2015
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Death in the line of duty...

National Institute for Occupational Safety and Health NIOSH

A report from the NIOSH Fire Fighter Fatality Investigation and Prevention Program February 27, 2017

Volunteer Fire Fighter Dies After Inhaling Super-heated Gases at a Residential Structure Fire—New York

Executive Summary

On December 19, 2015, a 19-year-old male volunteer fire fighter (lieutenant in rank) with Department 41 died after inhaling super-heated gases in the basement at a residential structure fire. Department 19 was dispatched for a chimney fire in a residential structure at 1859 hours. Per predefined mutual aid agreements, Department 41 was dispatched for FAST (fire fighter assistance and search team) operations. The Department 41 Rescue Truck 4120, with the second assistant chief, the lieutenant, and an exterior fire fighter on-board, arrived first on-scene at 1910 hours. The Department 41 second assistant chief radioed Dispatch and reported a working fire. The Department 19 chief arrived next, followed by Engine 1910, with a lieutenant and one fire fighter onboard. The Department 19 chief assumed incident command and requested a second alarm. The Department 19 lieutenant pulled a preconnected 1¾-inch hoseline to the front door. The Department 41 second assistant chief and lieutenant grabbed two self-contained breathing apparatus from Engine 1910 and joined the Department 19 lieutenant on the hoseline. They donned their facepieces on the front porch, went on air, and proceeded inside and found fire burning up the walls behind a wood stove located near the center of the Side C wall. After knocking down the fire and pulling ceilings, the hoseline crew went outside. The Department 19 lieutenant reported to the incident commander while the Department 41 second assistant chief and lieutenant went to size up the basement. They found a basement door near the A-D corner and entered the basement about 10–15 feet. They found fire burning in the basement at the C-D corner and returned outside to get a hoseline. Soon after re-entering the basement with a charged hoseline, the Department 41 second assistant chief realized his lieutenant was missing and stepped outside to ask if anyone had seen the lieutenant. He reported the lieutenant as missing to a nearby chief. The FAST was activated and rescuers reentered the basement. The lieutenant was found on his knees, facing Side C near an open door leading to a utility room containing active fire. The lieutenant indicated he needed assistance. As the lieutenant was dragged outside, he became unresponsive. He received medical assistance and was transported to a local hospital where he was pronounced dead.

Photo of incident scene showing Side A and front door.
(*NIOSH photo.*)

Volunteer Fire Fighter Dies After Inhaling Super-heated Gases at a Residential Structure Fire—New York

Contributing Factors

- *Lack of crew integrity*
- *Improper SCBA use*
- *Inexperienced fire fighter*
- *Special service vehicle not equipped with SCBA*
- *Lack of training on fire dynamics*

Photo shows A-D corner and Side D basement door where fire fighters entered with hoseline to attack fire burning in basement. (*NIOSH photo.*)

Key Recommendations

- *Fire departments should ensure that crew integrity is properly maintained by visual (eye-to-eye), direct (touch), or verbal (voice or radio) contact at all times when operating in an immediately dangerous to life and health (IDLH) atmosphere.*
- *Fire departments should ensure that special service vehicles are equipped with the appropriate equipment as specified in NFPA 1901* Standard on Automotive Fire Apparatus.
- *Fire departments should ensure that fire fighters wear a full array of turnout clothing and personal protective equipment appropriate for the assigned task while participating in fire suppression and overhaul activities.*
- *Fire departments should ensure that Mayday training programs are developed and implemented so that fire fighters are adequately prepared to call a Mayday.*

Additionally,

Standard setting organizations, enforcement agencies, and authorities having jurisdiction should consider developing, implementing, and enforcing national fire fighter and fire officer training standards and requirements.

For further information, visit the program website at www.cdc.gov/niosh/fire or call toll free 1-800-CDC-INFO (1-800-232-4636).

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Introduction

On December 19, 2015, a 19-year-old male volunteer fire fighter (lieutenant in rank) died after inhaling super-heated gases in the basement of a burning residential structure. On December 21, 2015, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On January 26, 2016, the chief of the local police department contacted NIOSH and requested assistance in the investigation. On February 22–25, 2016, a safety engineer and a general engineer from the NIOSH Fire Fighter Fatality Investigation and Prevention Program traveled to New York to investigate this incident. They were accompanied by a physical scientist from the NIOSH National Personal Protective Technology Laboratory. The NIOSH investigators met with representatives of the local police department and three fire departments who responded to the incident. During the investigation, NIOSH met with representatives of the New York State Department of Labor (NY-DOL), the New York State Office of Fire Protection and Control (OFPC), and the forensic pathologist who conducted the autopsy. The NIOSH investigators reviewed the standard operating procedures and training records from the fire departments involved in this incident. The NIOSH investigators also reviewed the dispatch audio and transcribed records for this incident. The NIOSH investigators interviewed fire fighters and fire officers who responded to the structure fire.

Fire Departments

The volunteer fire department having jurisdiction in the area where this incident occurred (Department 19) has 64 active members with 31 trained and qualified for interior fire-fighting operations. This volunteer department has a chief, deputy chief, and two assistant chiefs. The fire department reports to a board of fire commissioners. Members must be at least 16 years old to join the department. All members, including the chief, assistant chiefs, and officers, are elected by a vote of the active members and approved by the fire department's board of directors. Department 19 serves a population of approximately 9,700 within an area of about 34.7 square miles. The fire department has two stations. Station 1 houses one Class A engine with 1,000-gallon water tank (Engine 1910), one Class A tanker with 1,800-gallon water tank (Tanker 1911), one brush truck with 250-gallon water tank (Rescue 1912), one mini-pumper with 300-gallon water tank (Engine 1914), and one six-wheeled utility vehicle (Brush 1916). Station 2 houses one Class A engine with 1,000-gallon water tank (Engine 1920), one Class A tanker with 3,000-gallon water tank (Tanker 1921), and two rescue vehicles (Rescue 1922 and Rescue 1924). The department also operates four command vehicles assigned to chief officers.

Department 19 had a number of written operating guidelines for handling various situations. These operating guidelines covered general fire department membership, fireground operations, station activities, company officer qualifications, inspection and cleaning of turnout gear, driver training, incident command system, radio communications, seat belt use, self-contained breathing apparatus use, emergency vehicle operations, fire fighter assistance and search team (FAST) training and operation,

fire fighter survival, Mayday, and other topics. Department 19 responds to approximately 250 calls per year with approximately 5 to 10 percent of the total calls being fire calls. Department 19 responded to 213 calls in 2013, 297 calls in 2014, and 326 calls in 2015. The fire department is rated as a Class 5 department by the International Standards Organization (ISO) rating system. 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 [ISO 2016].

Department 41, where the deceased lieutenant was a member, had 20 active members, including 15 members at the time of the incident who were trained for interior fire-fighting operations. Department 41 serves a population of approximately 1,600 in an area of approximately 9 square miles. The fire department has two engines, one rescue truck, and one command vehicle. Engine 4110 is a Class A engine with a 750-gallon water tank and 1500-gallons-per-minute (gpm) pump. Engine 4130 is a Class A engine with a 1500-gallon water tank and 1500-gpm pump. Rescue 4120 is a squad vehicle (pickup truck). Response area coverage for Department 41 includes a north-south interstate highway and a major east-west railroad. Department 41 is rated as a Class 5 department by ISO. Department 41 responds to approximately 145 calls per year with approximately 1 to 3 of the total calls being structural fire calls. Department 41 responded to 165 calls in 2013, 138 calls in 2014, and 138 calls in 2015. These numbers include 4 to 7 fire calls per year of all types, including building fires, chimney or flue fires, fuel burner/boiler fires, passenger vehicle fires, outside rubbish/trash/waste fires, brush/grass fires, and dumpster fires.

Prospective members wanting to join Department 41 must be at least 16 years old, submit an application, and receive approval from the board of directors. To be an interior fire fighter, they must complete and receive a New York State Fire Fighter I certification and be at least 18 years old with 1 year of experience. To serve as a FAST member, additional training is required. To drive a fire department emergency vehicle, fire fighters must be at least 21 and complete driver training. At the time of the incident, Department 41 had very limited written standard operating guidelines that covered minimum qualifications for interior fire-fighting, self-contained breathing apparatus (SCBA) use, 2-in-2-out policy, rapid intervention team, protective clothing, and use of “blue lights” on personal vehicles. *Note: SOPs are typically defined as procedures that must always be followed with very rare variance—for example, size-up reports, 360-degree size up, water supply establishment, self-contained breathing apparatus use in immediately dangerous-to-life-or-health atmospheres, stopping at red lights, and seat belt use. SOGs are typically guidelines providing suggestions on how to operate based upon current circumstances and officer discretion—for example, stretching hoselines, hoseline placement, and ventilation.*

Both fire departments are dispatched by the county’s 911 dispatch system. Fireground radio channels are not recorded. A transcribed record of the dispatch audio was provided to NIOSH for this investigation.

Training and Experience

New York State does not have minimum training requirements for volunteer fire fighters. However, the Federal Occupational Safety and Health Administration (OSHA) regulation 29 Code of Federal Regulations (CFR) 1910.156(c)(1) applies to all fire departments in New York State (NYS) [OSHA

2008]. Each fire department or authority having jurisdiction may establish training and education and expected hazards within their response areas.

In New York State, OSHA 1910.156(c)(1) is enforced for fire fighters and public employees by the New York Department of Labor (NY-DOL), Public Employee Safety and Health Bureau (PESH). OSHA 1910.156(c)(1) states:

> The employer shall provide training and education for all fire brigade members commensurate with those duties and functions that fire brigade members are expected to perform. Such training and education shall be provided to fire brigade members before they perform fire brigade emergency activities. Fire brigade leaders and training instructors shall be provided with training and education which is more comprehensive than that provided to the general membership of the fire brigade [OSHA 2008].

In 2015, the New York State (NYS) Office of Fire Prevention and Control (OFPC), with input from the New York Department of Labor (NY-DOL), Public Employees Safety and Health Bureau (PESH), and fire service organizations within the state of New York developed a recommended set of "Best Practices for Fire Department Training Programs." The purpose of the "Best Practices" is to assist fire departments in complying with OSHA CFR 1910.156(c)(1).

The NYS OFPC "Best Practices" contains recommended core competencies that fire department training programs should address. These include recommended core competencies for exterior fire-fighting, interior fire-fighting, and incident commanders. The NYS OFPC "Best Practices" also includes recommendations for annual refresher training and OSHA/NYS PESH-required annual training.

Appendix One contains the NYS OFPC Recommended Best Practices for Fire Department Training Programs.

The Department 41 lieutenant who died in this incident had joined the fire department at age 16 and had been a volunteer fire fighter for 3 years. He received emergency medical technician (EMT) basic certification in 2015. Other documented training included self-contained breathing apparatus (SCBA) use, SCBA emergencies, rapid intervention team (RIT) training, driver training on Rescue 4120, rescue drags, ladders, Mayday, turnout gear and radio, hand tools, overhaul, power tools, ropes, hoisting tools, brush fire-fighting operations, forcible entry, wide area search, and hoseline deployment. Following the incident, the Department 41 lieutenant was posthumously promoted to the rank of captain.

The incident commander had over 35 years of fire service experience and had served Department 19 as both chief and assistant chief. Documented training included accident victim extrication, basic structural collapse, basic wildland fire suppression, commanding the initial response, live fire training evolutions, confined space, emergency control of hazmat incidents, fire behavior and arson awareness, firefighter survival, firefighting essentials, hazardous materials incident command, introduction to fire officer, National Incident Management System (NIMS) 700, fire officer and several other topics.

Equipment and Personnel

The incident involved the local volunteer fire department (Department 19) being dispatched for the report of a chimney fire with a volunteer fire department (Department 41) dispatched for FAST Team operations per predefined mutual aid agreements.

Fire department units and crews dispatched on December 19, 2015, for the initial alarm included:

- Engine 1910: Department 19 lieutenant and driver (exterior fire fighter)
- Chief 19: Department 19 chief in fire department chief's vehicle
- Engine 4110: Department 41 first assistant chief, driver, and one fire fighter
- Rescue 4120: Department 41 second assistant chief, lieutenant, and exterior fire fighter

Additional Department 19 units responding on the first alarm. These units and fire fighters were involved in water supply operations and were not directly involved in the fire suppression attack operations.

- Tanker 1911
- Tanker 1921
- Rescue 1914
- Rescue 1922
- Utility 1912

After confirming the working fire, the incident commander (Chief 19) requested a second alarm. Nearby fire departments were dispatched for mutual aid. Department 66 moved to cover and stand by at the Department 19 Station 1. Department 53 moved to cover and stand by at Department 19 Station 2. Department 29 responded to the scene with a pumper and interior fire fighters. Fire department 66 units and crews were en route to relocate to Station 1 when they were directed to report to the scene. Department 36 was dispatched to cover Department 19 Station 1. Fire department 66 units and crews involved in the fire suppression operations included:

- Engine 6610: three fire fighters
- Chief 66: Department 66 chief in fire department chief's vehicle
- Chief 66: Department 66 first assistant chief in fire department vehicle

Timeline

Note: This timeline is provided to set out, to the extent possible, the sequence of events as the fire departments responded. The times are approximate and were obtained from review of the fire dispatch records, police dispatch records, witness interviews, and other available information collected by NIOSH. In some cases the times may be rounded to the nearest minute, and not all events have been included. The timeline is not intended, nor should it be used, as a formal record of events.

- **1858 Hours**
  Local county dispatch center receives call reporting a chimney fire.

- **1859 Hours**
  Department 19 dispatched along with Department 41 as the FAST Team.

- **1900–1903 Hours**
  Chief 19, Engine 1910, Engine 4110, and Rescue 4120 en route.

- **1910 Hours**
  Rescue 4120 first on-scene. Department 41 second assistant chief reports working fire. Chief 19 arrives on-scene, assumes incident command, and requests second alarm. County-wide fire coordinators alerted.

- **1911 Hours**
  Engine 1910 arrives on-scene.

- **1915 Hours**
  Chief 19 (incident command) requests tanker operations be set up at end of driveway. Command also requests additional tanker from Department 4.

- **1918 Hours**
  Command radios Dispatch to report hoseline in operation on inside structure (main level).

- **1920 Hours**
  Engine 6610, en route to cover Department 19 Station 1, is diverted to the fire scene.

- **1921 Hours**
  Water tanker operations established at end of driveway.

- **1938 Hours**
  Mayday for fire fighter missing in basement.

- **1947 Hours**
  Mayday cancelled. All personal on fireground accounted for. Hoselines in operation.

- **1957 Hours**
  Medic Unit 665 en route to hospital with Department 41 fire fighter.

- **2013 Hours**
  Medic Unit 665 at hospital. Department 41 fire fighter transferred to emergency room.

- **2035 Hours**
  Department 41 fire fighter pronounced dead at hospital.

Personal Protective Equipment

At the time of the incident, the Department 41 lieutenant was wearing blue jeans and a long-sleeved cotton shirt under his fire department-issued turnout pants, coat, fire boots, helmet, and gloves. The self-contained breathing apparatus (SCBA) he was using was taken off the Department 19 Engine 1910. He was also carrying a radio issued by his fire department, Department 41. NIOSH investigators

took custody of a self-contained breathing apparatus, reported to have been used by the Department 41 lieutenant, which was sent to the NIOSH National Personal Protective Technology Laboratory for additional evaluation. The SCBA air cylinder contained approximately 1700 psig of air. An air sample was taken from the cylinder and sent out for quantitative analysis.

It was later determined by the local and state police departments that the SCBA transferred to NIOSH custody was not the SCBA used by the Department 41 lieutenant. No further evaluation was conducted on the SCBA, and it was transferred back to the custody of the local police department on March 28, 2016. The SCBA used by the Department 41 lieutenant was never positively identified.

Structure and Incident Scene

This incident occurred in a one-story, single-family residential house of approximately 1,029 square feet. The structure was built in 1976. The three-bedroom, one-bath structure was of modular construction, which consisted of a Type 5 wood frame platform construction and measured approximately 42 feet x 24 feet 8 inches. The structure was built over a full basement with a poured concrete floor and concrete block walls. The basement was partially finished with gypsum drywall covering the ceiling and some of the exterior walls. A walk-out basement door was located on Side D near the A-D corner. Interior steps located along the Side D wall provided interior access from the main level to the basement. The floor of the main level was constructed of wooden 2 x 6-inch joists covered with particle board. The roof structure contained 2 x 4-inch wooden trusses. The roof deck was oriented-strand board (OSB) covered with asphalt shingles. A utility room located in the rear of the basement contained a propane furnace; however, at the time of the fire, the only source of heat in use within the structure was the wood-burning stove located on the main level near the center of the Side C wall. The wood stove was equipped with a single wall chimney pipe, which extended from the back of the stove, passed through the exterior wall, and entered a concrete block chimney located on the exterior of the Side C wall. It was reported that the wood stove on the main level was used extensively and the chimney had not been cleaned for over 1 year. There was no built-in sprinkler or fire suppression system within the structure. A smoke detector was present but was reported to be nonfunctional and did not sound at the time of the fire.

The structure was located on a wooded knoll surrounded by pine and hardwood trees on approximately 2.4 acres. A long, narrow dirt and gravel driveway led uphill from the paved county road to the structure. Due to the location, water supply was established by staging water tankers on the county road at the end of the driveway. A 3-inch supply line was laid up the driveway to Engine 4110.

According to the New York State Office of Fire Prevention and Control, the fire originated in the interior of the rear (Side C) wall. The cause was determined to be accidental and related to the solid-fuel heating equipment located in the immediate area. Photo 1, Photo 2, Diagram 1, and Diagram 2 illustrate the incident location.

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Photo 1. View of Side C. The origin of the fire was determined to be in the Side C wall in the area of the concrete block chimney. The cause was determined to be accidental and related to the solid-fuel heating equipment located in the immediate area.
(*Photo courtesy of city police department.*)

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Photo 2. Wood burning stove used as primary source of heat for the structure. Stove has been pulled away from the chimney for investigation purposes.
(*Photo courtesy of New York State Office of Fire Prevention and Control.*)

Volunteer Fire Fighter Dies After Inhaling Super-heated Gases at a Residential Structure Fire—New York

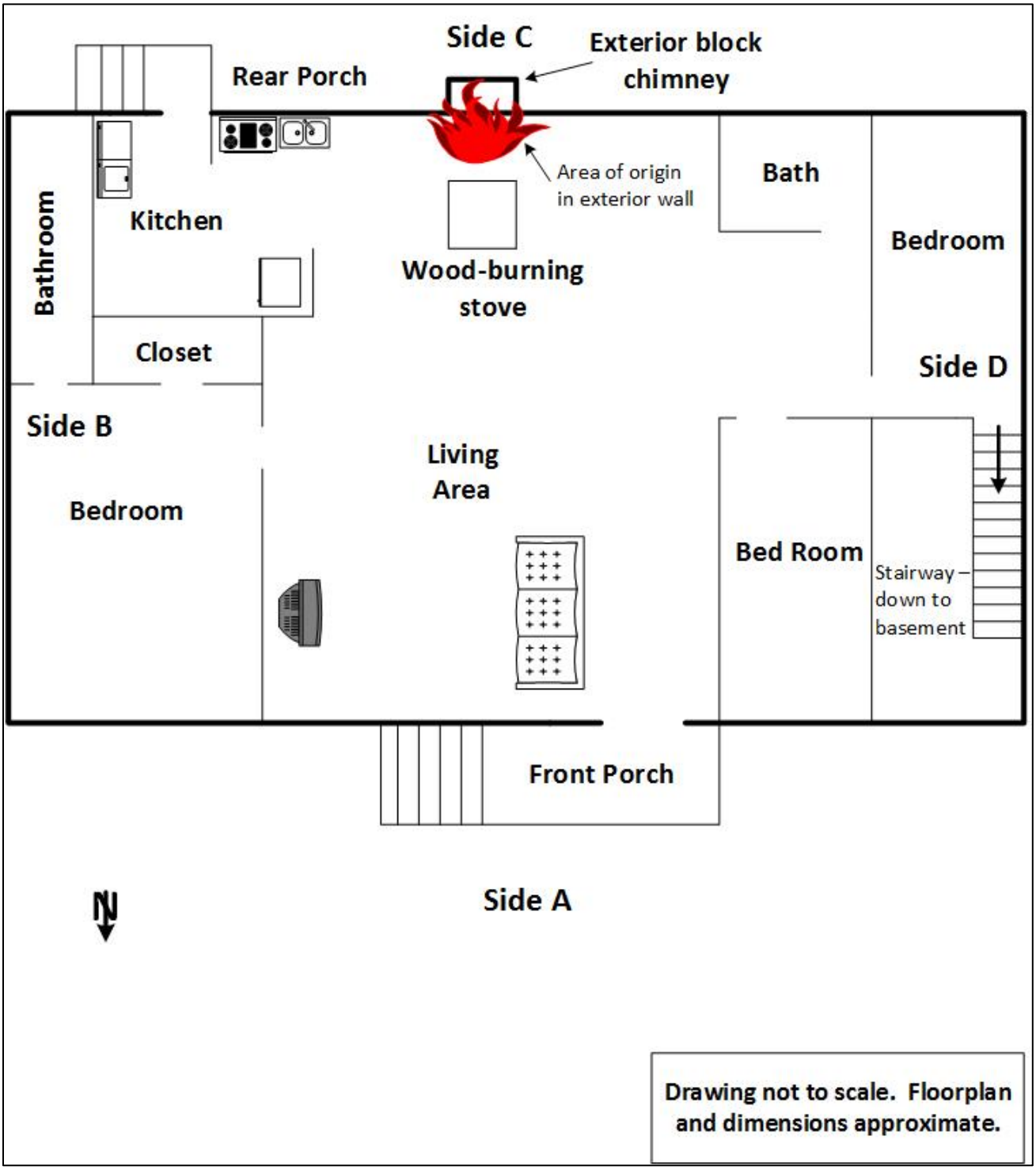

Diagram 1. General layout of the one-story residential structure.
(*NIOSH diagram.*)

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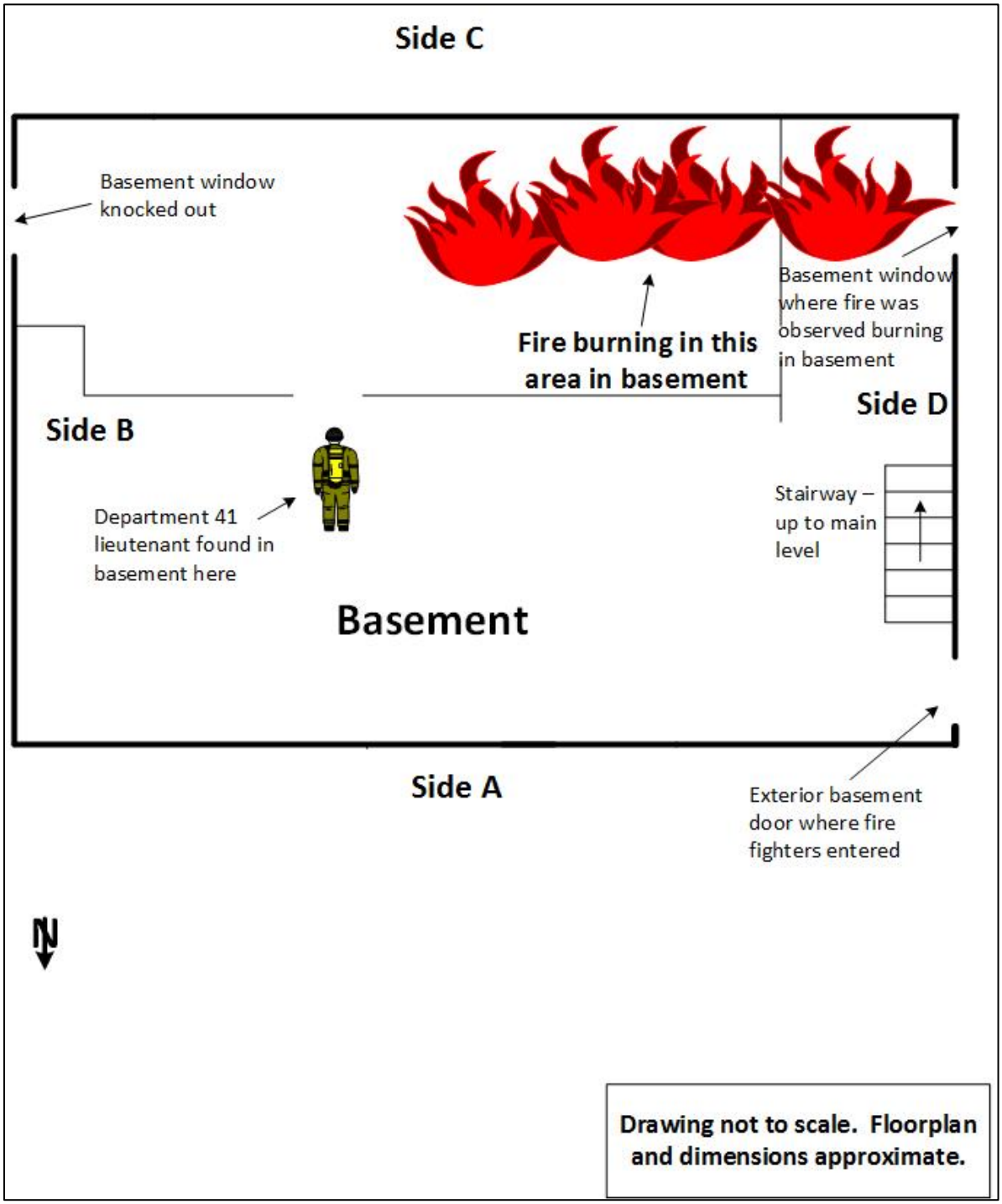

Diagram 2. General layout of the basement and location where Department 41 lieutenant was found.
(*NIOSH diagram.*)

Weather Conditions

On December 19, 2015, at approximately 1853 hours, the weather was overcast with the temperature reported to be 36 degrees Fahrenheit, relative humidity at 48 percent, and winds from the west/northwest at 15 miles per hour with gusts reported up to 27.6 miles per hour [Weather Underground 2015]. Fire fighters interviewed by NIOSH reported that just prior to the fatality, the smoke conditions on the fireground rapidly changed with dense smoke banking down, reducing visibility around the exterior of the structure. Research by the National Institute of Standards and Technology has shown wind speeds on the order of 10 to 20 mph (16 to 32 km/hr) are sufficient to create wind-driven fire conditions in a structure with an uncontrolled flow path [Madrzykowski and Kerber 2009].

Investigation

On December 19, 2015, at approximately 1858 hours, the local county 911 dispatch center received a phone call from a resident reporting a chimney fire in her single-family residential dwelling. At 1859 hours, the local volunteer fire department (Department 19) was dispatched along with a mutual aid fire fighter assistance and search team (FAST) Team (Department 41).

The Department 19 chief (Chief 19) responded at 1900:33 hours in his department chief's vehicle. Engine 1910 responded from Station 1 at 1902:26 hours with a crew consisting of a lieutenant and a fire fighter. Tanker 1911 responded at 1903:55 and Tanker 1921 responded at 1906:45 hours. Additional fire fighters responded in Rescue Squad 1922.

Six members of Department 41 were helping with a community holiday function at the time of the dispatch. Engine 4110 and Rescue Squad 4120 were at the holiday function and responded from this location. Rescue 4120 responded with a crew of three including the second assistant chief, a lieutenant (the victim), and a fire fighter trained for exterior fire support. Engine 4110 responded at 1901:49 hours with a crew consisting of a driver, the first assistant chief, and a fire fighter.

Rescue 4120 arrived first on-scene at approximately 1910 hours and reported a working fire to Dispatch. The Department 19 chief (Chief 19) arrived very soon after and assumed incident command. Chief 19 did a thorough 360-degree walk around the structure and observed fire on the exterior wall along both sides of the concrete block chimney located at Side C. He observed the flames were rolling up the exterior wall that extended to the roof. The Department 41 fire fighters donned their turnout gear while the Chief 19 conducted the 360-degree size-up. Rescue 4120 did not carry any self-contained breathing apparatus onboard.

Engine 1910 arrived on-scene at 1911:24 hours. The Department 19 lieutenant donned his turnout gear and self-contained breathing apparatus and then pulled a 1¾-inch preconnected handline from Engine 1910 toward the front porch. The Department 41 second assistant chief and lieutenant grabbed two self-contained breathing apparatus from Engine 1910 and joined the Department 19 lieutenant on the handline. *Note: Department 19 and Department 41 use different models of self-contained breathing apparatus from different manufacturers. During the NIOSH interviews, it was reported that fire fighters had trained on using both models during mutual aid FAST Team training exercises. Records indicated that the Department 41 lieutenant was fit tested with a size large facepiece at his department.*

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At the time of this incident, he was using a self-contained breathing apparatus from a different manufacturer with a size medium facepiece (see Photo 3). Engine 4110 arrived soon after Engine 1910.

Photo 3. Photo for representative purposes only. Facepiece on the left is representative of the SCBA facepieces used by Department 41. The facepiece on the right is representative of the SCBA facepieces used by Department 19. The Department 41 lieutenant was using a facepiece similar to the one on the right during the incident.
(*NIOSH photo.*)

At 1915 hours, Command radioed Dispatch and requested a second alarm. Department 66 was dispatched to cover and stand by at the Department 19 Station 1. Department 53 was dispatched to cover and stand by at Department 19 Station 2. Company 29 was dispatched and responded to the scene with a pumper and interior fire fighters. While en route to cover at Station 1, Department 66 units and crews were directed to report to the scene. Department 36 was dispatched to cover

Department 19 Station 1. He also requested a tanker from a fourth mutual aid department (Department 4).

Tanker 1911 and Tanker 1921 arrived on-scene. Both tankers staged at the end of the driveway and set up tanker relay operations. A 3-inch supply line was laid up the unpaved driveway to supply Engine 1910 at the structure.

The hoseline crew (the Department 19 lieutenant, Department 41 second assistant chief, and Department 41 lieutenant) went on air on the front porch and entered the structure through the front door and quickly observed fire burning along the wall and ceiling at Side C behind the wood stove (see Diagram 1). The Department 19 lieutenant worked the nozzle while the two Department 41 fire fighters helped with the hose. Chief 19 advised Dispatch that one hoseline was in operation at 1918:22 hours.

The Department 41 first assistant chief and fire fighter donned their turnout gear and staged in the front yard as the FAST Team. The Engine 4110 driver helped the Engine 1910 driver connect a 3-inch supply line from 4110 to 1910 for water supply. The Department 41 exterior fire fighter helped flake out the hoseline and retrieved hand tools as needed. The Department 29 fire fighters also stood by at command as an additional FAST Team.

At 1920 hours, Engine 6610 was directed by Dispatch to proceed directly to the scene. Engine 6610 carried a crew of three fire fighters. The Department 66 chief and first assistant chief responded to the scene separately in their department vehicles.

The Department 19 lieutenant working the nozzle inside the structure was wearing a helmet camera, which was turned on when he exited Engine 1910 and donned his turnout gear. The video recording showed the hoseline crew working inside the structure for approximately 14 to 14½ minutes. After knocking down the fire, they pulled ceilings and walls, checking for fire extension. The smoke cleared out quickly and they were able to remove their facepieces before moving outside.

When the Department 66 chief and first assistant chief arrived on-scene, they observed light, white and grey smoke coming from the structure. The fire on the main level appeared to be knocked down. The Department 66 chief sent the assistant chief to do a 360-degree size-up while he went to speak to Command.

The Department 19 lieutenant went to speak to Command about the status of the fire. Three fire fighters from Department 66 entered the main level to complete overhaul operations. The Department 41 second assistant chief and Department 41 lieutenant also spoke with Command about checking the conditions in the basement. They knocked out a basement window on Side B and the second assistant chief stuck his head inside the basement and observed light smoke in the basement. They reported this to Command and then walked through the yard to the A-D corner and found a closed door leading into the basement. The second assistant chief kicked in the door and they both entered the basement about 10–15 feet, walking from the door on Side D toward Side B. A wall running parallel to the front and back walls (Sides A and C) separated the basement roughly in half (see Diagram 2). The wall was constructed of thin paneling attached to wooden studs. The second assistant chief pulled a piece of

paneling back and observed fire burning along the Side C wall and at the C-D corner. Since the smoke conditions in the basement were light, they were not on air at this point. They decided to go outside and retrieve a hoseline to knock down the fire in the basement. The Department 41 second assistant chief and Department 41 lieutenant reported their observations to the incident commander and discussed the need to pull a hoseline into the basement to extinguish the rest of the fire.

As the Department 66 first assistant chief was walking around the structure he observed two basement windows, one on Side D and one on Side C near the C-D corner. The glass was still intact in these two windows. Through these windows, he observed fire burning in the basement at the C-D corner. About this time, the smoke conditions changed, and thick, dark smoke banked down, covering the fireground. The wind was reported to be blowing from Side B toward Side D. A positive pressure fan was set up on the front porch by a Department 19 fire fighter and turned on to help clear the smoke from the main level. Windows on the main level were also knocked out.

The Department 41 second assistant chief and lieutenant walked back to Engine 4410 and pulled a 2-inch preconnected hoseline to the basement door. The second assistant chief radioed to the Engine 4110 driver to charge the line. A fire fighter from a mutual aid department approached the Department 41 fire fighters and offered his assistance on the hoseline. After bleeding the hoseline, the Department 41 second assistant chief advanced the nozzle inside the basement door. The Department 41 second assistant chief stated that the Department 41 lieutenant was right behind. The third fire fighter was at the doorway to help feed in the hose. Both the Department 41 second assistant chief and the third fire fighter on the hoseline reported that the smoke conditions were bad inside the basement at this time. They both stated that they were on air because of the smoke conditions. Very shortly after the Department 41 second assistant chief entered the basement, he realized that the lieutenant was not behind him and he began to call for the lieutenant by name. He stepped outside the basement door and yelled for the lieutenant. The Department 66 first assistant chief was standing just outside the door watching the hoseline operation. The Department 41 second assistant chief told the Department 66 first assistant chief that he had lost a fire fighter and asked if anyone had seen the lieutenant. The Department 66 first assistant chief yelled out to the Department 66 chief standing a short distance away that a fire fighter was missing. The Department 66 chief radioed a Mayday. At 1938:34 hours, Command also radioed Dispatch and reported that a fire fighter was missing in the basement. The ambulance crew staged at the county road was directed to come up the driveway to the scene. Command also activated the FAST Team at this time. *Note: During interviews, the Department 66 chief and first assistant chief reported seeing three fire fighters on the hoseline enter the basement. There were conflicting reports from many fire fighters interviewed by NIOSH investigators as to whether the Department 41 lieutenant had his facepiece on or not.*

The FAST Team members grabbed their tools and went on air and proceeded to the basement door, accompanied by the Department 19 lieutenant. The Department 41 second assistant chief and the Department 19 lieutenant entered the basement door. The Department 19 lieutenant told the mutual aid fire fighter to grab the nozzle and knock down the fire in the C-D corner. The Department 41 first assistant chief followed the rescuers into the basement. As they spread out to search the main part of the basement, the Department 41 second assistant chief observed the light from the missing lieutenant's chest-mounted flashlight and quickly moved toward the lieutenant. The lieutenant was

kneeling on the floor, in front of an open door leading to the room at the back of the basement. The Department 41 second assistant chief asked the lieutenant if he was OK and the lieutenant replied, "No, I am not all right." The Department 19 lieutenant radioed to Command that they had found the missing lieutenant. As the three rescuers grabbed onto the lieutenant and started dragging him toward the basement door, the lieutenant became unresponsive. The lieutenant was dragged outside face up. Video from the helmet camera worn by the Department 19 lieutenant was inconclusive as to whether or not the Department 41 lieutenant was wearing his facepiece when he was pulled outside.

As soon as the lieutenant was outside the door, the rescuers turned him over and began removing his helmet and self-contained breathing apparatus. None of the fire fighters interviewed by NIOSH remembered hearing the lieutenant's PASS device or low-air alarm sounding. The Department 66 chief and the Department 41 first assistant chief checked the lieutenant's pulse. The lieutenant was not breathing and did not have a pulse. Fire fighters performed chest compressions until the ambulance crew arrived. The lieutenant was loaded onto a stretcher and carried down the driveway to the ambulance. The lieutenant was transported to the local hospital emergency center at 2013 hours where he was pronounced dead at 2035 hours.

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 ultimately led to the fatalities:

- Lack of crew integrity
- Improper SCBA use
- Inexperienced fire fighter
- Special service vehicle not equipped with SCBA
- Lack of training on fire dynamics

Cause of Death

According to the medical examiner's report, the cause of death was asphyxia due to inhalation of heated products of combustion. The autopsy found second-degree radiant burns completely covering the nose with smaller burns on the left ear and near the center of the forehead in line with the eyebrows.

Recommendations

Recommendation #1: Fire departments should ensure that crew integrity is properly maintained by visual (eye-to-eye), direct (touch), or verbal (voice or radio) contact at all times when operating in an immediately dangerous to life and health (IDLH) atmosphere.

Discussion: When a crew enters a structure, the members should remain in contact by visual (eye-to-eye), verbal (radio or person-to-person), or direct (by touch) contact. NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program* states in Paragraph 8.5.5, "Crew members operating in a hazardous area shall be in communication with each other through visual, audible, or

physical means or safety guide rope, in order to coordinate their activities." Additionally, NFPA 1500 Paragraph 8.5.6 states, "Crew members shall be in proximity to each other to provide assistance in case of an emergency" [NFPA 2013b].

The International Association of Fire Chiefs, Safety, Health, and Survival Section has redefined the *Rules of Engagement for Structural Fire Fighting*. One of the objectives is to ensure that fire fighters always enter a burning building as a team of two or more members and no fire fighter is allowed to be alone at any time while entering, operating in, or exiting a building. A critical element for fire fighter survival is crew integrity. Crew integrity means fire fighters stay together as a team of two or more. They must enter a structure together and remain together at all times while in the interior, and all members come out together. Crew integrity starts with the company officer ensuring that all members of the company understand their riding assignment, have the proper personal protective equipment, and have the proper tools and equipment. Upon arrival at the incident, the company is given a task to perform by the incident commander. The company officer communicates to the members of the company what their assignment is and how they will accomplish their assignment. As the members of a company enter a hazardous environment together, they should leave together to ensure that crew integrity is maintained. If one member has to leave, the whole company leaves together [IAFC 2012].

It is the responsibility of every fire fighter to stay in communication with crew members at all times. All fire fighters should maintain the unity of command by operating under the direction of the incident commander, division/group supervisor, or their company officer at all times. The ultimate responsibility for crew integrity and ensuring no members get separated or lost rests with the company officer. They should maintain constant contact with their assigned members by visual observation, voice, or touch while operating in a hazard zone. They should stay together as a company or crew. If any of these elements are not adhered to, crew integrity is lost and fire fighters are placed at increased risk. If a fire fighter becomes separated and cannot re-connect with his/her crew immediately, the fire fighter should attempt to communicate via portable radio with the company officer. If reconnection is not accomplished after three radio attempts or reconnection does not take place within 1 minute, a Mayday should be declared. If conditions are rapidly deteriorating, the Mayday should be declared immediately. As part of a Mayday declaration, the fire fighter should next activate the radio's emergency alert button (where provided), followed by manually turning on the PASS alarm. Similarly, if the company officer or the fire fighter's partner recognizes they have a separated member, they should immediately attempt to locate the member by using their radio or by voice. If contact is not established after three attempts or within 1 minute, a Mayday should be declared immediately [IAFC 2012].

In this incident, it was reported that three fire fighters entered the basement as a hoseline crew. Very soon after entering the basement, the nozzle man (Department 41 second assistant chief) realized that the lieutenant was not behind him and began to call out for him. The Department 41 second assistant chief went outside and reported to the Department 66 first assistant chief that the lieutenant was missing. The FAST Team was activated and the lieutenant was found shortly after rescuers re-entered the basement.

Recommendation #2: Fire departments should ensure that all fire fighters are trained in and recognize the importance of situational awareness.

Discussion: The book, *Essentials of Fire Fighting and Fire Department Operations*, defines situational awareness as an awareness of the immediate surroundings [IFSTA 2008]. On the fireground, every fire fighter should be trained to be constantly alert for changing and unsafe conditions. This applies not only to the conditions found within a burning structure, but to the exterior fireground as well. Fire fighters may encounter a wide variety of surface features that they must walk across while performing fireground tasks. For example, surfaces may be wet, slippery, ice-covered, or uneven and may be vegetation-covered or include debris from the burning structure. Downed power lines, broken or leaking natural gas meters and distribution lines, unstable structures, and other environmental factors are just some of the hazards that may be present on the fireground.

One of the most critical aspects of coordination between crews is maintaining situational awareness. The opposite of situational awareness is tunnel vision where the fire fighters become so focused on fire fighting or other operational assignments that they fail to sense changes in their environment. Fire fighters can maintain their situational awareness by looking up, down, and around themselves as well as listening for new or unusual sounds and feeling vibrations or movement. Fire fighters and officers should communicate any changes in their environment to other members as well as to the incident commander. Each first responder is responsible for their safety plus the personnel they are working with. Maintaining situational awareness protects against complacency and tunnel vision. The incident scene creates a significant risk to fire fighters, and it is the responsibility of the incident commander and command organization officers to minimize fire fighter exposure to unsafe conditions and stop unsafe practices [IAFC 2012].

In this incident, the Department 41 lieutenant became separated from the hoseline crew soon after the three-person crew entered the basement. For unknown reasons, the Department 41 lieutenant did not radio a Mayday or activate his PASS device. The lieutenant inhaled super-heated gases and products of combustion and did not survive his injuries.

***Recommendation #3: Fire departments should ensure that special service vehicles are equipped with the appropriate equipment as specified in NFPA 1901* Standard on Automotive Fire Apparatus.**

Discussion: NFPA 1901 *Standard on Automotive Fire Apparatus* specifies the minimum equipment and tools to be carried on automotive fire apparatus. Chapter 6 “Initial Attack Fire Apparatus,” Chapter 8 “Aerial Fire Apparatus,” Chapter 9 “Quint Fire Apparatus,” and Chapter 10 “Special Service Fire Apparatus” all require that at least one self-contained breathing apparatus (SCBA) be provided for each assigned seating position on the apparatus [NFPA 2016]. Fire departments should ensure that all in-service apparatus to be dispatched to an emergency situation are equipped with at least the minimum requirements specified in NFPA 1901.

In this incident, Department 41 members were participating in a community holiday function when they were dispatched. Fire department apparatus Engine 4110 and Rescue 4120 were located at the community function at the time of the dispatch. Rescue 4120 was used by Department 41 as a rescue vehicle and brush truck. It does not carry its own water supply. Rescue 4120 was not equipped with

SCBA. Rescue 4120 was the first fire apparatus to arrive at the scene of the structure fire, followed by the Department 19 chief and Department 19's Engine 1910. Two of the Department 41 fire fighters (including the Department 41 lieutenant) joined with the Department 19 lieutenant who had arrived on Engine 1910 to form the entry team. Since Rescue 4120 was not equipped with SCBA, the two Department 41 fire fighters took SCBA from Engine 1910. The Department 41 lieutenant was not trained or fit-tested on the model of SCBA used by Department 19.

Recommendation #4: Fire departments should ensure that fire fighters wear a full array of turnout clothing and personal protective equipment appropriate for the assigned task while participating in fire suppression and overhaul activities.

Discussion: NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program*, Chapter 7, contains the general recommendations for fire fighter protective clothing and protective equipment [NFPA 2013b]. Chapter 7.1.1 specifies that "the fire department shall provide each member with protective ensembles, ensemble elements 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." Chapter 7.1.2 states, "Protective ensembles, ensemble elements and other protective equipment shall be used whenever the member is exposed or potentially exposed to the hazards for which it is provided." Chapter 7.1.3 states, "Structural fire-fighting and proximity fire-fighting protective ensembles and ensemble elements shall be cleaned at least every 6 months as specified in NFPA 1851 Standard on Selection, Care, and Maintenance of Structural Fire Fighting Protective Ensembles [NFPA 2014b]." Chapter 7.2.1 states, "Members who engage in or are exposed to the hazards of structural fire fighting shall be provided with and shall use a protective ensemble that shall meet the applicable requirements of NFPA 1971 Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting [NFPA 2013c]." Chapter 7.10.7 states, "When engaged in any operation where they could encounter atmospheres that are immediately-dangerous-to-life-or-health (IDLH) or potentially IDLH, or where the atmosphere is unknown, the fire department shall provide and require all members to use SCBA that has been certified as being compliant with NFPA 1981 *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*" [NFPA 2013d]. Additionally, the OSHA Respirator Standard requires that all employees engaged in interior structural fire fighting use SCBAs [OSHA 1998]. Additionally, SCBA are required to have integrated personal alert safety systems (PASS) devices meeting the requirements of NFPA 1982 *Standard on Personal Alert Safety Systems (PASS)* [NFPA 2013e].

During this incident, the Department 41 lieutenant inhaled super-heated gases and products of combustion, which led to his death. It was unclear as to whether or not he had on his facepiece when he entered the basement. Documented burn injuries to his nose, forehead, and left ear were consistent with wearing a fire helmet but not wearing a facepiece or protective hood. The lieutenant also did not activate his integrated PASS device, possibly due to unfamiliarity with the SCBA he was using. The SCBA used by the lieutenant was not positively identified so NIOSH was unable to test an SCBA as part of this investigation.

Recommendation #5: Fire departments should ensure that fire fighters are properly trained with the specific SCBA that they are using and also in SCBA repetitive skills training and out-of-air SCBA emergencies.

Discussion: Muscle memory, repetitive skill coordination in the operational use of specific SCBA is a learned skill that fire fighters must master for each manufacturer/model of SCBA they are trained to use. Fire fighters should never enter an IDLH atmosphere using an SCBA that they are not trained on, fit-tested for, and thoroughly familiar with.

Fire Fighters need to understand and be thoroughly familiar with the specific SCBA model that they are using. It is critically important when a department changes manufacturer or model that they provide extensive time and experience in training with the new model. If fire fighters have "muscle memory, repetitive skills training" based on the manufacturer's operational instructions, they would be more able to overcome an out-of-air emergency involving their SCBA. In the aviation industry, this skill building is sometimes referred to as cockpit time. Although a pilot may have extensive experience in one aircraft, he/she needs to have sufficient "cockpit time" in the plane that they are presently flying in order to overcome and control an unanticipated issue. In the same way, a fire fighter must have sufficient "cockpit time" with their SCBA because they operate in an IDLH environment and there is little time to react so the responses have to be learned and automatic. Although the principles of different SCBA manufacturers and models may be the same, the controls, visual and audio signals, and the valves and their locations are different for all models.

Repetitive skills training with SCBA is vital for fire fighters working inside an IDLH atmosphere. SCBA skills training is an ongoing process that should be performed regularly to ensure that fire fighters "know their SCBA." The benefits of repetitive skills training with SCBA are an increased comfort and competency level, decreased anxiety, lower air consumption, increased awareness of the user's air level (noticing and using the heads-up display [HUD]), and an automatic muscle memory response of the vital function controls, such as the don/doff buttons, main air valve, emergency bypass operating valve, and auxiliary air connections (i.e., rapid intervention crew/universal air connection [RIC/UAC] and the buddy breather connection). Repetitive skills training can also provide the user with an increased ability to operate these functions and controls in a high-anxiety moment or an emergency. Many times these skills will be necessary with gloved hands, limited vision, and reduced ability to hear commands from others. Performed in conditions that are non-IDLH, repetitive skills training helps build the fire fighters' muscle memory skills so their hands will be able to activate the controls with gloves on and the operation will be a conditioned or second-nature response. Fire fighters have died in IDLH conditions because they did not react properly to an out-of-air emergency [NIOSH 2011, 2012b]. In this incident, the SCBA used by the Department 41 lieutenant was never positively identified.

Overcoming out-of-air emergencies is an important goal of repetitive skills training. Fire fighters also need to understand the psychological and physiological effects of the extreme level of stress encountered when they run low on air or become lost, disoriented, injured, or trapped during rapid fire progression. Most fire training curricula do not include discussion of the psychological and physiological effects of extreme stress, such as encountered in an imminently life-threatening situation, nor do they address key survival skills necessary for effective response. Understanding the psychology

and physiology involved is an essential step in developing appropriate responses to life-threatening situations. Reaction to the extreme stress of a life-threatening situation, such as being trapped, can result in sensory distortions and decreased cognitive processing capability [Grossman and Christensen 2008]. In the book *Stress and Performance in Diving*, the author notes that while all training is important: "We know that under conditions of stress, particularly when rapid problem-solving is crucial, over-learning responses is essential. The properly trained individual should have learned coping behavior so well that responses become virtually automatic, requiring less stop and think performance" [Bachrach and Egstrom 1987; NIOSH 2013a].

All SCBA come with a user's manual. Fire fighters need to take the time and read these manuals, independent of the training they are given, and then practice with considerable repetitive skill building. Reading the user's manual provides only the baseline knowledge in the operational characteristics. The skill comes from considerable repetitive muscle memory training and is specific to each manufacturer and model. These skills are vital to the fire fighter to assist him/her in overcoming an out-of-air emergency with the SCBA that they are wearing. Although most all of the air function principles are similar, the control locations and operations can be totally different.

The first two fire departments that responded to this incident were part of a county-wide mutual aid plan that identified a mutual aid department to respond as the FAST Team at all working structure fires. During this incident, the first fire fighters on-scene arrived in Rescue 4120, which did not carry any self-contained breathing apparatus. When Engine 1910 arrived on-scene, the Department 41 fire fighters grabbed SCBA from Engine 1910 that were not the same make and model as what they regularly trained on. The Department 41 second assistant chief reported to NIOSH investigators that he was familiar with the operation and use of the Department 19 SCBA. The Department 41 lieutenant was fit-tested with a size large facepiece. The SCBA that he was reported to be wearing was a different manufacturer and had a size medium facepiece. Autopsy information suggested that he did not have a facepiece on when he inhaled superheated gases and products of combustion. The SCBA used by the lieutenant was not positively identified so NIOSH was unable to test an SCBA as part of this investigation.

Recommendation #6: Fire departments should ensure that fire fighters are trained to activate their personal alert safety system (PASS) devices whenever they are in imminent danger.

Discussion: Every fire fighter who may be required to enter an immediately dangerous-to-life-or-health (IDLH) environment should be equipped with a personal alert safety system (PASS) device meeting the requirements of the NFPA 1982 *Standard on Personal Alert Safety Systems* (2013 edition or the latest edition) [NFPA 2013e].

NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program* (2013 edition), Chapter 7.1, states, "The fire department shall provide each member with protective ensembles, ensemble elements, and protective equipment designed to provide protection from hazards to which the member is likely to be exposed and that is suitable for the tasks the member is expected to perform" [NFPA 2013b]. Chapter 7.2.1 states, "Members who engage in or are exposed to the hazards of structural fire fighting shall be provided with and shall use a protective ensemble that shall meet the applicable requirements of NFPA 1971 *Standard on Protective Ensembles for Structural Fire Fighting*

and Proximity Fire Fighting" [NFPA 2013c]. NFPA 1500, Chapter 7.16.2, states, "Each member shall be provided with, use, and activate his or her PASS devices in all emergency situations that could jeopardize that person's safety due to atmospheres that could be IDLH, in incidents that could result in entrapment, in structural collapse of any type, or as directed by the incident commander or the incident safety officer." Annex A to NFPA 1500 (A7.16.2) states:

> The mandatory use and operation of a PASS by fire fighters involved in rescue, fire suppression, or other hazardous duty is imperative for their safety. The primary intent of this device is to serve as an audible device to warn fellow fire fighters in the event a fire fighter becomes incapacitated or needs assistance. Previous fire fighter fatality investigation reports document the critical need to wear and operate PASS devices when fire fighters operate in hazardous areas. Investigation results show that fire fighters often failed to activate the PASS unit prior to entering a hazardous area. Training and operational procedures are imperative to ensure activation of the PASS whenever PASS devices are used.

In this incident, the Department 41 lieutenant was wearing a self-contained breathing apparatus that contained an integrated PASS device. He did not manually activate his integrated PASS device, and his radio was not equipped with an emergency button. There was no evidence that the Department 41 lieutenant attempted to transmit a Mayday over his radio. The integrated PASS device was not sounding at the time the lieutenant was found in the basement and removed by rescuers. The rescuers might have identified his location sooner if the PASS device had been manually activated.

Recommendation #7: Fire departments should ensure that all task-level operations are conducted with the approval of the incident commander within the framework of an incident action plan.

Discussion: Although there is no evidence that freelancing contributed to this line-of-duty death, this recommendation is presented as best practice for all fire fighters operating on the fireground. An important part of the safe fireground operations is ensuring that all task-level operations and activities are conducted within the framework of the approved incident action plan (IAP). Failure to work within the framework of the IAP is called freelancing [Dodson 2007]. An IAP is defined as a written or unwritten plan for managing an emergency [IFSTA 2008]. The incident commander is responsible for assembling an IAP that is implemented by organized teams performing specific tasks. These tasks are assigned to organized teams in the form of orders. Each team is responsible for carrying out the order and providing updates to the incident commander on a regular basis. Additionally, the team must relay information about any pertinent hazards or conditions that may be important to the overall IAP [Delmar 2000].

In the fire service, freelancing is often viewed as a dangerous, risk-taking action. Fire fighters have been seriously injured and killed while engaging in a freelance operation [Dodson 2007]. By definition, freelancing is an operation or task being performed unknown to the incident commander or other working crews [Dodson 2007]. Freelancing is often attributed to a lone worker, although the term can be applied equally to a rogue crew that has decided to engage in a particular task. Freelancing, either by an individual or a crew, can be deadly [Dodson 2007].

Incident commanders, sector or division officers, chief officers, safety officers, company officers, and individual fire fighters can use their basic knowledge of fireground operations to predict situations that can lead to freelancing. One of the most obvious forms of freelancing is a crew in staging or assigned as a rapid intervention crew that wants to get to where the action is.

In this incident, the Department 41 lieutenant became separated from the hoseline crew soon after the three-person crew entered the basement. The lieutenant inhaled super-heated gases and products of combustion. Once it was realized that the lieutenant was missing, he was quickly located and removed from the basement but succumbed to his injuries. The rescuers might have identified his location sooner if the PASS device had been manually activated.

Recommendation #8: Fire departments should ensure that Mayday training programs are developed and implemented so that fire fighters are adequately prepared to call a Mayday.

Discussion: The first and foremost priority for fire fighter safety is not getting oneself into a situation that could potentially cause injury or death. The fire fighter must maintain situational awareness at all times while operating on the fireground. Fire fighters must understand that when they are faced with a life-threatening emergency, there is a very narrow window of survivability, and any delay in egress and/or transmission of a Mayday message reduces the chance for a successful rescue. Knowledge and skill training on how to prevent a Mayday situation and how to call a Mayday should begin and be mastered before a fire fighter engages in fireground activities or other immediately dangerous to life and health environments. Beginner fire fighter training programs should include training on such topics as air management; familiarity with an SCBA, a radio, or PPE; crew integrity; reading smoke, fire dynamics, and fire behavior; entanglement hazards; building construction; and signs of pending structural collapse. Fire fighters must be able to recognize when they find themselves in a questionable position (whether immediately dangerous or not) and be trained on procedures for when and how a Mayday should be called. A fire fighter's knowledge, skill, and ability to declare a Mayday must be at the mastery level of performance. This performance level should be maintained throughout their career through training offered more frequently than annually [IAFF 2012].

Fire departments must understand that each fire fighter may have a different interpretation of what is life-threatening. The ability of a fire fighter to call a Mayday is a complicated behavior that includes the affective, cognitive, and psychomotor domains of learning and performance [Clark 2005; Grossman and Christensen 2008]. Any delay in calling a Mayday reduces the chance of survival and increases the risk to other fire fighters trying to rescue the downed fire fighter. This incident illustrates the need for fire fighters to be given specific training on determining when a Mayday must be called.

No rules are established for determining when a Mayday must be called, and Mayday training is not included in the job performance requirements in NFPA Fire Fighter I or II standards. It is up to the authority having jurisdiction to train members for emergency operations [NFPA 2013a, b] and to develop rules and performance standards for a fire fighter to call a Mayday. The National Fire Academy (NFA) has an on-line course addressing the fire fighter Mayday doctrine: Q133 Firefighter Safety, Calling the Mayday, a 2-hour program covering the cognitive and affective learning domain of the fire fighter Mayday doctrine [Clark 2005]. The NFA course H0134 Calling the Mayday: Hands-on Training, an 8-hour course covering the psychomotor learning domain of the fire fighter Mayday

doctrine, was handed off to state fire training academies and metro fire departments [Clark 2008]. These courses are based on the military methodology used to develop and teach ejection doctrine to fighter pilots. The NFA Mayday courses present specific Mayday parameters or rules for determining when a fire fighter must call a Mayday. The courses may help fire departments in developing and teaching Mayday procedures for fire fighters. Also, NFPA 1001 *Standard for Fire Fighter Professional Qualifications* includes job performance requirements related to the fire fighter calling for assistance (such as a Mayday situation) [NFPA 2013a].

The International Association of Fire Fighters (IAFF) Fire Ground Survival program is another resource for fire departments and was developed to ensure that training for Mayday prevention and Mayday operations is consistent among all fire fighters, company officers, and chief officers [IAFF 2012].

Any Mayday communication must contain the location of the fire fighter in as much detail as possible and, at a minimum, should include the division (floor) and quadrant. It is imperative that fire fighters know their location when in IDLH environments at all times to effectively be able to give their location in the event of a Mayday. Once in distress, fire fighters must immediately declare a Mayday. The following example uses LUNAR (Location, Unit, Name, Assignment/Air, Resources needed) as a prompt: "Mayday, Mayday, Mayday, Division 1 Quadrant C, Engine 71, Smith, search/out of air/vomited, can't find exit." When in trouble, a fire fighter's first action must be to declare the Mayday as accurately as possible. Once the incident commander and rapid intervention team (RIT) know the fire fighter's location, the fire fighter can then try to fix the problem, such as clearing the nose cup, while the RIT is en route for rescue [USFA 2006].

A fire fighter who is breathing carbon monoxide (CO) quickly loses cognitive ability to communicate correctly and can unknowingly move away from an exit, other fire fighters, or safety before becoming unconscious. Without the accurate location of a downed fire fighter, the speed at which the RIT can find them is diminished, and the window of survivability closes quickly because of lack of oxygen and high CO concentrations in an IDLH environment [Clark 2005, 2008; USFA 2006].

In this incident, the Department 41 lieutenant became separated from the hoseline crew soon after the three-person crew entered the basement. The lieutenant inhaled super-heated gases and products of combustion. The nozzle man on the hoseline (Department 41 second assistant chief) began to look for the missing lieutenant and stepped outside the basement and reported the missing lieutenant to a nearby first assistant chief from Department 66. The Department 66 first assistant chief advised the Department 66 chief who radioed a Mayday. The identification and last known location of the missing lieutenant were not immediately reported. It is unknown if the Department 41 lieutenant would have been able to call a Mayday, but he did speak briefly with rescuers when he was located.

Recommendation #9: Fire departments should integrate current fire behavior research findings developed by the National Institute of Standards and Technology (NIST) and Underwriter's Laboratories (UL) into operational procedures by developing or updating standard operating procedures, conducting live fire training, and revising fireground tactics.

Discussion: The National Institute of Standards and Technology (NIST) and Underwriters Laboratories (UL) have conducted a multi-year series of live burn experiments designed to replicate conditions in modern homes and residential structures to validate previous testing done in laboratory settings. The results of these experiments provide fire fighters with assessment tools to better recognize, predict, and react to fires involving new materials and construction. The fire research experiments were conducted in cooperation with the Fire Department of New York, Chicago Fire Department, Spartanburg South Carolina Fire and Rescue, and other agencies. The live burn tests are aimed at quantifying emerging theories about how fires are different today, largely due to new building construction and the composition of home furnishings and products. In the past, these products were mainly composed of natural materials, such as wood and cotton. Today's products contain large quantities of petroleum-based products and synthetic materials that burn faster and hotter and generate large volumes of fuel-rich smoke. Where a fire in a room once took approximately 20 minutes to flashover (igniting all the contents) today's furnished rooms reaches flashover in as little as 4 to 5 minutes [NIST, UL 2013].

Modern living spaces tend to be more open, less compartmentalized and better insulated than homes built years ago. As a result, interior residential fires can generate oxygen-depleted, fuel-rich environments within minutes. This fire condition of hot, fuel-rich smoke is highly reactive to the introduction of oxygen. Opening a door or venting a window introduces massive quantities of oxygen to this environment, which promotes explosive and rapid transition to flashover. These same conditions can occur in commercial structures as seen in the fire at the Charleston, South Carolina, Sofa Super Store [NIOSH 2009a].

The NIST and UL experiments evaluated individual and combinations of methods for strategically ventilating and isolating fires to delay and/or prevent flashover. In contrast, kicking a door open or breaking a window (particularly large surface windows like panes found in sliding glass doors) without knowledge of conditions inside creates a portal for air that introduces immense quantities of oxygen into an oxygen-limited, high-heat, fuel-rich, fire environment.

Fire suppression operations have traditionally been conducted using the interior attack as a means to reduce water damage and limit fire damage to structures. These operations must be coordinated with ventilation operations to reduce the risk to fire fighters working in the interior. Previous research and examinations of line-of-duty deaths have shown that uncoordinated ventilation events occurring with fire fighters in the structure prior to suppression have led to tragic results [NIOSH 2009a, 2012a, 2013b]. One means of eliminating the possibilities of this occurrence is the use of a transitional attack. The transitional attack directs a fire stream into the structure from the exterior to cool superheated fire gases and reduce the heat release rate of the fire prior to the fire fighters entering the building. Two major concerns with the transitional attack are the potential harm that might occur to people trapped in the structure and the amount of water damage to the structure. Further research is needed to document the changes of the thermal environment within the structure and the impact on the viability of people who might be trapped in the structure [NIST, UL 2013].

Based upon the NIST and UL research, the following actions regarding critical fireground operations should be taken into account at every fire scene:

- Size-up
  Size-up must be performed at every fire. Consideration must be given to situational conditions, such as occupied or unoccupied structure, fire location and size of the fire, building contents, construction features, weather, and available resources. Ensure a 360-degree size-up is conducted whenever possible. A tactical plan must be developed, communicated, and implemented in an organized and disciplined manner for each fire.

- Ventilation
  Fire departments need to manage and control openings in structures during fire-fighting operations. All ventilation must be coordinated with suppression activities. Uncontrolled ventilation introduces large volumes of oxygen into the structure, resulting in a rapid increase in fire development. This increased heat release rate elevates the risk of burns to fire fighters caught in the flow path. Limiting fire growth, fire spread, controlling the flow path of inlet air and flow of fire gases during tactical operations are critical actions that reduce fire fighter exposure to untenable conditions.

- Fire-fighting Operations
  Water should be applied to the fire as soon as possible given the fuel-rich, high heat-release environment the fire service operates in today. Water application through an exterior opening into the fire compartment may be the best first action fire fighters take before entering the structure to conduct an interior attack.

  Fire attack teams should cool the interior spaces of a fire building during the fire attack. Water application from the safest location possible prior to committing personnel into smoldering, ventilation-limited, or fully developed spaces reduces risk and control fires more effectively.

- Rapid Intervention
  Fire department rapid intervention procedures should be updated to include putting water on the fire as soon as possible and controlling ventilation openings during fire fighter Mayday incidents [ISFSI 2013].

In this incident, fire fighters had received little training based upon modern fire behavior research conducted by NIST, Underwriters Laboratories, and other research organizations. Recent research by NIST, Underwriters Laboratories, and others has shown that limiting ventilation openings and coordinating hoseline deployment/water application with controlled ventilation can reduce interior temperatures. This temperature reduction makes interior conditions safer for both occupants and fire fighters [NIST, UL 2013].

Recommendation #10: Fire departments should conduct regular mutual aid training with neighboring departments.

Discussion: Mutual aid companies should train together and not wait until an incident occurs to attempt to integrate the participating departments into a functional team. Differences in equipment and

procedures need to be identified and resolved before an emergency occurs when lives may be at stake. Procedures and protocols that are jointly developed and have the support of the majority of participating departments will greatly enhance overall safety and efficiency on the fireground. Once methods and procedures are agreed upon, training protocols must be developed and joint training sessions conducted to relay appropriate information to all affected department members.

Fire departments should develop and establish good working relationships with surrounding departments so that reciprocal assistance and mutual aid is readily available when emergency situations escalate beyond response capabilities. The fire departments involved in this incident were part of a county-wide mutual aid plan that identified a mutual aid department to respond as the FAST Team at all working structure fires. During this incident, the first fire fighters on-scene arrived in Rescue 4120, which did not carry any self-contained breathing apparatus. When Engine 1910 arrived on-scene, the Department 41 fire fighters grabbed SCBA from Engine 1910 that were not the same make and model as what they regularly trained on. The Department 41 second assistant chief reported to NIOSH investigators that he was familiar with the operation and use of the Department 19 SCBA. The experience level that the Department 41 lieutenant had with the model SCBA used by Department 19 is unknown. It was reported to NIOSH investigators that Department 19 and Department 41 had engaged in mutual aid training exercises including simulated Maydays at FAST Team training.

Recommendation #11: Standard setting organizations, enforcement agencies, and authorities having jurisdiction should consider developing, implementing, and enforcing national fire fighter and fire officer training standards and requirements.

Discussion: In 2008, the National Volunteer Fire Council (NVFC) adopted a policy position that all volunteer fire departments should establish a goal to train all personnel to a level consistent with the mission of the fire department, based on the job performance requirements outlined in NFPA 1001 *Standard for Fire Fighter Professional Qualifications* [NFPA 2013a]. The NVFC is committed to ensuring that volunteer fire fighters have an appropriate level of training to safely and effectively carry out the functions of the department(s) to which they belong, and this issue actually encompasses the entire fire service and not just the volunteer ranks:

> The roles and responsibilities of the fire service have evolved over the years. As the breadth and scope of what it means to be a firefighter has expanded, to varying degrees depending on the jurisdiction, the necessity for training within the fire service has grown. Unfortunately, a large number of volunteer fire departments are still operating with personnel who are not trained to a level consistent with national consensus standards for basic firefighter preparedness. This can lead to ineffective and unsafe responses that put lives and property at risk. As the need for proper training has become more urgent, many volunteer fire departments are finding it increasingly difficult to attract new members. The average age of volunteer firefighters has risen steadily over the past two decades, as many young people move out of rural areas and the ones who stay find themselves with less free time to devote to training" [NVFC 2010].

Standard setting organizations, states, and authorities having jurisdiction should move to develop national standards so that fire fighters across the United States are trained to the same minimum levels.

Volunteer Fire Fighter Dies After Inhaling Super-heated Gases at a Residential Structure Fire—New York

In 2015, the New York State (NYS) Office of Fire Prevention and Control (OFPC), with input from the New York Department of Labor (NY-DOL) Public Employees Safety and Health Bureau (PESH) and fire service organizations within the state of New York, developed a recommended set of "Best Practices for Fire Department Training Programs." The purpose of the "Best Practices" is to assist fire departments in complying with OSHA CFR 1910.156(c)(1).

The NYS Office of Fire Prevention and Control (OFPC) "Best Practices" outlines recommended core competencies that fire department training programs should address. These include recommended core competencies for exterior fire-fighting, interior fire-fighting, and incident commanders. The NYS OFPC "Best Practices" also includes recommendations for annual refresher training and OSHA/NYS PESH-required annual training.

Appendix One contains the NYS Office of Fire Prevention and Control (OFPC) Recommended Best Practices for Fire Department Training Programs.

Many fire fighters, especially in the volunteer ranks, may be called upon to fill company officer and incident commander roles when they may not have received adequate training for the additional responsibilities that are required of fireground officers. Fire department members that are assigned to or assume supervisory positions at an incident scene must have an additional level of competencies that are necessary to ensure for the safety of themselves and the members they supervise while mitigating the hazard encountered. A company officer must have the correct combination of practical experience, training, and skill sets that correspond with their job requirements and expected functions in order to execute the expected duties in a safe, effective, efficient, and competent manner. The company officer fulfills a mission critical role within the fire service that directly affects department personnel, public safety, and community accord. The title carries with it the opportunity to ride the "front seat" and be in charge of directing a company to address incident operations and demands dictated by the company's function, responsibility, and task assignment. NFPA 1021 *Standard on Fire Officer Professional Qualifications* provides clear and concise job performance requirements (JPR) that can be used to determine if an individual, when measured to the standard, possesses the skills and knowledge to perform as a fire officer [NFPA 2014a]. At a minimum, fire departments should ensure that all fire fighters who are expected to perform the duties of a company officer or greater responsibility have the necessary knowledge and experience and receive adequate training equivalent to NFPA Fire Fighter II as defined by NFPA 1001 and Fire Officer as defined by NFPA 1021. In general, NFPA Fire Fighter I reflects minimum training standards for a fire fighter who is always working under supervision. NFPA Fire Fighter II addresses the assumption of command and transfer of command but does not contain specific job performance requirements to illustrate the required skills.

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Investigator Information

This incident was investigated by Timothy Merinar, Safety Engineer, and Matt Bowyer, General Engineer, with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field

Investigations Branch, Division of Safety Research, NIOSH, located in Morgantown, West Virginia. Jay Tarley, Physical Scientist with the NIOSH National Personal Protective Technology Laboratory, participated in the field investigation and also was responsible for the self-contained breathing apparatus evaluation process. An expert technical review was provided by Dr. Burton A. Clark, EFO, www.AmericanFireCulture.com. A technical review was also provided by the National Fire Protection Association, Public Fire Protection Division.

Additional Information

Wind Driven Fire

Wind blowing into the broken window of a room on fire can turn a "routine room and contents fire" into a floor-to-ceiling firestorm. Historically, this has led to a significant number of fire fighter fatalities and injuries, particularly in high-rise buildings where the fire must be fought from the interior of the structure. For more information, see the National Institute of Standards and Technology (NIST) website: https://www.nist.gov/%3Cfront%3E/wind-driven-fires.

Modern Fire Behavior

This website is meant to serve as a clearinghouse of news and training information related to Modern Fire Behavior and Modern Building Construction Research, Tactics, and Practices along with actual street experiences (http://modernfirebehavior.com/). ModernFireBehavior.com is a joint effort between www.FirefighterCloseCalls.com and the Underwriters Laboratories Fire Safety Research Institute.

IAFC Rules of Engagement for Firefighter Survival

The international Association of Fire Chiefs (IAFC) is committed to reducing fire fighter fatalities and injuries. As part of that effort, the nearly 1,000 member IAFC Safety, Health and Survival Section has developed the DRAFT "Rules of Engagement for Structural Firefighting" to provide guidance to individual fire fighters and incident commanders, regarding risk and safety issues when operating on the fireground. The intent is to provide a set of "modern procedures" for structural fire fighting to be made available by the IAFC to fire departments as a guide for their own standard operating procedure development process (http://www.iafcsafety.org/downloads/Rules_of_Engagement).

IAFF Fire Ground Survival Program

The purpose of the International Association of Fire Fighters (IAFF) Fire Ground Survival Program is to ensure that training for Mayday prevention and Mayday operations is consistent among all fire fighters, company officers, and chief officers. Fire fighters must be trained to perform potentially life-saving actions if they become lost, disoriented, injured, low on air, or trapped. Funded by the IAFF and assisted by a grant from the U.S. Department of Homeland Security through the Assistance to Firefighters (FIRE Act) grant program, this comprehensive fireground survival training program applies the lessons learned from fire fighter fatality investigations conducted by the National Institute for Occupational Safety and Health (NIOSH) and has been developed by a committee of subject matter experts from the IAFF, the International Association of Fire Chiefs (IAFC), and NIOSH (http://www.iaff.org/HS/FGS/FGSIndex.htm).

National Institute for Standards and Technology (NIST)—Fire on the Web

Fire on the Web is a collection of resources from the Building and Fire Research Laboratory's Fire

Research Division at NIST. These web pages provide links to fire-related software, experimental fire data, and mpeg/quick time movies of fire tests that can be downloaded and/or viewed with a web browser (http://www.nist.gov/el/fire_research/firesafety/fireontheweb.cfm).

Underwriters Laboratories (UL) Firefighter Safety Research Institute (FSRI)
An online course offered by the **UL FSRI** highlights the tactical application of nearly two decades of research at the National Institute of Standards and Technology (NIST) and UL on how best to fight modern fires. In 2012, the New York City Fire Department (FDNY), NIST, and UL FSRI set fire to abandoned townhouses on Governors Island, New York, in a series of experiments to examine tactics for controlling fires and rescuing occupants inside burning homes (http://www.firecompanies.com/modernfirebehavior/governors%20island%20online%20course/story.html).

Disclaimer

Mention of any company or product does not constitute endorsement by the National Institute for Occupational Safety and Health (NIOSH). In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date.

Appendix One

New York State
Division of Homeland Security and Emergency Services
Office of Fire Prevention and Control

Recommended Best Practices for Fire Fighter Training

Volunteer Fire Fighter Dies After Inhaling Super-heated Gases at a Residential Structure Fire—New York

NYS Division of Homeland Security and Emergency Services **Office of Fire Prevention and Control**	Issue Date: January, 2015 Revision Date:

Recommended Best Practices For Fire Department Training Programs

1. Purpose:

The NYS Office of Fire Prevention and Control, with input from the Department of Labor's Public Employees Safety and Health Bureau (PESH) and fire service organizations, has developed a recommended set of "Best Practices" for use by fire departments. The purpose of these "Best Practices" is to assist fire departments in complying with the Occupational Safety and Health Administration's (OSHA) Regulation 29 Code of Federal Regulations (CFR) 1910.156(c)(1), ["§1910.156(c)(1)"]. In New York State this regulation is enforced for firefighters and public employees by the DOL's Public Employee Safety and Health Bureau (PESH).

This document and guidance herein is not intended to formulate a regulatory mandate nor is the purpose of this document to dictate specific training courses. It is intended to identify "best practices" and core competencies that should be included in all training programs based upon the job duties of individual firefighters. These recommendations should not be considered to be all inclusive of the subject areas necessary to develop a comprehensive training program, but will be useful in developing a training program that meets the intent of OSHA Regulation 29 CFR 1910.156(c)(1), ["§1910.156(c)(1)"].

2. Scope:

OSHA Regulation Section 1910.156(c)(1), applies to all fire departments in New York State, and requires that members be provided with training and education commensurate with the duties and functions that such members are expected to perform. Further, §1910.156(c)(1) provides that those who may find themselves as or are designated as Incident Commanders and training instructors must be provided with training and education which is more comprehensive than that provided to the general membership.

Training and education is not required to come from any one particular source or class of instruction and may include experience, vendor training, department in-house training and training that is provided by the State's fire service organizations. Regardless of where the training is obtained it is imperative to document any and all training that is being utilized to satisfy the competencies listed in this policy.

3. Definitions:

For the purposes of this guidance "fire brigade" as referenced in the OSHA regulation means fire department. Fire department is defined as any entity providing fire and emergency rescue services including but not limited to career, paid, volunteer or combination fire departments; for example a village fire department, fire district, fire protection district, independent fire company providing fire protection, or a privatized fire brigade providing fire protection in an industrial or commercial environment.

4. Training Program Best Practices By Function:

Fire departments in New York State vary widely in type, function, capability and size. As such, each may establish training and education curriculum for their personnel which best reflects the hazards or complexity of their response area. Accordingly, a training and education curriculum which is developed in-house or by an outside consultant or vendor which addresses the specific competencies for each

category of duty or function as outlined below, would be deemed to satisfy compliance with §1910.156(c)(1). Nothing in these "Best Practices" is intended to limit a fire department from establishing training requirements which exceed these recommended core competencies or limit a fire department from developing and using past, current or future training classes, drills, or other classroom training and/or pertinent topical training subjects to satisfy section 1910.156(c)(1). It is imperative that all training curriculums and programs must be thoroughly documented as part of each fire departments recordkeeping policy(s) in order to afford training credit to its members.

The competencies listed in each section are not in order of importance or in any particular sequence. Included with the recommended core competencies for each category of firefighter are examples of specific training courses which could fulfill various core competencies and ultimately will help ensure compliance with §1910.156(c)(1). Contact information for each provider referenced herein, is listed on the last page.

4.1 Exterior Firefighters:

All firefighters should complete a training program(s) addressing these core competencies:

1) Complete a training program addressing the subject areas/core competencies associated with OSHA 29 CFR1910.120 requirements or Hazardous Materials First Responder Operations
2) Complete a training program addressing the subject areas/core competencies associated with Infection Control to achieve compliance with OSHA 29CFR1910.1030
3) Complete the objectives for Basic First Aid
4) Complete the objectives for Cardio-Pulmonary Resuscitation
5) Completion of the latest version of the National Incident Management System (NIMS) courses ICS-700 and ICS-100
6) Fire safety principles familiarization
7) Tool and scene safety awareness
8) Building Construction in relation to fire service operations
9) Understanding fire behavior and development
10) Familiarizations with personal protective equipment (PPE) and self-contained breathing apparatus (SCBA) as assigned;
11) Familiarization with fire service communication operations
12) Familiarizations with incident management principles
13) Familiarizations with fire prevention principles
14) Arson awareness
15) Familiarizations with fire extinguisher operations
16) Familiarizations with hose practices, nozzles and fire streams (excluding interior structural fire attack)
17) Understanding of water supply operations
18) Familiarization with ground ladder operations; and
19) Ropes and knots

Related training programs which may address some or all of the specific core competencies, stated above, for exterior firefighters include:

1. NYS Office of Fire Prevention and Control
    a. Basic Exterior Firefighting Operations (Competencies 6 – 19) and Hazardous Materials First Responder Operations (Competency 1); or
    b. Firefighter I (Competencies 1 and 6 – 19), *[Competencies 3 – 5 are prerequisites for graduation from the FF1 Program]*
2. NYS OFPC Legacy (Historical) Training recognized as equivalent:
    a. Scene Support Operations (Competencies 6 – 19) and Hazardous Materials First Responder Operations (Competency 1)

b. Firefighting Essentials (Competencies 6 – 19) and Hazardous Materials First Responder Operations (Competency 1), or
c. Basic Firefighter (Competencies 6 – 19) and Hazardous Materials First Responder Operations (Competency 1)

3. Suffolk County Fire Academy, Scene Support Operations (in addition, a Hazardous Materials Operations level training program will need to be completed)

4.2 Interior Firefighters:

In addition to core competency training provided for all exterior firefighters, interior firefighters should complete a training program(s) addressing the following core competencies:

1) How to Initiate a response to a reported emergency
2) Fire service communication operations
3) Familiarizations with assigned self-contained breathing apparatus (SCBA) during emergency operations
4) Safe fire apparatus response to an emergency incident
5) Scene safety and operating at an emergency incident
6) Familiarization with forcible entry techniques
7) Operating as a team member within a hazardous area
8) Familiarization with ground ladder operations
9) Familiarizations with safe operations at vehicle fires
10) Understanding outside or exterior fires and defensive operations
11) Familiarizations with structure fire search and rescue operations
12) Familiarization with interior fire attack operations
13) Familiarization horizontal and vertical ventilation operations
14) Understanding overhaul operations
15) Familiarizations with salvage and property conservation techniques
16) Familiarization with water supply operations
17) Understanding of fire chemistry and behavior
18) Familiarization with fire extinguisher operations
19) Ground cover fires
20) Fire equipment, hose and PPE inspection and maintenance
21) Building construction related to interior structural firefighting operations

Related training programs which may address some or all of the specific core competencies, stated above, for interior firefighters include:

1. NYS Office of Fire Prevention and Control
   a. Firefighter I (Competencies 1 – 21)
   b. Certified basic firefighter training program under NYS Firefighter minimum training standards (Competencies 1 – 19 of the Exterior Firefighter and 1 – 21 of the Interior Firefighter)
2. NYS OFPC Legacy (Historical) Training recognized as equivalent:
   a. Firefighting Essentials or Essentials of Firefighting, Initial Fire Attack and Hazardous Materials Operations (Competencies 1 – 21)
   b. Basic Firefighter, Intermediate Firefighter and Hazardous Materials Operations (Competencies 1 – 21)
3. National Certification for Firefighter I and National Certification for Hazardous Materials Operations- Core Competencies
4. Nassau County Fire Academy
   a. Essentials of Firefighting and Primary Firefighting
5. Suffolk County Fire Academy, Firefighter I

4.3 Apparatus Operators:

In addition to core competencies for exterior firefighters, apparatus operators should complete a training program addressing the following core competencies:

1) Performing routine preventive maintenance, inspection and being capable of initiating the service of vehicle systems, components, equipment, tools and appliances assigned to the vehicle and be capable of initiating correction of any deficiencies noted.
2) Be capable of documenting routine maintenance, inspection and service of the vehicle's systems, components, equipment, tools and appliances mounted on or assigned to vehicle. Be capable of initiating correction of any deficiencies noted during this process or any corrective actions required to address deficiencies
3) Be capable of demonstrating safe operation of the vehicle in compliance with applicable laws, regulations and standards during routine driving and emergency responses
4) Be capable of demonstrating defensive driving practices
5) Be capable of demonstrating safe maneuvering of the vehicle around obstructions and in restricted spaces both forward and reverse
6) Be able to demonstrate safe backing procedures and the use of a spotter
7) Be knowledgeable of operational capabilities and limitations of the vehicle, its systems and components, equipment, tools and appliances mounted on or assigned to that vehicle
8) Understand the operation of the functional systems, tools, equipment and appliances mounted on or assigned to the vehicle; and
9) Be capable of demonstrating the ability to operate the pump or other functional systems on the apparatus.

Related training programs which may address some or all of the specific core competencies, stated above, for apparatus operators include:

1. NYS Office of Fire Prevention and Control
    a. Apparatus Operator- Emergency Vehicle Operator's Course (EVOC), (Competencies 1 – 9, in addition to local training specific to the fire department's vehicles)
2. Insurance Company sponsored EVOC programs with a practical skills driving course component, in addition to local training specific to the fire department's vehicles
3. Suffolk County Fire Academy
    a. Emergency Vehicle Operations (EVOC), in addition to local training specific to the fire department's vehicles
4. National Certification for any of the Apparatus Operator series, in addition to local training specific to the fire department's vehicles

4.4 Incident Commanders:

As outlined in section 1910.156(c)(1) of the OSHA regulations, those chiefs, officers or firefighters who have been designated or may perform the duties of a fire service incident commander must receive training which is superior than that provided to the general membership of the fire department. In addition to the training provided to the general membership those who may be acting as an Incident Commander should have received training prescribed for an interior firefighter, general knowledge of apparatus/pump operations, as well as education in incident command operations. Incident command training and education is not required to come from any one particular source or class. The training to educate those designated or who may find themselves in the position as an Incident Commander should include supervision, leadership, and command methodologies necessary for mitigating emergency situations during hazardous and stressful environments incorporating the best safety practices.

Volunteer Fire Fighter Dies After Inhaling Super-heated Gases at a Residential Structure Fire—New York

In addition to the core competencies required for interior firefighters and apparatus operators, incident commanders should have a demonstrated knowledge and experience in the following core competencies:

1) Safe and effective assignment and supervision of tasks, or responsibilities to managing unit officers at emergency incidents (including those on highways and roadways), during training and under routine or non-emergency circumstances
2) Be capable of communicating clear direction and supervision of members during training
3) Knowledge of administrative policies and procedures and records management, including incident reports
4) Knowledge of building construction and fire behavior, including structural soundness and the significance of fire load;
5) Be capable of evaluating and implementing scene security and evidence preservation;
6) Be capable of developing and implementing an incident action plan;
7) Be capable of conducting a post-incident analysis;
8) Be knowledgeable of safety principles, including injury and accident prevention;
9) Be familiar with fire department injury and accident reporting requirements according to department policies;
10) Be familiar with firefighter health and wellness for recognition of issues, e.g. stress, heart attack and other issues that would hinder firefighter's response capabilities.
11) An understanding of strategy, tactics and operations in fire suppression;
12) An understanding of vehicle extrication procedures and department capabilities and limitations;
13) Awareness of other situations expected to be encountered in the department's immediate response area
14) Be capable of initiating scene size-up procedures;
15) Be familiar with initial arrival report ("C.A.N. [Conditions, Actions, Needs] - Report") protocols
16) Be familiar with radio communications operations;
17) Be capable of communicating fire-ground reports (location of fire, water on fire, searches, knock-down, etc.) and
18) Be familiar with urgent & mayday communication protocols;
19) Be familiar with how to mitigate miscellaneous emergencies (Gas leaks, CO, Electrical, elevator rescues, hazmat containment etc.);
20) Understand RIT/FAST Operations and how to implement them;
21) Obtain a certificate for the latest version of NIMS ICS-200;
22) Understanding the use and limitations of special fire department equipment, e.g. gas meters, thermal imaging cameras, self-escape equipment, gas powered tools etc.

Related training programs which may address some or all of the specific core competencies, stated above, for incident commanders include:

1. NYS Office of Fire Prevention and Control
    a. Fire Officer I (2009) (Competencies 1 – 20 and 22) and ICS-200 (Competency 21)
2. NYS OFPC Legacy(Historical) Training recognized as equivalent:
    a. Introduction to Fire Officer and Fire Officer I (Competencies 1 – 20 and 22) and ICS-200 (Competencies 21)
3. National Certification for Fire Officer I(Competencies 1 – 20 and 22) and I-200 (Competency 21)
    a. First Line Supervisors Training Program(Competencies 1 – 22)
4. Suffolk County Fire Academy
    a. Introduction to Fire Officer and Fire Officer I and ICS-200

4.5 Training Guidance for Fire Department Training Instructors:

Fire department training instructors must receive a higher level of training and education than the fire department members they will be instructing. This includes being more knowledgeable about the functions to be performed by the fire department and the hazards involved. The instructors should be qualified to train fire department members and demonstrate skills in communication, methods of teaching, and instructional motivation.

Training Instructors should demonstrate and possess the following skill set core competencies to instruct personnel effectively which includes but is not limited to:

1) Preparation
2) Presentation
3) Application
4) Testing
5) Summary and
6) Knowledge base of relevant subject matter, applicable policies, rules and regulations

Related training programs which may address some or all of the specific core competencies, stated above, for fire department training instructors include:

1. NYS Office of Fire Prevention and Control
    a. Principles of Instruction (Competencies 1 – 6)
    b. Fire Instructor I (Competencies 1 – 6)
2. NYS OFPC Legacy(Historical) Training recognized as equivalent:
    a. Training Officer Workshop I & II (Competencies 1 – 6)
    b. Educational Methodology (Competencies 1 – 6)
3. National Certification for Fire Instructor I (Competencies 1 – 6)
4. Suffolk County Fire Academy
    a. Principles of Instruction
    b. Fire Instructor I
5. Nassau County Fire Academy
    a. Principles of Instruction

5. Training Provider Contact Information:

NYS Office of Fire Prevention and Control
www.dhses.ny.gov/ofpc/training/training-outreach.cfm

Suffolk County Fire Academy
www.scfa-li.org

Nassau County Fire Academy
www.veebfsa.org

Firefighter Annual Refresher Training Guidance

For compliance with pertinent OSHA Standards as required in the NYS Public Employee Safety and Health Act

Annual Firefighter Training

Intent:

The intent of this document is to define the pertinent OSHA/PESH requirements which require annual refresher training designed to maintain proficient firefighter knowledge, skills and abilities in accordance with 29 CFR 1910.156(c)(2) and increase overall firefighter safety in accordance with other applicable OSHA/PESH standards.

This document pertains only to the annual refresher training. Fire Departments should refer to the OFPC Best Practices for Fire Department Training Document for suggested courses to meet the requirements of initial training and/or for the appropriate training for additional roles in the FD.

OSHA/PESH Required Annual Training:

Below is a chart outlining OSHA/PESH topics required for all Fire Departments to conduct annually for all members so that those members demonstrate knowledge and proficiency in the topics listed.

Topic	Standard
Hazardous Materials/Emergency Response	1910.120(q)(8)
Respiratory Protection	1910.134(k)(5)
Blood Borne Pathogen	1910.1030(g)(2)(ii)(B)
Right to Know	Article 28 Section 878
Workplace Violence	NYCRR Part 800.6
Fire Extinguishers (if required to use)	1910.157(g)(2)

OSHA/PESH Standard 29 CFR 1910.156(c)(2)

In addition to the above required training, OSHA/PESH Standard 29 CFR 1910.156(c)(2) requires that Fire Department Training Programs be designed to address annually the proficiency of each member's knowledge and abilities as it relates to that member's expected assignment.

Such assignments may include Exterior Firefighter, Interior Firefighter, Apparatus Operator, Fire Officer/Incident Commander and Fire Training Officer.

The annual refresher training should be comprised of current content and of sufficient duration so that each member can demonstrate knowledge and abilities in their assigned duties. It is important to maintain documentation of all training conducted to comply with these requirements. While no

specific time is allotted to the annual training or specific topics (e.g. 8 hours), this clarification is not intended to shorten the previously established timeframe, but to provide you with the flexibility to adjust the length of time spent on specific topics that your department feels are more or less necessary.

The OFPC Best Practices for Fire Department Training Programs document outlines subject matter that can be considered for annual refresher training for each member's expected assignment.

Fire Departments must document each member's annual proficiency training to maintain knowledge, skills and ability proficiencies as related to that member's expected assignment.

This annual refresher requirement does not take into account special operations or activities that would exceed the requirements for this refresher training and should be considered separately based on the needs of the firefighters assigned to those activities.

Suggestions:

In addition to subject area topics discussed in a firefighter's initial training, additional topics for annual refresher training may include those listed below. It is also important to maintain an awareness of current fire service trends and advancements as they relate to your Fire Department and response area.

Some suggested topics may include:

- Hazard Recognition
- Fire Station Safety
- Response Safety
- Fire Scene Safety
- Protective Clothing
- SCBA Use
- Tools
- Equipment

Summary:

The overriding consideration when determining the appropriateness of fire service training intended to address annual firefighter refresher training is:

- Does the training relate to the expected duties and assignments of the firefighter;
- Does it provide a means to refresh or evaluate competencies the firefighter is expected to perform; and
- Does the training increase the level of safety for the firefighter.

PESH (4/14)