



Career Fire Fighter Dies and Two Career Fire Fighters Injured in a Flashover During a House Fire - Ohio

SUMMARY

On March 21, 2003, a 25-year old male career fire fighter (the victim) was fatally injured in a flashover during a house fire. The victim and two other fire fighters were on an interior attack crew and had just gone through the front door of a single family residence. The hose line was uncharged and the crew was calling for water when a flashover occurred. From the time the victim arrived on scene until the flashover was approximately four minutes. After the flashover, fire fighters on the front porch witnessed the victim walk toward the front door then turn and retreat into the structure. The two other fire fighters on the interior crew exited through the front door. They were injured and transported to the hospital where they were treated and released. The victim was located and removed from the structure within 10 minutes. He was transported via ambulance to the hospital where he was pronounced dead.

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

- *review and revise existing standard operating procedures (SOPs) for structural fire fighting to ensure fire fighters enter burning structures with charged hose lines*
- *ensure that a Rapid Intervention Team (RIT) is established and in position prior to initiating an interior attack*
- *ensure that ventilation is closely coordinated with interior operations*
- *ensure that crew continuity is maintained on the fireground*
- *ensure that fire command always maintains close accountability for all personnel operating on the fireground*

Additionally, emergency dispatchers should:

- *obtain as much information as possible from the caller and report it to the responding fire fighters*



Photo Courtesy of Fire Department

The **Fire Fighter Fatality Investigation and Prevention Program** is conducted by the National Institute for Occupational Safety and Health (NIOSH). The purpose of the program is to determine factors that cause or contribute to fire fighter deaths suffered in the line of duty. Identification of causal and contributing factors enable researchers and safety specialists to develop strategies for preventing future similar incidents. The program does not seek to determine fault or place blame on fire departments or individual fire fighters. To request additional copies of this report (specify the case number shown in the shield above), other fatality investigation reports, or further information, visit the Program Website at

www.cdc.gov/niosh/firehome.html
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Fatality Assessment and Control Evaluation Investigative Report #F2003-12

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INTRODUCTION

On March 21, 2003, a 25-year old male career fire fighter (the victim) was fatally injured in a flashover during a house fire. On March 24, 2003, the U.S. Fire Administration (USFA) notified the National Institute for Occupational Safety and Health (NIOSH) of this fatality. On April 14-17, 2003, three occupational safety and health specialists and a safety engineer from the NIOSH Fire Fighter Fatality Investigation and Prevention Program investigated the incident. The NIOSH team met with the Chief and District Chiefs of the department, representatives from the local International Association of Fire Fighters (IAFF), and interviewed all but one of the fire fighters and officers involved in the incident. The incident site was visited and photographed by the NIOSH team. The department's standard operating procedures (SOPs), training records for the victim, 911 dispatch transcripts, fire investigator reports and the medical examiner's report were reviewed.

As part of the NIOSH Fire Fighter Fatality Investigation and Prevention Program, the Respirator Branch, National Personal Protective Technology Laboratory (NPPTL) conducted an evaluation of one self – contained breathing apparatus (SCBA) at the request of the fire department. The SCBA was reported to be last used during interior fire-fighting operations at the structure fire on March 21, 2003 by an injured fire fighter. The performance of this SCBA did not play a role in this fatality and a summary of this report is available from NPPTL.¹

Department

The career fire department involved in this incident has 785 uniformed fire fighters that operate from 26 fire stations. The department serves a metropolitan population of approximately 350,000 within a geographic area of about 77 square miles.

Training

The fire department provides all new recruits with a 20-week training program conducted at the city's Fire Academy. The victim had 3 years of experience as a career fire fighter and was certified in the State of Ohio as a Fire Fighter Level II, Fire Safety Inspector, and Basic Emergency Medical Technician (EMT). The victim had successfully completed numerous other training courses such as: first responder operations, workplace violence, Haz-Mat operations, thermal imaging, defensive driving, and weapons of mass destruction – chemical & radiological emergencies.

Equipment and Personnel

There were 4 apparatus on scene during the 1st alarm response prior to the flashover. Additional units were dispatched in 2nd and 3rd alarms; however, only those units directly involved in operations preceding the fatal event are discussed in the investigation section of this report. The initial dispatch was at 0845 hours. Units and apparatus listed in order of arrival on the scene included:

- Staff vehicle with District Chief as the Incident Commander
- Engine 9 with officer, fire apparatus operator (FAO), victim, and one fire fighter
- Ladder 2 with officer, FAO and two fire fighters
- Engine 2 with officer, FAO and two fire fighters
- Ladder 32 with officer, FAO and two fire fighters

Approximately 17 fire fighters were on scene when the flashover occurred at approximately 0852 hours. All firefighters were equipped with a full array of bunker gear, SCBAs, portable radios and personal alert safety system (PASS) devices.

Structure

The incident structure was a two-story, single-family residence of ordinary construction built in the 1910s (Photo 1). The first and second floor had approximately 1,200 square feet of furnished living area, with an 825 square foot finished basement



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below grade. The first floor consisted of a living room, dining room and kitchen (Diagram 1). There was a 150 square foot covered front porch and a 60 square foot covered back porch at the rear of the structure. The second floor had three bedrooms and a bathroom. Exterior construction was brick over wood framing with aluminum siding on the second floor. The roof consisted of asphalt shingles and the house set on a level corner lot. Interior construction was wood paneling and the ceilings were plaster over wood lathe on the first floor.

According to the fire investigators, the origin and cause of the fire was from unattended food left on a natural gas stove in the kitchen. The occupants of the home evacuated prior to arrival of fire fighters, but first responding units were unaware of their status.

Weather

At the time the fire occurred the weather was overcast with a temperature of approximately 50°F and a wind speed of about 8 mph from the west-southwest.

INVESTIGATION

On March 21, 2003, at 0845 hours, fire fighters were dispatched to a residential house fire. The first responder to arrive on the scene was the District Chief at 0848 hours, who assumed incident command (IC) and immediately conducted a size-up of the structure. He reported to dispatch heavy fire showing in the southeast rear corner with heavy smoke. *(Note: It is department policy to dispatch a district chief, 2 engine companies and 2 truck companies on a residential house fire).* After confirming a structural fire, three additional units (a Rapid Assistance Team, a Rescue unit and an additional District Chief) were automatically dispatched to the scene per department policy. *(Note: These units did not arrive on the scene until after the flashover).* The IC was unaware that the home was unoccupied and proceeded with aggressive interior operations.

Activity of the victim and his crew on the fireground prior to the flashover

Engine 9 arrived on the scene at 0849 hours and parked at the front of the structure near a hydrant (Diagram 2). The officer and the victim took a 1¾-inch hose line and headed to the front door. The other fire fighter from Engine 9 stayed at the rear of the apparatus and unloaded the hosebed to the street. When the crew arrived at the front door, it was locked so they went to the rear of the structure. The IC was at the rear of the structure and ordered the crew to make a forceable entry through the front door. The FAO made the connection to the hydrant. The officer and victim brought the hose line back to the front of the structure while the other fire fighter retrieved an axe from Engine 9. The officer, victim, another fire fighter from Engine 9 and a fire fighter from Engine 2 (who had just arrived) donned their SCBA masks and prepared to enter the structure. The officer from Engine 9 radioed his FAO twice to charge the hose line. Since the hose line was still not charged, the officer from Engine 9 left the porch and proceeded to the apparatus to check on the water supply. The FAO yelled out that the line was charged. After checking the hose line, the officer saw the tangled hose in the yard (Photo 2). The officer immediately went to the hose and began to flake it out removing the kinks. While the officer was attending to the hose, the victim and two fire fighters on the front porch made forceable entry through the front door with the hose line still uncharged. Conditions in the interior were heavy smoke and intense heat. The fire fighter from Engine 9 came out of the structure to check on the water supply. He saw his officer working on the hose line; he went back inside the structure assuming that the line would soon be charged.

Within seconds, a flashover occurred (0852 hours) fully engulfing the first floor in heavy flame. The two fire fighters on the interior crew exited out the front door with their bunker gear smoldering. The victim



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was seen by exterior crews still within the structure. He proceeded away from the exit into the fire. The officer on Engine 9 did not realize that a member of his crew was still inside the structure; he saw three fire fighters on the front porch and assumed that all the interior crew had escaped the flashover.

Other critical apparatus and fire fighter activities on the fireground prior to the flashover

Ladder 2 arrived on the scene at 0850 hours. Upon arrival, fire fighters had trouble determining which house was on fire since heavy smoke obscured the street. Ladder 2 passed in front of the house and setup on the west side of the structure. After the apparatus was set up, a fire fighter climbed the ladder onto the roof and made a vertical ventilation hole in the southeast corner directly over the fire (Photo 2). The FAO from Ladder 2 began to climb the ladder with a pike pole when the flashover occurred. (*Note: The vertical ventilation hole was cut through the roof but the second floor ceiling had not been penetrated*). Flame burst out of the windows on the west side of the structure. The IC immediately ordered the Ladder 2 fire fighter off the roof and Ladder 2 began to setup ladder pipe operations. Upon arrival, the officer and another fire fighter from Ladder 2 were venting some of the first floor windows on the southwest corner when they saw the tangled hose in the side yard. They assisted with removing the kinks. After ventilating the ground windows, the second fire fighter from Ladder 2 assisted Engine 2 in deploying a 1¾-inch hose line from Engine 9 and proceeded to the front of the structure. When the flashover occurred, the second fire fighter from Ladder 2 saw the victim running through the first floor and thought he was going to exit out a side window. When he did not observe his exit, he immediately prepared for search and rescue operations.

Engine 2 also arrived at 0850 hours, but Ladder 2 was blocking the road on the west side of the structure. The FAO drove the apparatus around the

block and secured a hydrant southwest of the structure. The rest of the crew from Engine 2 dismounted and assisted Engine 9. One fire fighter assisted the interior crew; the officer and second fire fighter got a second 1¾-inch handline from Engine 9 and proceeded to the rear of the structure. (*Note: The officer from Engine 2 thought the rear porch was on fire*). At the back of the structure, the IC verbally ordered Engine 2 back to the front door to back up Engine 9. When they arrived at the front door, the flashover occurred.

Ladder 32 arrived on the scene at 0851 hours and positioned in the front of the building behind Engine 9. The crew was setting up the truck and had only been on the scene for a minute when the flashover occurred. The officer and fire fighter from Ladder 32 also saw the victim still inside the structure immediately after the flashover occurred.

Fire fighter activities on the fireground after the flashover

After the flashover, the IC ordered an evacuation, accountability, requested a second alarm, and initiated defensive operations. The two injured fire fighters now located in the front yard were given first aid. Officers from Engine 2, Ladder 2, and a fire fighter from Ladder 32 took a charged hose line and made entry through the front door. The fire fighter from Ladder 32 performed a search of the first floor. Several other fire fighters assisted with the rescue effort and additional handlines were used through the front and back door. The victim was located in the dining room and lowered out of a window into the side yard, where resuscitation was immediately begun. The victim's bunker gear, SCBA, portable radio and PASS device were all heavily damaged from the fire. The victim was removed from the structure within 10 minutes of the flashover and transported via ambulance to an area hospital where he was pronounced dead. The two fire fighters on the interior crew were both injured (the fire fighter



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from Engine 2 injured his hip and the fire fighter from Engine 9 received second degree burns to the ears). The injured fire fighters were treated and released from the emergency room.

CAUSE OF DEATH

The medical examiner's report listed the victim's cause of death as severe 3rd degree burns.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Fire departments should review and revise existing standard operating procedures (SOPs) for structural fire fighting to ensure fire fighters enter burning structures with charged hose lines.²⁻³

Discussion: It is department policy to initiate an aggressive interior attack (offensive strategy) whenever possible. The department SOPs for structure fires state the first fire line will be a 1¾-inch hose line and that line will be backed-up with a minimum size line of 1¾-inch. In this incident, poor hose deployment resulted in a lack of water supply for the interior attack crew. The initial 1¾-inch hose line from Engine 9 was 350 foot long (seven 50 foot sections) which became severely kinked restricting water flow. The backup handline was also uncharged at the time of the flashover. Department SOPs did not specifically state that a handline is to be charged prior to advancing into a structure on an offensive interior attack. Essentials of Fire Fighting 4th Edition states, "When advancing a hose line into a burning structure, air should be bled from the line once it is charged and **before** entering the building." Firefighters should continually train in establishing water supply, proper hose deployment, and advancing and operating hose lines to ensure successful interior attacks. Refresher training should be provided to all fire fighters on a regular basis or as needed to ensure effective fire fighting skills are maintained.

Recommendation #2: Fire departments should ensure that a Rapid Intervention Team (RIT) is established and in position prior to initiating an interior attack.⁴⁻⁵

Discussion: A rapid intervention team (RIT) should respond to every major fire. The team should report directly to the IC 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 task 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. A RIT should be established, in position and ready for deployment during the initial stages of an incident and before interior fire fighting operations begin. In this incident, a RIT responded after the working structural fire was confirmed, but did not arrive until after the flashover had occurred.

Recommendation #3: Fire departments should ensure that ventilation is closely coordinated with interior operations.^{3,6-7}

Discussion: Ventilation must be closely coordinated with the interior fire attack. Fire can quickly spread in a structure, causing problems such as a flashover which occurred in this incident. Ventilation timing is extremely important and must be carefully coordinated between interior operating crews and ventilation crews. Ventilation is necessary to release heat, smoke, and fire which improve the interior conditions so that fire fighters can perform such duties as advancing to the fire with a hose line for extinguishment and for conducting search and rescue. Incident command should determine if ventilation is needed and where ventilation is needed. The type of ventilation should be determined based on evaluation of the structure and the location of any



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interior crews. In this incident, vertical ventilation was not fully completed prior to crew entry and ventilation might have helped prevent the flashover.

Recommendation #4: Fire departments should ensure that crew continuity is maintained on the fireground.³

Discussion: In this incident, the interior attack crew was from two engine companies without an officer. Team continuity involves knowing who is on your crew and who is the leader, staying within visual contact at all times (if visibility is obscured then teams should remain within touch or voice distance of each other), communicating your needs and observations to the team leader, rotating to rehab and staging as a team, and watching out for other team members. These key factors help to reduce serious injury or even death resulting from the risks involved in fire fighting operations by providing personnel with the added safety net of fellow team members. As crews enter a hazardous environment together, they should leave together to ensure that crew continuity is maintained.

Recommendation #5: Fire departments should ensure that fire command always maintains close accountability for all personnel operating on the fireground.⁸

Discussion: Although there is no evidence that this recommendation would have prevented this fatality, it is being provided as a reminder of a good safety practice. There was some confusion immediately after the flashover as to the victim's location by his officer. Accountability on the fireground is paramount and may be accomplished by several methods. It is the responsibility of all officers to account for every fire fighter assigned to their company and relay this information to the IC. A fire fighter should communicate with the supervising officer by portable

radio to ensure accountability and indicate completion of assignments and duties. One of the most important aids for accountability at a fire is the Incident Command System (ICS). As a fire escalates and additional fire companies respond, communication assists the IC with accounting for all fire fighter companies at the fire, at the staging area, and at rehabilitation. With an accountability system in place, the IC may readily identify the location of all fire fighters on the fireground. Additionally, the IC would be able to initiate rescue within seconds of realizing a fire fighter is trapped or missing.

Recommendation #6: Emergency dispatchers should obtain as much information as possible from the caller and report it to the responding fire fighters.³

During this incident, the fire fighters were unaware that the structure was unoccupied and the IC could have used this information to formulate a different suppression strategy. The building occupant who reported the fire to 911 indicated that all occupants were exiting the structure and this critical information was not reported to fire fighters. Emergency dispatchers should always try to obtain all information available from the caller. This would include any information regarding the type of structure, occupancy, injuries, the fire or emergency condition, the possible location of the fire, address of the incident, and call-back numbers.

REFERENCES

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INVESTIGATOR INFORMATION

This investigation was conducted by Steve Berardinelli and Mark McFall, Safety and Occupational Health Specialists and Tim Merinar, Safety Engineer with the Fire Fighter Fatality Investigation and Prevention Team, Fatality Investigations Team, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH located in Morgantown, West Virginia. Also assisting in the investigation was Tommy Baldwin, Safety and Occupational Health Specialist with the NIOSH Fire Fighter Fatality Investigation and Prevention Program, Cardiovascular Disease Component located in Cincinnati, Ohio.



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Photo 1. Front of incident structure



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Photo 2. Aerial view of structure after incident. Photo courtesy of fire department



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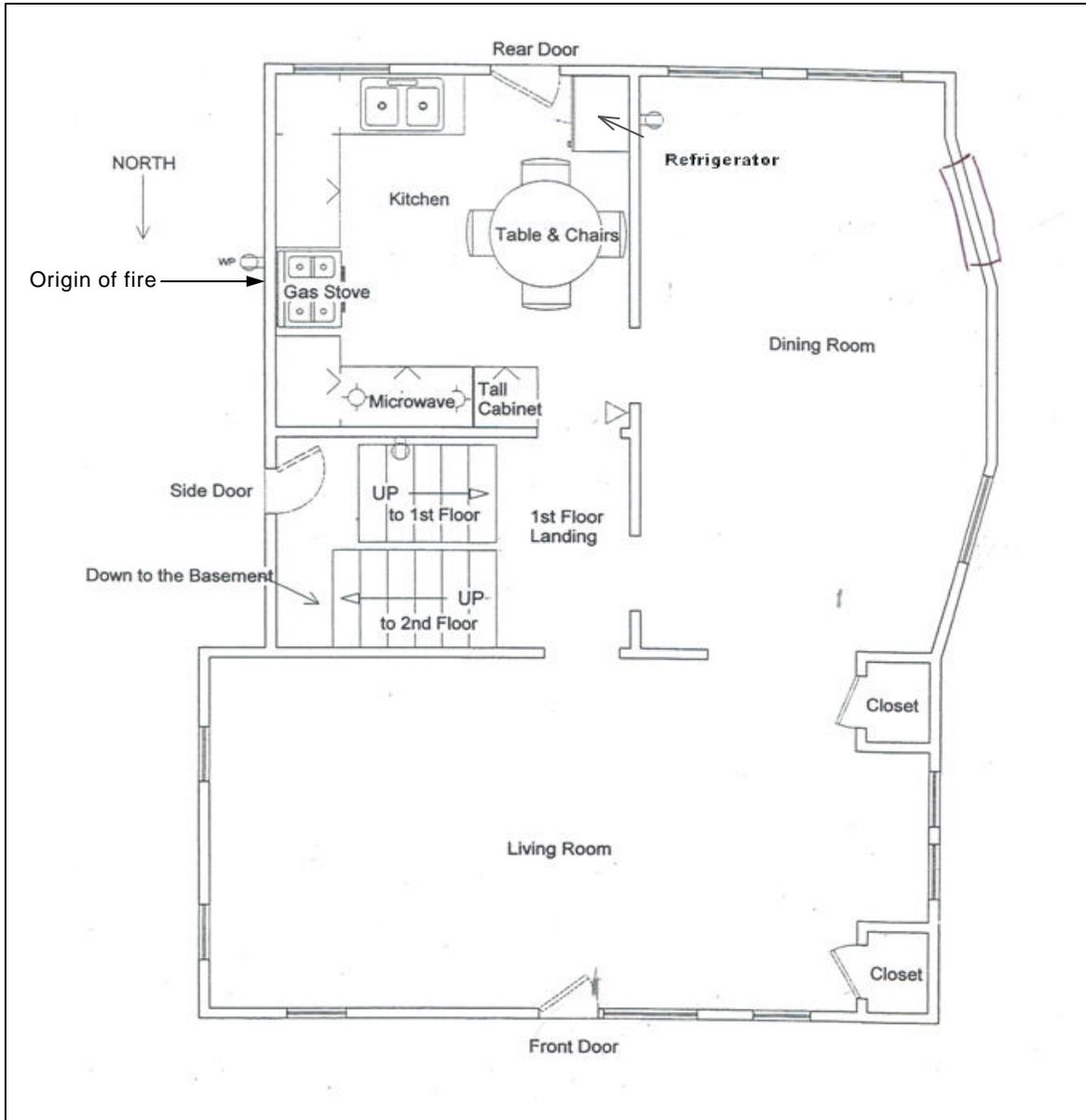


Diagram 1. Layout of 1st floor of incident structure



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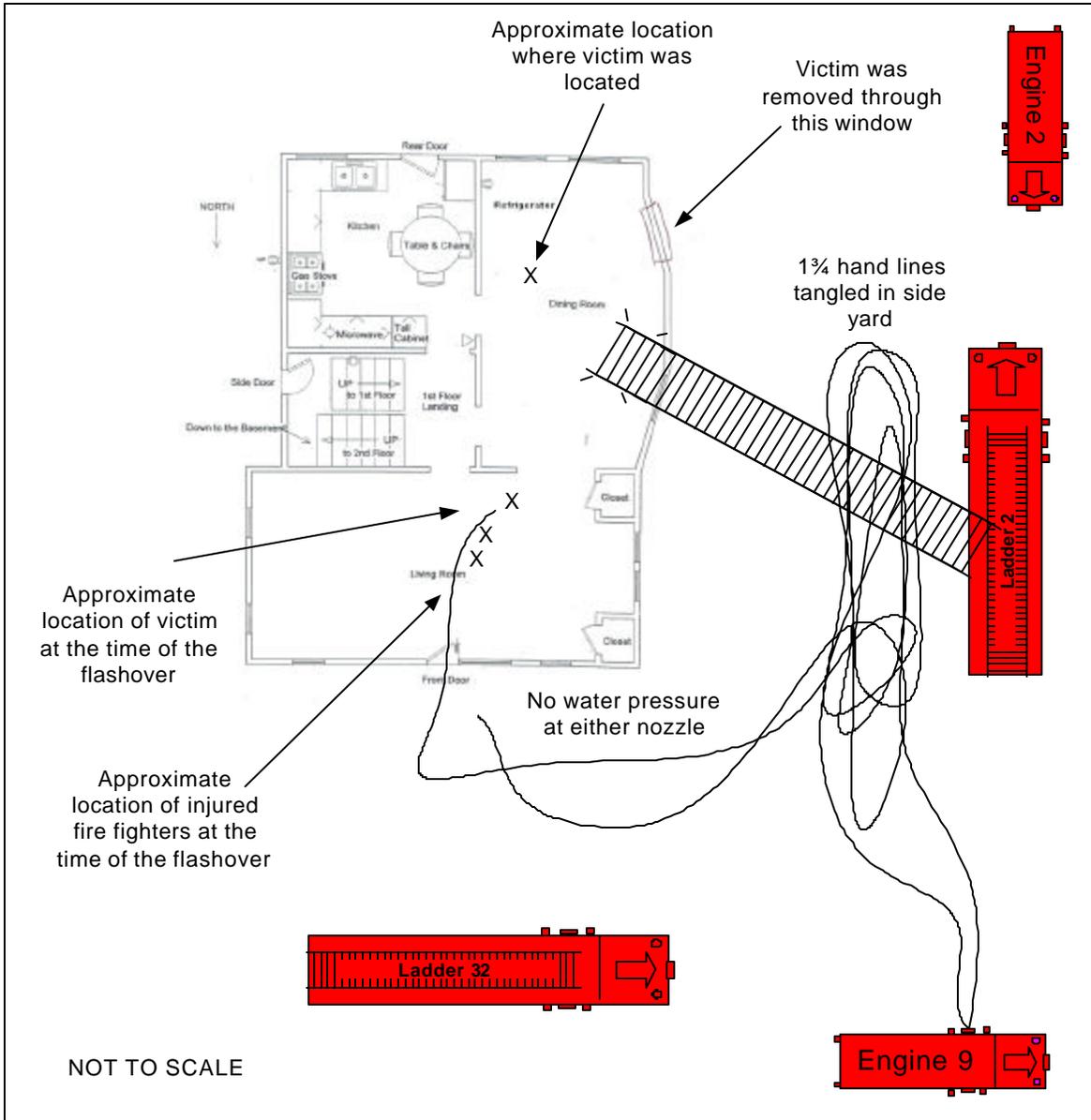


Diagram 2. Aerial view of incident scene at the time of the flashover

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