unit #2 was fully involved on the corner of Side 1 and Side 4 (Diagram 1). The female resident (survivor) was the person seen in the window. The three children that were reported as being trapped did not survive and were later found in the debris of Unit #2.*

The IC ordered the fire fighter from Ladder 514 and a fire fighter from Squad 557 to rescue a civilian (the female resident) on the second floor of the exposure apartment. The two fire fighters pulled a 1 ¾ handline from Engine 513 and entered the front door (door was open upon their arrival), advancing the handline to the second-floor landing. No fire was visible from the second floor-landing, and debris from either the ceiling or walls fell onto the two fire fighters.

At 0140 hours, IC 501 (Fire Chief of the combination department), while still en route to the scene, radioed Central Dispatch and requested a mutual-aid Ladder Company. At 0141 hours, IC 501 arrived on the scene and assumed command from BC #1. Squirt 542 arrived on the scene and was ordered by the IC to take a position in the rear of the building (See [Diagram 1](#)). At 0143 hours, mutual-aid Ladder Company 2 (still en route) was ordered by the IC to stage in front of Engine 513. Engine 541, responding to the scene, was given orders by the IC to provide manpower to the front (Side 1) of the building and to bring air packs. A second Battalion Chief (BC #2) from the combination fire department arrived on the scene in his privately owned vehicle (POV). BC #1 advised BC #2 that people had been seen in the window of the exposure apartment and advised BC #2 to have a crew advance to the second floor for a primary search. At approximately 0144 hours, mutual-aid Ladder Company 2 arrived on the scene and was ordered by the IC to search the second floor of the exposure apartment.

At 0145 hours, the IC radioed Central Dispatch and advised them that they had two three-story dwellings that were well involved and that they would momentarily be going into service with the deck gun. BC #2, Victim #3, and a fire fighter entered the exposure apartment with a 1 ¾-inch handline to conduct a primary search of the second floor. BC #2 assumed command of the second floor search. *Note: Fire fighters reported to NIOSH investigators that the conditions on the second floor consisted of low visibility and flame rollover along the ceiling.*

At 0151 hours, the IC reported to Central Dispatch that they had multiple handlines and master streams in service and that they were making good progress on the water supply. The IC also reported that the civilian victim was unaccounted for and that they had two handlines in service on the second floor of the exposure checking the occupancy. Engine 521 arrived on the scene and was ordered by the IC to report to Ladder 514.

At 0152 hours, Central Dispatch notified the IC that they were approaching the 20-minute mark (from initial dispatch). The IC acknowledged Central Dispatch's notification. The IC then radioed the Squirt 542 crew and ordered them to continue flowing water (with their deck gun) into the main fire building and then advised them that they had people in the exposure building. The officer of Squirt 542 acknowledged the transmission.

Central Dispatch reported "multiple handlines in service and a master stream in service at two three-story twin. Occupants still unaccounted for at 0155." Multiple crews were searching the first and second floors of the exposure apartment during this time. Crews accessed the second floor from both the interior stairwell from the living room and by laddering the front porch roof and a second-floor bedroom window on Side 2. Additional crew members were operating on the roof above the kitchen and utility room on Side 3, removing second-floor windows.

At 0157 hours, a fire fighter from the second-floor exposure apartment advised the IC that the second floor was starting to give way. The IC acknowledged. Another radio transmission from an unknown fire fighter told the crews on the second floor to put down their handlines and get out. A fire fighter from the second floor notified the IC that they were evacuating the second floor and that the roof and the ceiling were coming down. The IC acknowledged and then radioed Central Dispatch to give the order to discontinue all master stream operations. At 0158 hours, Central Dispatch broadcast the order for companies to cease all master stream operations.

At 0159 hours, Central Dispatch advised the IC that BC #1 was reporting that they had one victim (civilian woman) coming out the rear of the fire building. The IC then ordered fire fighters to the rear of the building. The Lieutenant from Engine 541 reported to the IC that they had a missing fire fighter from the second floor of the exposure apartment. *Note: The fire fighter that had entered the building with Victim #3 and BC #2 to conduct the primary search of the second floor was the reported missing fire fighter. The fire fighter had gone down to the first floor and assisted with removing the civilian woman from the rear of the structure.* The Lieutenant from Engine 541 brought a thermal imaging camera (TIC) to the second floor where the Lieutenant and BC #2 used the TIC to search for the missing fire fighter.

At 0200 hours, the IC ordered an evacuation of the building to conduct a personnel accountability report (PAR). Central Dispatch announced that the emergency evacuation signal procedure had been ordered. All units were ordered to sound their warning devices (air horns). A career fire fighter from the mutual-aid career department, who was operating on the second floor, attempted to radio his officer to report that the second floor was giving way. *Note: The career fire fighter was unable to communicate directly with the IC. The mutual-aid career fire department has a different operating frequency from the combination fire department in charge of the scene.* The evacuation signal sounded before the fire fighter received a confirmation of his report. Crews exited the building and reported to their respective officers. Victim #1, Victim #2 and BC #2 met with the IC in front of the building (Side 1). *Note: BC #1 was on Side 3 of the structure at this time and was not involved in the conversation taking place with the IC, Victim #1, Victim #2 and BC #2.* Victim #3 and the Lieutenant from Engine 541 exited the front of the building. Victim #1, Victim #2 and BC #2 relayed to the IC that they would continue the search in the exposure building.

At 0203 hours, Central Dispatch advised the IC that they had reached the 30-minute mark of the incident. The IC announced over the radio that the missing fire fighter had been accounted for. Victim #1, Victim #2, Victim #3, BC #2, and four fire fighters (from Rescue 455) reentered the exposure apartment, through the front door, to continue their search efforts. The interior command officer (BC #1) reentered the structure through the rear of the building.

At 0205 hours, the IC radioed BC #1 (who was now inside the exposure apartment on the first floor) and advised him that they were going to put a deck gun in service. BC #2 radioed Victim #2 requesting that crews advance the 1 3/4-inch handline to the top of the steps. While standing at the front door to the exposure apartment, Victim #1 informed the IC that the interior conditions were getting worse and that they were going to come out. Victim #2 and BC #2 were at the top of the stairs and could see fire rolling along the ceiling and could hear timbers falling in the fire apartment. Victim #2, followed by BC #2, proceeded down the stairs, when at approximately 0206 hours, the building collapse occurred. Victim #1, Victim #3, and four fire fighters from Rescue 455 were in the living room on the first floor when the collapse occurred (See [Diagram 2](#)).

At 0208 hours, the IC requested a second alarm and reported that they had a total collapse of the building with possibly eight trapped fire fighters (Victim #1, Victim #2, Victim #3, four fire fighters [from Rescue 455] and one Battalion Chief [BC #2]). The IC requested mutual-aid rescue companies.

At 0209 hours, Central Dispatch struck a second alarm and dispatched Rescue 1 and Rescue 32. The IC requested a personnel accountability report (PAR) for all fire fighters. BC #2 was rescued and removed through the rear of the structure. One of the trapped fire fighters rescued himself by crawling through the debris and into the alley on Side 2.

At 0221 hours, the IC requested a third and fourth alarm from Central Dispatch for additional truck and rescue companies. Recovery efforts continued over the next several hours. The three remaining trapped fire fighters were removed and attended to by on-scene EMS personnel.

Between 0804 and 0819 hours, Victim #1, Victim #2, and Victim #3 were removed from the scene and pronounced dead. *Note: Victim #1 and Victim #3 had manual personal alert safety system (PASS) devices. Victim #2 did not have a PASS device. There were no reports of any PASS device sounding during the rescue or recovery efforts.* At 0820 hours, the IC reported to Central Dispatch that all three victims had been removed.

CAUSE OF DEATH

The cause of death as recorded on the death certificates for Victim #1, Victim #2, and Victim #3 was fixed compression.

RECOMMENDATIONS/DISCUSSIONS

Recommendation #1: Fire departments should ensure that the department's structural fire fighting standard operating guidelines (SOGs) are followed and refresher training is provided. [1, 2](#)

Discussion: It is imperative that companies perform their duties as described in the Standard Operating Guidelines (SOGs) unless directed or approved by the Incident Commander (IC) to do otherwise. Dunn states "A standard operating procedure (or guideline) provides accountability and control. It is a general plan of who does what and when. It lets companies know where they should be operating and what they should be doing. A standard operating procedure should be created for the most frequent type of fire to which a company responds."

The SOGs of the combination fire department involved in this incident, covers incident scene size-up, interior/exterior operations (use extreme caution when an interior attack is to be performed in structures exhibiting signs of "burning through the roof" and "interior fire attack operations are not to be performed within unsafe structures or 'surround and drown' designated structures"). In addition, the SOGs cover fire fighter safety (donning and checking for the proper operation of personal protective equipment, that all interior attack activities are to be conducted in full turnout gear, PASS device, and SCBA on and charged).

When conducting an exterior attack "exterior activities must be watchful of both falling debris and interior activities. Should an interior crew be approaching or within an exterior attack area, exterior crews must shut down water streams to assure interior crew safety. When conducting exterior attack constant examination of roof and wall integrity must be performed to prevent collapse on working crews." The department SOGs regarding fire fighter safety state that "fire extinguishment and control must consider fire fighter safety first. As such, under no conditions shall a fire fighter be involved in fire suppression activities without full turnout gear, PASS device, and SCBA on and charged. Should any condition or perceived condition present itself such that a fire fighter feels threatened or unsure of activities, immediate exiting and termination of attack is to occur."

Fire fighters on the initial attack reported that either ceiling or wall material fell upon them as they ascended the stairs to the second floor. In addition, numerous fire fighters, that had been operating on the second floor of the exposure apartment moments prior to the evacuation, reported to NIOSH investigators that the second floor had started to give way and that the roof and ceiling were coming down.

Recommendation #2: Fire departments should ensure that the Incident Commander (IC) formulates and establishes a strategic plan for offensive and defensive operations. [3-6](#)

Discussion: An incident that involves trapped occupants, a fully involved structure, numerous emergency personnel and multiple fire departments is one of the most difficult scenes to manage. The ability to manage a complex incident is dependent upon the Incident Commander (IC) formulating and establishing a strategic plan that outlines objectives and how those objectives will be accomplished. It is imperative that all emergency personnel operating on the scene clearly understand the strategic plan and provide feedback, such as progress reports, to the IC. This would allow the IC to continuously evaluate the status of the set objectives, ensure fire fighters safety and to determine if any changes to the strategic plan are warranted.

According to NFPA 1500, paragraph 8.1.8, "at an emergency incident, the incident commander shall have the responsibility for the following: (1) Arrive on-scene before assuming command. (2) Assume and confirm command of an incident and take an effective command position. (3) Perform situation evaluation that includes risk assessment. (4) Initiate, maintain, and control incident communications. (5) Develop an overall strategy and an incident action plan and assign companies and members consistent with the standard operating procedures. (6) Initiate an accountability and inventory worksheet. (7) Develop an effective incident organization by managing resources, maintaining an effective span of control, and maintaining direct supervision over the entire incident, and designate supervisors in charge of specific areas or functions. (8) Review,

evaluate, and revise the incident action plan as required. (9) Continue, transfer, and terminate command. (10) On incidents under the command authority of the fire department, provide for liaison and coordination with all other cooperating agencies. (11) On incidents where other agencies have jurisdiction, implement a plan that designates one incident commander or that provides for unified command. (12) Interagency coordination shall meet the requirements of NFPA 1561, *Standard on Emergency Services Incident Management System*.” NFPA 1561, paragraph 4.1.1 states that “the purpose of an incident management system shall be to provide structure and coordination to the management of emergency incident operations, in order to provide for the safety and health of emergency services organization personnel and other persons involved in those activities.”

Klaene and Sanders state that “a strategic plan is derived from an analytical approach to information gained through size-up. The result should be a straightforward, easy-to-understand strategy outlining the major objectives. Size-up is a continuous process, as conditions constantly change; therefore, the strategic plan must remain flexible. The strategic plan provides the central focus for operations.” Brunacini also notes that “a major function of the fire ground commander involves translating his evaluation and forecast of conditions into the overall operational strategy. This basic strategy decision serves the critical purpose of determining if the operation will be conducted in the offensive or defensive mode. The development and management of the overall strategy becomes the basis for rescue and fire fighting action.”

Klaene and Sanders state that “structural conditions bear heavily on the offensive/defensive decision. Even with sufficient resources, an interior attack should not be conducted in an unsafe building. A building that is in danger of imminent collapse should not be entered for any reason. However, rescue efforts may be justified in a building that is currently structurally sound but may ultimately fail if it continually undergoes attack from the fire.”

Klaene and Sanders state that “the entire operation is governed by the offensive/defensive decision. Large master stream appliances can be used to support rescue efforts in large, complex structures with fire separations. When master streams are being used during an offensive operation for any reason, coordination through command is critical. An operation that begins as an offensive attack is sometimes changed to defensive, but the actions being taken during either attack must be coordinated as offensive or defensive; they must never be both.” Brunacini states that “the offensive and defensive modes are independent events. Effective fire operations (safe, sane, and predictable) are conducted either on the inside or the outside of the building. Any mixture of the two basic modes begins to set the stage for loss of life and property.

Recommendation #3: Fire departments should ensure that the incident commander (IC) continuously evaluates the risk versus gain during operations at an incident. [3](#) [7](#)

Discussion: According to NFPA 1500, “the incident commander shall integrate risk management into the regular functions of incident command.”

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

Additionally, “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.”

Brannigan states that “fire burning in balloon frame walls destroys the structural integrity of the building. Collapse is a serious threat. Fires in balloon-frame buildings should be observed from the exterior, by an officer specifically assigned to that function, and positioned far enough away to see the entire building.

Recommendation #4: Fire departments should ensure that a separate Incident Safety Officer (ISO), independent from the Incident Commander, is appointed. [3](#) [8-10](#)

Discussion: According to NFPA 1500, paragraph 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.” The Division of Fire Safety for the State of New Jersey, also notes that “a safety officer shall be appointed by the incident commander during incidents which require such a function. The safety officer shall report directly to the incident commander and the safety officer has the authority to stop immediately, alter or suspend operations which may cause serious injury to emergency personnel on the incident scene.” Kipp and Lofflin state that “the incident safety officer is responsible for the management of safety and health at an incident scene. The member serving as the incident safety officer must be a company, battalion, or chief officer, be familiar with the organization’s incident management plan, have fireground command or incident management experience, be able to identify unsafe incident scene conditions and hazards, and enforce procedures relating to protective clothing and equipment and other regulations.” The incident safety officer can collect information in the form of a reconnaissance or 360° size-up of the incident allowing the ISO to identify hazards, evaluate hazards, prioritize hazards, control hazards, and monitor hazards.

Recommendation #5: Fire departments should ensure that fire fighters conducting interior operations (e.g., search and rescue, initial attack, etc.) provide periodic progress reports to the IC. [4](#)

Discussion: Progress reports ensure that the IC is kept up-to-date on the status of assigned tasks and building and fire conditions encountered by interior crews. This provides the IC the means by which to measure and evaluate the direction and success of the incident.

Klaene and Sanders state that “frequent progress reports are essential to the incident commander, who should have a good overall view of the incident. Interior crews and crews working in areas not visible to the incident commander are the eyes and ears of the incident commander. Progress reports also provide everyone on the fireground with information on other aspects of the fire that relate to their own particular operations.”

Recommendation #6: Fire departments should ensure that accountability for all personnel at the fire scene is maintained. [4](#), [6](#)

Discussion: According to NFPA 1561, “the personnel accountability system shall be used at all incidents.” “Where assigned as a company/crew/unit, members shall be responsible to remain under the supervision of their assigned supervisor” and “members shall be responsible for following personnel accountability system procedures.”

Klaene and Sanders state that “the incident management system is the cornerstone of an effective accountability system. A good organizational structure accounts for all personnel operating at the scene and assigns responsibility for each with a reasonable span of control via sectoring.”

Recommendation #7: Fire departments should ensure that a Rapid Intervention Team (RIT) is established and in position. [3](#), [4](#)

Discussion: A rapid intervention team (RIT) should respond to every major fire. A RIT should be established, in position and ready for deployment during the initial stages of an incident. The team should report to the officer in command and should remain at an area designated by the IC until an intervention is required to rescue a fire fighter. The RIT should have all the tools necessary to complete the job—e.g., a search rope, rescue rope, first-aid kit, and a resuscitator to use in case a fire fighter needs assistance. These teams can intervene quickly to rescue fire fighters who become disoriented, lost in smoke-filled environments, trapped by fire, involved in structural collapse, or run out of breathing air. In this incident, fire fighters on the scene were assembled as the RIT after the collapse occurred.

Recommendation #8: Fire departments should ensure that the officer in charge of an incident recognize factors (e.g.,

structural defects, large body of fire in an old structure, etc.) when analyzing potential building collapse. [11](#)

Discussion: The threat of a partial or complete structural collapse is always a real possibility that requires the officer in charge to continuously look for those factors (e.g., structural defects, large body of fire in an old structure, etc.) that would indicate such a possibility.

Dunn states “one important consideration is the possibility that the falling structure will cause the failure of a smaller structure nearby or of another part of the same structure. In some instances when fire fighters inside a burning building report a collapse danger to the Chief in charge of the fire, the Chief may order a partial or complete withdrawal of fire fighters.” Dunn states “a chief officer may direct complete withdrawal of a fire building and its surroundings at any time a serious structural defect is discovered. Some structural hazards or warning signs which would justify this drastic action are: a structure leaning to one side; large volumes of runoff water from exterior hose streams through mortar joints or over tops of windowsills; roofs from which joists have fallen; a building that has sustained any interior collapse; or a large body of fire in an old structure. The last warning sign listed is the one that most often causes a fireground commander to withdraw fire fighters from a burning building. A rapidly spreading fire throughout a hundred-year-old structure is a danger to fire fighters because of the possibility of structural collapse. Most old buildings in this country contain wood as a structural member, so a large, uncontrolled body of fire in a building with a combustible structure must be considered a warning sign.” Master streams also pose an additional hazard when evaluating a potential building collapse. When evaluating master stream dangers Dunn states “a master stream is a ground or aerial nozzle with a fog or straight stream capable of delivering more than 300 gallons of water per minute to a fire. If a master stream is delivering three or four tons of water through a straight stream nozzle at 100 feet per second, it can collapse part of a building atop a fire fighter. As a general rule interior fire fighting should not be carried out in areas where powerful master streams are directed.”

At this particular incident, multiple master stream appliances (a deck gun [Engine 513], a ladder pipe [Ladder 514] and an elevated master stream operating from a boom [Squirt 542]) were in service at various stages of the incident.

Recommendation #9: Fire departments should ensure, when feasible, that fire fighters should respond together, in one emergency vehicle, as a crew.

Discussion: Response of members from an all volunteer or combination department can have many possibilities. Some of these possibilities include having all members reporting to the station before responding to an incident or possibly allowing Chief Officers to respond directly to the scene. One consideration is to have all on-call or in-station staff respond together as one crew in one emergency vehicle as opposed to having separate crew members respond in multiple apparatus. This would alleviate errors in accountability and increase the crew’s ability and efficiency in their response to an incident.

During the initial response to this incident, multiple apparatus responded with one or two crew members on-board. Since this incident, the current policy of the combination fire department involved in this incident is to have in-station crew members respond as one crew on one apparatus.

Additionally, municipalities should consider

Recommendation #10: Establishing and maintaining regional mutual-aid radio channels to coordinate and communicate activities involving units from multiple jurisdictions. [8](#), [12](#)

Discussion: An effective radio communication system is a key factor in fire department operations. The communication system is used for receiving notification of emergencies, alerting personnel and equipment, coordinating the activities of the units engaged in emergency incidents, and providing nonemergency communications for the coordinating fire departments. Units responding to or engaged at incidents should have the necessary radio frequencies/channels to be in contact with other units. The Division of Fire Safety for the State of New Jersey states that “communication between officers and members is critical to safety of all personnel in an emergency situation. Radio communication is an essential tool for personnel operating during an emergency. Communication must be maintained between units on the scene and dispatch, operating personnel and the incident commander, and between members of an operating unit.”

The mutual-aid career department operated on a fireground frequency of 153.905 MHz. The combination and mutual-aid volunteer company operated on a fireground frequency of 154.355 MHz. Mutual-aid career department personnel from Ladder 2 were unable to communicate directly with the IC while conducting a primary search of the second floor of the

exposure apartment. The crew's Battalion Chief had to position himself in the vicinity of the IC to enable him to relay progress reports from the Ladder 2 crew.

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INVESTIGATOR INFORMATION

This incident was investigated by Mark McFall and Virginia Lutz, Safety and Occupational Health Specialists, and Richard Braddee, Team Leader, Fire Fighter Fatality Investigation and Prevention Team, Trauma Investigations Section, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH.

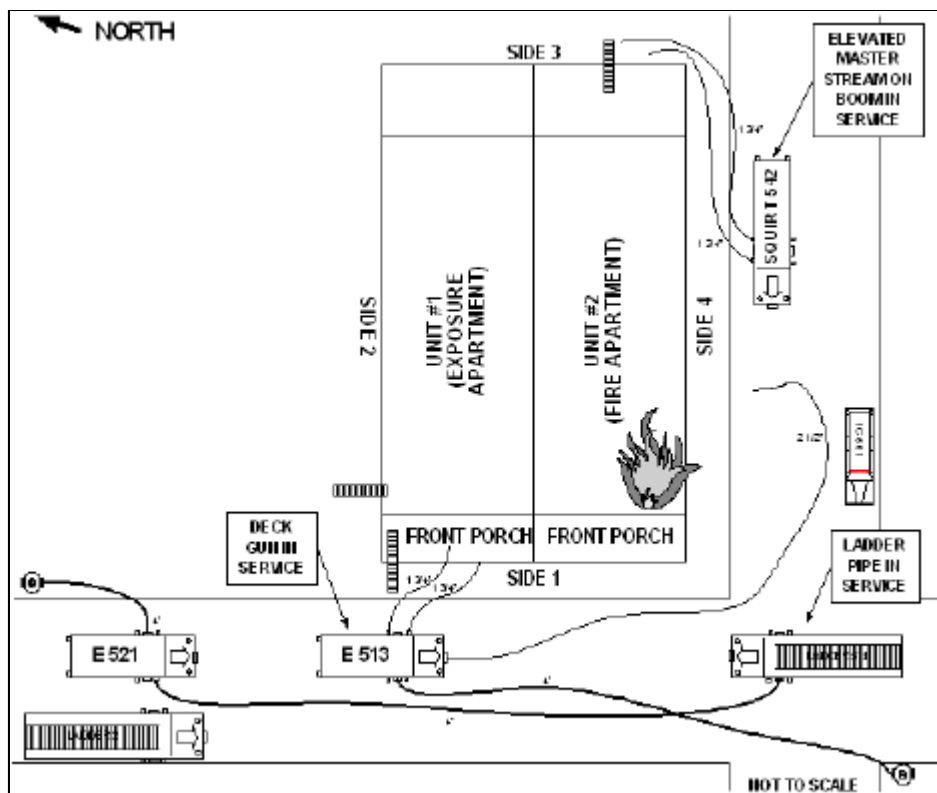


Diagram 1. Aerial view of incident site

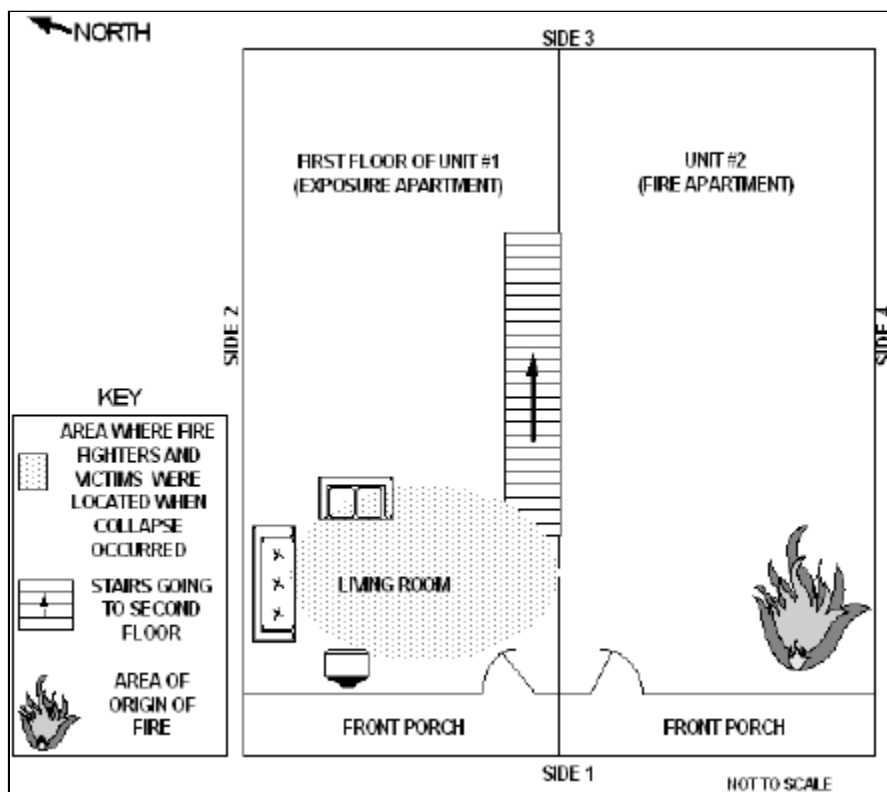


Diagram 2. Aerial view of first floor of incident site



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