Career Captain Sustains Injuries at a 2-1/2 Story Apartment Fire then Dies at Hospital – Illinois

Executive Summary

On November 2, 2012, a 54-year-old male career captain sustained injuries at a 2-1/2 story apartment building fire then died at a local hospital. The fire occurred only blocks from the victim's fire station. Battalion Chief 19 (BC19) was the first to arrive on scene and reported heavy smoke coming from the rear and front of the structure's attic. BC19 surveyed the interior of both floors, while the captain and a fire fighter from Engine 123 stretched a 2½-inch line with a gated wye to 1¾-inch hoseline to the 2nd floor. BC19 radioed the captain from the rear of the 1st floor apartment that there was heavy fire in the rear covered porch and stairwell. The captain (victim) and the fire fighter stretched the hoseline towards the rear of the second floor apartment. Before water could be applied to the fire the captain told the fire fighter they had to "get out." Engine 49 (2nd due engine) had stretched a 2½-inch hoseline down the alley to the rear and get into position to put water through the attic window. The captain moved halfway back in the hallway towards the kitchen and yelled out that he needed help. As the fire fighter drug the captain to the kitchen, additional fire fighters who reached the 2nd floor heard the Captain and fire fighter collapse on the floor in front of them. A Mayday was called by the Squad 5 Lieutenant on the second floor and the victim was carried down the stairs to the front yard. The victim responded to basic life support measures and was moved to Ambulance 19 for advanced life support. The victim was transported to the local hospital where he had complications during airway management and died.

Front view of the fire structure
(NIOSH Photo)

Contributing Factors

- *Modified building construction with multiple ceilings and a multi-story enclosed rear porch*
- *Horizontal ventilation contributed to the rapid fire growth*
- *Fireground communications*
- *Lack of proper personal protective equipment*
- *Lack of a sprinkler system in the residential rental building.*

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Key Recommendations

- *Ensure that fireground operations are coordinated with consideration given to the effects of horizontal ventilation on ventilation-limited fires*
- *Ensure that the Incident Commander communicates the strategy and Incident Action Plan to all members assigned to the incident*
- *Ensure that the Incident Commander establishes a stationary command post during the initial stages of the incident for effective incident management, which includes the use of a tactical worksheet, enhanced communications, and a personnel accountability system*
- *Ensure use of risk management principles at all structure fires*
- *Ensure proper personal protective equipment is worn*
- *Ensure that communications are acknowledged and progress reports are relayed*
- *Ensure that Incident Commanders are provided chief aides to help manage information and communication*
- *Ensure that staffing levels are maintained.*

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Introduction

On November 2, 2012, a 54-year-old male career captain (the victim) sustained injuries at a 2-1/2 story apartment building fire then died at a local hospital. On November 5, 2012, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On November 10-15, 2012, a general engineer, a safety and occupational health specialist, and an investigator from the NIOSH Fire Fighter Fatality Investigation and Prevention Program traveled to Illinois to investigate this incident. The NIOSH investigators met with the District Chief of Safety and Health, representatives of the fire department, fire marshal's office, and the International Association of Fire Fighters local union representatives. The NIOSH investigators visited the incident site to take photographs and measurements. Representatives from the National Institute of Standards and Technology (NIST) and the Underwriters Laboratories (U.L.) were on site gathering data for conducting a possible fire model and met with NIOSH investigators to discuss the incident. The NIOSH investigators interviewed officers, fire fighters, and emergency medical services personnel on scene at the time of the incident. The NIOSH investigators also visited the fire department's Breathing Apparatus Service Unit to inspect and evaluate the victim's self-contained breathing apparatus (SCBA) and personal protective equipment. The investigators reviewed fire department standard operating procedures, training records, dispatch records, and witness statements.

Fire Department

The career fire department involved in this incident has 98 stations with 4,314 uniformed members that serve a population of approximately 2,851,000 within an area of about 228 square miles.

Department members assigned to the Operations Division work a 24-on/48-off shift schedule with three shift platoons. The department operates 24 battalions in five divisions. The fire department currently has 96 engine companies, 61 truck companies, 4 squads (heavy rescue companies which are two-piece companies), 2 marine boats, 2 helicopters, plus various support apparatus for high-rise, hazardous materials incidents, and special operations. All fire department apparatus are maintained by the city's fleet maintenance division. Annual testing (e.g. pumps and ladders) as recommended by the National Fire Protection Association (NFPA), is conducted by qualified vendors. In addition to fire suppression, hazardous materials mitigation, and special operations response, the fire department operates an Emergency Medical Services (EMS) Division which consists of 12 Basic Life Support (BLS) Ambulances, 59 Advanced Life Support (ALS) Ambulances, and support staff including EMS Field Officers. Also, the fire department operates an aircraft rescue fire fighting (ARFF) Division at two airports within the city.

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The fire department has well documented written policies and procedures consistent with the requirements of NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program*,[1] Section 4.1 and 8.8 which are available to all department members at each fire station and all fire department offices. Policies and procedures on the incident command system, engine company operations, truck company operations, SCBA and personal protective equipment (PPE) use, Mayday procedures, radio use, Rapid Intervention Team (RIT), and other topics were reviewed. The fire department has a training facility that is in operation from 0700 to 1600 hours Monday through Friday. The fire department's training academy literature included training materials related to bowstring truss construction, lightweight truss construction and steel bar truss construction.

The fire department dispatch center (Fire Alarm Office) is part of the city's Office of Emergency Management and Communication (OEMC). The Fire Alarm Office operates with 6 dispatchers plus a supervisor on each 8-hour shift. The Fire Alarm Office processes approximately 1,800 calls per 24 hours or approximately 600 calls per shift.

The fire department is rated as a Class 2 department by ISO.[a] In the ISO rating system, Class 1 represents exemplary fire protection, and Class 10 indicates that the area's fire-suppression program does not meet ISO's minimum criteria.

Training and Experience

Beginning in August 2010, the Illinois Office of the State fire Marshal (OSFM) implemented new minimum certification standards for all firefighters in the State that meet or exceed the requirements of NFPA 1001 *Standard on Fire Fighter Professional Qualifications, Fire Fighter I and Fire Fighter II*. This career fire department enacted requirements that exceed the state's requirements. These new certifications, Basic Operations Firefighter (BOF) and Advanced Technician Firefighter (ATF) replace the current Firefighter II and Firefighter III respectively. There is a five year transition period during which firefighters may certify to either standard. Certification as a Basic Operations Firefighter requires:

- Successful completion of the BOF course
- Successful completion of a minimum of 180 instructional hours in BOF
- Passage of the State written exam and the State practical skills examinations
- Completion of the classroom portion of the Fire Service Vehicle Operation certification (Beginning in 2011, the FD requires all new hires to successfully complete the entire certification program)
- Successful completion of Hazardous Materials Operations certification (56 hours)
- Successful completion of Technical Rescue Awareness certification (8 hours)
- Certification in CPR
- NIMS 100 and 700
- Completion of the National Fallen Firefighter's "Courage to Be Safe" course.

[a] **ISO is an independent commercial enterprise which helps customers identify and mitigate risk. ISO can provide communities with information on fire protection, water systems, other critical infrastructure, building codes, and natural and man-made catastrophes. ISO's Public Protection Criteria program evaluates communities according to a uniform set of criteria known as the Fire Suppression Rating Schedule (FSRS). More information about ISO and their Fire Suppression Rating Schedule can be found at the website http://www.isogov.com/about/.**

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The fire department operates its own recruit training academy that recruits attend for at least 6 months, exceeding the state requirement. In addition to completing Basic Operations Firefighter certification requirements, recruits receive approximately 150 additional hours of firefighting training at the academy. Each recruit must also complete instruction in emergency medical services and be certified as a state of Illinois EMT-Basic (EMT-B). After completing the recruit training, each probationary fire fighter is assigned to a company. Fire fighters are required to participate in two hours of training per work shift. All pump operators on the fire department hold the career service rank of Fire Engineer for which they must pass competitive written and practical examinations. Ladder/Truck operators are referred to as a driver.

All Fire Engineers are given an additional 70 hours of instruction upon promotion and assignment to the field. Beginning in 2005, the fire department instituted a new requirement whereby new company officers receive 4 weeks of training that includes Management 1, Tactics 1, Instructor 1 and 1 week of departmental officer orientation and management training. In 2011 this training was expanded to 5 weeks and covers the entire curriculum of the NFPA 1021, *Standard on Fire Officer Professional Qualifications, Fire Officer*. Upon promotion to the rank of Captain, all officers receive an additional 2 weeks of managerial, tactical and incident management instruction. Upon promotion to Battalion Chief, all officers receive an additional 3 weeks of managerial, tactical and incident management instruction which includes ride-along time in operations with an experienced battalion chief.

In compliance with the National Incident Management System (NIMS) training requirement, the fire department requires all firefighters to complete NIMS training commensurate with their rank. The fire department's NIMS training requirements for firefighters, fire engineers, and battalion chiefs are greater than the federally mandated minimum requirements. Company officers are provided with opportunities to complete advanced NIMS training (ICS 300, ICS 400, All-Hazards Incident Management Team Training) that exceed the federal minimum requirements for their rank.

	Required Training	Optional Training
Firefighter, Fire Engineer	IS 100, IS 200, IS 700	
Lieutenant, Captain	IS 100, IS 200, IS 700	ICS 300, ICS 400, All-Hazards Incident Management Team Training
Battalion Chief	IS 100, IS 200, ICS 300, ICS 400, IS 700, IS 703, IS 704, IS 800	All-Hazard Incident Management Team Training
Exempt Rank	IS 100, IS 200, ICS 300, ICS 400, IS 700, IS 701, IS 702, IS 703, IS 704, IS 800	

Note: Exempt Rank is all the ranks above Battalion Chief

Including the training listed above, the Engine 123 Captain (victim) had a total of 11,076 hours of formal training within 32 years of fire fighting experience; the Tower Ladder 39 Lieutenant had 27,791

hours of formal training within 22 years of fire fighting experience; and the BC19 (Incident Commander) had a total of 24,647 hours of formal training within 33 years of fire fighting experience.

Equipment and Personnel

The fire department involved in this investigation provides two basic responses for reports of structure fires, which are a "Still" alarm or a "Still and Box" alarm. The Fire Alarm Office will dispatch a "Still" alarm assignment to initial reports of structure fire. The "Still" alarm dispatch sends two engine companies, two truck companies, and a battalion chief. If the Fire Alarm Office receives additional reports of a fire or a company arrives on scene and reports a "working fire," then a squad company, a command van, and a RIT complement will be dispatched. If the report of a fire is located in a squad company's first due area (approximately 40 blocks), then the squad company will be sent automatically. A "Still and Box" alarm is usually requested by a fire officer, though there are situations where the Fire Alarm Office can transmit a "Still and Box" alarm. These situations can include a person trapped in the fire building, multiple structures on fire, a large commercial building on fire, a building collapse, train derailment, an airport alert (aircraft in distress), or smoke in a building with a high life hazard (e.g. hospital, nursing home, theater).

Extra Alarms are designated as *2-11*, *3-11*, *4-11*, and *5-11* with defined response protocols for each. Any equipment needed above a fifth alarm (5-11) will be requested by the Incident Commander. *EMS Plan I, II, or III* are designed to be used when an incident escalates and the numbers of patients continue to increase. For example, the *EMS Plan I* consists of: 6 Ambulances (one being a basic life support ambulance), 1 Engine, 1 Truck, 1 Battalion Chief, 1 EMS Field Officer, and 1 Assistant Deputy Chief Paramedic.

In 2002, the department implemented procedures for a RIT Response in which a truck company and a battalion chief are dispatched to and designated as a "rapid intervention team" on every working fire. A RIT Response is comprised of 1 Truck Company, 1 Battalion Chief, 1 ALS Ambulance, and 1 EMS Field Officer. Additionally, the department has procedures for a "Mayday Response" which follows closely with the "RIT Response." In the event a "Mayday" is transmitted, protocol requires a "Still" alarm to be upgraded to a "Still and Box" alarm or if a "Mayday" is transmitted at a "Still and Box" alarm the incident is upgraded to a *2-11* alarm. If the incident is already a *2-11* alarm, the alarm level is upgraded at the discretion of the Incident Commander. The RIT Chief is also the designated Incident Safety Officer (ISO) at a structure fire unless the incident is upgraded to a 2-11 or higher alarm and additional chief officers are dispatched, at which time a separate ISO will be designated.

Per department procedures the following companies were dispatched to the initial report of this structure fire through the time of the Mayday:

Still Alarm
Engine 123 (E123): Captain (victim), engineer, 3 fire fighters
Tower Ladder 39 (TL39): Lieutenant, driver, 2 fire fighters – *Note: The company was riding one fire fighter short, which is referred to as a variance.*

Engine 49 (E49): Lieutenant, engineer, 2 fire fighters – *Note: Also on a variance*.
Truck 33 (T33): Captain, driver, 3 fire fighters
Battalion Chief 19 (BC19): Incident Commander (IC)
RIT Alarm
Truck 52 (T52): Lieutenant, driver, 3 fire fighters
Squad 5 (SQ5): Lieutenant and five fire fighters - *Note: A squad consists of one heavy rescue vehicle and a 55- foot Snorkel; Staffing includes an officer and three fire fighters on the heavy rescue vehicle and two fire fighters on the Snorkel.*
Battalion Chief 15 (BC15): RIT Chief
Ambulance 19 (A19): 2 Paramedics
Unit 455: EMS Field Officer
Unit 273: Command Van

Timeline

An approximate timeline summarizing the significant events in this incident is listed below. The times are approximate (rounded to the nearest minute) and were obtained by studying the available dispatch channel records, witness statements, run sheets and fire department records. The timeline is not intended, nor should it be used, as a formal record of events. Only those dispatch channel communications directly related to the fatal incident are included. *Note: This department uses the following terminology to designate the geographical sides of a structure/building: Sector 1 – front of the building, address side of the structure, or where "Command" is located; Sector 2 – side to the left of Sector 1(going clockwise); Sector 3 – rear of the building or opposite of Sector 1; Sector 4 – side to the right of Sector 1 when facing Sector 1.*

- **1716 Hours**
  Dispatch for a **Still Alarm** for "Smoke in the area:" E123; TL39; E49; T33; BC19. BC19 assumes incident command enroute, verifies working fire, and Dispatch initiates RIT response dispatching T52, SQ5, BC15, A19, 455 EMS Officer, and Command Van 273.

- **1717 Hours**
  E123, E49, TL39, and T33 enroute; BC19 on scene in less than a minute; BC19 enters structure to size-up scene.

- **1719 Hours**
  E123 on scene

- **1720 Hours**
  E49, T33, and TL39 on scene and reported black smoke out front attic window and heavy smoke and flame in rear.

- **1721 Hours**

E123 crew made entry with 1 ¾-inch hoseline to second floor; E49 pulls 2 ½-inch hoseline down alley in Sector 3; T33 sets up ground ladder on Sector 2; TL39 sets up aerial to go to the roof; A fire fighter from SQ5 and T33 assisted TL39; Approximately 30 seconds later, a TL39 firefighter went to Sector 3, entered the Sector 3 first floor exterior enclosed porch door and noticing fire light up in the stairwell; He preceded to kick in the mud room door to the first floor apartment then backed out to Sector 3

- **1723 Hours**
  IC radios victim that there is heavy fire in rear stairway and covered porch and that E49 is going to put water on fire from Sector 3; No reply heard from victim.

- **1724 Hours**
  E49 in Sector 3 puts water on the fire at the attic window with 2½-inch hoseline

- **1725 Hours**
  SQ5 makes entry on Sector 1

- **1727 Hours**
  TL39 had just completed first hole in roof on Sector 4; After hearing the Mayday over the radio from the SQ5 Lieutenant, the IC calls “Mayday” into dispatch and requests **2-11 Assignment**; Dispatch initiates a 2-11 Alarm

- **1728 Hours**
  IC in Sector 1 and runs to get A19’s crew

- **1729 Hours**
  Fire fighters carry the victim outside to Sector 1 and perform CPR.

- **1738 Hours**
  A19 enroute to hospital with victim

Personal Protective Equipment

At the time of the incident, the victim was wearing structural fire fighting turnout pants, coat, boots, and helmet. The victim was wearing a SCBA and was found with his facepiece on. It is not clear whether his PASS device was sounding or not.

NIOSH investigators inspected the SCBA and turnout gear worn by the victim. The victim was carrying a radio at the time of the incident. The fire department's standard operating procedure is to assign three radios for each truck company and squad company. The officer and driver/engineer carry radios. The third radio is assigned during roll call at the beginning of each work shift to a fire fighter based upon their assigned duties for the work shift. Duties requiring a fire fighter to carry a radio could include the hydrant fire fighter on engine companies, ventilation or forcible entry, roof ventilation,

elevator management at high rise fires, search and rescue and other truck company duties. *Note: At the time of this investigation, the fire department was awaiting delivery of a large quantity of radios that would equip every fire fighter with a portable radio.*

Each engine and truck company carries a thermal imager. Thermal imagers were used during the initial size-up and fire suppression.

The victim's SCBA was evaluated by the NIOSH National Personal Protective Technology Laboratory (NPPTL) and a summary report is enclosed as Appendix I. The full report is available upon request. NPPTL will conduct an evaluation of the personal protective clothing worn by the victim. The evaluation report will be included as an appendix once completed.

Weather

At the time of this incident, the weather was mostly cloudy with an approximate temperature of 45°F and a relative humidity of 62 percent. The wind was northeast at approximately 10 miles per hour.[2]

Structure

The structure involved in this incident was a 2-1/2 story residential structure originally built in 1896. The structure was approximately 17 feet wide by 57 feet long and totaled approximately 2,000 square feet. The structure had a ground level apartment, a 2nd floor apartment, and an attic or half story housing the hot water heater for the structure. The structure was constructed with a balloon framing system with a wood gable roofing system. The exterior of the structure was vinyl siding over original wood planking with oriented strand board (OSB) sheathing in some areas. The roof was asphalt shingles over wood planking. The interior floor consisted primarily of carpeting over wood plank with ceramic tile in the entry way. Interior walls were 2-inch x 4-inch wood frame covered with ½ inch gypsum board. The 2nd floor ceiling had multiple layers with small void spaces (see Photo 1). The attic had OSB decking on the floor. The structure showed evidence of prior substantial renovation work with updated exterior doors and windows. The rear porch area was closed in with wood planks covered by foam board and vinyl siding and provided a stairwell to the 2nd floor and attic.

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Photo 1. Second floor ceiling has multiple layers – drywall, 2 x 4 joists, lathe (subflooring), and 2 x 6 joists covered by OSB.
(NIOSH Photo)

Investigation

On November 2, 2012, a 54-year-old male career captain sustained injuries at a 2-1/2 story apartment building fire then died at the hospital. At 1716 hours, dispatch called a Still alarm for smoke in the area. Battalion Chief 19 was the first to leave the station that was just blocks away. He approached the fire structure by driving behind it then around to the front arriving on scene at 1717 hours. He reported a working fire with heavy smoke coming from the rear (Sector 3) and front (Sector 1) of the structure's attic. Per fire department standard operating procedures, dispatch initiated a RIT response. At 1718 hours, E123 arrived on scene and BC19 was on scene and had assumed incident command. The IC spoke with one of the occupants who stated everyone was out. The IC made entry through the front door to the stairwell to survey the interior of the 2nd floor. He noticed only a light haze throughout and glow around the Sector 3 door to the covered porch. The IC came back to the front door and met the E123 Captain (victim) and a fire fighter (pipeman). They had stretched a horseshoe load which is 100 feet of 2 ½ -inch , a gated wye, and 150 feet of 1 ¾-inch hoseline to go to the 2nd floor, which is a standard department hose lay for this type occupancy. At 1720 hours, E49, T33, and TL39 arrived on scene (see Diagram 1).

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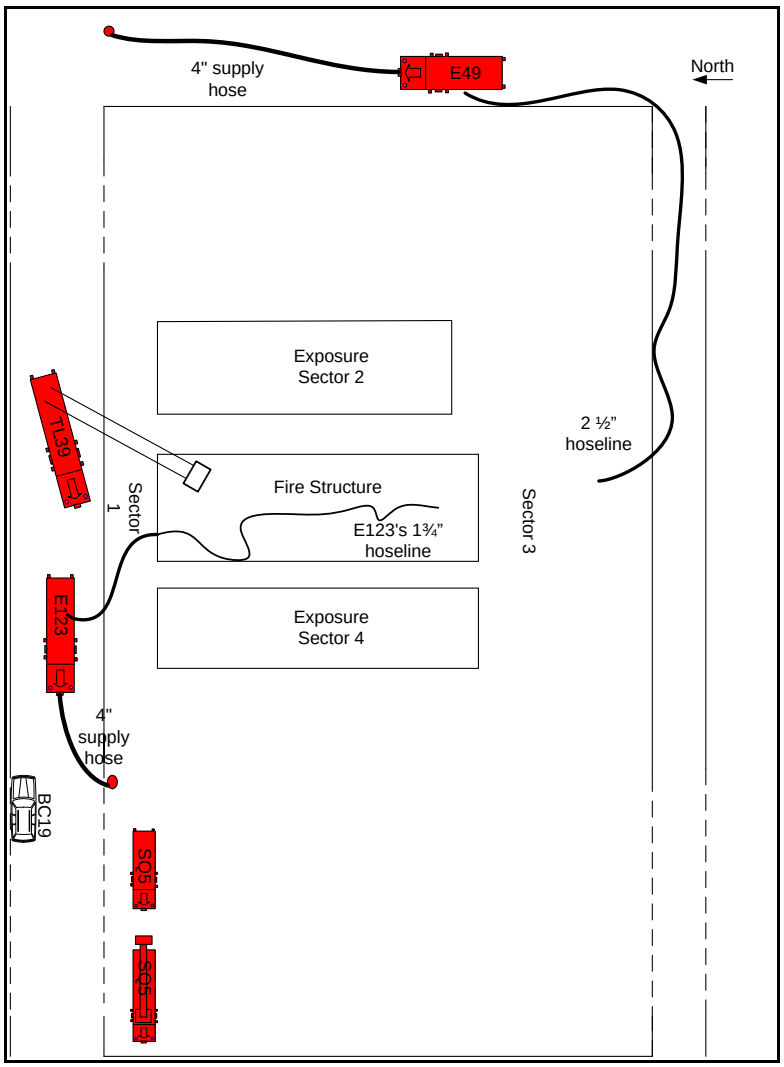

Diagram 1. Apparatus and hoseline placement

The IC made entry to the 1st floor apartment and worked his way to Sector 3. He opened the back door to the covered porch and noticed heavy fire in the covered porch and rear stairwell area (see Photo 2). At 1721 hours, the Victim and fire fighter were on the 2nd floor where they flaked out, charged, and began advancing the hoseline to the rear door of the apartment. The E49 crew had stretched a 2 ½-inch hoseline down the alley to Sector 3. The T33 crew set a ground ladder on Sector 2 and TL39 set the aerial to the roof about a third of the way back on Sector 2. A TL39 fire fighter went to Sector 3 to check doors. He first went to the basement door which he was unable to force open. Then, he went to the first floor exterior enclosed porch door which was unlocked and he opened it up. He stated that he noticed fire light-up in the stairwell. He kicked in the locked door to the first floor apartment, preceded to walk in, saw no fire then backed out.

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Photo 2. Covered porch and stairwell of Sector 3 from 1st floor apartment.
(NIOSH Photo)

At 1723 hours, the IC radioed the victim that there was heavy fire in the covered porch and attic area and that E49 was going to put water on the fire, around the Sector 3 attic window, but there was no acknowledgement from the victim. E49 proceeded to put water on the Sector 3. The IC returned out front to the command post and donned his turnout gear.

The Lieutenant from TL39, the Lieutenant and 2 fire fighters from SQ5, and a E123 firefighter/paramedic (FF/PM) were near the kitchen area on the 2nd floor when they heard a loud commotion. The FF/PM heard the victim yell "get out of here" (see Photo 3 and Photo 4). The FF/PM felt the victim's air cylinder and noticed it was hot. Also, he felt a mask that was dangling and thought it was the victim's but it was actually the E123's pipeman, who was tangled up with the victim. *Note: The E123 pipeman was on air and his facepiece became dislodged while assisting the victim.* The FF/PM had no radio and he couldn't locate the victim's radio so he yelled Mayday as he tried to get the victim and other crew member untangled. The TL39 Lieutenant and SQ5 fire fighters heard the FF/PM's verbal Mayday and the SQ5 Lieutenant tried to transmit a Mayday over heavy radio traffic (see Diagram 2). *Note: The victim's hoseline in the hallway (see Diagram 2) had burst but it is believed to have occurred during the thermal incident or post incident.*

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Photo 3. Hallway in which victim was operating prior to incident. Note the space heater that the victim was near when he yelled for help and the metal door that had been attached to the doorway in Photo 4 to the covered porch and was warped by the heat.
(NIOSH Photo)

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Photo 4. Second floor doorway to covered porch, in which, the victim was operating behind
(*NIOSH Photo*)

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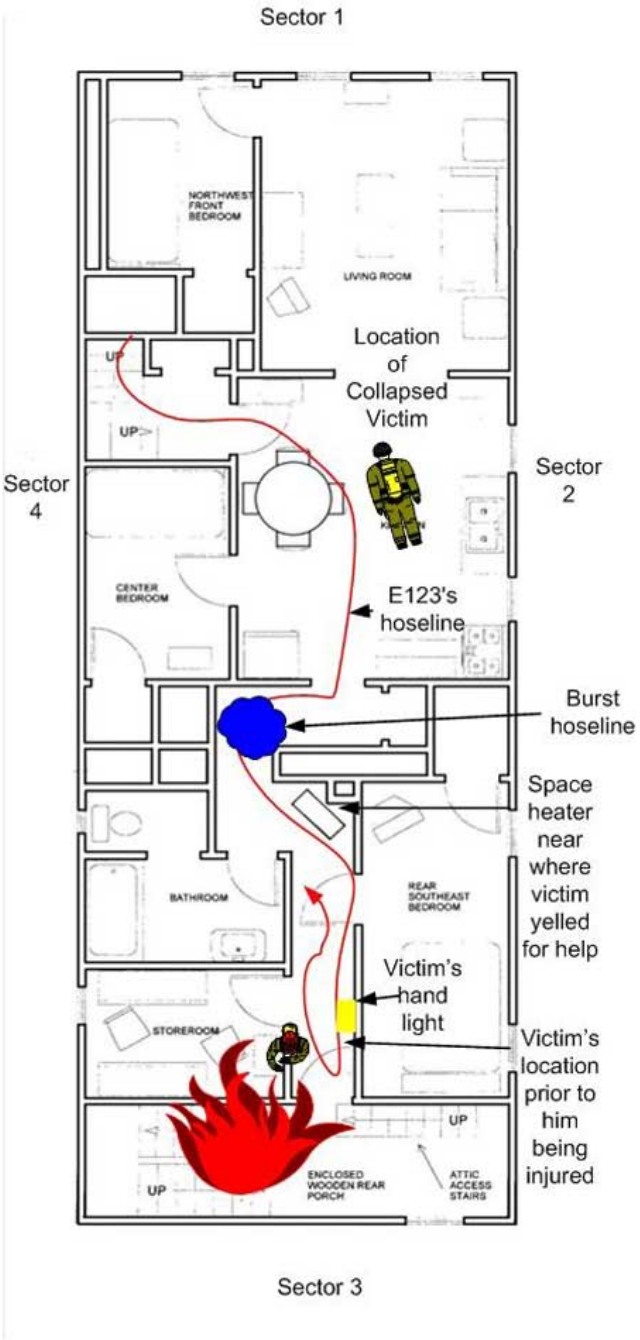

Diagram 2. Location of Victim and hoseline when found.

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At 1727 hours, the TL39 crew had just completed the first hole in the roof about midway on Sector 4 roof with minimal fire showing, when they heard the Mayday. The IC verified that a fire fighter was down, called a Mayday, and requested a 2-11 Assignment. Dispatch initiated a 2-11 alarm. SQ5 and other members on the 2nd floor grabbed the victim and got him down the stairs. The TL39 crew, with assistance from a T33 and SQ5 fire fighter, had just completed a second hole on Sector 4 of the roof about a third of the way back when conditions worsened. At 1729 hours, the roof ventilation crew was back in the aerial basket when they noticed the victim being brought out to the front yard. The victim was nonresponsive in the front yard and CPR was successfully performed. The IC met the A19 crew and escorted them to the victim. The revived victim was responsive and talking to the paramedics as he was loaded into the ambulance. At 1738 hours, the victim was transported to the local hospital where he had complications during airway management and died.

Fire Behavior

According to the arson investigator's report, the fire originated in the attic and was accidental in nature. It is unknown how long the fire had burned before it was observed by the residents on the 2nd floor in the enclosed rear porch. Smoke pouring out the attic (indicating the fire was in an advanced stage) was noticed by a person at the street corner west of the structure. He ran up and knocked on the door to let the residents know the structure was on fire. The residents immediately exited the structure.

The developing fire burning in the attic void space was ventilation limited and produced a large volume of unburned products of incomplete combustion and high pressure. The first arriving companies observed optically dark smoke from the 2-1/2 story apartment building coming from the front and rear attic windows. As the engine crew advanced a hoseline to the 2nd floor, BC19 searched the 1st floor and went to the rear of the structure and noticed fire in the enclosed rear porch area. Another engine crew advanced a hoseline down the back alley to the exterior rear of the structure. Once the 2nd floor rear porch door failed, the fire gases from the porch flowed into the hallway.

Indicators of significant fire behavior

- 911 Dispatch received multiple phone calls reporting a structure fire
- First arriving crews could see smoke from blocks away prior to arriving on scene
- BC19 saw smoke pushing out attic window in Sectors 1 and 3
- The BC went to 2nd floor and noticed glow around rear door to porch
- The BC went in 1st floor apartment to rear porch and noticed fire raining down in enclosed porch area
- BC reports working fire and dispatch sends a RIT response
- TL39 firefighter opened the first floor doors (one exterior and one interior) of Sector 3 to the enclosed porch and notices the fire intensifies up the stairwell (horizontal ventilation)
- The 2nd floor rear porch door fails
- BC calls for an engine crew to the outside of Sector 3 with 2 ½-inch hoseline to hit the eaves and attic window
- Truck company is in process of venting roof on Sector 4 side near Sector 3 with little smoke when they hear the Mayday over the radio

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- The TL39 crew, with assistance from a T33 and SQ5 fire fighter, cut a second hole on Sector 4 mid-way between chimneys, flames and black smoke came out the second hole then precede to the basket to get off roof
- Within minutes roof totally involved in flames
- Defensive operations were initiated.

Note: The National Institute of Standards and Technology (NIST) is developing a computerized fire model to aid in reconstructing the events of the fire. When completed, this model will be available at the NIST website: http://www.nist.gov/fire/ .

Contributing Factors

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. NIOSH investigators identified the following items as key contributing factors in this incident that led to the fatality:

- Modified building construction with multiple ceilings and a multi-story enclosed rear porch
- Horizontal ventilation contributed to the rapid fire growth
- Fireground communications
- Lack of proper personal protective equipment
- Lack of a sprinkler system in the residential rental building.

Cause of Death

According to the medical examiner, the victim's cause of death was inhalation injuries received at a structure fire.

Recommendations

Recommendation #1: Fire departments should ensure that fireground operations are coordinated with consideration given to the effects of horizontal ventilation on ventilation-limited fires.

Discussion: Many fire fighters do not think of opening the front door or any exterior door as ventilation, but rather as forced entry for access to search and attack the fire. While entry is necessary, one must also realize that air is being fed to the fire through the open door and there is little time before either the fire gets extinguished or it grows until an untenable condition exists, jeopardizing the safety of everyone in the structure. Forcing entry has to be thought of as ventilation, it must trigger the thought that air is being fed to the fire. The problem is that proper respect is not given to the fact that air is able to enter a structure by opening a door or cutting a hole, and can provide the missing piece of the fire triangle to a ventilation limited fire.[3]

Underwriter's Laboratories (UL) has conducted experiments that demonstrate the more ventilation openings that were made the faster the fire room transitioned to flashover. This demonstrates that even in modestly furnished homes, fuel is not the limiting factor and that more air will create more burning

and less tenability. Ventilating near the seat of the fire can localize combustion and temperatures within the house. Ventilating remotely from the seat of the fire will create a flow path which will expand the area available to burn and further decrease tenability within the homes. Allowing air into a ventilation limited fire low and letting the hot gases out high can create prime conditions for a flashover, even in a large volume like the two-story family room. More efficient ventilation can mean more efficient air entrainment which can lead to faster flashover times if water is not applied in the shorter tenability window.[3]

Recommendation #2: Fire departments should ensure the Incident Commander communicates the strategy and Incident Action Plan to all members assigned to the incident.

Discussion: When establishing "Command" at any incident, one of the most important responsibilities of the Incident Commander is to develop a strategy and create an appropriate Incident Action Plan. Based upon the initial size-up, the Incident Commander has to absorb and process a lot of information in a very short period of time. The Incident Commander develops the strategy, which is defined as the overall plan that will be used to control the incident.[1,4] The development and management of the overall strategy (situation evaluation, operational risk management plan, and evaluation and decision-making process) becomes the basis for the Incident Action Plan (tactics). *Note: For most Type V and Type IV incidents, these incidents most often will not have a formal (written) Incident Action Plan due to the short duration of the incident. In this case, the tactics serve as the Incident Action Plan.* The basic order of development is: **strategy**, first and **Incident Action Plan**, second. Connecting the strategic, tactical, and task levels so they all operate within the same basic strategy is a major goal of the incident management system.

For structural fire-fighting operations, the basis for the development of most tactical priorities is Lloyd Layman's acronym "*RECEO VS*". These seven factors: rescue, exposures, confinement, extinguishment, overhaul, ventilation, and salvage should be considered to assist developing the Incident Action Plan. Developing a tactical plan allows fire fighters to understand what the Incident Commander is trying to accomplish and helps them to understand their role in the process.[5]

At this incident, BC19 arrived on scene prior to the arrival of the first due engine company (Engine 123) and first due ladder company (TL39). BC19 established "Command" and then was able to develop a strategy and Incident Action Plan based upon his size-up of the incident. "Command" went inside the fire structure and made a quick evaluation. "Command" told the victim they needed to get on the 2nd floor. "Command" then went to Sector 3 through the 1st floor apartment and noticed fire on the rear covered porch area. The IC radioed the E123 captain that E49 was going to put water on the fire from the exterior but did not receive an answer from the E123 captain. He then instructed via radio E49 to hit the exterior attic window but was unclear where E123 was at the time due to no response from the captain.

Once the Incident Commander develops a strategy and the Incident Action Plan (tactics), this critical fireground information must be communicated via the radio to all members assigned to the incident including the dispatch center. Everyone has to know the strategy that is being implemented and understand their role by acknowledging via radio their position and role. Since the E123 captain did

not acknowledge the radio transmission, it is unclear if he received or understood it and may have moved into harms way or already had been injured.

Recommendation #3: Fire departments should ensure that the Incident Commander establishes a stationary command post during the initial stages of the incident for effective incident management, which includes the use of a tactical worksheet, enhanced communications, and a personnel accountability system.

Discussion: When a chief officer (e.g., battalion chief, district chief, deputy chief) arrives on scene, he/she should automatically assume a standard stationary, exterior, and remote command position and immediately assume "Command" and begin functioning as the incident commander.[6] Command officers generally establish and continue command and control functions inside their vehicles or at the rear of the vehicle, which has a command board.

According to NFPA 1561 *Standard on Emergency Services Incident Management System*, §5.3.1 states, "The incident commander shall have overall authority for management of the incident." In addition to conducting an initial size-up, the incident commander must establish and maintain a command post outside of the structure to assign companies and delegate functions, and continually evaluate the risk versus gain of continued fire fighting efforts.[6]Also, NFPA 1561 requires all members working in an immediately dangerous to life or health (IDLH) atmospheres to work in pairs. Any supervisor given an assignment in a potential IDLH atmosphere needs to have an aide or assistant to provide safety and accountability.[7]

In accordance with 29 Code of Federal Regulations 1910.134(g)(4), it requires there to be at least two firefighters stationed outside during interior structural firefighting, prepared to enter if necessary to rescue the firefighters inside. However, the incident commander has the flexibility to determine whether more than two outside firefighters are necessary when more than two firefighters go inside. In a situation where the burning structure is very large, additional outside firefighters may be warranted to ensure effective assistance and rescue. For example, where the firefighting involves entry from different locations or levels, two outside fire fighters may have to be stationed at each point of entry. One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.[8]

In establishing a command post, the incident commander shall ensure the following (NFPA 1561, §5.3.7.2):

- The command post is located in or tied to a vehicle to establish presence and visibility.
- The command post includes radio capability to monitor and communicate with assigned tactical, command, and designated emergency traffic channels for that incident.
- The location of the command post is communicated to the communications center.
- The incident commander, or his/her designee, is present at the command post.
- The command post should be located in the incident cold zone.[6]

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The tactical worksheet is a critical piece of equipment because it helps the incident commander organize tasks by providing reminders, prompts, and a convenient workspace for tracking companies and apparatus. It allows them to slow down during what could be a large, multi-alarm incident (although the worksheet can be used for fires big and small, as well as EMS incidents, to help develop proficiency) and record vital information that may help them make future operational decisions. By documenting the assignments of division/group officers, and division/group resources, the incident commander creates a visual reference of the overall fireground organization and deployment.[7]

The tactical worksheet is also an excellent tool when the "passing of command" must occur. On the fireground, the officer taking over command can quickly check the worksheet and obtain a strong understanding of the initial deployment of resources, the need for additional apparatus and equipment, and the status of units in the staging area.

The function of resource accountability should be assigned to personnel who are responsible for maintaining the location and status of all assigned resources at an incident. As the incident escalates, this function would be placed under the planning section. This is separate from the role of the incident commander. The incident commander is responsible for the overall command and control of the incident. Due to the importance of responder safety, this function should be assigned to dedicated accountability personnel as the size and complexity of the incident dictates. A number of positions could function in this role including a staff assistant(s), chief officer(s), or another responder(s).

There are many means of accounting for resources. Components can include tactical worksheets, command boards, apparatus riding lists, company responder boards, electronic bar-coding systems, and so forth. These components can be used in conjunction with one another to facilitate the tracking of responders 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.[7]

In this incident, BC19 was completing his size-up by performing an interior walk-through and went out to Sector 1 to put on his bunker gear just prior to the Mayday being called. A command post had not been established prior to the Mayday. Though BC19 took command of this incident, a permanent command post was not established until Command Van 273 arrived on scene at 1723 hours.

Recommendation #4: Fire departments should ensure use of risk management principles at all structure fires.

Discussion: While it is recognized that fire fighting is an inherently hazardous occupation, risk management principles established by the fire service are based on the philosophy that greater risks will be assumed when there are lives to be saved and the level of acceptable risk to fire fighters is much lower when only property is at stake. Interior offensive fire fighting operations can increase the risk of traumatic injury and death to fire fighters from structural collapse, burns, and asphyxiation. In this incident, it was made clear by the 2nd floor occupants that no civilians were in the buildings. When it is confirmed that there is no risk, the IC must then decide what risks they are willing to place their personnel in based on risk-versus-gain.

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Established risk management principles suggest that more caution should be exercised in abandoned, vacant, and unoccupied structures and in situations where there is no clear evidence indicating that people are trapped inside a structure and can be saved.[9] The IC, with input from the assigned incident safety officer and/or division/group supervisors, is responsible for evaluating conditions at a structure fire and determining safe tactics for fighting the fire. To accomplish this, the IC should use a standardized strategic decision-making model. First, the IC should size up the critical fireground factors.[10] Before ordering an offensive attack, the IC must make a determination that offensive (interior) operations may be conducted without exceeding a reasonable degree of risk to fire fighters and must be prepared to discontinue the offensive attack if the risk evaluation changes during the fire fighting operation. A full range of factors must be considered in making the risk evaluation, including (but not limited to) the following:

- Presence of occupants in the building
- A realistic evaluation of occupant survivability and rescue potential
- Size, construction, and use of the building
- Age and condition of the building
- Nature and value of building contents
- Location and extent of the fire within the building
- Adjacent exposures (structures)
- Fire involvement or compromise of the building's structural components
- Residential or commercial structure
- Delayed discovery/reporting and its effect on burn time and structural stability
- Considerations of fire loading and fire behavior
- A realistic evaluation of the ability to execute a successful offensive fire attack with the resources that are available.[9-10]

These fireground factors must be weighed against the risk management plan. Fire fighters are routinely exposed to certain known and predictable risks while conducting operations that are directed toward saving property. The IC is responsible for recognizing and evaluating those risks and determining whether the level of risk is acceptable or unacceptable. However, risks taken to save property should always be less than those to save lives.[9] Risks to fire fighters versus gains in saving lives and property must always be considered when deciding whether to use an offensive or defensive attack. The IC should routinely evaluate and re-evaluate conditions and radio progress reports in reaching objectives to dispatch and on scene fire fighters. This process allows the IC to determine whether to continue or revise the strategy and attack plans.[1, 10] NFPA 1500, section 4.2, provides detailed information regarding the risk management plan.[1]

Incident demands on the modern fireground, unlike those of the past, require ICs and commanding officers to have increased technical knowledge of building construction with a heightened sensitivity to fire behavior, a focus on operational structural stability, and considerations related to occupancy risk versus the occupancy type. Strategies and tactics must be based on occupancy risk, not occupancy type, and must orchestrate sufficient staffing, fire flow, and tactical patience in a manner that identifies with the fire profiling and the predictability of the occupancy profile and accounts for presumptive fire

behavior.[11] The first arriving officer, as well as the IC, must make an informed judgment (before and ongoing) as to what is at risk – people or property. This judgment will determine the risk profile for the incident. Many fire fighters stand by the notion that all incidents are "people" events until proven otherwise. Historically, the fire service has a poor history of changing risk-taking strategies based upon the people/property issue.[12]

Recommendation #5: Fire departments should ensure proper personal protective equipment is worn.

Discussion: NFPA 1500 *Standard on Fire Department Occupational and Health Program* states, "the fire department shall provide each member with protective clothing and protective equipment that is designed to provide protection from the hazards to which the member is likely to be exposed and is suitable for the tasks that the member is expected to perform…protective clothing and protective equipment shall be used whenever a member is exposed or potentially exposed to the hazards for which the protective clothing (and equipment) is provided."[1]

NFPA 1971 *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting* has established minimum requirements for structural fire fighting protective ensembles and ensemble elements designed to provide fire fighting personnel limited protection from thermal, physical, environmental, and bloodborne pathogen hazards encountered during structural fire fighting operations.[13] These requirements will assist in protecting firefighters, but only if they wear the PPE as recommended by the manufacturer.

In this incident, the victim was not wearing his hood or both structural fire fighting gloves and sustained thermal injuries to those unprotected areas. The inhalation injuries received by the victim may have occurred when the victim retreated from Sector 3 towards the kitchen and possibly dislodging his facepiece along the way. *Note: There was a significant indentation in the drywall, at the corner, just past the space heater (see Diagram 2), that may have been made by the victim in a panic when he retreated to the kitchen area.* The E123 pipeman's facepiece was dislodged when he was assisting the victim in retreating from Sector 3. Additionally, the IC entered a potential IDLH environment without proper PPE to conduct an interior size-up. If conditions had drastically changed while the IC was in the structure, the IC would have been at risk of injury.

Recommendation #6: Fire departments should ensure that communications are acknowledged and progress reports are relayed.

Discussion: National Fire Protection Association (NFPA) 1561, *Standard on Emergency Services Incident Management System*, Section 6.3 Emergency Traffic states: To enable responders to be notified of an emergency condition or situation when they are assigned to an area designated as immediately dangerous to life or health (IDLH), at least one responder on each crew or company shall be equipped with a portable radio and each responder on the crew or company shall be equipped with either a portable radio or another means of electronic communication.[7] The U.S. Fire Administration report, *Voice Radio Communications Guide for the Fire Service*, [14] provides an overview of radio communication issues involving the fire service. Effective fireground radio communication is an important tool to ensure fireground command and control as well as helping to enhance fire fighter

safety and health. It is every fire fighter and company officer's responsibility to ensure radios are properly used. Ensuring appropriate radio use involves both taking personal responsibility (to have your radio, having it on, and on the correct channel) and a crew-based responsibility to ensure that the other members of your crew (subordinates, peers, and supervisor) are doing so as well.

Receiving interior/exterior status updates is critical to the safety of fire fighters on the incident, rescue/recovery efforts, and overall control of the incident. The decision to commit interior fire fighting personnel or establishing a collapse/hazard zone for exterior fire fighting personnel should be made on a case-by-case basis with proper risk-benefit decisions being made by the incident commander.[15, 16] The fireground is very dynamic, and conditions can either improve or deteriorate based on fire suppression activities, and available resources, and most importantly assessments/size-ups of the incident are necessary to detect a change on the fireground.

In this incident, the IC radioed the victim that E49 would be operating outside Sector 3 and intended to put a hoseline into operation but did not receive a reply. Also, a TL39 fire fighter opened the 1st floor doors at Sector 3 and observed the fire accelerate in the rear stairway but did not radio this observation to his officer or the IC.

Recommendation #7: Fire departments should ensure that Incident Commanders are provided chief aides to help manage information and communication.

Discussion: A chief's aide, staff assistant, or field incident technician (FIT) is a position designed to assist an IC with various operational duties during emergency incidents. The chief's aide is an essential element for effective incident management and for a successful outcome of the incident. The importance of having a chief's aide assigned to a battalion chief is to insure that the tasks associated with incident management can be initiated even before arrival on scene. The benefit of having a chief's aide is that the battalion chief can focus on radio communications, initiate the development of the strategy and tactics for the incident, and began to develop an incident action plan. The battalion chief is able to focus on the critical incident management tasks versus trying to operate the vehicle and locate the incident scene under emergency response conditions. If a chief's aide is not provided for a battalion chief, the tasks are delayed until a fire fighter or fire officer is appointed to this position. At an emergency incident, the staff assistant can assist with key functions, such as managing the tactical worksheet; maintaining personnel accountability of all members operating at the incident (resource status and situation status); monitoring radio communications on the dispatch, command, and fireground channels; control information flow by computer, fax, or telephone; and access reference material and pre-incident plans.

The personnel accountability system is a vital component of the fire fighter safety process. The system is designed to account and track personnel as they perform their fireground tasks. In the event of an emergency or "Mayday," the personnel accountability system must be able to provide the rapid accounting of all responders at the incident. This is one of the chief's aide's essential responsibilities.

Another important chief's aide function is the role of a driver in addition to their role as part of the command team. Chief Officers are required to respond quickly to emergency incidents. In their

response, they have to be fully aware of heavy traffic conditions, construction detours, traffic signals, and other conditions. More importantly, the chief officer must also monitor and comprehend radio traffic to assess which companies are responding, develop a strategy for the incident based upon input from first-arriving officers, and develop and communicate an incident action plan that defines the strategy of the incident. A chief's aide can assist the battalion chief or chief officer in processing information without distraction and complete the necessary tasks en route to the scene.[6]

Departments should consider the aide to be an individual who has the experience and authority to conduct the required tasks. Other potential functions for the chief's aide include serving as group or division supervisors, training position to facilitate officer development, and non-emergency functions that are vital to the daily operations of the department (e.g., daily staffing and leave management).

In this incident, the IC was managing fire tactics when the Mayday occurred. His priority then focused on the Victim. A chief's aide would have been valuable managing the tactical worksheet; maintaining personnel accountability of all members operating at the incident (resource status and situation status); and monitoring radio communications on the dispatch, command, and fireground channels.

Recommendation #8: Fire departments should ensure that staffing levels are maintained.

Discussion: The National Fire Protection Association (NFPA) 1710 Standard identifies the minimum resources for an effective firefighting force to perform critical tasks. These tasks include establishing water supply, deploying an initial attack line, ventilating, performing search and rescue, and establishing a RIC. NFPA 1710 recommends that the minimum staffing levels for an engine company to perform effective and efficient fire suppression tasks is four.[17] However, NFPA 1710 Section 5.2.2.1 recommends that large jurisdictions with tactical hazards, high hazard occupancies, high incident frequencies, or other pertinent factors, these companies shall be staffed with a minimum of five or six on-duty members.[17] In addition, a recently released study by the National Institute for Standards and Technology (NIST), Report on Residential Fireground Field Experiments, concluded that a three-person crew started and completed a primary search and rescue 25 percent faster than a two-person crew and that four or five-person crews started and completed primary search and rescue 6 percent faster than a three-person crew.[18]

In this incident, TL39 and E49 were each riding with a position short. A full complement of personnel would have provided 2 additional fire fighters to aid in the ongoing size-up and to access fire behavior. Also, they would have provided a more efficient search and fire suppression, respectively.

Additionally,

Recommendation #9: Municipalities, building code officials, and authorities having jurisdiction should consider requiring apartment complexes and associated multiple-family dwellings that have been "retrofitted" into current structural building code requirements also be brought up to current codes for such things as sprinkler systems and adequate structural roof members when requests for permits are made.

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Discussion: There are many apartment complexes and multi-family dwellings, across the country, that were built prior to modern day building codes. These codes were developed and put in place to specifically protect life and property.

Fire development beyond the incipient stage is one of the greatest hazards that fire fighters are exposed to. This exposure and risk to fire fighters can be dramatically reduced when fires are controlled or extinguished by automatic sprinkler systems. NFPA statistics show that most fires in sprinklered buildings are controlled prior to fire department arrival by the activation of one or two sprinkler heads. The presence of automatic fire sprinklers also reduces the exposure risk to fire fighters in rescue situations by allowing the safe egress of building occupants before the fire department arrives on scene. Finally, by controlling fire development, the exposure to hazards such as building collapse and overhaul operations are greatly reduced, if not eliminated.

In this incident, having a sprinkler system possibly could have contained the fire to the room of origin.

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Investigator Information

This incident was investigated by Matt E. Bowyer, General Engineer, Stacy C. Wertman, Safety and Occupational Health Specialist, and Murray Loflin, Investigator, with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH located in Morgantown, WV. Dr. Thomas R. Hales, Medical Officer, Fire

Fighter Fatality Investigation and Prevention, Division of Surveillance, Hazard Evaluations and Field Studies, NIOSH located in Cincinnati, Ohio provided medical review and comment. An expert technical review was provided by Joseph T. Comas, Deputy Chief Fire Marshal of Philadelphia Fire Department. A technical review was also provided by the National Fire Protection Association, Public Fire Protection Division. Dan Madrzykowski, Fire Protection Engineer, National Institute of Standards and Technology, provided input on horizontal ventilation.

Disclaimer

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Appendix One

Self-Contained Breathing Apparatus

National Personal Protective Technology Laboratory
Technology Evaluation Branch

Disclaimer

Investigator Information

The performance tests were conducted by Mike Commodore, Engineering Technician. The SCBA inspection and this report were written by Thomas D. Pouchot, General Engineer. These investigators are part of the Technology Evaluation Branch, National Personal Protective Technology Laboratory, National Institute for Occupational Safety and Health, located in Bruceton, Pennsylvania.
The purpose of Respirator Status Investigations is to determine the conformance of each respirator to the NIOSH approval requirements found in Title 42, *Code of Federal Regulations*, Part 84. A number of performance tests are selected from the complete list of Part 84 requirements and each respirator is tested in its "**as received**" condition to determine its conformance to those performance requirements. Each respirator is also inspected to determine its conformance to the quality assurance documentation on file at NIOSH.

In order to gain additional information about its overall performance, each respirator may also be subjected to other recognized test parameters, such as National Fire Protection Association (NFPA) consensus standards. While the test results give an indication of the respirator's conformance to the NFPA approval requirements, NIOSH does not actively correlate the test results from its NFPA test equipment with those of certification organizations which list NFPA-compliant products. Thus, the NFPA test results are provided for information purposes only. Selected tests are conducted only after it has been determined that each respirator is in a condition that is safe to be pressurized, handled, and tested.

Respirators whose condition has deteriorated to the point where the health and safety of NIOSH personnel and/or property is at risk will not be tested.

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Status Investigation Report of One Self-Contained Breathing Apparatus from the IL Fire Department Submitted By the NIOSH Division of Safety Research NIOSH Task Number 18826

Background

As part of the ***National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program***, the Technology Evaluation Branch agreed to examine and evaluate the SCBA identified as the Mine Safety Appliances Company FireHawk, 4500 psi, self-contained breathing apparatus (SCBA). This SCBA status investigation was assigned NIOSH Task Number 18826. The NIOSH Division of Safety Research was advised that NIOSH would provide a written report of the inspections and any applicable test results of this SCBA from the Fire Department. The SCBA, contained within a plastic SCBA storage container, was delivered to the NIOSH facility in Bruceton, Pennsylvania on December 6, 2012. After its arrival, the package was taken to building 20 and stored under lock until the time of the evaluation.

SCBA Inspection

The package was opened in the Respirator General Inspection Area (building 20) and a complete visual inspection was conducted by Tom Pouchot, General Engineer, NPPTL. The SCBA was initially examined and inspected on December 11, 2012 and designated as Unit #1. On January 4, 2013, the SCBA was examined component by component, in the condition as received to determine its conformance to the NIOSH-approved configuration. The visual inspection process was photographed. The Unit #1 SCBA was identified as the MSA FireHawk, 30 minute, 4500 psi unit, NIOSH approval number TC-13F-0475.

Unit #1 was judged to be safe to pressurize and test with a replacement cylinder. A replacement cylinder was supplied by the Fire Department.

SCBA Testing

The purpose of the testing is to determine the SCBA's conformance to the approval performance requirements of Title 42, *Code of Federal Regulations*, Part 84 (42 CFR 84). Further testing is also conducted to provide an indication of the SCBA's conformance to the National Fire Protection Association (NFPA) Air Flow Performance requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, 1997 Edition.

NIOSH SCBA Certification Tests (in accordance with the performance requirements of 42 CFR 84):

1. Positive Pressure Test [§ 84.70(a)(2)(ii)]
2. Rated Service Time Test (duration) [§ 84.95]
3. Static Pressure Test [§ 84.91(d)]
4. Gas Flow Test [§ 84.93]
5. Exhalation Resistance Test [§ 84.91(c)]

6. Remaining Service Life Indicator Test (low-air alarm) [§ 84.83(f)]
National Fire Protection Association (NFPA) Tests (in accordance with NFPA 1981, 1997 Edition):
7. Air Flow Performance Test [Chapter 5, 5-1.1]
Units # 1 was tested on January 18, 2013 utilizing a substitute cylinder supplied by the Fire Department.

Summary and Conclusions
A SCBA from the Fire Department was submitted to NIOSH by the NIOSH Division of Safety Research for evaluation. The SCBA was delivered to NIOSH on December 6, 2012 and initially inspected on December 11, 2012. A complete inspection of the SCBA unit was performed on January 4, 2013. The unit was identified as the MSA Company FireHawk, 4500 psi, SCBA (NIOSH approval number TC-13F-475), a 30 minute duration unit. Unit #1 suffered some damage and was covered with dirt, grime and soot. The cylinder valve as received could be opened by hand and some air was remaining in the unit. The cylinder gauge was not readable. The facepiece was dirty with some signs of wear. The unit harness was dirty with some signs of wear. Visibility through the lens was fair to good due to the dirt present. The low pressure hose threaded connection was not tight at the intermediate connection point. The RIC fitting was not assembled tightly. The PASS unit functioned. The SCBA air cylinder had some slight damage but was black due to dirt and or soot. The NFPA/SEI label was not present and but the NIOSH label was visible and readable.

The air cylinder on the Unit #1 had a manufactured date of 05/01. Under the applicable DOT-SP-10915-4500 exemption, the air cylinder is required to be hydro tested every 5 years, starting on or before the last day of 05/06. The Unit #1 cylinder hydro labels were damaged and could not be read or determine if the cylinder was within specification. Approximately 200 PSIG of air was measured remaining in the cylinder.

A replacement air cylinder for Unit #1, supplied by the Fire Department, was used for testing. The low pressure hose intermediate connection and the RIC fitting were tightened prior to testing. No other maintenance or repair work was performed on the units at any time. SCBA Unit #1 **did not** meet the requirements of the NIOSH Rated Service Time Test, as the unit service time as tested was less than the rated 30 minutes. Unit #1's exhalation valve leaked continously causing the reduced service time. Unit #1 **did** meet the requirements of all of the other NIOSH tests. This unit passed the NFPA test. In light of the information obtained during this investigation, NIOSH has proposed no further action on its part at this time. Following the visual inspection, the SCBA was returned to storage pending return to Fire Department.

If the unit is to be placed back in service, the SCBA must be repaired, damage components replaced, cleaned, tested, and inspected by a qualified service technician, including such testing and other maintenance activities as prescribed by the schedule from the SCBA manufacturer. Typically a flow test is required on at least an annual basis.