



1000 FREDERICK LANE, MORGANTOWN, WV 26508 • 304.285.5916

Paid-On-Call Fire Fighter Becomes Disorientated and Dies Following Stairway Collapse in Two-Story Vacant Structure Fire – Illinois

Executive Summary

On May 5, 2019, a 24-year-old career firefighter became disorientated and died following a stairwell collapse on the 2nd floor during a fire in a vacant commercial structure. At 0334, Engine 201 responded to a report of a structure fire with heavy smoke. Upon arrival the Engine 201 lieutenant and the assistant chief noticed heavy smoke on Side Charlie and the 2nd story windows on Side Bravo. Engine 204 arrived and connected to a hydrant on Side Bravo. The lieutenant and a firefighter from Engine 201 made entry after forcing open the south door on Side Bravo to search the 1st floor. Engine 201 took tools and a 1¾-inch hoseline off Engine 204 into the structure to perform a search. They encountered a mattress and debris on fire near the middle of the structure and some fire along an east wall (Side Delta). After extinguishing the fire and completing their search of the 1st floor, they exited the building, and changed their SCBA cylinders. At approximately 0357 hours, the municipal fire chief and additional resources arrived on scene. Ground ladders were placed at windows on Side Bravo while a Side Bravo door was forced open. The lieutenant and firefighter from Engine 201 were preparing to re-enter the building. They came to the open door and noticed the stairs to the 2nd floor. Several stairs appeared to be structurally unsound, so a roof ladder was used to bridge the stairs. They ascended to the 2nd floor with a hoseline, hand tools, and a thermal imager (TI) carried by the lieutenant. The thermal imager indicated heat on the Side Delta wall but no fire. They met the assistant chief, who had ascended one of the ground



**Side Bravo of the fire building
(NIOSH Photo)**

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ladders to the 2nd floor. Assistant Chief 2 felt his ears starting to burn and said that the firefighters needed to back out of the 2nd floor. Assistant Chief 2 indicated he was going to exit via the ground ladder. The lieutenant misunderstood and thought Assistant Chief 2 was getting low on air. The lieutenant noticed conditions worsening and indicated to the firefighter the need to exit the 2nd floor. The lieutenant believed the firefighter was right behind him as he started down the stairs. As he stepped on the roof ladder lying on the stairs, the stairs collapsed sending him under the stairwell, covering him with debris. The lieutenant immediately called a Mayday. The lieutenant called out for the firefighter. He searched under the stairwell for the firefighter plus tried to self-rescue but was driven back by the heat along the Side Delta wall. The rapid intervention team (RIT) was sent in and was able to pull the lieutenant out. The lieutenant indicated the firefighter must still be on the 2nd floor. RIT teams made several attempts to access the 2nd floor via the ground ladders. They could not advance towards the middle of the building due to deteriorating conditions. The strategy was switched to defensive operations until the fire was knocked down. At approximately 0541 hours, Engine 3 from an adjoining county fire department arrived with a specialized RIT crew of four firefighters. The RIT accessed the firefighter by using the roof of the one-story Side Delta exposure (Delta 1). The RIT entered a 2nd floor window on Side Delta of the fire building. Following the sound of a personal alarm safety system (PASS) alarm, the RIT located the firefighter, approximately 2 hours and 27 minutes after the Mayday. The fallen firefighter was placed in a stokes basket, lowered to the ground, and loaded into an ambulance.

Contributing Factors

- *High risk/low frequency event – abandoned commercial structure*
- *Lack of firefighter survival skills*
- *Insufficient incident management*
- *Lack of crew integrity*
- *Lack of mutual aid box alarm system (MABAS) training*

Key Recommendations

- *Fire departments should ensure a standard operating procedure/standard operating guideline for high risk/low frequency events is developed, implemented, and firefighters are trained for fires in commercial structures*
- *Fire departments should ensure firefighters are properly and repetitively trained in “out of air” and “low air” self-contained breathing apparatus (SCBA) emergencies*
- *Fire departments should ensure Mayday training programs are developed and implemented so firefighters are prepared to call a Mayday*

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- *Fire departments should ensure crews are properly assigned when operating in an immediately dangerous to life and health (IDLH) atmosphere*
- *Fire departments should ensure firefighters communicate critical incident benchmarks to the incident commander throughout the incident*
- *Fire departments should ensure all fireground ventilation is coordinated with firefighting operations*
- *Fire departments should ensure a single, effective incident management system is established with one designated incident commander, especially when multiple fire departments respond to automatic aid incidents*
- *Fire departments should ensure firefighters are trained in fireground survival procedures*
- *Fire departments that have adopted the Mutual Aid Box Alarm System (MABAS), should participate in training exercises so that standard operating procedures/standard operating guidelines can be implemented and enforced*
- *Fire departments should ensure adequate incident scene rehabilitation is established in accordance with NFPA 1584, Standard on the Rehabilitation Process for Members during Emergency Operations and Training Exercises*
- *Municipalities should ensure fire department telecommunicators are properly trained and certified, which includes the operation of alarm box cards for proper dispatching of resources.*

The National Institute for Occupational Safety and Health (NIOSH) initiated the Fire Fighter Fatality Investigation and Prevention Program to examine deaths of fire fighters in the line of duty so that fire departments, fire fighters, fire service organizations, safety experts and researchers could learn from these incidents. The primary goal of these investigations is for NIOSH to make recommendations to prevent similar occurrences. These NIOSH investigations are intended to reduce or prevent future fire fighter deaths and are completely separate from the rulemaking, enforcement and inspection activities of any other federal or state agency. Under its program, NIOSH investigators interview persons with knowledge of the incident and review available records to develop a description of the conditions and circumstances leading to the deaths in order to provide a context for the agency's recommendations. The NIOSH summary of these conditions and circumstances in its reports is not intended as a legal statement of facts. This summary, as well as the conclusions and recommendations made by NIOSH, should not be used for the purpose of litigation or the adjudication of any claim.

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



LINE OF DUTY DEATH REPORT

F2019-09 • June 30, 2022

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Introduction

On May 5, 2019, a 24-year-old career firefighter became disorientated and died following a stairway collapse on the second floor in an abandoned commercial structure fire. On May 6, 2019, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. From May 28 to June 1, 2019, a general engineer and a safety and occupational health specialist from the NIOSH Fire Fighter Fatality Investigation and Prevention Program traveled to Illinois to investigate this incident. The NIOSH investigators interviewed the officers and firefighters from the local and mutual aid fire departments involved in this incident. NIOSH investigators also met and collected information from the state fire marshal and the medical examiner.

Fire Department

This fire department has one station with 12 active paid, on-call members which serves a population of approximately 7,000 within an area of about 22 square miles. The department averages 110 calls a year with 15 responses to working fires.

At the time of the incident, the fire department had one 2011 engine (Engine 204) which had a 1250 gallon per minute pump and a 750-gallon tank; one 1994 ladder truck (Engine 201) which had a 1250 gallon per minute pump and a 750-gallon tank; one 1998 rescue pumper, which had a 1500 gallon per minute pump and a 750-gallon tank; one 1994 tender with a 2000-gallon tank; and a 2008 F250 brush truck. All fire department apparatus and ambulances are maintained by the county's fleet maintenance division and annually tested by qualified vendors.

The fire department has minimal written policies and procedures, which are available to all department members. The current policies and procedures are implemented and enforced. New policies and procedures are being developed to adequately cover the function of the fire department.

This fire department is a member of an organization known as the Mutual Aid Box Alarm System (MABAS). This is a system designated to assist with response to fire and emergency medical services. It provides specialized response teams and station coverage during state declared disasters or when an incident overwhelms the available resources of a participating community. The MABAS requires that all members agree to and sign a contract that includes standards of operation, incident command procedures, minimum equipment staffing requirements, and safety and on-scene terminology. This

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agreement also aids departments and agencies by having predetermined resources that will be sent to assist other communities when in need. This allows the fire chief and incident commanders to focus on operational needs during a serious incident, knowing that a predetermined set of resources is responding upon issuance of a single order by command. There were 10 fire departments within the county and a few fire departments from neighboring counties on this MABAS.

Training and Experience

The state of Illinois has no minimum training requirements for firefighters (See **Appendix One**).

The deceased firefighter had seven years of service with the fire department. From 2013 to 2018, the firefighter had taken multiple courses from the Illinois Fire Service Institute, University of Illinois, such as Basic Engine Company Operations; Firefighter Rescue and Survival; Rapid Intervention Team Basics; Roof Operations; Search Techniques for the Fireground; Combatting Single Family Dwelling Fires; Basic Responder Intervention Team; Technical Rescue Awareness; Ventilation; and numerous other operational courses.

The first arriving officer, Engine 201 lieutenant, had 27 years of fire service experience. The lieutenant had certificates for Basic Company Officer; Fire Service Vehicle Operator; Statewide WMD Response: Hazardous Materials Awareness Course; IS-00100 *Introduction to Incident Command System*; IS-00200 *ICS for Single Resources and Initial Action Incidents*; IS-00700 *National Incident Management System (NIMS)*; IS-00804 *Emergency Support Function (ESF) #4 Firefighting*; IS-00809 *Emergency Support Function (ESF) #9 Search and Rescue*; IS-00810 *Emergency Support Function (ESF) #10 Oil and Hazard Material Response*; and numerous other operational courses.

The initial incident commander, a municipal Assistant Chief 2, had 22 years of fire service experience. Assistant Chief 2 had certificates for Basic Operations Firefighter; Technical Rescue Awareness; Statewide Weapons of Mass Destruction (WMD) Response: Hazardous Materials Awareness Course; Fire Service Vehicle Operator; and numerous other operational courses.

The municipal fire chief, Fire Chief 2, had 40 years of fire service experience and 3 years as fire chief. The fire chief certificates were not provided by the Fire Department.

Building Construction

The fire structure was an unoccupied, commercial building built in approximately 1917 and was for sale. It was a 2-story Type 3 ordinary construction building. The dimensions were approximately 80 feet by 50 feet with two brick wythes or double interconnected brick exteriors (See **Photos 1-4**). The roof was flat with a rubberized coating. The 1st floor interior walls were comprised of paneling and were peg boarded. The 2nd floor walls were a combination of lath and plaster with some remolded walls with nominal wood framing covered with drywall (See **Diagrams 1 and 2**).

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**Photo 1. Side Alpha of the fire building.
(NIOSH photo)**



**Photo 2. Side Bravo of the fire building.
(NIOSH photo)**

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**Photo 3. Side Charlie of the fire building
(NIOSH photo)**



**Photo 4. Side Delta, 2nd story of the fire building.
(NIOSH photo)**

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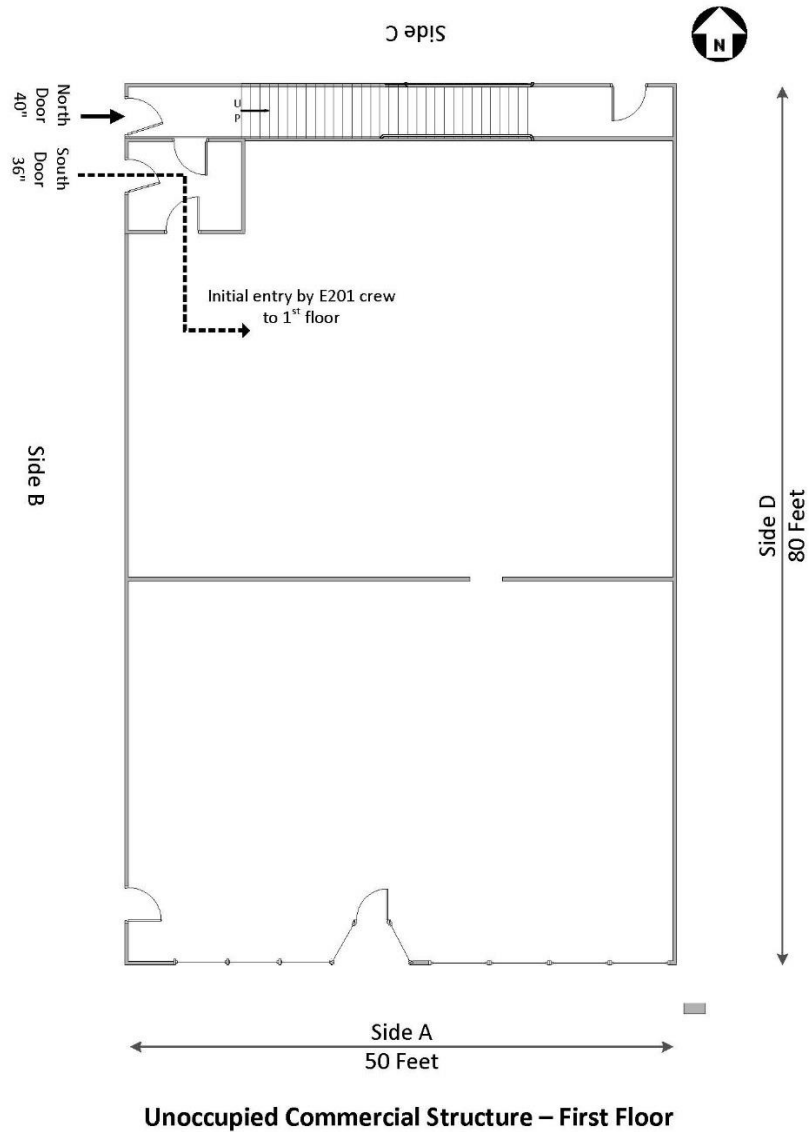


Diagram 1: Floor plan of the 1st floor of the fire building.

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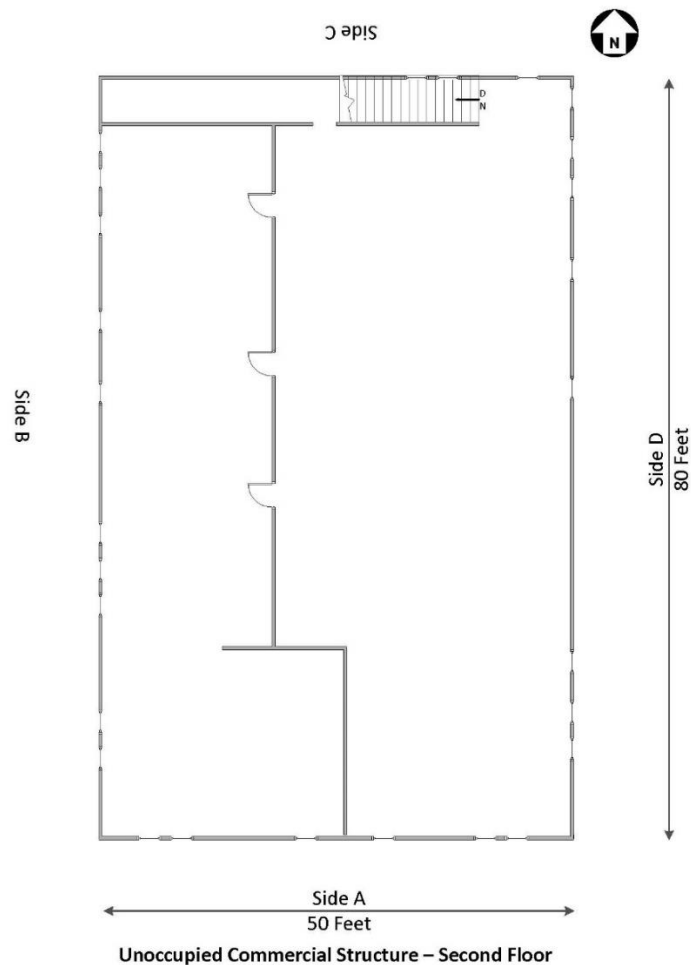


Diagram 2: Floor plan of the 2nd floor of the fire building.

Timeline

The following timeline is a summary of events that occurred as the incident evolved. Not all incident events are included in this timeline. The times are approximate and were obtained by studying the dispatch records, audio recordings, witness statements, and other available information. This timeline also lists the changing fire behavior indicators and conditions reported, as well as fire department response and fireground operations. The timeline is not intended, nor should it be used, as a formal record of events.

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Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
A passing delivery driver called 911 stating, “smoke coming from building.”	0334 Hours	Municipal fire department’s Engine 201 (Lieutenant and firefighter), Engine 204 (two firefighters), and Assistant Chief 2 were dispatched to a fully involved structure fire, smoke showing in the rear.
Local Assistant Police Chief a block away reported moderate smoke in windows on Side Alpha and heavy smoke on Side Charlie. Municipal Fire Department’s Fire Chief 2 enroute from out of town and radioed dispatch to tone out MABAS Boxes 1 and 2.	0340 Hours	Local assistant police chief blocked Main Street.
	0345 Hours	Engine 201 and Assistant Chief 2 enroute.
Dispatch toned out MABAS Box 2.	0350 Hours	Engine 101 (3 firefighters), Engine 503 (a firefighter), Engine 603 (a firefighter with 2 firefighters in privately owned vehicles (POVs)), Ladder 805 (4 firefighters), Fire Chief 1, Assistant Fire Chief 1, Fire Chief 3, Fire Chief 5, and Fire Chief 6 were dispatched.
	0351 Hours	Fire Chief 2 enroute from station.
	0352 Hours	Engine 302 (3 firefighters) enroute (MABAS Box 1).
Assistant Chief 2 reported heavy smoke Side Charlie and 2 nd floor windows on Side Bravo.	0353 Hours	Engine 201 and Assistant Chief 2 arrived on-scene. Engine 501 (3 firefighters) and 2 firefighters POV enroute (MABAS Box 1).

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Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0355 Hours	Engine 204 arrived on-scene.
Engine 201 firefighter stated “hot inside, don’t let anyone enter” on first floor after exiting primary search.	0356 Hours	Engine 603 arrived on-scene.
	0357 Hours	Fire Chief 2 and Engine 501 arrived on-scene.
	0358 Hours	Fire Chief 6 arrived on-scene.
	0359 Hours	Engine 101, Fire Chief 1, Assistant Fire Chief 1, and Fire Chief 5 arrived on-scene.
	0400 Hours	Fire Chief 3 from fire department 3, Ladder 805, and Engine 302 arrived on-scene. Engine 120 (MABAS Box 2) enroute.
Ladder 805 ordered to take out second floor windows on Side Alpha, reported lazy gray smoke on second floor.	0401 Hours	
Ladder 805 noticed smoke on second floor becoming denser. Took reading with thermal imager. Noticed getting hotter but no visible flames. Crew moved Ladder 805 about 50 feet east.	0417 Hours	Engine 503 enroute.
	0420 Hours	Engine 503 on-scene.

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Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
Assistant Chief 2 and the Engine 201 crew were on second floor near stairwell. Assistant chief's ears were starting to burn. The Engine 201 lieutenant noticed conditions worsening and advised evacuating. An Engine 603 firefighter at bottom of stairs was getting extremely hot and yelling up Engine 201 to evacuate.	0423 Hours	
The Engine 201 Lieutenant was on the stairs when it collapsed sending him to the first floor and calling a Mayday.	0424 Hours	
<i>Command advising Mayday Alarm.</i>	0425 Hours	The incident commander called a 3 rd alarm, assigned a rapid intervention team (RIT) chief, and activated RIT.
	0431 Hours	<i>One firefighter rescued and one firefighter still missing.</i>
	0443 Hours	<i>Firefighter still missing.</i>
	0459 Hours	Engine 903 and Engine 2 enroute.
Command advised dispatch to contact MABAS 45 for 3 engines and RIT team.	0501 Hours	
Command repeated request for 3 engines and RIT Team.	0511 Hours	
	0512 Hours	MABAS Air 45 on-scene.

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Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	0513 Hours	Engine 2 on-scene.
	0519 Hours	Engine 903 on-scene.
Specialized RIT team responding.	0537 Hours	
Collapse zones established.	0541 Hours	RIT on-scene.
2nd floor conditions were deteriorating.	0544 Hours	Ceased RIT operations and defensive operations.
Railway operations halted through town.	0558 Hours	
	0618 Hours	Two aerials and four monitors operated on the exterior.
	0657 Hours	<i>Downed firefighter located by RIT crew following the sound of the PASS.</i>
Chiefs met to discuss a recovery plan for the downed firefighter.	0700 Hours	
	0721 Hours	<i>All fire suppression stopped for firefighter removal.</i>

Personal Protective Equipment

At the time of the incident, the deceased firefighter was wearing his station uniform, turnout coat and pants, gloves, hood, helmet, boots, SCBA with an integrated PASS device, and portable radio.

NOTE: The SCBA was evaluated by the NIOSH National Personal Protective Technology Laboratory (NPPTL) and passed all tests (See Appendix Two).

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Weather and Road Conditions

The weather was mostly cloudy with an approximate temperature of 54°F. The wind was northwest at 3 miles per hour and no recorded gusts. The humidity was 97 percent with a barometric pressure of 29.38 [Weather Underground, 2019]. Weather was not a factor in this incident.

Investigation

At 0334, Engine 201 and Brush Truck 205 responded to a structure fire with heavy smoke that was called in by a passing delivery driver. The assistant police chief was only a block away and blocked the main road when he heard the call. The assistant police chief noticed heavy smoke in the rear and moderate smoke on the 1st floor through the front windows. At approximately 0353 hours, the municipal fire department's Engine 201, and the Assistant Chief 2 (Brush Truck 205) arrived on-scene and noticed heavy smoke on Side Charlie and from the 2nd story windows on Side Bravo.

Engine 204 arrived and connected to a hydrant on Side Bravo as the Engine 201 lieutenant and a firefighter made entry after forcing the south door on Side Bravo. They went right through an interior door to search the 1st floor. The Engine 201 crew took hand tools and a charged 1¾ hoseline off Engine 204 and entered the building to search the 1st floor. They encountered a mattress and debris on fire near the middle of the structure and some fire along an east wall. After extinguishing the fire and completing their search of the 1st floor, they exited the structure. The Engine 201 lieutenant and firefighter went to change their SCBA cylinders. Two firefighters from Engine Company 603 had arrived in a privately-owned vehicle (POV) while another drove Engine 603 and parked on Side Alpha. The Engine 201 firefighter came out and stated to one of the Engine 603 firefighters, "It's hot. Don't let anyone go inside."

At approximately 0357 hours, the Fire Chief 2 (municipal FD fire chief) and additional engines had arrived. Engine 501 parked on Side Charlie of the structure. Assistant Chief 2 had two firefighters from Engine 201 place a ground ladder to the 4th window going south on Side Bravo. Two firefighters from Engine 204 placed a 2nd ground ladder to another Side Bravo window while Fire Chief 5 and Assistant Chief 2 unsuccessfully tried to force the interior door to the left just inside the south Side Bravo door. They moved to the north Side Bravo door where trash and debris were obstructing the entrance. They went back to the south door and Fire Chief 5 removed trash and a 2-inch x 4-inch wood brace which revealed access to a stairwell (**See Photo 5**). *Note: The building had a far southside door on Side Bravo that was not utilized by the initial crews.* Fire Chief 5 then went to help establish the rapid intervention team.

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Photo 5. Side Bravo north and south doors, shown left to right. Engine 201 firefighters placed a ground ladder to the completely cleared window on the 2nd floor.

NIOSH Photo

At approximately 0400 hours, Fire Chief 3 and Engine 302 arrived on-scene. Fire Chief 2 asked Fire Chief 3 to take Command. Fire Chief 3 established Command at his vehicle at the Side Alpha/Side Bravo corner of the street. Ladder 805 arrived on-scene and parked on Side Alpha (See

Diagram 3). Ladder 805 was supplied with water from a 5-inch supply line from a hydrant on the Side Alpha/Side Bravo corner and was instructed by Fire Chief 2 to take out the 2nd floor windows on Side Alpha using the aerial apparatus. This task involved removing plywood from the windows. At this time, lazy gray smoke was observed on the 2nd floor by the Ladder 805 firefighters. The Engine 201 lieutenant and firefighter came to the doorway and noticed the stairs to the 2nd floor. As they started to ascend, they noted the first several stairs were structurally unsound, so a 16-foot roof ladder was placed to bridge the initial stairs. They ascended the straight stairway to a top landing and turned to the right to the 2nd floor with a hoseline off Engine 204, hand tools, and a thermal imager. The three Engine 603 firefighters entered the stairwell, and one manned the roof ladder while they fed hose through the door and up the stairs.

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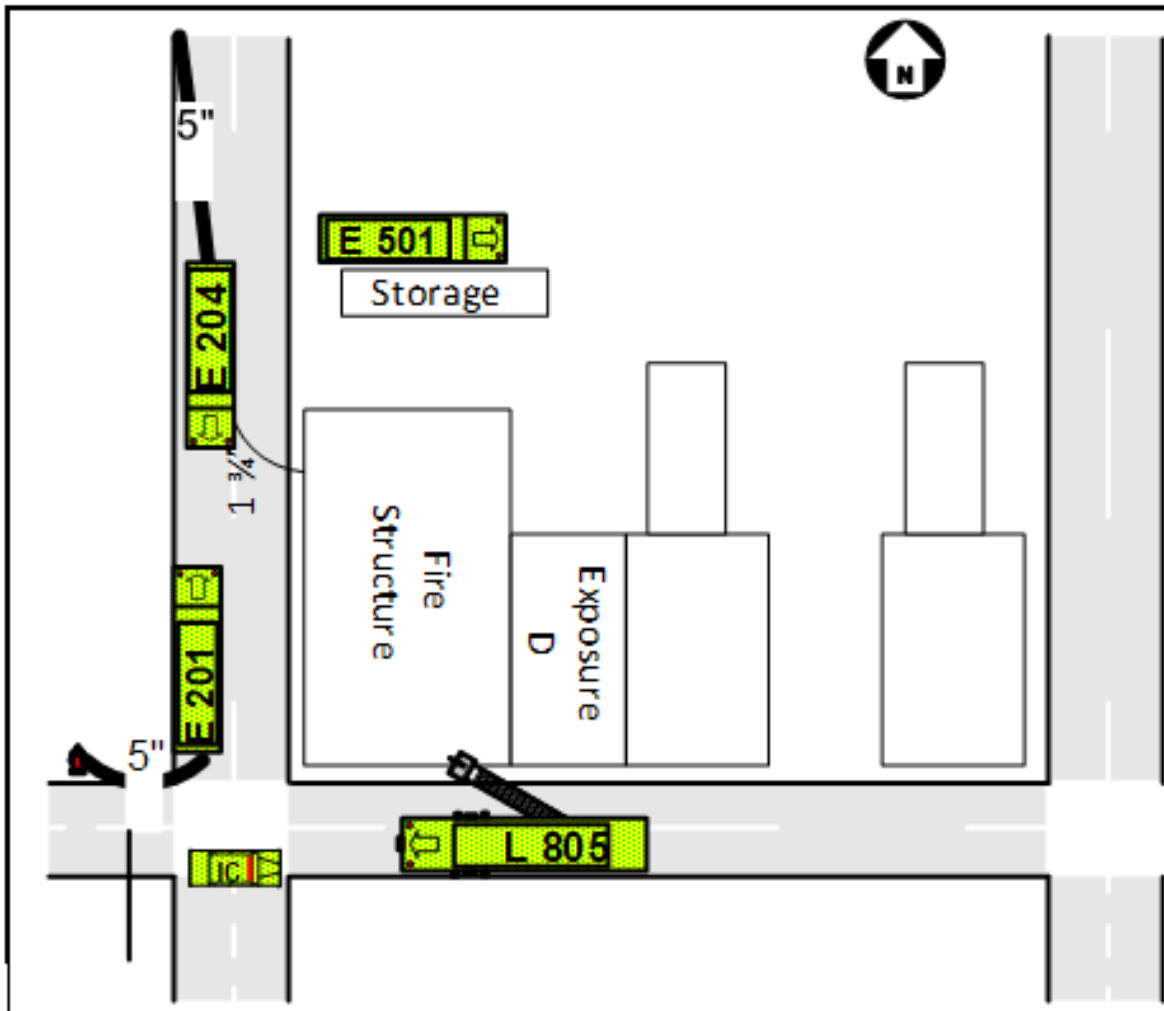


Diagram 3. Initial apparatus and hoseline placement.

On Side Alpha, the Ladder 603 crew had set-up near the Side Alpha/Side Delta corner and noticed smoke becoming heavier on the 2nd floor. The crew moved the ladder further west. About this time, the Engine 201 lieutenant noticed heat on the Side Delta wall on the 2nd floor with the thermal imager but no fire. They met Assistant Chief 2 who had ascended the ground ladder on the west wall to the 2nd floor window with the Engine 204 lieutenant who stayed at the window with a hoseline. Assistant Chief 2 said his ears were starting to burn and told the firefighter that they needed to back out.

The lieutenant misunderstood and thought the Assistant Chief 2 was getting low on air. Assistant Chief 2 indicated he was going to exit the ladder he had come up. Prior to exiting, Assistant Chief 2 scanned the 2nd floor with a thermal imager but saw no fire. Seconds later, the Engine 201 lieutenant noticed conditions were worsening and told his firefighter they needed to exit the structure. The Engine 603 firefighter, on the 1st floor, that manned the attic ladder was yelling up the stairwell that it was getting hot. He said he could hear the lieutenant and firefighter talking. The Engine 603 firefighter's foot then

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broke through the stair tread that was one step up from the stair the attic ladder was anchored to. He yelled even louder to get out. He was told to exit by Assistant Fire Chief 1 (Operations Chief) and Fire Chief 1 (Safety Chief), who were at the south door on Side Bravo. The lieutenant believed the Engine 201 firefighter was right behind him as he started down the stairs. He had made it to the landing between the floors and was approaching the attic ladder when the stairs collapsed sending him under the stairwell and covering him with debris.

Assistant Chief 2 went to Fire Chief 6 on Side Bravo and asked if the Engine 201 lieutenant and firefighter had come out. At approximately 0425 hours, the Fire Chief 6 was about to radio the lieutenant when the lieutenant called a Mayday. This Mayday was followed up with a Mayday by one of the Engine 603 firefighters. Two Ladder 805 firefighters went to the south door on Side Bravo to assist. Three Engine 603 firefighters in the stairwell heard the crash followed by screams. They turned to see the stairs were gone but noticed a flashlight moving in the debris. They moved the roof ladder out of the debris pile to the side as their low air alarms started going off.

The lieutenant called out and searched under the stairwell for the firefighter. The lieutenant tried to self-rescue going towards the east wall but was driven back by the heat. The incident commander asked Fire Chief 2 and the Operations Chief if they heard the Mayday. The incident commander called for a 3rd alarm and assigned Fire Chief R as the RIT Chief. *Note: Fire Chief R was from a neighboring county to the west and one of their ladder companies arrived just prior to the Mayday.* Fire Chief R headed to the Side Bravo/Side Charlie corner with his ladder crew. The incident commander moved everyone not involved in the RIT operations off the red communications channel.

The RIT crew, comprised of the Engine 302 crew and a firefighter from the Ladder 805, made entry as the Engine 603 crew exited. Assistant Chief 2 took an axe to the door to split it off the hinges, and the RIT crew cleared debris in the stairwell to get to the lieutenant. Looking through a hole in the bottom riser of the stairs, the Ladder 805 RIT member could see the lieutenant who had taken off his SCBA to try and self-rescue. The RIT member grabbed the lieutenant by the boot but pulled his boot off. The

North side door to the stairwell had been removed and they were able to get the lieutenant out (**See Photo 6 and Diagram 4**).

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Photo 6. The stairwell against Side Charlie where the lieutenant and firefighter made entry to 2nd floor. The lieutenant was rescued by RIT underneath of the stairwell.

Photo by NIOSH

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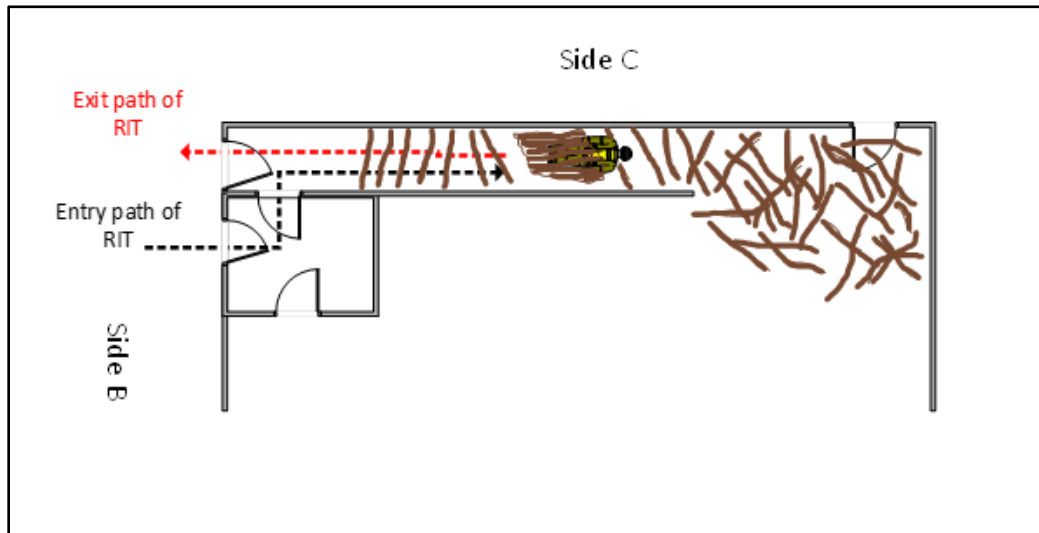


Diagram 4: The rapid intervention team’s path to removing the lieutenant.

A second crew was looking under the stairs for the firefighter and the RIT Chief sent his ladder crew to a door on Side Charlie near the Side Charlie/Side Delta corner (See **Photo 7**). They met up a crew on a hoseline to search the east wall but found no signs of the firefighter. The lieutenant mentioned to the Ladder 805 RIT member that he must still be on the 2nd floor. A RIT member asked for a 24-foot ladder to bridge the collapsed stairs, but it was a too short. The RIT member made it halfway up and could hear a PASS device sounding but had to descend. He wanted to try a 35-foot ladder, but it was too large to get into place. The RIT member then went back to the south door and noticed an opening above the door into a small room. He used a hoseline to cool it down and managed to do a right-hand search with a thermal imager but couldn’t see the missing firefighter.

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Photo 7. Side Charlie door with A/C unit over top of it. The stairwell landing to 2nd floor that collapsed is just above door and A/C unit inside the wall.

Photo by NIOSH

The lieutenant went to Command and stated the firefighter must be on the 2nd floor. The incident commander sent a firefighter to inform the RIT Chief. The RIT Chief had been meeting with the Operations Chief and Safety Chief about maintaining fire attack. They decided the firefighter may be on the 2nd floor. Multiple four-man RIT teams were assembled and made several attempts to access the 2nd floor via the ground ladders on Side Bravo. They could not advance towards the middle of the building due to heavy smoke and fire. RIT operations were stopped. The strategy was changed to defensive operations. Two master streams were operated through the Side Bravo windows from Engines 201 and 204. Engine 501 operated a master stream on Side Charlie and a ladder pipe from Ladder 1 on Side Alpha.

The incident commander called for more resources as conditions on the 2nd floor deteriorated. The department's air truck arrived at about 0512 hours. At approximately 0519 hours, Fire Chief 9 and Engine 903 arrived on-scene. Fire Chief 9 went to Command, was assigned as an assistant safety officer, and started his 360-degree size-up. At approximately 0541 hours, Engine 3 from an adjoining county fire department arrived with a specialized RIT crew consisting of a lieutenant and three firefighters. Collapse zones had been established. A ground ladder had been placed on Side Alpha of

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Delta 1 Exposure. Fire Chief 9 noticed two firefighters on the roof, so he ascended the ladder. Once he stepped off the ladder a PASS alarm could be heard. When he and the firefighters removed the plywood sheeting from a window near the center of Side Delta, the PASS was clearly louder. Fire Chief 9 descended the ladder to inform Command. A chiefs' meeting was held, and it was decided to send a firefighter from Ladder 805 and the specialized RIT crew of four from Engine 3 into the structure. They would only go in about 10 feet while being tied off to a tagline with Fire Chief 9 at the window.

The RIT team utilized Ladder 805's aerial to get on the Delta 1 Exposure 1st floor roof. They entered the fire structure through the 2nd floor window, near the Side Alpha/Side Delta corner (**See Photo 8**). A Ladder 805 firefighter brought full SCBA cylinders to the roof. The RIT crew crawled through about 30 feet of debris without a tagline and located the firefighter with his PASS sounding (**See Photos 9 and 10, Diagram 5**). The firefighter was found face down with all his personal protective equipment (PPE) and a short multi-tool axe on his belt. A thermal imager was found near his hand but no hoseline. The RIT crew had to crawl over much debris while bringing the firefighter out. The firefighter's axe kept getting caught, and they needed to untangle it. They got to the window where they had made entry and Fire Chief 9 was able to assist with moving the firefighter through the window. Approximately 2 hours and 27 minutes after the Mayday, the RIT crew brought the firefighter out. He was removed from a 2nd floor window of the fire structure on the Delta 1 Exposure 1st floor roof. Fire Chief 9 took off the firefighter's SCBA cylinder and disconnected his regulator. The firefighter's chinstrap was on, and his hood and mask were in place. The firefighter was placed in a stokes basket and lowered down with the ground ladders. He was then loaded into the ambulance.



Photo 8. The Delta Exposure 1 first floor roof. The third window from left was used by RIT to recover firefighter.

Photo by NIOSH

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Photo 9. A view of the 2nd floor from Delta 1 Exposure roof. Note the hole in the Side Charlie/Side Delta corner. The red star indicates the approximate location of downed firefighter.

Photo by NIOSH

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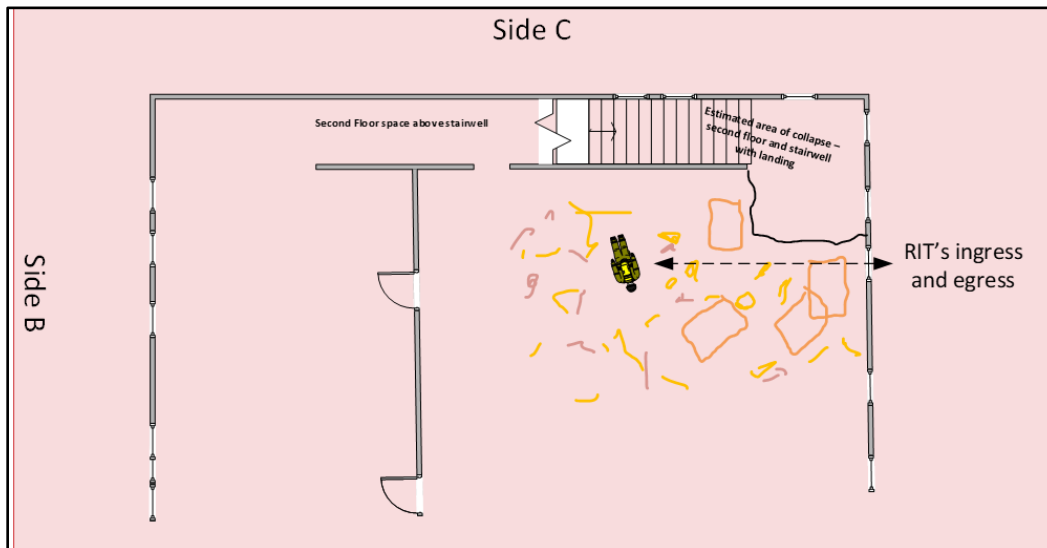


Diagram 5: Approximate location of the downed firefighter and the collapse on the 2nd floor.



Photo 10. A view of the 2nd floor looking from Side Charlie/Delta corner to the Side Alpha/Side Bravo corner. The hole in the floor is approximately 10 feet x 25 feet on Side Charlie/Side Delta corner where the stairwell was located. The downed firefighter (indicated by red star) was located approximately 10 feet to the right of the mattress near the right corner of the hole.

Photo by NIOSH

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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:

- High risk/low frequency event – abandoned commercial structure
- Lack of firefighter survival skills
- Insufficient incident management
- Lack of crew integrity
- Lack of MABAS training.

Cause of Death

According to the death certificate, the county coroner determined the cause of death was asphyxiation due to smoke inhalation. No signs of physical trauma or significant burns.

Recommendations

Recommendation #1: Fire departments should ensure a standard operating procedure/standard operating guideline for high risk/low frequency events is developed, implemented, and firefighters are trained for fires in commercial structures.

Discussion: Demands on the fireground require incident commanders and commanding officers to have increased technical knowledge of building construction and structural stability with a heightened sensitivity to fire behavior and the potential for catastrophic fire events. Strategies and tactics must be based on occupancy risk, which varies with occupancy type. Thus, sufficient staffing, fire flow, and tactical patience that align with the fire profiling and the predictability of the occupancy profile and accounts for presumptive fire behavior are also critical [Command Safety 2010]. The occupancy hazards (hazards create risks) should impact the risks vs benefit analysis. The occupancy type can drive strategies and tactics. An occupancy type that indicates potential for a high/heavy fuel loads would indicate the need to have a higher gallon per minute flow for the fire attack. The first arriving officer, as well as the incident commander, should make a judgment as to what is at risk – people or property. This judgment will determine the risk profile for the incident. Many firefighters stand by the notion that all incidents are “people” events until proven otherwise. Historically, the fire service has a poor history of changing risk-taking strategies based upon the people/property issue [Dodson 2005].

The challenges of conducting operations at commercial structures, that may range in size and age, requires the advanced understanding of building construction, structural design, fire dynamics, and an integration of adaptive fire management principles that require distinctively unique firefighting methodologies, practices, and tactical deployment. Commercial structures are not residential structures and cannot be managed with conventional strategies, tactics, and deployment approaches. From an incident management standpoint, a more rigorous level of command resiliency, tactical patience, and discipline is required.

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Since no two fire departments are alike, there is no standard scale to measure and evaluate frequency and severity of risk. Some fire departments will have a greater or lesser degree of tolerance for risk than others. The intent of the risk management process is for a fire department to develop a standard level of safety. This standard level of safety defines the parameters of the acceptable degree of risk for which members perform their job functions.

When assuming command of a commercial structure fire, fire officers who do not have a deployment strategy for low frequency/high risk incidents may resort to what they did at a similar incident or what they've seen and heard most frequently. These individuals use memory recall or recognition primed decision making to try and find a match in terms of training, experience, and competencies for developing an effective strategy and tactics. If there is nothing to draw from, the individuals will resort to actions that they are familiar or comfortable with. The process for developing a strategy and tactics is methodical and must start from the beginning of the incident with the arrival of the 1st alarm companies. If steps are skipped or missed, it becomes very difficult to change the outcome as the incident progresses.

There is very little room for deviation at a commercial structure on the tactical level and task level. The tactics for firefighting operations at a commercial structure fire should be based upon standard departmental procedures or guidelines.

Frequency is how often something does, or might, happen. Severity (risk) is a measure of the consequences if an undesirable event occurs (**See Diagram 6**). Each risk will have its own set of factors that will dictate how the fire department determines the severity of the consequences. Priority of the risk is in direct relation to inherent risks that have had a harmful effect on the fire department and its members [NFA 2009].

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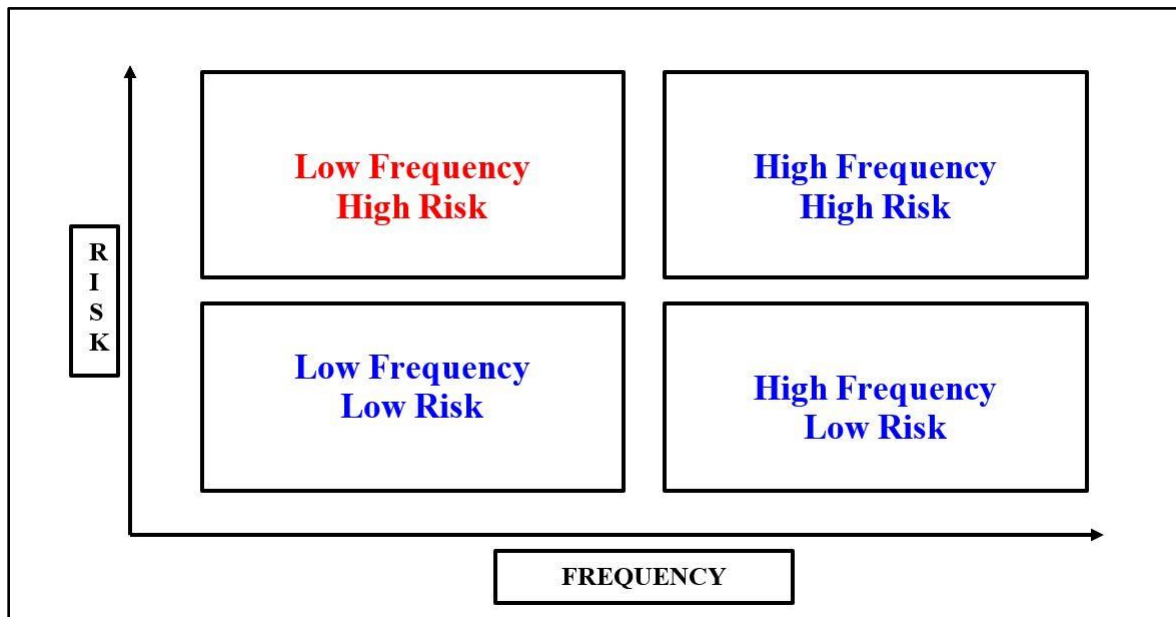


Diagram 6. Risk versus Frequency.

The frequency is in direct proportion to inherent risks that could have a harmful effect on firefighters.

Courtesy of Graham Research Consultants

Commercial structure fires are low frequency/high risk events from the standpoint that they do not occur on a regular basis, but when they do occur the risks are significant. A fire department should have a standard operating procedure in place to effectively manage these incidents. This deployment strategy should address staffing, incident management, appropriate strategy and tactics, adequate water supply, and other resource and logistical management issues.

At this incident, the over 100-year-old two-story vacant commercial structure needed repair. After assessing the condition of the stairs, it was unlikely a civilian was on the second floor. Ground ladders to the second floor were in place and could have been utilized to avoid the inherent risk of the unsound stairs.

Recommendation #2: *Fire departments should ensure firefighters are properly and repetitively trained in “out of air” and “low air” SCBA emergencies.*

Discussion: Repetitive skills training using a self-contained breathing apparatus (SCBA) is a vital necessity for firefighters working in an IDLH atmosphere. Repetitive skills training can increase the ability to operate SCBA functions and controls in a high-anxiety moment or an emergency. Many times, these skills must be performed with gloved hands, limited vision, and reduced ability to hear commands or information from other firefighters or fire officers. Repetitive skills training allows

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firefighters to engage buttons such as the bypass valve, cylinder wheel or main line valve, and buddy breathing connection in training conditions that are in a non-IDLH atmosphere. This helps build the firefighters' muscle memory skills so their hands will be able to activate the controls with gloves on and the operation will be a second-nature response.

Firefighters need to be trained to use their equipment and repetitive-skills training reinforces the muscle memory to properly activate the correct controls. Overcoming out-of-air emergencies is an important goal of repetitive-skills training. Firefighters also need to understand the psychological and physiological effects of the extreme level of stress encountered when they run low on air, become lost, disoriented, injured, or become trapped during rapid fire progression. Most fire training curricula does not include discussion of the psychological and physiological effects of extreme stress, such as that 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/disorientated, can result in sensory distortions and decreased cognitive processing capability [Grossman 2008]. In the book *Stress and Performance in Diving* [Bachrach 1987] 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.”

Air management is a shared responsibility for the firefighters using the SCBA as well as those commanding the incident. Fire departments and firefighters need to understand what it means to manage their SCBA air (especially with a 1,200 liter/42 cubic-foot/30-minute cylinder), the importance of leaving an IDLH atmosphere prior to a low air alarm sounding, and the need to treat low-air alarms as an emergency or Mayday situation to prompt immediate planned actions.

The International Association of Fire Chiefs, Safety, Health, and Survival Section *Rules of Engagement for Structural Firefighting* states that all firefighters should maintain continuous awareness of their air supply, situation, location, and fire conditions [IAFC 2012]. Fire departments should also consider retiring 1,200 liter/42 cubic-foot volume SCBA cylinders and replace with 1,800-liter/64 cubic-foot volume cylinders or higher. Additional information on what should be evaluated when looking at one's ability to use an SCBA and air management can be found in NFPA 1404 *Standard for Fire Service Respiratory Protection Training* [NFPA 2018a].

Firefighters should frequently check their air supply while in a structure, which should include prior to entering the structure, labor demanding tasks (e.g., pulling ceiling/charged hoselines, ascending stairs), before/after entering an interior room to search, and before entering large open spaces or long corridors.

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Recommendation #3: Fire departments should ensure Mayday training programs are developed and implemented so firefighters are prepared to call a Mayday.

Discussion: Fire departments should ensure that all firefighters and officers receive Mayday training on a regular basis. It is essential to train firefighters to recognize when they are in trouble, know how to call for help, and understand how the incident commander and others must react to a responder in trouble [Jakubowski and Morton 2001].

The most important element that firefighters need to know is when to declare a Mayday. Recognizing that they are in, or about to be in, a life-threatening situation is the first step in improving the firefighter's chances of survival. Many fire departments don't have a simple procedure for how a firefighter communicates when in trouble, a critical situation where communications must be clear and concise. [Jakubowski and Morton 2001]. A Mayday declaration is such an infrequent event in any firefighter's career. The need to frequently train on recognizing when to declare a Mayday, how to declare a Mayday, and what steps to take to improve the chances for survival (self-rescue).

Firefighters should understand that when they are faced with a life-threatening emergency, there is a very narrow window of survivability. The lack of a transmission of a Mayday message reduces the chance for a successful rescue. Knowledge and skills training on preventing a Mayday situation or how to call a Mayday should be mastered before a firefighter engages in fireground activities in an IDLH atmosphere. This mastery should be maintained throughout their career through training offered more frequently than once per year. [IAFF 2010; Sendelbach 2004]. Any delay in calling the Mayday reduces the window of survivability and also increases the risk to the RIT [Clark 2005, 2008; IAFF 2010; USFA 2006].

Firefighter training programs should include such topics as air management; familiarity with a SCBA, a radio, and PPE; crew integrity; reading smoke, fire dynamics, and fire behavior; entanglement hazards; and building construction and signs of pending structural collapse. Firefighters need to understand that their PPE and SCBA do not provide unlimited protection. Firefighters should be trained to stay low when advancing into a fire as extreme temperature differences may occur between the ceiling and floor. When confronted with an emergency situation, the best action to take may be immediate egress from the building or to a place of safe refuge (e.g., behind a closed door in an uninvolved compartment, in a staging area on a lower floor) and manual activation of the PASS device. A charged hoseline should always be available for a tactical withdrawal while continuing water application or as a lifeline to be followed to egress the building. Conditions can become untenable in a matter of seconds.

Firefighters should be 100% confident in their competency to declare a Mayday for themselves. Fire departments should ensure that any personnel who may enter an IDLH atmosphere meet the standards for Mayday competency set by the authority having jurisdiction throughout their active-duty service. Presently, there are no national Mayday standards for firefighters to be trained to and most states do not have Mayday standards.

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Mayday Information

Mayday training is not included in the job performance requirements in NFPA 1001, Firefighter 1 or 2, standards [NFPA 2019]. It is up to each authority having jurisdiction to develop rules and performance standards for a firefighter to call a Mayday. There are many resources available to the fire service on Mayday information, education, and training.

Project Mayday

Project Mayday is a website that collects and examines information about firefighter Maydays. Since 2015, Don Abbott has been reviewing the submissions and developing data that reveals the demographics of firefighter close calls and line-of-duty deaths. Information submitted to the project shows the importance of self-survival skills. The bulk of the firefighters who find themselves in a Mayday situation are able to affect a self-rescue. The data supports the need for rapid intervention crews (RIC) as 349 firefighters were rescued by the rapid intervention crew or rapid intervention group.

The information provided helps firefighters focus on training and develop procedures to survive the fireground. Don Abbott continues his contribution to the fire service with this valuable resource. The data collected provides insight on actual Maydays by both career and volunteer firefighters. In addition, if a firefighter were involved in a Mayday situation, please submit the information to the website. The information can help other firefighters [Project Mayday 2022].

International Association of Fire Fighters

The International Association of Fire Fighters (IAFF) Fireground Survival program is another resource for fire departments. It was developed to ensure that training for Mayday prevention and Mayday operations is consistent among all firefighters, company officers, and chief officers [IAFF 2010].

Firefighters 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 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/disorientated, can result in sensory distortions and decreased cognitive processing capability [Grossman and Christensen 2008].

Mayday Basics

Any Mayday communication must contain the location of the firefighter in as much detail as possible and, at a minimum, should include the division (floor) and quadrant. It is imperative that firefighters know their location at all times when in an IDLH atmosphere to effectively be able to give their location in the event of a Mayday. Once in distress, firefighters must immediately declare a Mayday.

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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 firefighter's first action must be to declare the Mayday as accurately as possible [USFA 2006]. Once the incident commander and RIT know the firefighter's location, the firefighter can then try to follow a hoseline or manually activate their PASS device while the RIT is enroute for rescue. Command should communicate to the firefighter that help is coming and remind them to activate their PASS device and/or get on the hoseline.

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

Firefighters should never hesitate to declare a Mayday. The word Mayday is easily recognizable and is an action word that can start the process of a rescue. The use of other words to declare an emergency situation should be discouraged because these are not as recognizable as an immediate action word that will start a rescue process.

When a Mayday is transmitted, incident commanders have a very narrow window of opportunity to locate the lost, trapped/disorientated, or injured member(s). The incident commander should restructure the strategy and incident action plan (tactics) to include a priority rescue [NFPA 2020].

Recommendation #4: Fire departments should ensure crews are properly assigned when operating in an IDLH atmosphere.

Discussion: Upon arrival at an incident, a company is given a task to perform by Command. The company officer communicates to the crew their assignment and how they will accomplish their assignment. In the absence of Command's arrival, crews of first arriving apparatus should have predetermined assignments. The intent of assignments is to ensure crew integrity and the risk of firefighters becoming lost or missing is eliminated. Companies working at the task level have the greatest stake in the personnel accountability system because they operate inside an IDLH atmosphere or hazard zone. No hazard zone management system can outperform unsafe behaviors at the task level.

The strategic and tactical levels of an incident response and all activities outside of the hazard zone are in place to support the task level. The task level is the most important level on the incident site because it helps prevent problems in an IDLH atmosphere.

Task level responsibilities include:

- Following all staging procedures
- Being properly assigned into the hazard zone
- Using the personnel accountability system properly
- Staying together as a company

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- Attaching all members to a hoseline
- Maintaining an adequate air supply at all times to safely exit the hazard zone
- Understanding that the maximum depth into a structure is 175 feet and based on air supply
- Understanding that there is no freelancing [Blue Card 2018].

Company officers should be properly assigned and not initiate tasks without Command's knowledge. The company officer should announce their entry and provide an accountability report upon exiting the hazard zone to either Command or their assigned division or group supervisor. Once a company has completed its task assignment, the officer should report to Command and ask for further orders.

It is always the responsibility of every firefighter to remain with crew members. The ultimate responsibility for crew integrity and ensuring no members get separated, become missing, or lost rests with the company officer. The officer should maintain constant contact with their assigned members by visual observation, voice, or touch while operating in the hazard zone. Officers should ensure firefighters stay together as a company or crew. If any of these elements are not adhered to, crew integrity is lost, and firefighters are placed at an increased risk.

Crew communications when members are operating on an incident can be difficult at best. Background noise from other crews moving throughout the structure, saws operating on the roof, water flowing from hoselines, and apparatus noise from outside the structure can make it extremely difficult for crews to effectively communicate. When company officers call out to crew members for their locations and receive a response of "over here" in return, it makes it extremely difficult to maintain crew integrity; generalities in zero-visibility conditions are ineffective. A firefighter stating, they are "near a door or window" can be more effective if the officer and crew took mental pictures while entering the structure and developed a virtual map in their own mind.

If a member becomes disoriented, the member should move toward the officer's voice or toward the officer banging a tool on the floor to assist with their reorientation. Company communication methods should be determined by the company officer while establishing company operating procedures. Members should have the discipline to report to their officer, which ensures personnel accountability and firefighter safety [Fire and Rescue Departments of Northern Virginia 2013].

A company officer can keep track of their personnel in smoky conditions by calling out to their crew members. This will also be necessary when conducting a personnel accountability report (PAR). It should be noted that when calling out members by name, it is best to use the member's last name. It is possible to have crew members with the same first name which would cause confusion. Another means of silent communication is when the officer touches or taps the member to point them in the required direction. An example may be tapping a member on the right shoulder which would mean conduct a right-hand search, a tap on the left shoulder, a left-hand search, or tap directly on top of the head could mean to move straight ahead. Again, a method should be developed and practiced by crews prior to entering in an IDLH atmosphere.

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If a firefighter becomes separated and cannot re-connect with their crew immediately, the firefighter 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 one minute, a Mayday should be declared. If conditions are rapidly deteriorating, the Mayday should be declared immediately. In addition to declaring a Mayday, the firefighter should activate the radio's emergency alert button (where provided), followed by manually turning on the PASS device. Similarly, if the company officer or the firefighter'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 one minute, a Mayday should be declared immediately [IAFC 2012].

Crew integrity is also essential to fireground accountability. All firefighting operations should be conducted under the department's accountability system. A key component of a recognized personnel accountability system includes tags or passports with crew names that are given to an accountability officer or resource status officer at the point of entry. The system should be able to identify the location of assigned crews within a small geographic area of an incident scene. A personnel accountability system should have the capability of always identifying who is operating on the fireground, their assignment, and their location. When a firefighter becomes lost or missing, the personnel accountability system should be able to identify that firefighter. All personnel accountability should be managed at the point of entry to maintain continual awareness of which firefighters are in the hazard zone. Tags or passports collected only at the command post do not maintain awareness of firefighters in or out of a building [IAFC 2012].

At this incident, it is unclear if the Engine 201 crew was given orders to go to the 2nd floor. The company officer did maintain communications with his firefighter right up until the lieutenant headed toward the stairs. It is unclear why the firefighter did not follow his lieutenant.

Recommendation #5: Fire departments should ensure firefighters communicate critical incident benchmarks to the incident commander throughout the incident.

Discussion: The size-up of interior conditions are just as important as exterior size-up. Incident commanders monitor exterior conditions while the company officers monitor interior conditions and communicate these conditions to the incident commander as soon as possible. Knowing the location and the size of the fire inside the building lays the foundation for all subsequent operations including the incident commander's initial strategy [Klaene and Sanders 2007].

When operating inside a structure, company officers should communicate to the incident commander when making initial entry, while searching and clearing areas, during fire attack, while progressing between floors, and when exiting the structure. These are all critical incident benchmarks that impact the incident action plan.

Proper size-up and risk-versus-benefit analysis require that incident commanders gather several key pieces of information and be kept informed of the constantly changing conditions on the fireground. Incident commanders should develop and utilize a system that captures pertinent incident information

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to allow continuous situational evaluation, effective decision-making, and development of an incident management structure. Decisions can be no better than the information on which they are based. Incident Commanders should use an evaluation system that considers and accounts for changing fireground conditions to stay ahead of the fire. If this is not done, the incident action plan will be out of sequence with the phase of the fire and the incident commander will be constantly surprised by changing conditions [Brunacini 2002; NIOSH 2010; Smith 2002; TSFRS 2013].

The incident commander uses critical fireground factors as a checklist of the major issues involved in size-up, decision-making, initiating operations, and review and revision. The incident commander deals with these critical factors through a systematic management process that creates a rapid, overall evaluation; sorts out the critical factors in priority order; and then seeks out more information about each factor [Brunacini 2002].

Incident commanders should train and prepare through practice to engage in conscious information management. Critical incident factors and their possible consequences offer the basis for a standard incident management approach. A standard information approach is the launching pad for effective incident decision making and successful operational performance. The incident commander should develop the habit of using the critical factors in their order of importance to make the specific assignments within the overall incident action plan.

Incident commanders should develop a standard information system and use effective techniques to keep informed at the incident. The incident commander can never assume the action-oriented responder engaged in operational activities will stop what they are doing so they can feed the incident commander with a continuous supply of top-grade, objective information. It is the incident commander's responsibility to do whatever is required to stay effectively informed [NIOSH 2010].

For all members operating at an incident scene radio discipline is essential. All radio transmissions should be reserved for relevant messages such as benchmarks, PARs, safety issues or concerns, needed resources, changing conditions, emergency traffic and a Mayday, as opposed to transmissions that add little to the IAP. All members on the fireground should be trained to always consider "Is my transmission necessary?".

Recommendation #6: Fire departments should ensure all fireground ventilation is coordinated with firefighting operations.

Discussion: Fire departments should manage and control the openings to the structure to limit fire growth and spread and to control the flow path of inlet air and fire gases during tactical operations. All ventilation must be coordinated with suppression activities. Uncontrolled ventilation allows additional oxygen into the structure, which may result in a rapid increase in the fire development and increased risk to firefighters due to increased heat release rates within the flow path. Underwriters Laboratories (UL) released a report on the *Impact of Ventilation on Fire Behavior in Legacy and Residential Construction*. This report addressed multiple ventilation locations and the possibility of creating fuel-

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limited fires. The research indicated it was not possible to create fuel-limited fires with multiple ventilation openings. The report stated, “It is more likely that the fire will respond faster because the already open ventilation location is allowing the fire to maintain a higher temperature than if everything was closed” [Underwriters Laboratories 2010].

The flow path of a fire is how a fire moves through the structure as determined by incoming and outgoing vents for air, since air allows fire to sustain or grow [Underwriters Laboratories 2010]. Identifying and controlling the flow path involves knowing where the air comes from and where it’s headed, and its importance cannot be underestimated. The identification of the flow path should find its way into every after-action review. To ensure the safety of the firefighters, it is important that firefighters be in a safe location while trying to locate the fire that is heating the cooled space. Once the fire is under control, the fire can be completely extinguished.

The UL research was conducted on one-story and two-story houses. The data collected from this research project provides valuable insight into the impact of ventilation on fire behavior in both legacy and contemporary residential construction [Underwriters Laboratories 2010]. Based upon the UL research, the following tactical elements should be considered during fireground operations:

- **Stages of fire development:** The stages of fire development change when a fire becomes ventilation limited. It is common with today’s fire environment to have a decay period prior to flashover, which emphasizes the importance of an effective ventilation strategy.
- **Forcing the front door is ventilation:** Forcing entry must be thought of as ventilation as well. While forcing entry is necessary to fighting a fire, it also adds another vent that feeds air to the fire. When this happens, the clock is ticking before either the fire gets extinguished or it grows until an untenable condition exists, jeopardizing the safety of everyone in the structure.
- **Flow paths:** Every new ventilation opening provides a new flow path for the fire. This could create very dangerous conditions when there is a ventilation-limited fire.
- **No smoke showing:** During the UL experiments, a common event was that once the fire became ventilation-limited, the smoke being forced out of the gaps of the houses greatly diminished or stopped all together. No smoke showing during size-up should increase awareness of the potential conditions inside.
- **Coordination:** If you add air to the fire and don’t apply water in the appropriate time frame, the fire gets larger, the hazard to the firefighters and potential victims increases, and safety decreases. A clear and direct communication between companies or crews assigned to ventilation, fire attack, and other tactical functions that take place inside the structure are required.
- **Smoke tunneling and rapid air movement through the front door:** Once the front door is opened, attention should be given to the flow of air through the front door. A rapid inrush of air, or tunneling effect, could indicate a ventilation-limited fire.
- **Vent Enter Isolate and Search (VEIS):** During a VEIS operation, primary importance should be given to closing the door to the room to isolate the room from any flow paths to or from the room. This eliminates the impact of the open vent and increases tenability for potential occupants and firefighters while the smoke ventilates from the now isolated room [Underwriters Laboratories 2010].

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Command should conduct a complete and thorough size-up at all fires to ensure that the location of the fire has been identified and communicated to all fire fighters on the scene. Once the fire location has been determined, the strategy and tactics can be addressed and communicated in order to control the incident in a safe and effective manner.

Recommendation #7: Fire departments should ensure a single, effective incident management system is established with one designated incident commander, especially when multiple fire departments respond to automatic aid incidents.

Discussion: The primary objective is always to manage the incident. According to Fire Chief Billy Goldfeder, “before any incident occurs, fire department leadership within any area where multiple fire departments respond with one another, be it automatic aid or mutual aid, must ensure that there is a clear policy and procedure along with regular training to ensure interoperability” in incident management and radio operations on the scene [Goldfeder, 2019]. A single, effective incident management system is crucial to the management of all emergency incidents. This system is commonly known as the Incident Command System, or ICS.

A single incident commander should be able to apply ICS in a manner that supports effective and efficient management of the incident. The use of ICS should not create additional challenges for incident commanders, but rather provide a systematic approach to ensuring a successful outcome of the incident [NFPA 2020]. When different departments respond to the same incident, the incident management system or incident commander needs to blend these resources in the overall strategic plan and integrate them into the command structure (even if they have separate radio systems). This is accomplished through the use of divisions or groups at the incident scene and not having separate commanders on the same incident.

An incident management system (using a single incident commander) is intended to provide a standard approach to the effective management of emergency incidents. The National Fire Protection Association’s NFPA 1500 *Standard on Fire Department Occupational Safety, Health, and Wellness Program* [NFPA 2021] and NFPA 1561 *Standard on Emergency Services Incident Management System and Command Safety* [NFPA 2020] both state that an incident management system shall be used at all emergency incidents.

NFPA 1561, sub-section 3.3.29, defines an incident management system as “a system that defines the roles and responsibilities to be assumed by responders and the standard operating procedures to be used in the management and direction of emergency incidents and other functions” [NFPA 2020]. Section 4.1 states, “The incident management system shall provide structure and coordination to the management of emergency incident operations to provide for the safety and health of emergency services organization responders and other persons involved in those activities.” Section 4.2 states, “The incident management system shall integrate risk management into the regular functions of incident command” [NFPA 2020].

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The incident management system covers more than just fireground operations. The incident management system should ensure command, control, and firefighter safety. This includes scene size-up, continuous risk assessment, declaring a strategy, an incident action plan, personnel accountability, communications, rapid intervention crews, roles and responsibilities of the safety officer, and interoperability between multiple agencies (mutual aid departments, law enforcement, emergency medical services, state and federal government agencies, and officials, etc.) and surrounding jurisdictions (automatic aid or mutual aid responders).

One of the most critical components of the ICS is the development and implementation of an incident action plan (IAP) [NFPA 2020]. For the fire service, the IAP is often communicated verbally. The IAP is based on the resources immediately available and those responding. The goal of the ICS is determined in accordance with the incident priority from which a strategy must emerge. Tactical objectives, aimed at meeting the strategy, are determined and specific assignments made. Additionally, a personnel accountability system should be established as assignments are made.

Recommendation #8: Fire departments should ensure firefighters are trained in fireground survival procedures.

Discussion: As part of emergency procedures training, firefighters need to understand that their PPE and SCBA do not provide unlimited protection. PPE that is not properly donned or worn may provide reduced protection or no protection at all, if a firefighter becomes disorientated and is unable to escape. In such cases, delay in egress or transmitting a Mayday message may be fatal. However, the Mayday message should be transmitted as soon as the crew is in a defensible position. The International Association of Fire Fighters (IAFF) and the International Association of Fire Chiefs (IAFC) has developed the IAFF Fire Ground Survival program to ensure that training for Mayday prevention and Mayday operations are consistent between all firefighters, company officers, and chief officers [IAFF 2010]. Firefighters must act promptly when they become lost, disoriented, injured, low on air, or disorientated [Carter, Childress, and Coleman, et. al. 2000; Hoffman 2002; DiBernardo 2003; Angulo, Clark, and Auch 2004; Sendelbach 2004; Miles and Tobin 2004].

After quickly assessing the tenability of their location, the firefighter must transmit a Mayday while they still have the capability and sufficient air, noting their location if possible. As noted above, firefighters may need to move away from untenable fire conditions before calling the Mayday. The next step is to manually activate their PASS device. To conserve air while waiting to be rescued, firefighters should try to stay calm, be focused on their situation, and avoid unnecessary physical activity. They should survey their surroundings to get their bearings and determine potential escape routes such as windows, doors, hallways, changes in flooring surfaces, etc., and stay in radio contact with the incident commander and other rescuers. Additionally, firefighters can attract attention by maximizing the sound of their PASS device (e.g., by pointing it in an open direction), pointing their flashlight toward the ceiling or moving it around, and using a tool to make tapping noises on the floor or wall.

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A crew member who initiates a Mayday call for another person should quickly try to communicate with the missing member via radio and, if unsuccessful, initiate another Mayday providing relevant information on the missing firefighter's last known location. Training should include situations dealing with "uncontrolled" SCBA emergencies, egress through small openings, emergency window egress, building collapse, and other situations that could be encountered during a Mayday situation.

Additional emphasis should be placed on appropriate procedures for tactical withdrawal under worsening fire conditions, and/or pending building collapse [Dodson 2005]. The use of an operational retreat is designed to quickly remove firefighters from operations in an unsafe or potentially unsafe environment. The incident commander shall initiate an operational retreat whenever the operational area is deemed unsafe for emergency personnel. All personnel operating in the unsafe area shall evacuate as the operational retreat procedures are initiated. Operational retreat shall begin with radio traffic announcing "EMERGENCY TRAFFIC" with directions for all emergency personnel to evacuate the operational area. An emergency egress signal shall be sounded [IAFF 2010; LAFD 2016]. For example: Repeated short air horn blasts of approximately 10 seconds, followed by 10 seconds of silence. The sequence of the air horn blast for 10 seconds followed by 10 seconds of silence should be repeated three times.

Upon hearing the operational retreat signal, all firefighters should immediately withdraw from any operations they are performing and leave the operational area. All company officers should immediately perform a PAR of all personnel they are responsible for and report the results to the incident commander.

In addition to training on breathing apparatus emergencies, egress through small openings, emergency window egress, etc., additional emphasis should be placed on appropriate procedures for tactical withdrawal under worsening fire conditions and structural collapse situations.

At this incident, it is unknown if the firefighter from Engine 201 understood what was happening, that he clearly needed to evacuate, or that the stairwell was comprised and that he needed to find a different means of egress.

Recommendation #9: Fire departments, local and municipal governments, and authorities having jurisdiction that have adopted the Mutual Aid Box Alarm System (MABAS) should participate in joint area-wide training exercises so that consistent procedures can be implemented and enforced.

Discussion: With automatic and special called mutual aid being common these days for a variety of reasons (primarily staffing and response times), it is essential that those departments and companies operate off the same policies, procedures, and guidelines. Some areas of the country have enacted the MABAS which facilitates this concept. Furthermore, those agencies should drill regularly to assure complete familiarization with each agency, their equipment, personnel, and operating modes. The drills

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should be based upon common policies and procedures. Additionally, equipment compatibility (including simple radio channel/talk group switching to assure reliable communications) should be determined prior to using nearby automatic or special call mutual aid agencies. There needs to be an understanding of and training in fireground discipline to assure all personnel are where they are expected to be at all times and are following the same expected policies to assure their minimal risk of injury or death [Goldfeder, 2019].

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 all participating departments will greatly enhance overall safety and efficiency on the fireground. Once methods and procedures are agreed upon, training protocols should 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 fire departments. This ensures reciprocal assistance and mutual aid is readily available when emergency situations escalate beyond local response capabilities.

This incident quickly escalated into a major fire event due to the size of the structure, limited access due to renovation work, and available resources. The incident commander quickly upgraded the alarm and called for additional resources. Automatic mutual aid response protocols dispatched several mutual aid departments including one department dispatched as the RIT. However, it was stated during the interview process that prior training with other fire departments had not been conducted.

Note: The following recommendations were not considered contributing factors but are being provided as examples of best practices to be considered.

Recommendation #10: Fire departments should ensure adequate incident scene rehabilitation is established in accordance with NFPA 1584, Standard on the Rehabilitation Process for Members during Emergency Operations and Training Exercises.

Discussion: NFPA 1584, *Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises* establishes the minimum criteria for developing and implementing a rehabilitation process for fire department members at incident scene operations and training exercises while operating within an incident management system [NFPA 2022]. Incident scene rehabilitation (“Rehab”) is a term often used for the care given to firefighters and other responders while performing their duties at an emergency scene. The physical and mental condition of personnel should be monitored as part of the overall assessment. This ensures a firefighter’s health does not deteriorate to the point it affects the safety of other firefighters or endangers the safety and integrity of the operation. Incident Commanders should consider the circumstances of each incident and make suitable provisions

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for rest and rehabilitation for personnel. This process should include medical evaluation and treatment, food and fluid replenishment, and rest and relief from extreme climatic conditions.

NFPA 1584 states that an incident commander should establish rehabilitation operations when emergency operations pose a safety or health risk to firefighters and other responders. Rehabilitation operations should be provided in accordance with fire department SOPs, NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, and NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety* [NFPA 2021; NFPA 2020].

When the size of the operation or geographic barriers limit member's access to the rehabilitation area, incident commanders should establish more than one rehabilitation area. The site should be far enough from the effects of the operation so members can safely remove their personal protective equipment and can be afforded physical and mental rest [USFA 2008]. Once "Rehab" area(s) have been established, this information should be communicated over the radio, so all members know the location of "Rehab" or know where to report when assigned to "Rehab."

Several considerations for rehabilitation sites are as follows:

- Should be far enough away from the scene that personnel may safely remove their turnout gear and SCBA and be afforded physical and mental rest from the stress and pressure of the emergency or training evolution. Provisions should be available to have SCBA cylinders refilled.
- Should provide suitable protection from the prevailing environmental conditions. During hot weather it should be in a cool, shaded area, and during cold weather it should be in a warm, dry area.
- Should enable personnel to be free of exhaust fumes and noise from apparatus, vehicles, or equipment, including those involved in the rehabilitation group operations.
- Should be large enough to accommodate multiple crews based on the size of the incident.
- Should be easily accessible by emergency medical service units.
- Should allow prompt re-entry back into the emergency operation upon recuperation.
- Crews assigned to rehab will be instructed to turn portable radios off and/or have radio and thermal imager portable batteries recharged or exchanged [USFA 2008] (**See Diagram 7**).

The Rehab Group Supervisor should secure all necessary resources required to adequately staff and supply the rehabilitation area. The supplies should include the following items:

- Fluids: water, activity beverage, and ice
- Food: soup, broth, or stew in hot/cold cups
- Medical devices: blood pressure cuffs, stethoscopes, oxygen administration devices, cardiac monitors, intravenous solutions, and thermometers
- Other: awnings, fans, tarps, heaters, dry clothing, extra equipment, floodlights, blankets and towels, traffic cones, and fire line tape (to identify the entrance and exit of the rehabilitation area)
- Hygiene facilities to decontaminate all exposed skin surfaces
- Restroom facilities [USFA 2008].

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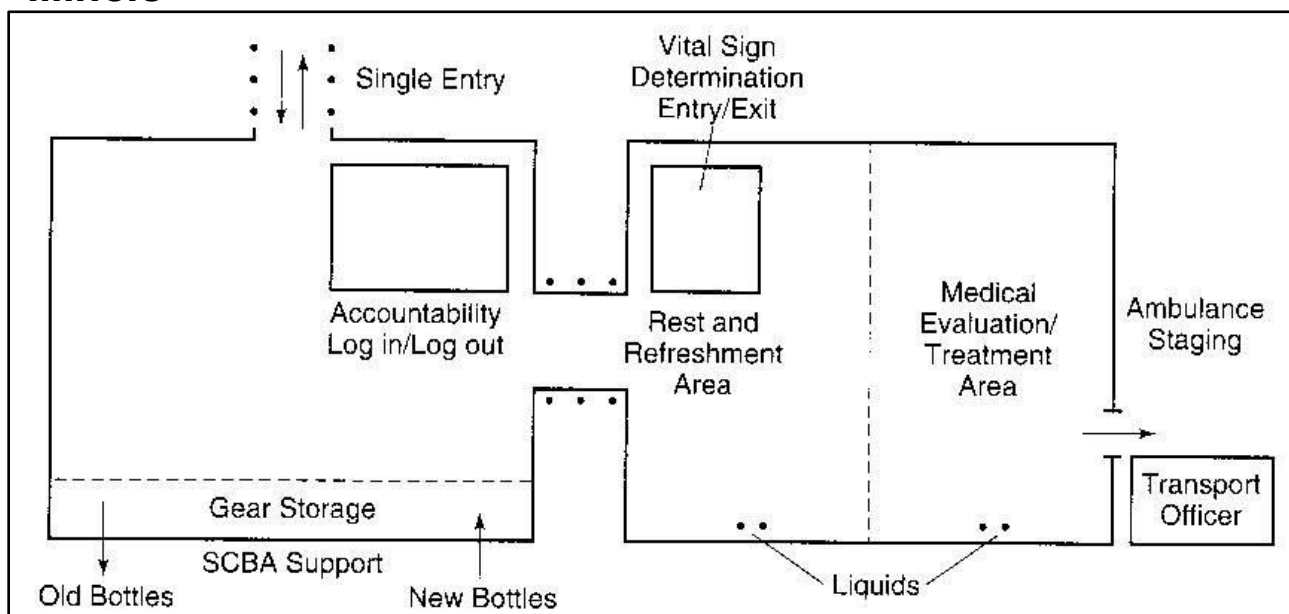


Diagram 7. An example of how a “Rehab” area can be organized. There are many ways to establish an effective “Rehab” area.

(Diagram courtesy of the United States Fire Administration)

Recommendation 11: Municipalities should ensure fire department telecommunicators are properly trained and certified, which includes the operation of alarm box cards for proper dispatching of resources.

Discussion: Effective fireground radio communication is an important tool to ensure fireground command and control as well as helping to enhance fire fighter safety and health. The radio system must be dependable, consistent, and functional to ensure that effective communications are maintained, especially during emergency incidents. Fire departments should have a “Communications” standard operating procedure (SOP)/standard operating guideline that outlines the communication procedures for fireground operations. The SOP/SOG should be periodically reviewed and updated. Fire departments should ensure that the Communication or Dispatch Center is part of this revision process. Another important aspect of this process is an effective education and training program for all members of the department and the dispatchers [Kunadharaju et al. 2010].

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety* provides basic requirements for fireground communications in Chapter 6, “Communications and Information Management” [NFPA 2020]. The chapter addresses the key components for effective fireground communications, such as the requirements for a dispatch radio channel, a command radio channel, and a tactical radio channel; use of plain text for transmitting strategic modes of operation and situational reports; emergency traffic including Mayday; and telecommunicator (dispatcher) support [NFPA 2020].

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One of the consistent factors defined in line-of-duty death investigation reports is the incident commander can be overwhelmed with fireground radio communications. This is especially true if the incident commander has to monitor the dispatch channel and the fireground tactical channel. Fire departments need to ensure that fireground radio communication systems are designed and operated to take this issue into account [NFPA 2020]. There are several ways to ensure that the incident commander can effectively manage fireground communications.

The best solution is to have a trained dispatcher monitoring the fireground radio channel. Dispatchers should meet the requirements of NFPA 1061, *Professional Qualifications for Public Safety Telecommunications Personnel* [NFPA 2018b]. The dispatcher is in a secure environment, isolated from fireground distractions and noise. The dispatcher should have access to playback technology with the ability to listen to hard-to-understand messages. The dispatcher should also have access to "identifier" information, which identifies the portable radio making the transmission. Like any other aspect of the fire service, all personnel need to be properly trained before being assigned to a critical task. In the world of fireground operations today, effective radio communications are critical, and the dispatcher is one of the most critical components in the radio communications systems. Proper training of a dispatcher involves more than teaching which buttons to push and how to figure out what companies to send where. Dispatchers need a thorough understanding of the incident management system, fireground strategy and tactics, and firefighting vernacular. Most important is to define the dispatcher's role during emergency operations with such responsibilities as fireground benchmarks, notifying the incident commander of lapsed time intervals for a personnel accountability report, emergency traffic, a Mayday, roll calls, or building evacuations. Dispatchers need to understand the critical role they play in the incident management system [NFPA 2020].

Another important function for the dispatcher is to communicate with the incident commander about critical incident benchmarks. One responsibility of the dispatcher is to ensure that personnel accountability report is conducted every 10–15 minutes during the incident. The dispatcher should prompt the incident commander every 10–15 minutes to conduct a personnel accountability report. Other responsibilities are to ensure that the incident commander communicates critical fireground benchmarks during the incident, such as a complete scene size-up with declared strategy, water is on the fire, a primary search is completed with outcome, command is being transferred, a Mayday has occurred and a request has been made for additional tactical channels and emergency traffic, fire is knocked down, and fire is out. This is not an all-inclusive list, but an idea of critical fireground benchmarks [NFPA 2020]. The job of dispatching should not be assigned to a new fire fighter or to a police dispatcher who does not have adequate training in fireground radio communications. There are numerous line-of-duty death reports of incidents in which the dispatcher had information that a fire fighter was in distress yet failed to act on that information [NFPA 2020].

Dispatching is not a job that should be left to just one person who may be called away from monitoring the fireground radio to field telephone calls or dispatch runs. Dispatchers who monitor a fireground radio channel must be able to put 100% of their concentration into listening for missed messages and providing support to resources on-scene. Ideally, one dispatcher should be assigned to each fireground

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channel in use [Varone 2003]. Many fire departments assign a tactical radio operator or dispatcher to the assigned fireground tactical channel. This dispatcher is assigned the incident until Command clears the tactical channel.

Telecommunicators accomplish rapid responses by using pre-arranged “box alarm” cards. These cards show the response of the primary apparatus of the local fire departments and possible outside departments utilizing auto-aid agreements to a given box alarm level.

In this incident, dispatchers contacted neighboring departments in the MABAS but did not utilize the box alarm cards, which suggests procedures may need to be revised. This caused some confusion on the fireground by the fire chiefs, as they believed that additional/different resources were coming, such as, an air truck. MABAS 1 and 2 were requested at 0340 hours. The *Timeline* designates that MABAS 2 was dispatched at 0350 hours, MABAS 45 was requested at 0501 hours, with a repeated request at 0511 hours. An air truck was on-scene at 0512 hours and the RIT was on-scene at 0541 hours. It is crucial to have MABAS support for a high risk/low frequency incident.

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Investigator Information

This incident was investigated by Matt E. Bowyer, General Engineer, and Karis Kline-Field, Occupational and Safety Health Specialist, with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH located in Morgantown, WV. An expert technical review was provided by Michael Richardson, Division Chief of Training and Safety, St. Matthews Fire Department, Louisville, KY. A technical review was also provided by the National Fire Protection Association, Public Fire Protection Division.

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Appendix One Office of the Illinois State Fire Marshal State Fire Training Requirements

The Office of the Illinois State Fire Marshal, Division of Personnel Standards and Education is responsible for the requirements as defined in *TITLE 41: FIRE PROTECTION, CHAPTER I: OFFICE OF THE STATE FIRE MARSHAL, PART 141 POLICY AND PROCEDURES MANUAL FOR FIRE PROTECTION PERSONNEL*.

The Division of Personnel Standards and Education (DPSE) is responsible for assisting local governments in improving the levels of education and training standards for local fire fighters. This division manages a program of training and certification for over 50,000 firefighters in Illinois. The program involves developing standards, utilizing the input of SCAC Committee members, for training, testing, and certifying at all levels including firefighting, fire prevention, public education, fire investigation, fire department management and specialties including apparatus driver, airport firefighter, hazardous materials, and rescue.

The Division of Personnel Standards and Education also administers the Claims for Reimbursement program for firefighter training costs. The DPSE Web Access Program will give fire departments access to our Personnel Standards and Education system. They will be able to update contact information and rosters. Fire departments are able to search and request the following: course completion rosters, request for examinations, and applications for certification. Reports will be available for fire fighter courses and classes.

The authority having jurisdiction (AHJ) should ensure that all personnel are properly trained to respond to an incident for which they will be assigned. The *Illinois Minimum Firefighter Training Guide* from the Illinois Office of the State Fire Marshal recognizes national standards for fire fighter training. In all cases it is the responsibility of the authority having jurisdiction to:

- provide quality training in these skill areas to each person expected to work within the identified hazards
- and to assess hazards in their community and provide additional training as may be necessary to safely address emergencies.

The authority having jurisdiction should ensure that a minimum requirement training program is established in accordance with *29 CFR 1910.156 (C), Fire Brigades* and should ensure personnel meet the age and fit for duty requirements set forth by the authority having jurisdiction.

The authority having jurisdiction should ensure personnel meet the requirements of *29 CFR 1910.134, Respiratory Protection*. The authority having jurisdiction should ensure the education and training of personnel and operations comply with NFPA Standards:

- NFPA 1001, *Standard for Fire Fighter Professional Qualifications*.

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- NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*.
- NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments*.

The authority having jurisdiction should establish an accountability system to ensure that personnel only operate in an area and at the level commensurate to their training.

Overview

The Illinois Firefighter Minimum Training Committee developed a guide to assist fire department officers in determining areas of training for personnel that correlate to the duties performed. The guide outlines specific training competencies that should be met prior to personnel being allowed to engage in certain activities as it relates to 1) station only, 2) exterior, and 3) high risk operations.

Work Area Definitions

- *Area 1: Station Support Operations:*
Activities at the fire station relevant to a structure fire that may be occurring.
- *Area 2: Exterior/Support Operations:*
Activities relevant to a structure fire between the station and on the fire scene but not on or in the burning structure.
- *Area 3: High Risk Operations:*
Activities relevant to a structure fire that places the firefighter on or in the burning structure.
- *Area 4: Firefighter Basic Certification:*
As outlined by the Illinois Office of the State Fire Marshal.

Training → to → Certification

The premise of *Training to Certification* is to provide a mechanism for those fire departments that wish to start with Area 1 training of their personnel and move to and through the certification process if certification is desired. This guide will provide a mechanism that allows fire fighters to complete practical skills starting at Area 1 and apply them up to Area 4 (Basic Fire Fighter Certification). Specific time constraints may apply for length of completion of classroom and practical examinations, as prescribed by the Office of the Illinois State Fire Marshal.

Area 1: Station Training and Recommendations

Fire department personnel completing this area of training are prepared for activities encountered at the fire station. Fire department personnel who respond to an emergency scene should complete *Area 2* training.

- Age Requirements (4.1)
- Education Requirements (4.1)
- Medical Evaluation/Fit for Duty NFPA 1582, NFPA 1001
- Minimum Training
 - Infectious Disease Control (4.3)
 - CPR/AED Training (AHJ, A.4.3)

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- Fire Department Organization/SOP's (5.1.1, 5.2.-B) Fire Department Documents (5.1, 5.2, 5.2.1)
- Personal Protective Clothing/Equipment (AHJ)
 - PPE for station use
 - Eye protection
 - Station clothing/gear
 - Hand protection
 - Hearing protection
- Fire Department Communications (5.2.1, 5.2.2, 5.2.3, 5.2.4)
 - Receiving phone calls
 - Initiate response
- Relay verbal and written information
 - Operate communications equipment
- Compressed Air Systems SCBA (5.5.1)
 - Use of compressor/fill station
 - Use of cascade system
- Knowledge of SCBA components and operation
- Small Tools / Power Tools (5.5.1)
 - Operations/safety and cleaning of small tools
- Ladders (5.5.1)
 - Inspection/cleaning
- Fire Hose (5.5.2)
 - Hose construction/cleaning
 - Hose loads and finishes
- Vehicle Operations (AHJ)
 - Driving regulations and procedures
 - Backing procedures
 - Department hand and audible signals

Area 2: Exterior/Support Training and Recommendations

Fire department personnel completing this area should be minimally trained to conduct exterior operations, for example: defensive firefighting, fireground support operations and driving emergency vehicles.

- Minimum Training
 - Fire Department Organization/SOP's (5.1.1, 5.2.-B)
 - Fire Department Command (AHJ, 5.1.1)
 - Scene Safety (5.3.3, 5.3.18, A5.3.3)
 - Personal Protective Clothing/Equipment (5.1.2, 5.3.3, A5.3.1, A5.3.2)
 - Communications (5.2, 5.2.1, 5.2.2, 5.2.3, 5.2.4)
 - SCBA (5.3.1)
 - Fire Behavior (5.3.12)
 - Building Construction (5.3.4)

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- Water Supply (5.3.15)
- Fire Hose (5.3.8-A, 5.5.2)
- Fire Streams (5.3.7, 5.3.10, 5.5.1)
- Ladders (5.3.6, 5.5.1)
- Ventilation Concepts (5.3.11-A, 5.3.12-A)
- Small Tools / Power Tools (5.1.2, 5.3.12, 5.3.13, 5.3.17, 5.3.20, 5.5.1)
- Vehicle Operations (AHJ, 5.3.2, 5.3.3, A5.3.3)

Area 3: High Risk Training and Recommendations

Fire department personnel proficient in skills execution within this area should be minimally trained to work in a hazardous environment, for example: interior structural operations, search and rescue, ventilation, etc. The AHJ is responsible for carefully evaluating the knowledge and skills proficiency of personnel completing this training and education. The AHJ should evaluate the hazards within their respective communities to determine what additional training is necessary to properly prepare the firefighting personnel.

- Minimum Training
 - Fire Department Organization/SOP's (5.1.1, 5.2.-B)
 - Fire Department Command (AHJ, 5.1.1)
 - Scene Safety (5.3.3, 5.3.5, 5.3.18, A5.3.3)
 - Personal Protective Clothing/Equipment (5.1.2, 5.3.3, 5.3.19, A5.3.1, A5.3.2)
 - Communications (5.2.1, 5.2.2, 5.2.3, 5.2.4, A5.2.4)
 - SCBA (5.3.1, 5.3.2, 5.3.9, 5.1.1, A5.3.1)
 - Fire Behavior (5.3.8, 5.3.12, 5.3.16, A5.3.8)
 - Building Construction (5.3.3)
 - Ventilation (5.3.11, 5.3.12)
 - Search/Rescue (5.3.5, 5.3.9)
 - Fire Hose (5.3.7, 5.3.8, 5.3.10, 5.3.13, A5.3.8)
 - Fire Streams (5.3.7, 5.3.8, 5.3.10, 5.3.11, 5.3.19, 5.5.2)
 - Water Supply (5.3.15 A5.3.15)
 - Small Tools / Power Tools (5.1.2, 5.3.3, 5.3.9, 5.3.11, 5.3.12, 5.3.13, 5.3.17, 5.3.19, 5.3.20)
 - Forcible Entry (5.3.4, 5.3.9, A5.3.4)
 - Ladders (5.3.6, 5.3.9, 5.3.10, 5.3.11, 5.3.12, 5.5.1, A5.3.6)
 - Salvage/Overhaul (5.3.13, 5.3.14)
 - Coordinated Attack Drills (5.3.10, A 5.3.5, A5.3.8, A5.3.9, A5.3.10, A5.3.16,)
 - Vehicle Operations (AHJ, 5.3.2,5.3.3, A5.3.3)

Area 4: Fire Fighter Basic Certification (OSFM)

Fire Departments or firefighters pursuing Fire Fighter Basic certification will follow the requirements set forth by the Illinois Office of the State Fire Marshal.

Personnel of a fire department that have completed Area 1 through Area 3 training may apply practical skills obtained and documented towards their Fire Fighter Basic certification as long as they were

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completed and documented in accordance with the Illinois Office of the State Fire Marshal policy pertaining to the Fire Fighter Basic Course (Classroom/Practical Skills Testing).

- Additional Fire Fighter Basic Certification Requirements
 - Meet or exceed all FF Basic JPR (Partially covered in Area 1-3 Training)
 - Fire Service Vehicle Operator (Partially covered in Area 1-3 Training)
 - Hazardous Materials First Responder (Not covered in Area 1-3 Training)
 - Technical Rescue Awareness (Not covered in Area 1-3 Training)
 - NIMS 100 (Not covered in Area 1-3 Training)
 - NIMS 700 (Not covered in Area 1-3 Training)
 - Courage to be Safe (Not covered in Area 1-3 Training)

Maintaining Training Records

The student is ultimately responsible for maintaining their training log and documenting any training they attend.

It is the responsibility of the authority having jurisdiction to validate the training and maintain all training records.

Certifications

The Illinois Office of the State Fire Marshal offers the following certifications through their evaluation and testing process.

Listed below are the certification levels offered.

SUBPART D: CERTIFICATION LEVELS

- [Section 141.301 Basic Operations Firefighter](#)
- [Section 141.302 Airport Firefighter](#)
- [Section 141.303 Advanced Technician Firefighter](#)
- [Section 141.306 Fire Apparatus Engineer](#)
- [Section 141.308 Fire Officer I](#)
- [Section 141.309 Company Fire Officer](#)
- [Section 141.310 Fire Service Executive Support](#)
- [Section 141.312 Fire Department Incident Safety Officer](#)
- [Section 141.313 Fire Department Health and Safety Officer](#)
- [Section 141.314 Fire Officer II](#)
- [Section 141.315 Advanced Fire Officer](#)
- [Section 141.316 Chief Fire Officer](#)
- [Section 141.317 Fire Department Safety Officer](#)
- [Section 141.318 Fire Service Instructor I](#)
- [Section 141.320 Fire Service Instructor II](#)
- [Section 141.322 Fire Service Instructor III](#)
- [Section 141.324 Training Program Manager](#)
- [Section 141.326 Basic Fire Prevention Officer](#)

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- [Section 141.327 Fire Inspector I](#)
- [Section 141.328 Youth Firesetter Intervention Specialist](#)
- [Section 141.329 Fire Inspector II](#)
- [Section 141.330 Public Fire and Life Safety Educator I](#)
- [Section 141.331 Advanced Fire Prevention Officer](#)
- [Section 141.334 Fire Investigator](#)
- [Section 141.336 Arson Investigator](#)
- [Section 141.344 Hazardous Materials First Responder – Operations](#)
- [Section 141.346 Hazardous Materials Technician](#)
- [Section 141.348 Hazardous Materials Incident Command](#)
- [Section 141.352 Rescue Specialist – Confined Space](#)
- [Section 141.354 Trench Operations](#)
- [Section 141.356 Trench Technician](#)
- [Section 141.360 Structural Collapse Operations](#)
- [Section 141.362 Structural Collapse Technician](#)
- [Section 141.364 Vehicle and Machinery Operations](#)
- [Section 141.366 Vehicle and Machinery Technician](#)
- [Section 141.367 Rope Operations](#)
- [Section 141.370 Fire Service Vehicle Operator](#)
- [Section 141.371 Rope Technician](#)
- [Section 141.372 Water Operations](#)
- [Section 141.375 Watercraft Technician](#)
- [Section 141.380 Invalidation of Certification](#)

Testing

Except as otherwise noted in this Part, **Section 141.205: Testing Facilities and Proctors**, all State written examinations will be developed, provided, and administered by Office personnel. Local instructors desiring to schedule State examinations should contact the Office to establish a time and place for the examination. While the Office will endeavor to schedule examinations at sites throughout the State as requested, the number of examination requests may necessitate delays and regional testing. The training facility requesting the State examinations be given should have facilities for the examination. When large numbers of persons are to be tested, Office personnel may request additional assistance of the facility or fire department in monitoring the administration of a test.

Illinois Occupational Safety and Health Administration

The following sections will cover **minimum legal training requirements for Illinois fire departments/fire districts**. This guide cannot possibly cover every IL-OSHA regulation that a fire department may be subject to, but it will cover training requirements that are most commonly associated with the fire service. For example, if a fire department performs confined space rescue, they may be subject to training required by *29 CFR 1910.146 Permit Required Confined Spaces* not discussed in this guide.

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NOTE: Some training requirements are objective/performance based while others specify a minimum number of hours. Initial training is required in almost all cases and ongoing training may be required annually, quarterly, as identified, or at another frequency.

NOTE: Some standards mandate specific training topics and objectives while others simply state that training must take place.

NOTE: Some standards also require that the trainee also demonstrates competency in the training topics.

Civil Penalties: The Illinois Occupation Safety & Health Act (IOSHA) (820 ILCS 219/85) provides the Director of Labor statutory authority to propose civil penalties for violations of the act. The penalty structure is used on a limited basis to provide an incentive for preventing or correcting violations that the employer failed to abate. While penalties are not designed as punishment for violations, the penalty amounts should be sufficient to serve as an effective deterrent to the most severe of violations.

Training Requirements:

- **Training required by 1910.120 Hazardous Waste Operations and Emergency Response**

This is the OSHA standard that contains requirements for emergency personnel that respond to hazardous materials incidents. Every fire department has the potential to respond to a known or unknown hazardous material incident. The levels of training required by this standard are based on the duties and functions to be performed by each member. The minimum training level is the first responder awareness level. Some fire departments may have members at higher levels such as operations, technician, specialist, and incident commander. If members operate at these levels, fire departments need to ensure they have had training and can demonstrate competency based on their level in accordance with 1910.120. Initial training shall take place before being permitted to respond to a hazardous materials incident.

 - First responder awareness level. First responders at the awareness level shall have sufficient training or have had sufficient experience to objectively demonstrate competency in the following areas: Understand hazardous substances are, and the risks associated with them in an incident.
 - Understand the potential outcomes during an emergency when hazardous substances are present.
 - Recognize the presence of hazardous substances in an emergency.
 - Identify the hazardous substances, if possible.
 - Understand the role of the awareness level individual in the fire department emergency response plan including site security and control and the *Emergency Response Guidebook*.
 - Realize the need for additional resources and make appropriate notifications.

Trainers. Trainers shall have satisfactorily completed a training course for teaching the subjects they are expected to teach, such as the courses offered by the United States National Fire Academy, or they shall have the training and/ or academic credentials and instructional

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experience necessary to demonstrate competent instructional skills and a good command of the subject matter of the courses they are to teach.

Refresher Training. Those employees who are trained shall receive annual refresher training of sufficient content and duration to maintain their competencies or shall demonstrate their competency in those areas at least yearly. A statement shall be made on the training or competency, and if a statement of competency is made, the employer shall keep a record of the methodology used to demonstrate competency.

- **Training required by 1910.132 Personal Protective Equipment Standard**

The fire department is required to train all members that may be required to wear PPE before being allowed to perform work requiring the use of PPE. The training shall include:

- when PPE is necessary what PPE is necessary
- how to properly don/doff
- adjust and wear PPE
- the limitations of PPE
- the proper care, maintenance, useful life, and disposal of PPE

When the fire department has reason to believe that a member who has already been trained does not have the understanding and skill required, the member shall be retrained.

- **Training required by 1910.134 Respiratory Protection Standard**

This standard applies to all members of a fire department that may be required to wear respiratory protection (most often an SCBA) as part of their duties and functions. Members that clearly do not have duties and functions that would require the use of respiratory protection are exempt from this standard. **NOTE:** *IL-OSHA has no requirement for fire department/districts to engage in interior structural firefighting, however, if a department elects to engage in this activity, it must have a functional respiratory protection program compliant with the standard.*

Fire departments are required to provide effective training to members who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary.

The employer shall ensure that each employee can demonstrate knowledge of at least the following:

- Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator
- What the limitations and capabilities of the respirator are
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions
- How to inspect, put on and remove, use, and check the seals of the respirator
- What the procedures are for maintenance and storage of the respirator

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- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators
- The general requirements of the department/district respiratory protection program
- Training shall be conducted in a manner that is understandable to the employee
- The employer shall provide the training prior to requiring the employee to use a respirator in the workplace

Retraining shall be administered annually and when the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill
- Any other situation arises in which retraining appears necessary to ensure safe respirator use.

- **Training required by 1910.156 Fire Brigades Standard**

The fire department shall provide a policy that details the type, amount, and frequency of training to be provided to members.

The fire department/district shall provide training and education for all members based on the duties and functions they are expected to perform. This training shall be provided before members engage in emergency activities. Fire department leaders (members expected to command an incident) and training instructors shall be provided with training and education which is more comprehensive than that provided to the general membership.

The fire department shall ensure that training and education is conducted frequently enough to assure that each member is able to perform their assigned duties and functions satisfactorily and in a safe manner. All members shall be provided with training at least annually. Members expected to perform interior structural firefighting shall be provided with training at least quarterly.

The quality of the training program shall be similar to those conducted by state level fire training schools. An example would be the Illinois Fire Service Institute.

- **Training required by 1910.157 Portable Extinguishers Standard**

The fire department shall provide initial and annual training on portable fire extinguishers to include the general principles of fire extinguisher use and the hazards involved in incipient stage firefighting.

- **Training required by 1910.1030 Bloodborne Pathogens Standard**

All fire department/district members that respond to emergencies may come into contact with bloodborne pathogens and are required to receive training. Even if an agency does not perform

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emergency medical service functions, members may be exposed to bloodborne pathogens during rescue activities.

The training shall take place at the time of initial assignment and at least annually thereafter. Fire departments/districts shall provide additional training if changes in tasks or procedures affect occupational exposure.

The minimum training program requirements are:

- An accessible copy of the regulatory text of this standard and an explanation of its contents
- A general explanation of the epidemiology and symptoms of bloodborne diseases
- An explanation of the modes of transmission of bloodborne pathogens
- An explanation of the employer's exposure control plan and the means by which the employee can obtain a copy of the written plan
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials
- An explanation of the use and limitations of methods that will prevent or reduce exposure including appropriate engineering controls, work practices, and personal protective equipment
- Information on the types, proper use, location, removal, handling, decontamination, and disposal of personal protective equipment
- An explanation of the basis for selection of personal protective equipment
- Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge
- Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials
- An explanation of the procedures to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available
- Information on the post exposure evaluation and follow-up that the employer is required to provide for the employee following an exposure incident
- An explanation of biohazard signs and labels.
- An opportunity for interactive questions and answers with the person conducting the training session.

The person conducting the training shall be knowledgeable in the subject matter above.

Training records shall include:

- The dates of the training sessions
- The contents or a summary of the training sessions
- The names and qualifications of persons conducting the training
- And the names and job titles of all persons attending the training sessions. Training records shall be maintained for 3 years from the date on which the training occurred.

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Appendix Two

Summary of Personal Protective Equipment Evaluation

Status Investigation Report of two Self-Contained Breathing Apparatus Submitted by the NIOSH Division of Safety Research for the Fire Department

This report provides a summary of NPPTL's inspection and evaluation methods and findings for the self-contained breathing apparatus (SCBA) used by the fire department firefighter during a fatal event. The SCBA being used was an MSA Model Firehawk® M7, 4500 psi, 30-minute unit. The fire department was advised that NIOSH NPPTL would provide a written report of the investigation and any applicable test results.

Synopsis of Findings

The SCBA unit inspected and evaluated by NPPTL was identified as an MSA Model Firehawk® M7, 4500 psi, 30-minute unit with NIOSH Approval Number TC-13F-302. The unit was hand delivered by DSR investigators with a replacement facepiece that was supplied by the Department. During the inspection process by the NPPTL investigators, it was determined that a replacement cylinder was needed because the investigators were not able to verify that the hydrostatic test was in compliance. As received, the cylinder was empty with the valve closed and not attached to the GCA fitting. The MMR bypass was found in the closed position. Overall condition of this unit was fair with normal wear and tear.

This unit did not meet the requirements of the NIOSH Positive Pressure Test (Standard Test Procedure Number 120, 42 CFR Part 84 Reference: Subpart H, 84.70 (a)(2)(ii)), which caused a failure of the Rated Service Time Test (Standard Test Procedure Number 121, 42 CFR Part 84 Reference: Subpart F, § 84.53 (a) and Subpart H, § 84.95 (a) and (b)), even though the unit lasted for 31.56 minutes. The unit passed all the other NIOSH tests except the Remaining Service Life Indicator Test (Standard Test Procedure Number 124, 42 CFR Part 84 Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)). The mechanical alarm portion (bell) of this unit only sounded the first two times during this test and failed. The electronic portion of this test passed. The unit did not pass the NFPA Airflow Performance Test - NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services* (2013 Edition) Reference: Chapter 5, Performance Requirements, Sec. 5-1.1. The testing apparatus was not able to overcome the pressure for the first breath activation to initiate the test.

It was suspected that the bodily fluids observed by the NPPTL investigators during the inspecting and testing process contributed to the pressure failures. The NIOSH investigators transported the unit to MSA headquarters in Cranberry Township, Pennsylvania on Tuesday August 6, 2019, so that the manufacturer could inspect the mask mounted regulator. MSA verified that the MMR had bodily fluids inside the diaphragm and all around the seal. It was also verified that the MMR was out of adjustment.

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The manufacturer determined that these factors contributed to the unit failing the tests, but they did not have a contributing factor to the fatality.

Case Conclusion

No evidence was identified to suggest that the SCBA unit inspected and evaluated contributed to the fatality. NIOSH determined that there was no need for corrective action with regards to the approval holder or users of SCBAs manufactured under the approval number granted to this product.

<https://www.cdc.gov/niosh/npptl/ppe-fireservice/pdfs/ChristopherIllinoisFireDepartment23126-508.pdf>