



CITY OF WATERBURY FIRE DEPARTMENT



Battalion Chief Examination Reading List

1. Fireground Strategies, 3rd Edition, Anthony Avillo
2. Chief Officer, Principles and Practices, 3rd Edition, David J. Purchase, **Chapters 1-4, 7, 11**
3. The Evolving Fireground: Research Based Tactics, Sean Gray and P.J. Norwood
4. NIOSH Report 2010-18, A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut
5. NIOSH Report 2014-19, Career Fire Fighter Dies from an Out-of-air Emergency in an Apartment Building Fire - Connecticut
6. Waterbury Harassment in the Workplace Policy, March 27, 2003
7. Waterbury Family Medical Leave Policy Statement, September 29, 2006
8. 2017-2021 Local 1339 Collective Bargaining Agreement, Article XXX; Substance Abuse Testing, **Sections 1-8**
9. WFD SOP C-001, Assumption, Transfer, Designation and Responsibilities of Command
10. WFD SOP C-003, ICS Organizational Structure for Initial Incidents
11. WFD SOP C-004, ICS Organizational Structure for Major Incidents
12. WFD SOP EO-005, Emergency Scene Reporting
13. WFD SOP S-013, Accountability for Personnel at Emergency Incidents

Publishers Phone Numbers and Websites

- CT Fire Academy Book Store (860) 627-6363 www.portal.ct.gov/cfpc
- PennWell Publishing (800) 752-9764 www.pennwellbooks.com
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A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Executive Summary

On July 24, 2010, a 40-year-old male career lieutenant (Victim #1) and a 49-year-old male career fire fighter (Victim #2) were found unresponsive at a residential structure fire. The victims and two additional crew members were tasked with conducting a primary search for civilians and fire extension on the 3rd floor of a multifamily residential structure. The fire had been extinguished on the 2nd floor upon their entry into the structure. While pulling walls and the ceiling on the 3rd floor, smoke and heat conditions changed rapidly. Victim #1 transmitted a Mayday (audibly under duress) that was not acknowledged or acted upon. Minutes later the incident commander ordered an evacuation of the 3rd floor. As a fire fighter exited the 3rd floor, Victim #1 was discovered unconscious and not breathing, sitting on the stairs to the 3rd floor. Approximately 7 minutes later, Victim #2 was discovered on the 3rd floor in thick, black smoke conditions. Both victims were removed by the rapid intervention team (RIT) and other fire fighters who assisted them. Both victims were pronounced dead at local hospitals.

Contributing Factors

- *Failure to effectively monitor and respond to Mayday transmissions*
- *Less than effective Mayday procedures and training*
- *Inadequate air management*
- *Removal and/or dislodgement of self-contained breathing apparatus (SCBA) facepiece*
- *Incident safety officer (ISO) and rapid intervention team (RIT) not readily available on scene*
- *Possible underlying medical condition(s) (coronary artery disease)*
- *Command, control, and accountability.*



Incident structure following extinguishment.
(Photo courtesy of Keith Muratori.)

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Key Recommendations

- *Ensure that radio transmissions are effectively monitored and quickly acted upon, especially when a Mayday is called*
- *Ensure that Mayday training program(s) and department procedures adequately prepare fire fighters to call a Mayday*
- *Train fire fighters in air management techniques to ensure they receive the maximum benefit from their SCBA*
- *Ensure that fire fighters use their SCBA during all stages of a fire and are trained in SCBA emergency procedures*
- *Ensure that a separate incident safety officer (ISO), independent from the incident commander, is appointed at each structure fire with the initial dispatch*
- *Ensure that a rapid intervention team (RIT) is readily available and prepared to respond to fire fighter emergencies*
- *Consider adopting a comprehensive wellness and fitness program, provide annual medical evaluations consistent with NFPA standards, and perform annual physical performance (physical ability) evaluations for all fire fighters.*



Incident scene.
(Photo courtesy of Keith Muratori.)

The National Institute for Occupational Safety and Health (NIOSH), an institute within the Centers for Disease Control and Prevention (CDC), is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. In 1998, Congress appropriated funds to NIOSH to conduct a fire fighter initiative that resulted in the NIOSH "Fire Fighter Fatality Investigation and Prevention Program" which examines line-of-duty-deaths or on duty deaths of fire fighters to assist fire departments, fire fighters, the fire service and others to prevent similar fire fighter deaths in the future. The agency does not enforce compliance with State or Federal occupational safety and health standards and does not determine fault or assign blame. Participation of fire departments and individuals in NIOSH investigations is voluntary. Under its program, NIOSH investigators interview persons with knowledge of the incident who agree to be interviewed and review available records to develop a description of the conditions and circumstances leading to the death(s). Interviewees are not asked to sign sworn statements and interviews are not recorded. The agency's reports do not name the victim, the fire department or those interviewed. The NIOSH report's summary of the conditions and circumstances surrounding the fatality is intended to provide context to the agency's recommendations and is not intended to be definitive for purposes of determining any claim or benefit.

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

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Introduction

On Saturday, July 24, 2010, a 40-year-old male career lieutenant (Victim #1) and a 49-year-old male career fire fighter (Victim #2) were found unresponsive at a residential structure fire. Both were transported to local hospitals where they were pronounced dead. On July 26, 2010, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On July 30, two safety and occupational health specialists from the NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) traveled to Connecticut to investigate this incident. The NIOSH investigators met with the deputy fire chief and representatives from the local fire fighters' union; the fire department's training division; the State of Connecticut Department of Public Safety, Division of State Police, Office of State Fire Marshal; health department; the local civil service director; private ambulance service; and the State of Connecticut's Department of Labor, Division of Occupational Safety and Health (CONN-OSHA). Interviews were conducted with the deputy fire chief, training division staff, the health department physician, a member of the fire fighter's union safety and productivity committee, the incident commander (IC), the general manager of the private ambulance service, fire fighters who were on scene, and the director of public safety communications. NIOSH investigators met with the state police to inspect and photograph the victims' structural fire fighting gear and self-contained breathing apparatus (SCBA) involved in the incident, and to review witness statements, photographs, and other available information obtained during their investigation. The NIOSH investigators visited, documented, and photographed the fire scene and structure. The NIOSH investigators reviewed the victims' pre-employment medical evaluations, annual medical evaluations, annual respirator fit testing, and medical examiner reports. The NIOSH investigators also reviewed training records for the victims and the IC, dispatch radio transcripts, photos and videos taken by bystanders, department standard operating procedures (SOPs), and SCBA air quality testing results and maintenance records. On January 20, 2011, a NIOSH investigator and the NIOSH Fatality Investigations Team Chief returned to Connecticut to meet with the fire chief and with representatives with CONN-OSHA and the state police.

Fire Department

This career fire department has 8 stations with 292 uniformed members which serve a population of approximately 140,000 within an area of about 17 square miles. At the time of the incident the fire department had 9 engines, 4 aerial ladders, and a heavy rescue truck.

Fire Department Operations

Field personnel within the fire department are divided into four platoons to cover two shifts a day. Each platoon works three straight 10-hour day shifts, followed by three days off, then three straight 14-hour night shifts. This averages out to a 42-hour workweek. Fire fighters can work overtime, which allows them to work 24 or more hours in a row.

The fire department's training division works from 0900 to 1630, Monday through Friday. The training division is responsible for assigning a designated incident safety officer (ISO) to respond to incidents that require one (e.g., hazardous materials responses and confirmed working structure fires). Training staff within this division are assigned as the on-duty ISO during normal duty hours. After

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

normal business hours and on weekends, an ISO is placed on an on-call status. The ISO is dispatched per dispatch protocols or upon request from the IC. The ISO will respond in a fire department vehicle from his/her home to the incident location with all required equipment to perform their duties.

The fire department has written operational procedure guidelines, standard operating procedures, and directives (OPG/SOP/D) that cover a wide range of administrative and operational topics.¹ Those OPGs/SOPs/Ds specific to this incident include the following:

- Mayday Procedures (*see summary of procedure in Appendix I*)
- SCBA Operation and Maintenance Instructions
- Use of SCBA
- SCBA Emergency Escape
- Personal Alert Safety System (PASS) Devices
- Rapid Intervention Team (RIT)
- Emergency Evacuations
- Radio Operation Instructions
- Radio Usage Guidelines
- Radio Guidelines for Fire Ground Channels
- Initial Dispatch and Multiple Alarm Procedures
- Incident Command System
- Accountability System
- Engine and Truck Company Operations and Responsibilities
- Training Requirements

The fire department does not have a procedure or guideline for fire fighter rehab at emergency incidents.

A contracted private ambulance service provides emergency medical services (EMS) to the city and to the fire department. The fire department may first respond to medical emergencies dispatched within the city limits to assist the ambulance service. Emergencies requiring EMS are routed through the city's dispatch center and then transferred to the ambulance dispatch center, which then logs all information before dispatching the appropriate station for an ambulance to respond. No procedures or guidelines are established between the ambulance service and fire department stating that an ambulance will be automatically dispatched to standby at a fire-related incident to render medical care and rehab services to fire fighters or civilians on scene when needed.

9-1-1 Communications Center

In April 2010, the city's fire and police 9-1-1 centers were consolidated into a new public safety communications department through a grant. Fire department lieutenants assigned to the original fire department 9-1-1 center did not transition into the new communications department, but were reassigned to the field. Civilian fire dispatchers from the fire department's 9-1-1 center did transfer into the new communications center. Prior to the communications center's opening, all fire dispatchers

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

were trained on the new computer-aided dispatch and radio systems and had taken or were scheduled to take an advanced fire service dispatch class. *Note: Dispatchers hired after 1990 were certified as telecommunicators through the State of Connecticut, Office of Statewide Emergency Telecommunications.*

These civilian fire dispatchers had been trained on fire department policies and dispatch procedures by fire department personnel prior to transferring to the new communications center. Training included fire department procedures on handling a Mayday, and the fire department had also established a Mayday procedure test to check the viability of the Mayday SOP. According to the fire department's SOP, this test was conducted every first day shift (Monday morning) (see summary of procedures in Appendix I).

NIOSH investigators were able to meet with and interview the communications center director regarding the incident and history of the new communications center. However, NIOSH investigators did not have an opportunity to interview the actual dispatcher(s) who worked the 9-1-1 console or the supervisor(s) on duty the day of the incident. According to the communications center director, two fire dispatchers (1 originally from the fire department's 9-1-1 center) handled the fire incident. Together, they had 40 years of dispatching experience for fire and police. Two supervisors were also available in the communications center during the incident. According to training records received, the two dispatchers and two supervisors held a current State of Connecticut certification as a *Public Safety Telecommunicator*. The supervisors had also been certified as a *Communications Center Supervisor* by the Association of Public-Safety Communications Officials, or APCO.

Coincidentally, following the incident, the fire department worked with the new communications center on installing equipment that would boost radio signals in dead areas, based on problems in previous incidents. The fire department does not recall having any radio transmission problems during the incident.

State Regulations

The State of Connecticut operates an occupational safety and health program in accordance with Section 18(b) of the Occupational Safety and Health Act of 1970. CONN-OSHA has adopted all federal OSHA standards that apply to public sector employers. CONN-OSHA enforces fire department compliance with the following regulations:

- Fire Brigades² 29 CFR 1910.156(b)(1), 1910.156(c), 1910.156(c)(2), 1910.156(d)(1), 1910.156(e)(1-5)
- Respiratory Protection³ 29 CFR 1910.134(c), 1910.134(e), 1910.134(f)(2), 1910.134(g)(1), 1910.134(g)(3), and 1910.134 (h)

Note: This list only contains enforceable regulations related to fire incidents.

Following their investigation, CONN-OSHA determined that the fire department had violated regulations set forth by the Connecticut's Occupational Safety and Health Act. As of January 24, 2011, these citations included:

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

- The employer did not furnish employment and a place of employment which were free from recognized hazards that were causing or likely to cause death or serious physical harm to employees in that the employer did not follow their existing Standard Operating Procedures regarding “Maydays”.
 - The employer did not follow existing Standard Operating Procedures regarding “Maydays” on July 24, 2010.
- 1910.101 (a): The employer did not determine that compressed gas cylinders under his control were in safe condition to the extent that can be determined by visual inspection. Visual and other inspections were not performed as prescribed in the Hazardous Materials Regulation of the Department of Transportation (49 CFR parts 171-179 and 14 CFR part 103). Where those regulations are not applicable, visual and other inspections shall be conducted in accordance with Compressed Gas Association Pamphlets C-6-1968 and C-8-1962, which incorporated by reference.
 - Hydrostatic testing was not performed on all SCBA air cylinders that were worn by fire fighters who perform interior structure firefighting.
- 1910.134(e)(1): Medical evaluations were not provided to employees to determine the employee’s ability to use a respirator, before the employee is fit tested or required to use the respirator in the work place.
 - Employer did not ensure that medical evaluations were performed on employees who wear self containing breathing apparatus (SCBA).
- 1910.134(f)(2): The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested at least annually.
 - Annual fit testing was not performed on fire fighters who wore self contained breathing apparatus while performing interior structure firefighting.
- 1910.134(g)(4)(iii): The employer did not ensure that each employee engaged in interior structural firefighting operations used SCBAs.
 - The employer did not ensure that all fire fighters wore self contained breathing apparatus while performing all aspects of interior structure firefighting on July 24, 2010.

Health, Wellness, and Fit-for-duty Program

In 1999, this fire department suffered a medical line-of-duty death that was investigated by NIOSH.⁴ NIOSH recommendations following that incident included the following:

- Conduct annual medical evaluations of all fire fighters to determine their medical ability to perform duties without presenting a significant risk to the safety and health of themselves and others
- Reduce risk factors for cardiovascular disease and improve cardiovascular capacity by phasing in a mandatory wellness/fitness program for fire fighters
- Perform an autopsy on all on-duty fire fighters whose death may be cardiovascular related.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

In early 2000, the fire department applied for a health and wellness grant that enabled them to purchase physical fitness equipment for all stations and nutritional services for approximately 2 years. At the time of the incident, fire fighters were allowed to work out at their own discretion, but no requirements or programs were established for physical fitness.

The city requires all fire fighter candidates to pass a pre-employment medical evaluation, a physical agility test, and a respirator fit test. The pre-employment medical evaluations are performed by a physician contracted by the city. The evaluation consists of a medical history, a physical examination, blood tests (complete blood count, chemistries, and lipids), urinalysis, spirometry, a resting electrocardiogram (EKG), an exercise stress test, a chest x-ray, a vision test, a hearing test, and a drug screen. Both victims successfully passed their pre-employment medical physicals.

In 2006, the fire department began offering annual medical evaluations conducted by the city's health department. The components of this evaluation are the same as the pre-employment evaluations, minus the exercise stress test, blood test, and urine drug screen. In 2007, some screening tests were added. The additional *mandatory* tests included pulse oximetry, color vision screening, and scoliosis screening. The additional *optional* tests included prostate examination; fecal blood test for colon cancer; and blood tests for diabetes, anemia, and hypercholesterolemia. In 2008, a clinician change in the health department resulted in most fire fighters not receiving their annual medical evaluation for that year, but the medical evaluations were quickly reinstated in 2009. Both victims passed their 2009 medical evaluations. In June 2010, the health department clinician made a recommendation that the fire department's annual physical evaluation meet requirements set forth in National Fire Protection Association (NFPA) 1582 *Standard on Comprehensive Occupational Medical Program for Fire Departments*.⁵

The city does not use the International Association of Fire Fighters/International Association of Fire Chiefs (IAFF/IAFC) Fire Service Joint Labor Management Candidate Physical Ability Test (CPAT) Program, which was developed as a fair and valid evaluation tool to assist in the selection of fire fighters and to ensure that all fire fighter candidates possess the physical ability to complete critical tasks effectively and safely.⁶ *Note: The fire department has been working with city officials to bring such a test to their department. Currently, the State of Connecticut, Commission on Fire Prevention and Control offers the CPAT to interested fire fighter candidates.*

In 2002, Victim #2 passed the city delivered pre-employment physical agility and strength test protocol, which consisted of: (a) torso bend and arm lift, (b) ground ladder climb, (c) stair climb, (d) sit-ups, (e) hose hoist, (f) dummy carry, and (g) dry hose pull, but he was not tested on the ground ladder climb or hose hoist. Hired in 2007, Victim #2 was not required to retake the pre-employment physical agility and strength test that he took in 2002, which made those test result 5 years old at the time of his hiring. Victim #1 was hired in 1994, and no pre-employment physical agility test records were available for Victim #1. At the time of the incident, the fire department did not require fire recruits or members of their department to pass an annual physical agility test.

The fire department annually fit tested (in house) fire department members who were required to wear a respirator or SCBA pursuant to the requirements of OSHA regulation 29 CFR 1910.134.³ *Note:*

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

NIOSH investigators did not confirm if all members of the fire department had received an annual fit test. Both victims successfully completed fit testing in January 2009; they had not received their 2010 fit test by the time of the incident.

Training and Experience

The fire department's training division oversees the department's recruit training program. The length of the training program has changed over the years and, at the time of the incident, was being conducted over a 14 week period. Victim #1 and Victim #2 completed their recruit training programs in 1994 and May 2008, respectively. The current recruit training program includes the following components:

- Orientation
- Fire Fighter I and II Certification (meets State of Connecticut Fire Academy certification requirements and NFPA 1001 *Standard for Fire Fighter Professional Qualifications*⁷)
- Medical Response Technician
- Hazardous Materials First Responder (Awareness and Operational levels)
- Incident Command System (ICS) 100, 200, and 700
- Aircraft Rescue and Firefighting Course
- Confined Space Rescue (Awareness level)
- 2Q (prepares potential fire apparatus operators; designed by the State of Connecticut, Department of Motor Vehicles)
- Physical Fitness Training (begins the 2nd week of recruit training; includes daily basic stretching exercises, walking and an untimed 3 mile run. No documentation is maintained on the progression of the recruit fire fighter's physical fitness level.)

Victim #1 had been with this department for approximately 16 years. Victim #1 was hired in July 1994 as a fire fighter after serving 5 years with another career fire department. He was promoted to the rank of lieutenant in February 2009. He held certifications in Fire Fighter I, Medical Response Technician, Hazardous Materials First Responder (Awareness and Operational levels), and Confined Space Awareness. He completed classes such as ICS 700, Fire Officer, Technical Rescue, and how to escape deadly situations inside burning buildings. He had also completed approximately 340 hours of documented yearly refresher training between 2004 and 2010; these hours included training on topics such as SCBA, safety, personal protective equipment (PPE), fire chemistry, and building construction.

Victim #2 had been with this department for approximately 2 years. Victim #2 was hired in December 2007 as a fire fighter with no prior firefighting experience. He held certifications in Fire Fighter I, Fire Fighter II, and Medical Response Technician. He completed classes such as ICS 100, 200, and 700a. He had also completed approximately 212 hours of documented yearly refresher training between 2009 and 2010; these hours included training on topics such as SCBA, safety, PPE, fire chemistry, and building construction.

The IC, at the time of the incident, had been with this department for approximately 33 years, holding the rank of a battalion chief for the past 5 years. Prior to becoming a battalion chief he held the rank of

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

a captain (9 years), a lieutenant (6 years), pumper/engineer (2 months), and fire fighter (13 years). He held certifications in Fire Fighter I, Medical Response Technician, Hazardous Materials First Responder (Operational level), and Confined Space Awareness. He completed classes such as Engine and Aerial Company Operations, Marine Fire Fighting, RIT, and how to escape deadly situations inside burning buildings. He had also completed documented courses on ICS, strategies and tactics, and command officer training including ICS in 1994 (in house/National Fire Academy), ICS Training in 1997 (in house), Managing Company Tactical Operations – Simulations in 2001 (state fire academy), Strategy and Tactics in 2004 (in house), IS-700 National Incident Management System in 2006 (Federal Emergency Management Agency (FEMA)/Emergency Management Institute), Chief Officers Training in 2006 (third party), ICS 300 in 2007 (FEMA), and ICS 400 in 2008 (state fire academy). *Note: Hours associated with these courses were not included in the IC's training record. Also, this may not constitute a complete list of training completed on ICS, strategies and tactics, and command officer training for the IC.* The IC had also completed approximately 136 hours of documented yearly refresher training between 2004 and 2010; these hours included training on topics such as SCBA, safety, hazardous materials, fire chemistry, and building construction.

Equipment and Personnel

1st Alarm Assignment:

- Engine 3 (E3) with an engineer, two fire fighters, and a captain
- Ladder 5 (L5) with an operator, two fire fighters, and a lieutenant (initial IC)
- Engine 4 (E4) with an engineer, two fire fighters, and a lieutenant
- Rescue 5 (R5) with a driver, three fire fighters (FF1, FF2, FF3), and a captain
- Ladder 11 (L11) with an operator, two fire fighters (FF4 and Victim #2) and a lieutenant (Victim #1)
- Engine 1 (E1) with an engineer, two fire fighters, and a captain
- Engine 7 (E7) as the initial RIT with an engineer, two fire fighters, and a lieutenant
- Battalion 1 (B1) with an aide (BA)

Note: See Diagram 1 for incident scene.

Additional units requested by the IC and/or dispatched to the scene:

- Deputy Chief (DC)
- Incident Safety Officer (ISO)
- Engine 12 (E12) to take over as RIT, with an engineer, two fire fighters, and a lieutenant
- Ambulance 7116 (A7116) with basic life support
- Ambulance 7110 (A7110) with basic life support
- Ambulance 7126 (A7126) with advanced life support

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Personal Protective Equipment

It was reported to NIOSH investigators that both victims entered the structure wearing a full array of personal protective equipment (PPE) and clothing, consisting of turnout gear (coat and pants), helmet, Nomex® hood, gloves, boots, and a SCBA with an integrated personal alert safety system (PASS) device. According to fire fighters interviewed by NIOSH investigators and state police witness statements, Victim #1 was found to be cyanotic with his facepiece suctioned to his face. The fire fighter who discovered Victim #1 did not recall hearing his PASS device alarming. Victim #2 was discovered with his facepiece properly connected to his regulator, but not positioned on his face. Victim #2's PASS device was alarming when he was discovered in the house. Both sets of turnout gear had their heat-resistant outer shells, moisture barriers, and insulating thermal linings present during the incident and documented during the investigation.

Both victims were equipped with handheld radios. The state police investigator reported to NIOSH investigators, during his inspection, that Victim #1's radio was still operable, including the emergency button; however, the radio believed to be Victim #2's was found to be inoperable, even after the batteries were replaced. *Note: NIOSH investigators cannot confirm if Victim #2's handheld radio was operable during the incident, but the radio that was designated for his position on the apparatus was keyed several times on the main dispatch channel while Victim #2 was being removed from the house.*

The victims' SCBAs were secured and retained by the state police investigators. NIOSH investigators were able to photograph and document both SCBAs. Both SCBA cylinders were 30-minute, 4500-psi units. The SCBAs did not appear to be degraded from fire or heat but did show signs of wear and tear. The SCBAs were manufactured in 2008 and found to be certified under the 2007 editions of NFPA 1981 *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services* and NFPA 1982 *Standard on Personal Alert Safety Systems*.^{8,9} Victim #1's SCBA cylinder was manufactured in September 1998 and had a stamped hydrostatic test date on the cylinder of April 2003. Victim #2's SCBA cylinder was manufactured in January 2004 but did not visually appear to have a stamped hydrostatic test date on the cylinder. Therefore, due to applicable DOT standards, it appeared that both SCBA cylinders were due for repeat hydrostatic testing in 2008 and 2009 respectively (every 5 years). The victims' SCBAs were evaluated by the NIOSH National Personal Protective Technology Laboratory (NPPTL) to determine conformity to the NIOSH-approved configuration (see Appendix II). Information contained in the PASS device data logger was also downloaded with assistance from the SCBA manufacturer (see Appendix II). The victims' structural fire fighting gear and PPE were also examined by NPPTL to determine conformity to NFPA voluntary consensus standards. *Note: This evaluation report will be added to this report as Appendix III, when completed.* NIOSH investigators do not believe that the PPE had any direct contribution to the two fire fighter deaths.

The fire department maintains their SCBA equipment and compressed breathing air refill system. The SCBA maintenance shop has manufacturer-certified technicians who work on the SCBAs. In May 2010, the fire department's stationary and mobile air refill system was evaluated by a third party and found to be in compliance with NFPA 1989 *Standard on Breathing Air Quality for Emergency*

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Services Respiratory Protection, 2008 edition,¹⁰ and Compressed Gas Association G-7.1-2004 Grade E standards and regulations.

Structure

Built in the early 1900s, the two-and-half-story house (see Photo 1) was purchased approximately 4 years prior to the incident as a multifamily rental occupancy. One family lived in the 1st floor apartment (approx. 1,300 sq. ft.); a second family lived in the 2nd floor apartment (approx. 1,300 sq. ft.) (See Diagram 2), and the owner occupied the finished half-story or attic space (approx. 700 sq. ft.) (See Diagram 3). The house also contained an unfinished basement (approx. 1,300 sq. ft.). The common front entrance contained access to the 1st floor apartment and a private stairwell, located at the A/D corner of the house, which provided access to the 2nd floor apartment. The house also had a single rear-entry door that provided access to a stairwell that led up to the owner's apartment and had landings to access all the apartments from the rear. According to the owner of the house, smoke detectors were installed within the house about a year prior to the incident. These smoke detectors were installed in every bedroom, in each hallway, and in the stairwells. The house did not have an installed sprinkler system and had been inspected in accordance with Department of Housing and Urban Development Section 8^a guidelines, according to the homeowner. The house was Type V wood frame construction, but, during the initial stages of the fire, was presumed by arriving fire fighters to be balloon-framed due to the era when it was constructed. State fire investigators were able to confirm Type V construction after closer inspection.

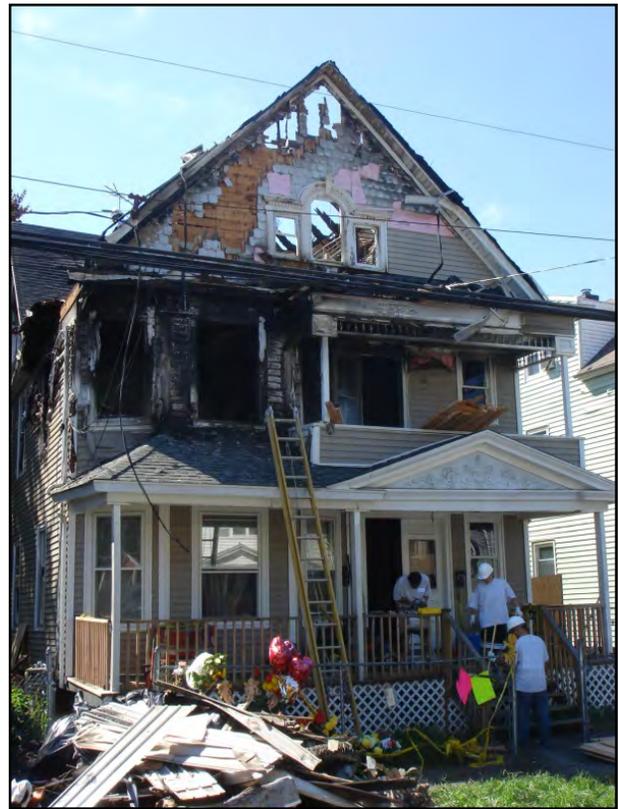


Photo 1. A-side of house during cleanup operations.
(NIOSH photo.)

The Office of the State Fire Marshal's building code compliance inspection showed that the house did not meet certain Connecticut Fire Safety Code requirements for this type of structure. NIOSH investigators do not believe that these non-compliance issues contributed to the deaths of the two fire fighters.

^a Federal assistance provided by the United States Department of Housing and Urban Development. Under the program, the owner(s) of the property receive rent subsidies to assist qualified low-income tenants in paying their rent.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Weather Conditions

The weather on July 24, 2010, was abnormally warm for this area. Temperatures were in the 90s with a heat index above 100°F. Partly cloudy skies and approximate winds of 10 miles per hour from the southwest were observed. Research by the National Institute of Standards and Technology has shown wind speeds on the order of 10 to 20 mph (16 to 32 km/hr) are sufficient to create wind-driven fire conditions in a structure with an uncontrolled flow path.¹¹ The weather caused heat exposure issues for fire fighters. The fire department does not have an emergency incident rehabilitation policy and several fire fighters received medical care on scene by EMS personnel, with some requiring transport to local hospitals for heat-related emergencies. Although water was provided to fire fighters during the incident, no rehab area was established.

Timeline

This timeline is provided to set out, to the extent possible, the sequence of events according to recorded and intelligible radio transmissions. Two channels were used during this incident: the main dispatch channel and channel 2 (fireground). Times are approximate and were obtained from review of the dispatch records, witness interviews, photographs of the scene, and other available information. Times have been rounded to the nearest minute. NIOSH investigators have attempted to include all intelligible radio transmissions, but some may be missing. This timeline is not intended, nor should it be used, as a formal record of events.

- **1544 Hours**
E3 and L5 dispatched to a report of an elevator rescue.
- **1546 Hours**
While en route, E3 contacted the dispatcher on the main dispatch channel and advised them they needed to redirect all companies to a possible house fire.
- **1547 Hours**
L5 copied E3's transmission on the main dispatch channel and redirected to the possible house fire.
E3 advised the dispatcher, on the main dispatch channel, that they had a fire on the 2nd floor and that they did not have a hydrant. *Note: It is unclear whether E3 established command, but L5 arrived just after E3 and established command.*
- **1548 Hours**
E3, E4, E1, E7 as RIT, L11, L5, R5, and B1 were dispatched on the main dispatch channel to the house fire.
- **1549 Hours**
L5 arrived on scene and their officer stated over the main dispatch channel, "2½-story wood frame with heavy fire coming from the 2nd floor, Alpha/Bravo side, L5 is now command."

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

- **1550 Hours**
E7 en route.

- **1551-1552 Hours**
E4 arrived on scene and laid a supply line in from the hydrant.
Over the main dispatch channel, L5 officer (initial arriving IC) advised the dispatcher that the bulk of the fire was knocked down by E3 and the primary search was in progress.
Over the main dispatch channel, the dispatcher advised L11 and E7 which way they should approach the scene.
Over the main dispatch channel, L5 officer requested an ambulance for an injured fire fighter (ankle injury).
Over the main dispatch channel, B1 advised the dispatcher that he was on scene, and he confirmed the first report of heavy fire with the bulk of the fire knocked down. B1 then took command of the incident.

- **1553 Hours**
L11 arrived on scene.
E1 took an additional hydrant.
A7116 dispatched to the incident for an injured fire fighter. *Note: Dispatch of A7116 was not part of the initial fire assignment. The 9-1-1 center contacted the EMS dispatch center via landline to request an ambulance for the injured fire fighter on scene after the request from the L5 officer.*

- **1554 Hours**
Over the main dispatch channel, the BA advised the dispatcher that the command post would be in front of the fire building and tag collection would be at the command post.
On channel 2, E4 officer asked E3 to charge the second hoseline.
E7 (RIT) arrived on scene.

- **1555 Hours**
On channel 2, E4 officer asked E3 again to charge the second hoseline.
Over the main dispatch channel, the IC requested the dispatcher to have the safety officer respond to the incident.
IC checked on the status of the ambulance.
Fire dispatch advised the IC that the ambulance was en route.

- **1556 Hours**
E3 advised the IC (on the main dispatch channel) that he needed hooks on the 2nd floor in the room of origin; the IC acknowledged the request.
Over the main dispatch channel, IC advised all companies, “Channel 2 fireground, channel 2 fireground.” *Note: Up to this point, companies on scene were operating on the main dispatch and channel 2. Fire dispatch assigned fireground operations to channel 2 for the incident.*

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

- **1557-1558 Hours**

IC called L11 on channel 2.

IC (on the main dispatch channel) confirmed with the dispatcher who was RIT (which was E7) on scene and advised them that their equipment was available at the command post.

Victim#1 acknowledged the IC's request for L11 on channel 2, but the IC did not respond.

E3 officer, who incorrectly identified himself as "E4," called command on channel 2 and stated they had a slight extension into the A/B corner. *Note: He was working overtime the day of the incident at the station that houses E3 and E4, which is also his normal duty station.*

The IC copied the E3 officer's transmission on channel 2 and asked him if he had enough hooks available; the E3 officer stated he did.

A7116 arrived on scene.

- **1559 Hours**

E3 officer on channel 2 advised the IC that they needed a hoseline to the 3rd floor because they could not reach it (fire extension) from the 2nd floor.

The IC acknowledged the E3 officer's transmission on channel 2.

The IC, on channel 2, advised Victim #1 that E1 was bringing a hoseline to the 3rd floor.

Victim #1 acknowledged the IC's transmission on channel 2 and advised, "A primary is in progress, which is negative; and, they are still checking for extension."

The IC acknowledged Victim #1's transmission.

- **1600 Hours**

Over the main dispatch channel, the ISO advised the dispatcher that he was responding (from home).

A7116 contacted EMS dispatch requesting a single ambulance to standby at the incident per the IC.

A7110 dispatched and en route to fire to standby.

On channel 2, the IC (at the command post) advised the E4 officer that he could see fire extending up the A/B corner. *Note: NIOSH investigators were not sure if this transmission was meant for the E4 officer or the officer from E3 who identified himself as E4. At 1559 hours, the E3 officer advised the IC of the extension to the 3rd floor.*

On channel 2, the E4 officer advised the IC that he was working on getting a line up to the 3rd floor.

- **1601 Hours**

Over the main dispatch channel, the dispatcher advised the IC that the ISO and DC were responding.

On channel 2, the L5 officer contacted "L5-Alpha" (believed to be L5's aerial ladder) to assist in the bucket; L5-Alpha acknowledged the transmission.

- **1602-1603 Hours**

On channel 2, the IC contacted the L5 officer to verify whether he thought he could make the roof with L5.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

On channel 2, the L5 officer stated that he was sending the driver down to talk to him. R5 officer advised the IC on channel 2 that the primary was negative on the 2nd floor. E4 attempted to contact L5 on channel 2, but was walked-on by R5-Alpha attempting to contact the R5 officer twice. E3 officer advised L5 on channel 2 that they needed to overhaul the porch on the 2nd floor, but he did not think L5 could get to it. L5 officer acknowledged E3 engineer's transmission on channel 2.

- **1604 Hours**

DC en route to the incident.

Over channel 2, R5 called the IC three times (no response).

Over channel 2, the E4 officer called the E3 pump operator twice to shut the fog nozzle hoseline down; the E3 pump operator acknowledged.

Victim #1 called the IC twice on channel 2 (no response).

- **1605 Hours**

Over the main dispatch channel, the IC requested another RIT from the dispatcher.

On channel 2, R5-Alpha advised the R5 officer that the primary above the fire floor (2nd floor) was complete.

On channel 2, the R5 officer attempted to contact the IC (no response).

E4 officer advised the E3 pump operator to recharge the fog nozzle hoseline; the E3 pump operator acknowledged.

- **1606-1607 Hours**

A7110 arrived on scene.

E12 dispatched and responded as the RIT. *Note: At 1604 hours, E12 was en route to the elevator rescue.*

On channel 2, the IC advised Victim #1 that he was getting a second hoseline to the 3rd floor for him. The IC asked Victim #1, "What's the situation up there?"

Victim #1 stated, "We got the line in place, it's charged, we have extension into the attic space..."

The IC then asked for Victim #1 to verify "if" he already had a line in place, but there was no response.

A member of E4 advised the IC that they had, "...line in operation on the number three floor."

A7116 en route to hospital with injured fire fighter.

- **1608 Hours**

R5 contacted the IC on channel 2 and advised him that they had one line in operation and he recommended that the roof be opened. *Note: A Vibralert® could be heard alarming during his transmission.*

IC advised R5 that they were preparing ground ladders to access the roof.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

- **1609 Hours**

E12 (RIT) arrived on scene.

Over the main dispatch channel, IC advised E12 of where the command post and equipment were located.

Victim #1 called command on channel 2 (no response).

IC and E1 personnel had a conversation on channel 2 about supplying water to an additional unit on scene. *Note: Victim #1 keyed his radio prior to and just after this conversation, but no transmissions occurred.*

- **1610-1612 Hours**

L5 officer called R5 on the main dispatch channel (no response).

On the main dispatch channel, the BA advised L5 and all companies to switch to channel 2.

E3 personnel contacted the IC on channel 2 and advised him that they might be able to open it (the roof) from the 2nd floor if they had hooks.

The IC called Victim #1 on channel 2 and was acknowledged, but no further transmissions occurred.

E4 (officer) called the nozzle man down to the 3rd floor. *Note: At this point, the nozzle man may be the driver of R5.*

L5 officer contacted R5 on channel 2.

R5 officer advised the L5 officer that they were operating on the 3rd floor and could not open the roof from there.

The IC attempted to contact Victim #1 on channel 2 (no response).

DC arrived on scene.

ISO arrived on scene.

- **1613 Hours (1st Mayday Call)**

On channel 2, FF2 called R5 (no response). He then called L11 (no response).

L5 officer advised L5-Alpha/Bravo to “come on down.” *Note: L5-Alpha/Bravo is believed to be on the roof.*

On channel 2, Victim #1 stated, “Mayday-Mayday-Mayday, we’re trapped on the rear stairs.”

Note: This transmission was very quick lasting only 3 seconds. A Vibralert, presumed to be Victim’s #1, can be heard alarming during his transmission. Victim #1’s Mayday call was not acknowledged over the radio.

FF2 advised L11 on channel 2, “...fire below you, B-side.”

E1 personnel had a brief conversation on channel 2 regarding water supply.

The IC called L11 on channel 2 (no response).

An unknown fire fighter’s transmission is heard stating, “Negative on that opening, negative on that roof opening.”

The IC called L11 on channel 2 again (no response).

- **1614 Hours**

The IC called E1 on channel 2 (no response).

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

The IC called the L11 officer (Victim #1) on channel 2 (no response).

- **1615 Hours**

On channel 2, the IC stated, “Command to all companies on the 3rd floor, vacate the 3rd floor; I repeat, command to L11 and E1, vacate the 3rd floor.”

- **1616-1619 Hours (2nd Mayday Call)**

The IC attempted to contact L11 again on channel 2 (no response).

The IC, on channel 2, then stated, “Command to E1.”

(1616.50 hours) On channel 2, FF2 stated, “Mayday, Mayday...Rescue 5 Bravo command we have a downed fire fighter rear steps. Mayday-Mayday-Mayday fire fighter down rear steps, 2nd floor.”

IC called L11 again on channel 2 (no response).

FF4 on channel 2 stated, “Ladder 11 irons to Ladder 11” (no response). *Note: An apparatus air horn is heard sounding in the background of this transmission.*

FF2 on channel 2 stated, “Rescue 5 Bravo command, Rescue 5 Bravo command we need help 2nd floor, send the RIT, we need fresh bodies.” *Note: No audio transmissions or emergency tones are heard on channel 2 or the main dispatch channel advising that the Mayday call had been acknowledged.*

DC contacted the IC on channel 2 to have him send the RIT to the rear stairs; the IC acknowledged. *Note: The RIT may have already been advancing up the rear stairs, but they ran into difficulty accessing the 2nd floor landing off the rear stairs because a charged hoseline was against the closed door.*

Dispatch attempted to contact command on channel 2 (no response).

The IC called L11 again on channel 2 (no response).

The DC contacted the IC requesting the ambulance on scene to come to the rear of the house. Victim #1 was extricated out the rear of the house.

- **1620 Hours**

A7110 began medical care for the downed fire fighter (Victim #1).

Over the main dispatch channel, the BA requested an advanced life support ambulance to the fire scene.

A7126 was dispatched to intercept A7110 at the fire scene to provide advanced life support.

(~1620.35 Hours) The following transmission is heard on channel 2, “...Ladder 11 ‘mayday’ (very quick transmission)...Ladder 11 (unintelligible word(s)).” *Note: The dispatch caller ID for this radio is designated as “L-11 FF3,” which was assigned to the fire fighter (designated as FF4 for this report) who later finds Victim #2 (see below 1624 hours). FF4 had not found Victim #2 at the time of this transmission.*

On channel 2, FF4 stated, “Ladder 11 irons to Ladder 11 can” (no response). *Note: “Ladder 11 can” was Victim #2’s designation that shift.*

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

- **1621 Hours**
A7126 en route to fire scene.
- **1622 Hours**
On channel 2, the ISO advised the IC that the fire fighter (Victim #1) was removed and they needed to do a roll call for everyone on scene.
On channel 2, the IC advised all company officers that the “incident is taking a PAR” (personnel accountability report).
Officers began calling in their respective PARs.
- **1624 Hours (3rd and 4th Mayday Calls)**
FF4 on channel 2 stated, “Mayday-Mayday, I have a fire fighter trapped on the 3rd floor, Mayday-Mayday-Mayday 3rd floor.” *Note: This Mayday is for Victim #2. A PASS device is heard alarming during FF4’s transmission.*
On channel 2, the IC stated, “This is command to all companies, vacate the building, I report, command to all companies, vacate the building.”
FF4 on channel 2 stated again, “Mayday-Mayday-Mayday, I’ve got another fire fighter down, another one, 3rd floor, hurry!”
- **1625 Hours**
Over channel 2, the dispatcher stated, “For a Mayday,” and activated the emergency evacuation tones. *Note: It is unknown why the evacuation tones were sounded instead of the Mayday tones. Their evacuation tone is an alternating, high-low sound, similar to a European siren. Their Mayday tone is a rapid, high to low pitch, chirping sound. This was dispatch’s first acknowledgement of a Mayday over the radio. No further radio traffic regarding the Mayday was provided by the dispatcher following the tone activation on channel 2.*
Over the main dispatch channel, the dispatcher stated, “For a Mayday,” and activated the emergency evacuation tones as well. *No further radio traffic regarding the Mayday was provided by the dispatcher following the tone activation on the main dispatch channel.*
- **1626 Hours**
The IC contacted the DC on channel 2. DC acknowledged with no further traffic from the IC.
The IC on channel 2 again advised all companies to vacate the building.
The dispatcher then activated the emergency tones on channel 2 and the main dispatch channel, and stated, “All companies per command vacate the building, all companies vacate the building.”
- **1627 Hours**
The ISO contacted the IC on channel 2 and stated, “We need to make contact with that Mayday, we need more information, we have not heard from them since the initial call.”
On channel 2, the IC stated, “Command to company declaring a Mayday; I repeat, command to the company declaring a Mayday sound off, sound off.”
A fire fighter from the RIT advised the IC on channel 2 that they were moving the fire fighter

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

off the 3rd floor.

On channel 2, the dispatcher advised the IC that the Mayday call was for the 3rd floor. A7126 arrived at the fire scene.

- **1628 Hours**
RIT advised the IC that they have the fire fighter (Victim #2) on the 3rd floor and will be bringing him down the rear stairs from the 3rd floor.
- **1630 Hours**
A7110 en route to the hospital with Victim #1 without assistance from A7126.
- **1632 Hours**
ISO asked for a progress report from the RIT on the Mayday.
RIT replied, “Coming down...3rd floor.”
ISO asked RIT to repeat their traffic.
A radio was keyed, but there was no transmission.
- **1634 Hours**
RIT personnel advised the IC that they had the fire fighter (Victim #2) down to the 2nd floor landing.
- **1640 Hours**
A7110 arrived at local hospital with Victim #1.
- **1643 Hours**
A7126 began medical care on second downed fire fighter (Victim #2). *Note: This time was taken from Victim #2’s patient care report and may not be accurate.*
- **1703 Hours**
A7126 arrived at local hospital with Victim #2.

Investigation

On Saturday, July 24, 2010, at 1544 hours, E3 and L5 were dispatched for a reported elevator rescue. While en route to this incident, personnel on E3 noticed smoke coming from a residential side street and immediately notified dispatch. E3 and L5 diverted to the residential side street. E3 arrived on scene first to find fire showing from the 2nd floor B-side window and smoke showing from the 2nd floor A-side windows (both windows located at the A/B corner). E3 was not able to lay a line into the scene because when they turned onto the residential side street they were unsure of which house was actually on fire. E3 pulled just past the house to allow room for L5 (see Diagram 1). The E3 officer exited E3 and quickly performed a size-up of the fire. The E3 officer felt that the fire could be quickly contained with the 500 gallons of water carried on E3 and the additional personnel arriving on L5. The E3 hydrant man and nozzle man exited the engine and pulled a dry 250-ft, 1¼-inch pre-connected attack

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

line to the 2nd floor landing (see Diagram 4). The E3 officer assisted them in flaking the hose out before joining them on the 2nd floor landing. While this was taking place, L5 arrived on scene, gave a size-up over the radio, and established command for the incident. The E3 nozzle man opened the bail and had no pressure. The E3 officer exited the house and removed kinks in the hoseline with assistance from L5 personnel. The E3 officer returned to the house and noticed that his nozzle man was coming down the 2nd floor stairs in pain. The E3 officer stayed with his hydrant man (who was now on the nozzle) and quickly extinguished the room and contents fire on the 2nd floor. The L5 officer called for an ambulance and took care of the injured fire fighter who apparently had sustained an ankle injury while advancing the charged hoseline toward the fire room.

While E3 operated in the fire room, E4 arrived on scene and laid a 5-inch supply line into E3. R5, L11, L1, E7 (RIT), and BC had arrived or were also arriving on scene. Two L5 fire fighters followed shortly by two R5 fire fighters (driver and FF1) and R5's officer entered the house following E3's hoseline to the 2nd floor, and the L5 operator raised the ladder to the A/B corner of the house. The two L5 fire fighters performed a primary search of the 2nd floor and opened windows as they progressed to the rear stairwell. This stairwell provided them access to the 3rd floor so that they could continue their primary search and check for extension above the fire room. The two L5 fire fighters were met with light smoke conditions and hot temperatures when they reached the 3rd floor (prior to any windows being opened). These two L5 fire fighters recalled radio transmissions from the L5 officer regarding the fire being knocked down and the BC arriving on scene and taking command. As they were walking to pull the baseboards below the windows in the front room (the front room was at the A/B corner, directly above the fire room), personnel from R5 (FF2/FF3) and L11 (Victims #1 and #2 and FF4) entered the 3rd floor, and they assisted L5 with opening windows on the B- and D-sides of the 3rd floor. *Note: Victim #1 received face-to-face orders from the IC to check on extension and ventilation on the 3rd floor. L11 personnel walked through the 1st floor apartment to the rear stairwell, not on air, and then walked up to the 3rd floor where they had to go on air.* Victim #2 assisted with pulling the baseboards in the front room while FF2 and FF3 used a thermal imaging camera to check for hot spots and extension. *Note: FF3 remembered speaking with Victim #1 in the kitchen area on the 3rd floor regarding the hot spots viewed on the thermal imaging camera and recalled hearing Victim #1 relaying the information to command.* Opening the windows on the 3rd floor allowed cross ventilation, which quickly increased visibility on the 3rd floor, but the room was still extremely hot.

The E4 nozzle man and officer pulled the second hoseline from E3 to back-up E3 personnel working on the fire floor. This second hoseline was a 200-ft, 1¾-inch pre-connect with a fog nozzle. The R5 officer, who was paired up with FF1, left the driver of R5 to pull ceilings in the fire room. The R5 officer and FF1 went up to the 3rd floor to check on conditions. The R5 officer recalled bumping into Victims #1 and #2 and FF4 in the front room of the 3rd floor. FF1 then had to exit the 3rd floor because his Vibralert was alarming. *Note: At this time, smoke conditions varied and personnel operating on the 3rd floor may not have been on air.* The R5 officer and Victim #1 had a conversation about the thermal imaging camera (TIC) showing how hot the walls were and how they needed a hoseline. The R5 officer and Victim #1 advised all personnel on the 3rd floor not to open the walls or ceiling until they had a charged hoseline in place. Victim #1 had previously requested a hoseline. *Note: At this point, E7/E1 may have been tasked by the IC with preparing an additional hoseline for the interior,*

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

thus removing E7 from the role of RIT. The IC then notified dispatch that he needed an additional engine company for RIT.

Once the E4 crew made it up to the 2nd floor it was determined that the hoseline was no longer needed in the fire room and the hoseline was redirected to the 3rd floor. This second hoseline only made it to the base of the stairwell that led to the 3rd floor. The E4 officer called for a “spare flake” and the E4 hydrant man and driver retrieved a 100-ft section of hose. This section of hose contained a smooth bore nozzle and a gated wye valve. When they returned with the extra section, the E4 officer ordered the E3 pump operator to shut down his hoseline. The E4 officer then left his crew at the base of the stairs to check conditions on the 3rd floor. The E4 nozzle man, hydrant man, and driver disconnected the fog nozzle from the second hoseline and connected the extra section with the smooth bore nozzle. The E4 officer recalled moderate smoke conditions, which were banked down to about chin level on the 3rd floor. He recalled moving furniture that was located above the fire room with personnel from R5 (FF2 and FF3). *Note: The E4 officer does not recall the whereabouts of Victims #1 and #2.* The two L5 fire fighters, who were operating on the 3rd floor, were ordered down (by the L5 officer) to begin roof ventilation operations. *Note: The IC had observed smoke conditions on the B-side suggesting the roof needed to be vented.* The E4 officer returned to the 2nd floor to assist the nozzle man and hydrant man in flaking and removing kinks from the hoseline before it was advanced to the 3rd floor. While they advanced the dry hoseline up to the 3rd floor, they were passed by R5 personnel (FF2 and FF3 and shortly after, possibly by the R5 officer), who were all exiting to get new air bottles. *Note: While FF2 and FF3 were walking through the 2nd floor to leave, the officer of E3 asked them to assist with checking extension in the fire room. Both were out of air, but many fire fighters interviewed by NIOSH investigators stated that conditions on the 2nd floor did not require them to be on air.* The E4 crew advanced the hoseline approximately 5-7 feet into the 3rd floor with assistance from FF4 and the E1 officer, and then the E4 officer called for the hoseline to be charged. The E4 officer recalled thick, black smoke banked down to just above floor level and the sound of fire around him (no visible fire) just prior to personnel opening the ceiling and walls. Personnel from R5 (driver) and possibly L11 continued opening the ceilings, dropping sheet rock around the hose crew. *Note: The E4 hydrant man recalled fire fighters coming up the stairs as they were operating their hoseline. NIOSH investigators believe this may have been the R5 officer (returning with a fresh air bottle) and possibly personnel from E1 and/or E7.*

The E4 nozzle man did not recall seeing any fire, but a lot of heat was released when the ceiling was opened. Thick black smoke was also released and pushed down to floor level. E4 continued to flow water on the 3rd floor when their nozzle man’s Vibralert began to alarm. He handed the nozzle over to the R5 driver and followed the hoseline out. The E4 officer and hydrant man remained on the hoseline. The R5 officer remembered that when he returned to the 3rd floor, the hoseline stretched by E4 could not reach the A-side of the house, black smoke had completely obscured visibility, and the heat on the 3rd floor had intensified. The R5 officer recalled speaking to someone about getting more lines into the 3rd floor. *Note: The R5 officer does not recall seeing Victims #1 or #2 on the 3rd floor at that time, and FF4 may have been in the process of exiting the 3rd floor to change his air bottle.* Shortly following this, the Vibralert for both the E4 officer and hydrant man started alarming. The E4 officer spoke to two unknown fire fighters and advised them to take the hoseline and back up the fire fighter on the nozzle (driver of R5). The E4 officer and hydrant man exited the house to retrieve fresh

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

air bottles. At some point, the R5 driver left the nozzle on the 3rd floor because his Vibralert was also alarming. He stated that he told 1 or 2 fire fighters that he was leaving the 3rd floor. *Note: NIOSH investigators cannot confirm who he spoke to.* The R5 officer exited the 3rd floor and saw a dry hoseline being flaked out on the 2nd floor, with assistance from FF1. *Note: E7/E1 personnel were working on getting this hoseline into operation.* The R5 officer exited the house and went to the command post to talk with the IC about how bad conditions were. It is unclear if the R5 officer walked to the A-side of the 3rd floor in the area of the front room prior to leaving the 3rd floor. NIOSH investigators cannot account for the exact location of Victims #1 or #2 on the 3rd floor. An E1 fire fighter stated that he operated a hoseline on the 3rd floor by himself (possibly after the R5 driver left) and heard a loud noise, immediately closed the nozzle, and yelled out to see if someone was there. He then left the 3rd floor.

NIOSH investigators believe that Victim #1 and Victim #2 were alone on the 3rd floor when Victim #1 transmitted, “Mayday-Mayday-Mayday, we’re trapped on the rear stairs.” His Mayday, lasting only 3 seconds, was never acknowledged over the radio by the 911 dispatcher(s), the IC, or other personnel on scene. While this was occurring, the dry, second hoseline was placed over the 3rd floor stairwell wall by an E1 fire fighter. FF2, still with FF3 in the fire room, radioed Victim #1 (directly following Victim #1’s Mayday transmission) to let him know that the fire was below him, B-side, but he got no response, so he decided to walk back through the house to the rear stairwell. FF3 exited the house to retrieve a new air bottle. The IC was also attempting to call personnel who were last known to be on the 3rd floor, with no response, which ultimately led to the IC ordering an evacuation. The E12 officer (who took over RIT), the on-call DC, and the ISO who all had just arrived on scene moments before Victim #1’s Mayday all stated they heard what they thought was a faint or muffled Mayday over the radio. The DC walked from his vehicle over to the command post and spoke to the IC and BA regarding the possible Mayday call; they were both unaware of the transmission. The E12 officer also approached the command post and spoke to the IC and DC regarding the Mayday. The IC was unaware of the Mayday transmission and the DC said he wasn’t sure if he heard one. There was no acknowledgement for a Mayday over the radio from the 911 dispatcher(s). *Note: There was no attempt to verify whether a Mayday was transmitted over the radio.* The DC and E12 personnel (RIT) then proceeded to walk down the B-side of the house.

While this was occurring, FF1, who was still on the 2nd floor landing, followed the charged hoseline from E4 to the 3rd floor. He stopped short of the 3rd floor door because he saw the figure of a fire fighter coming toward him in a crouched position. This fire fighter, later identified as Victim #1, leapt from the 3rd floor onto the stairs going down to the 2nd floor, landing on a knee wall separating the ascending and descending sides of the stairwell. FF1 immediately grabbed Victim #1 by his SCBA harness and assisted him over the wall onto the descending stairs. FF1 reported that Victim #1 landed on his feet, facing the sub landing. Victim #1 then turned around and sat down on the stairs, facing the door leading out to the 2nd floor. FF1 looked at him for a few seconds and noticed that his facepiece was still on and no alarms were alarming. FF1 did not feel anything was out of the ordinary so he continued to the 3rd floor. FF1 continued to follow the charged hoseline to the 3rd floor, wondering why the roof had not yet been opened. *Note: Once L5 personnel ascended the roof via a 28-ft ladder positioned on the B-side of the house, they were unable to operate the saw due to heavy smoke conditions emitting from the roof and eaves.* FF1 stated that the smoke was extremely black and thick.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

He told NIOSH investigators that he came upon a fire fighter on the hoseline. FF1 did not have a conversation with this fire fighter; he thought maybe he was on the nozzle or backing the nozzle man up because he heard water spraying toward the A-side (water was being sprayed from the 2nd floor). *Note: NIOSH investigators believe the fire fighter that FF1 came upon was Victim #2. NIOSH investigators cannot place any other fire fighters on the 3rd floor at this time. FF1 does not recall how this fire fighter was positioned.* FF1 then heard the IC call over the radio for the building to be evacuated. FF1 immediately turned around and followed the hoseline out.

While descending the stairs, FF1 came upon Victim #1 still sitting in the same position he had left him, with his facepiece on and no alarms sounding. FF1 nudged Victim #1 and told him they had to evacuate the house. Victim #1 then slumped over. FF1 quickly grabbed him and began pulling him down the stairs to the 2nd floor. Personnel from E7 and E1, who were working on the 2nd floor just off the stairs, quickly assisted FF1. FF2 got to the rear of the 2nd floor and saw that Victim #1 was unconscious and being brought down the stairs by FF1 and personnel from E7 and E1. FF2 immediately called the Mayday for Victim #1. *Note: Approximately, 3 minutes and 30 seconds passed from the time Victim #1 called his Mayday until FF2 called the Mayday for Victim #1.* The RIT (E12) was heading into the backyard when they heard this Mayday transmitted. The DC, who also heard FF2's Mayday call, later alerted the IC to send the RIT to the backyard, but they were already heading up the rear stairs. The IC stated to NIOSH investigators that he did hear this Mayday transmission and he proceeded to the backyard. Dispatch did not acknowledge this Mayday call over the radio, nor were they advised of a Mayday occurring at the incident. The IC was still attempting to contact L11 (Victim #1) after FF2 transmitted the Mayday. FF4 returned to the 2nd floor via the A-side stairwell to see Victim #1 being cared for. FF4, realizing Victim #2 was not with Victim #1, attempted to contact Victim #2 with no response. The RIT immediately assisted with getting Victim #1 down the stairs to receive medical care. *Note: The IC arrived at the backyard when Victim #1 was being carried from the house, so he ran back to the front of the house and alerted EMS personnel on scene.* Once Victim #1 was outside the house, CPR was immediately initiated and an automated external defibrillator was attached. Only basic life support measures were initiated by EMS personnel on scene due to their level of training. FF4 exited out the rear stairwell and began looking for Victim #2 asking several fire fighters if they had seen Victim #2, but no one was sure where he was. It is believed at this point that FF4 made the decision to re-enter the house and search for Victim #2. The ISO advised the IC that they needed a PAR and the IC advised personnel over the radio. At this time, the ISO was requesting a PAR and the IC was notifying personnel that they needed to evacuate the house.

FF4 entered the rear stairwell and went to the 3rd floor (it is unclear if any personnel followed him into the house). He followed a hoseline into the 3rd floor and found Victim #2 apparently lodged between a wall and a piece of furniture (see Diagram 5). Victim #2's PASS device and indicator lights were alarming; he did not have his facepiece on. FF4 stated that he called a Mayday for Victim #2 and then heard evacuation tones over the radio and then air horns from an apparatus. He transmitted a second Mayday because the first one was not acknowledged by dispatch or the IC. Dispatch acknowledged the second Mayday for Victim #2 and set off the evacuation tones (not the Mayday tones), but no further radio traffic from dispatch or the IC confirmed the specifics of the Mayday. The ISO radioed the IC and advised him that they needed additional information on the Mayday that was just called. The RIT and other fire fighters located in the backyard were working on getting to Victim #2 and

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

getting him off the 3rd floor and down the stairs. Many fire fighters at this point had gone through one or even two bottles and were exhausted. The RIT provided the IC with updates on their progress. The RIT recalled Victim #2 being caught between a sofa and a wall on his back with his arms out from his body when they found him (see Diagram 5). Victim #2 may have also been entangled in a hoseline. The RIT removed Victim #2 from the house, CPR was initiated and an automated external defibrillator was attached. Both victims were taken to local hospitals where they were pronounced dead.

NIOSH investigators can only speculate on what occurred on the 3rd floor that led Victim #1 to transmit a Mayday. FF1 stated to NIOSH investigators that he never heard the Mayday transmitted by Victim #1 and believed there were no causes for alarm when he saw Victim #1 exit the 3rd floor. FF1 does not recall hearing Victim #1's PASS device when he exited the 3rd floor or after he slumped over on the stairs. The victims' air packs were designed to go into pre-alarm within 20 seconds (can shake to reset) and then full alarm at 30 seconds (reset button must be used). Victim #1's facepiece was suctioned to his face when he was found. The question still remains why Victim #1 never removed his regulator or facepiece when he sat down on the stairs. It is unknown why Victim #2's facepiece was not positioned on his face. Both SCBA cylinders were empty upon inspection by state police investigators.

Fire Behavior

The room and contents fire was determined to have originated in a bedroom on the 2nd floor, A/B corner; it was quickly knocked down by E3 (see Photo 2). It is believed that the fire got into the eaves when it was lapping out the A/B corner windows, and then spread within the large void spaces in the ceiling and walls of the 3rd floor. The fire was situated toward the A/B corner of the 3rd floor, but the open void areas allowed smoke to accumulate within the ceilings and walls before they were opened.



**Photo 2. Remnants of a mattress and box springs within the room of origin on the 2nd floor.
(NIOSH photo.)**

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Operating on the 3rd floor at varying times were members from L5, R5, L11, E4, and E7. Initially, light-to-moderate smoke conditions were observed on the 3rd floor, depending on how close fire fighters were to the A-side of the 3rd floor. Fire fighters recalled the 3rd floor being very hot. TICs used by different individuals on the 3rd floor showed the room to be hot on the A-side and ceiling. Windows on the A-, B-, and D-sides were opened, allowing most of the smoke to self ventilate. Light smoke remained within the 3rd floor, with good visibility. Extension was checked around A- and B-side baseboards. Some fire fighters recall Victim #1 telling them the fire was in the ceiling and possibly the walls, and to not open those areas until a hoseline was in place. Even after providing horizontal ventilation on the 3rd floor, smoke conditions worsened, banking down to fire fighters' chin levels and becoming denser. While waiting for the hoseline, L5 members were reassigned by the IC to ventilate the roof to provide additional relief to the 3rd floor. The IC reported to NIOSH investigators that he ordered the roof vented because he saw smoke pushing out the B-side windows. Personnel from E4 advanced the charged hoseline to the 3rd floor, allowing the ceilings and walls to be opened. A mixture of thick, brown/black smoke quickly filled the room, reducing visibility. Photos 3-10 show conditions at the scene leading up to the first Mayday and then during the second Mayday.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut



Photo 3. Initial conditions observed when the BC arrived on scene at approximately 1551 hours.
Note: Fire was under control on the 2nd floor and fire fighters were checking for extension. White-to-gray smoke can be seen flowing in the direction of right to left from the gables. The A-side window on the 3rd floor had been opened for ventilation (unsure at what stage of the fire or by whom).
(Photo courtesy of fire department.)

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut



Photo 4. Conditions observed at 1608 hours by an off-duty fire fighter. *Note: Smoke had changed to gray and brown in color and was emitting from the eaves and A- and D-side windows which were manually opened by personnel working on the 3rd floor. A hoseline was being stretched to the 3rd floor.*

(Photo courtesy of Keith Muratori.)

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut



Photo 5. Conditions at approximately 1609 hours. *Note: L5 personnel were preparing to ascend the ladder placed on the B-side of the house. The IC (white helmet) is observing the scene. Smoke seen coming from the 3rd floor B-side double window and pushing from the eaves. At this time, ceiling and walls were likely being opened on the 3rd floor, and water would have been available.*
(Photo courtesy of fire department.)

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut



Photo 6. Conditions at approximately 1611 hours. *Note: L5 personnel were ascending the roof from the ground ladder on the B-side. Smoke color was still gray to brown in color and was becoming denser. Personnel were still working on the 3rd floor. Wind direction was right to left.*
(Photo courtesy of Keith Muratori.)

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut



Photo 7. Conditions at approximately 1613 hours. *Note: L5 personnel were on the peak of the roof and having difficulty starting the roof saw. Smoke was denser than before and pushing from the roof and eaves. The fire fighters were unable to vent the roof. NIOSH investigators believe that Victim #1 transmitted his Mayday about this time.*
(Photo courtesy of Keith Muratori.)

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut



Photo 8. Conditions at approximately 1616 hours. *Note: View from the A/D corner, scene conditions very close to when FF2 discovered FF1 pulling Victim #1 off the 3rd floor stairs. White and gray smoke can be seen flowing from the A-side window and eaves while brown smoke flowed from the D-side window.*

(Photo courtesy of Keith Muratori.)

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut



Photo 9. Mayday for Victim #1, called by FF2. Note: RIT personnel from E12 are seen heading to the rear of the house. L5 personnel were descending the roof via the B-side ground ladder. Fire is seen burning along the roof line above the A/B corner. Gray, dense smoke was flowing from the 3rd floor B-side double window and A-side window.
(Photo courtesy of Keith Muratori.)

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut



Photo 10. Fire vented through the roof. *Note: NIOSH investigators believe this photo shows conditions very close to the time that the Mayday was called for Victim #2 by FF4. Wind was pushing the smoke plume from right to left.*
(Photo courtesy of Keith Muratori.)

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:

- *Failure to effectively monitor and respond to Mayday transmissions*
- *Less than effective Mayday procedures and training*
- *Inadequate air management*
- *Removal and/or dislodgement of self-contained breathing apparatus (SCBA) facepiece*
- *Incident safety officer (ISO) and rapid intervention team (RIT) not readily available on scene*

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

- Possible underlying medical condition(s) (coronary artery disease)
- Command, control, and accountability.

Cause of Death and Injuries

Autopsies were conducted by the state medical examiner on both victims. Significant findings for Victim #1 included a focally severe occlusive coronary atherosclerosis ($\geq 95\%$ blockage) of his right coronary artery, 4 centimeters distal from its origin, and a carboxyhemoglobin (COHb) level of 4%, suggesting only minimal carbon monoxide exposure. His cause of death was listed as “asphyxia associated with smoke inhalation and exposure to fire.” Significant autopsy findings for Victim #2 include patchy severe atherosclerosis, producing approximately 80% occlusion of the left anterior descending coronary artery and up to 60% occlusion of the mid-portion of the right coronary artery, and a COHb level of 44% (a level consistent with fatal carbon monoxide poisoning). His cause of death was listed as “smoke inhalation with other significant condition(s) of coronary atherosclerosis.”

In addition to the deaths of the two fire fighters, the fire fighter from E3 suffered a broken ankle while advancing the hoseline, and numerous fire fighters suffered heat-related illnesses with 5 or 6 requiring transport to local hospitals.

Recommendations

Recommendation #1: Fire departments and dispatch centers should ensure that radio transmissions are effectively monitored and quickly acted upon, especially when a Mayday is called.

Discussion: Fireground communications can become very hectic and confusing when a fire fighter is in distress, becomes lost, or is trapped. Fire departments and dispatch centers need to be able to effectively monitor radio transmissions (e.g., Maydays) while on the fireground and within a dispatch center. A Mayday procedure can outline the fireground response plan and duties of fire fighters, officers, the dispatch center, and the IC. This will help reduce any confusion during the Mayday.

The term “Mayday” is the international distress signal. Fire fighters must act promptly when they become lost, disoriented, injured, low on air, or trapped.¹²⁻¹⁷ They should announce “Mayday-Mayday-Mayday” over the radio and manually activate their PASS device. A transmission of the Mayday situation should be followed by the last known location of the fire fighter, and if able, the individual’s identifier, such as “E3 pump.” A crew member who suspects a fire fighter(s) is in trouble or missing should quickly try to communicate with the fire fighter(s) via radio and, if unsuccessful, initiate a Mayday providing relevant information.

An emergency radio transmission reporting a “Mayday” is the highest priority transmission that may occur at any incident and should receive precedence from dispatch, the IC, and other units operating at the incident. When this emergency traffic is initiated, all other radio traffic should stop to clear the channel and allow the message to be heard. Mayday transmissions must always be acknowledged and immediate action taken. The IC must either personally handle the situation or designate another officer to do so. Part of “handling” a Mayday is to communicate with the fire fighter(s) in distress and with

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

any other fire fighters or officers involved. The sooner the IC is notified and a RIT is activated, the greater the chance of the fire fighter being rescued. If there is any question that a Mayday may have been transmitted and heard by someone (not all), it should also receive priority in verifying if it were a Mayday transmission. The IC should be made aware of this immediately, so that he can attempt to contact the potential individual who transmitted the Mayday or contact dispatch to verify the transmission. A possible Mayday transmission should never be overlooked.

During this incident, the IC had to monitor two different radio channels by using two different handheld radios. His BA also assisted in monitoring the two radio channels. At times, radio transmissions on one channel were missed or unanswered because the IC was transmitting on the opposite channel. The DC and officer of E12 all thought they heard what sounded like a Mayday (transmitted from Victim #1), and a face to face discussion occurred among them and the IC, but this possible Mayday transmission was not confirmed with dispatch, nor, at the time, the unknown fire fighter that transmitted it.

This fire department had established a Mayday procedure within the department that was practiced routinely with the communications center, but this routine radio check did not test fire fighter or dispatcher competencies in the Mayday procedure, or the ability of an IC to manage a Mayday incident. Weekly, dispatch would select a company and radio channel to practice the Mayday procedure. The dispatchers followed a procedure at a scheduled day and time, instead of having an unannounced Mayday called. The challenge for fire departments is providing realistic, safe training that accurately simulates fire conditions, but it is absolutely necessary that the Mayday training place fire fighters in positions that closely simulate an actual fire to realistically exercise one's Mayday skills.¹⁷ In this incident, Mayday transmissions were missed and not acknowledged. It is not known why the dispatch center did not hear or acknowledge the Maydays or why the Mayday tone was not used appropriately.

Fire departments should be aware of the recently released 2010 International Association of Fire Chiefs' (IAFC) *Rules of Engagement (ROE) of Structural Firefighting*.¹⁸ These guidelines recommend that fire fighters constantly monitor fireground communications for critical radio reports and declare a Mayday as soon as they are in danger. Although not addressed by the IAFC ROE, ICs and dispatch centers should also be constantly monitoring fireground communications for critical radio reports.

Also, the IAFF *Fire Ground Survival* program was developed to ensure that training for Mayday prevention and Mayday operations are consistent between all fire fighters, company officers, and chief officers.¹⁷

Recommendation #2: Fire departments should ensure that Mayday training program(s) and department procedures adequately prepare fire fighters to call a Mayday.

Discussion: The first and foremost priority for fire fighter safety is not getting oneself into a situation that could potentially cause injury or death. The fire fighter needs to maintain situational awareness at all times while operating on the fireground. Knowledge and skill training on how to prevent a Mayday

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

situation or how to call a Mayday should begin and be mastered before a fire fighter engages in fireground activities or other immediately dangerous to life and health (IDLH) environments. Beginner fire fighter training programs should include training on such topics as: air management; familiarity with an SCBA, a radio, or PPE; crew integrity; reading smoke, fire dynamics and behavior; entanglement hazards; building construction, and signs of pending structural collapse. If a fire fighter does find themselves in a questionable position (dangerous or not), they must be able to recognize this and be trained on procedures for when and how a Mayday should be called. A fire fighter's knowledge, skill, and ability to declare a Mayday must be at the mastery level of performance. This performance level should be maintained throughout their career through training offered more frequently than annually.¹⁷

In this incident, the fire department's Mayday SOP stated, "Whenever any member is in a situation that they believe to be life-threatening and unable to escape from, they will transmit a Mayday." Fire departments need to understand that each fire fighter may have a different interpretation of what is life-threatening. The ability of a fire fighter to call a Mayday is a complicated behavior that includes the affective, cognitive, and psychomotor domains of learning and performance.¹⁹ Any delay in calling a Mayday reduces the chance of survival and increases the risk to other fire fighters trying to rescue the downed fire fighter. This incident illustrates the need for fire fighters to be given specific Mayday procedures for when a Mayday must be called.

There are no rules on when a fire fighter must call a Mayday, and Mayday training is not included in NFPA fire fighter 1 or 2 standards.⁷ It is up to each authority having jurisdiction to develop rules and performance standards for a fire fighter to call a Mayday. The National Fire Academy Mayday courses present specific Mayday parameters or rules for when a fire fighter must call a Mayday. The courses may help fire departments in developing and teaching Mayday procedures for fire fighters.

The National Fire Academy has two courses addressing the fire fighter Mayday Doctrine, Q133 *Firefighter Safety: Calling the Mayday*, which is a 2-hour program covering the cognitive and affective learning domain of the fire fighter Mayday Doctrine; and, H134 *Calling the Mayday: Hands-on Training* which is an 8-hour course that covers the psychomotor learning domain of the fire fighter Mayday Doctrine. These courses are based on the military methodology used to develop and teach fighter pilots ejection doctrine. A training CD is available to fire departments free of charge from the U.S. Fire Administration Publications office.¹⁹⁻²⁰

Also, the IAFF *Fire Ground Survival* program is another resource fire departments can use and was developed to ensure that training for Mayday prevention and Mayday operations are consistent between all fire fighters, company officers, and chief officers.¹⁷

Recommendation #3: Fire departments should train fire fighters in air management techniques to ensure they receive the maximum benefit from their SCBA.

Discussion: It is dangerous for fire fighters to attempt to conserve air by intermittently removing their facepieces and taking a quick breath of ambient air. SCBA air cylinders contain a finite volume of air,

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

regardless of the size. Air consumption will vary with each individual's physical condition, their level of training, the task(s) being performed, and the environment. Working within structures requires that fire fighters be cognizant of the distance and the time required to reach the point of suppression activity from the point of entry/egress. When conditions deteriorate and visibility becomes limited, fire fighters may find that it takes additional time to exit when compared to the time it took to enter the structure.^{13,20} Depending on the individual's air consumption and the amount of time required to exit an IDLH environment, the low-air alarm may not provide adequate time to exit.

Air management techniques should be a regular part of fire fighters' training. NFPA 1404 *Standard for Fire Service Respiratory Protection Training*,²¹ Paragraph 5.1.4(2), requires fire departments to train fire fighters on air management techniques so that the individual fire fighter will develop the ability to manage air consumption while wearing a SCBA. NFPA 1404 A.5.1.4(2) specifies that the individual air management program should include the following directives: (1) fire fighters should exit an IDLH atmosphere before consumption of reserve air supply begins, (2) the low-air alarm is notification that the individual is consuming the reserve air supply, and (3) the fire fighter and his/her crew should take immediate action when a crew member's reserve air alarm is activated.

Fire departments should regularly conduct training exercises in which fire fighters perform various exercises and work tasks at different work rates until their SCBA cylinder air is exhausted. With this type of training, fire fighters will understand the length of time they can expect to work before the low-air alarm sounds and how long they have to exit once the alarm sounds. In order to comply with NFPA 1404, fire departments and fire fighters should follow the rule of air management which states, "Know how much air you have in your SCBA and manage that air so that you leave the hazardous environment before your low-air alarm activates."^{22,23} By being aware of these time parameters, fire fighters can make educated decisions on the time they can safely spend in IDLH atmospheres.

Prior to the Mayday issued by Victim #1, many fire fighters working on the 3rd floor had exited to change their air bottles, including members of the victims' crew. Both victims' SCBA cylinders were found to be depleted when they were found.

Fire departments should be aware of the recently released 2010 International Association of Fire Chiefs' (IAFC) *Rules of Engagement (ROE) of Structural Firefighting*.¹⁸ These guidelines recommend that fire fighters maintain awareness of their air supply, situation, location and fire conditions.

Recommendation #4: Fire departments should ensure that fire fighters use their SCBA during all stages of a fire and are trained in SCBA emergency procedures.

Discussion: Fire departments should adopt a zero tolerance response to all department members who only use an SCBA during interior firefighting. Non-visible fire does not mean "no hazard for fire fighters." Fire fighters are often tasked to operate within environments which pose inhalation hazards (e.g., toxic smoke and oxygen deficiency),²⁴ defined by the Occupational Safety and Health Administration (OSHA) as IDLH. OSHA 29 CFR 1910.134 (g)(4)(iii) states, "The employer shall ensure that all employees engaged in interior structural firefighting use SCBAs."³ NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program* states, "When engaged in any

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

operation where they could encounter atmospheres that are immediately dangerous to life or health (IDLH) or potentially IDLH, or where the atmosphere is unknown, the fire department shall provide and require all members to use SCBA that has been certified as being compliant with NFPA 1981 *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services.*^{8, 25} NFPA 1500 Section 7.9.8 restricts fire fighters from removing their facepieces anytime while operating in an IDLH or potentially IDLH atmosphere.

Fire fighters must understand that as temperatures increase in the initial stages of a fire, plastics begin to give off large quantities of various gases. This is called quantitative decomposition, and it happens long before materials reach their ignition temperatures.²⁶ The two principal toxins in smoke—carbon monoxide and hydrogen cyanide—act to deprive the brain of oxygen, and their effects would be enhanced due to the lower levels of oxygen in the air.²⁷ Hydrogen cyanide is a colorless, odorless gas that is released from plastics, natural and synthetic building components, and household items like carpet fibers and polyurethane foam cushions—all of which were present in the structure. Symptoms of hydrogen cyanide exposure include confusion, involuntary muscle movement, vertigo, shortness of breath, or coma.²⁸ Also, carbon monoxide, a by-product of incomplete combustion, can be present before fire fighters visualize fire, and its exposure will present in the same manner as hydrogen cyanide. Even if nothing but carbon dioxide, water vapor, and nitrogen were present in the fire products, and these were to mix with the air being breathed by a fire fighter, then the oxygen percentage would be reduced below the normal 21%. At 15% oxygen, fire fighters can experience lethargy, poor coordination, and confused thinking. During this incident, there were multiple instances where fire fighters inside the structure and on the roof operated without donning an SCBA and/or their facepiece in moderate to heavy smoke conditions.

Emergencies created by, or associated with, the use of an SCBA can be overcome in several ways. Fire departments should develop and implement a comprehensive respiratory protection program²¹ that includes fire fighter fitness, training, and competency and skill assessments in SCBA and emergency procedures. Fire fighters should remember the first rule in any emergency situation—do not panic. Panic causes an increased breathing rate, which causes an increase in air consumption and an inability to focus on emergency procedures. Removing one's facepiece in an IDLH atmosphere can immediately expose the respiratory system to a potentially fatal environment, thus incapacitating an individual. Choosing to leave one's SCBA facepiece on may be the best chance in providing additional time for a fire fighter to be rescued. Fire fighters should follow their department's SOPs regarding emergency SCBA procedures and emergency communications. Fire departments who do not have written procedures on SCBA use should develop and enforce them. Proper training along with an implemented and enforced policy or procedure will assist fire fighters with proper maintenance, use, and removal of an SCBA.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Recommendation #5: Fire departments should ensure that a separate incident safety officer (ISO), independent from the incident commander, is appointed at each structure fire with the initial dispatch.

Discussion: According to NFPA 1561 *Standard on Emergency Services Incident Management System*,²⁹ “The incident commander shall have overall authority for management of the incident and the incident commander shall ensure that adequate safety measures are in place.” This shall include overall responsibility for the safety and health of all personnel and for other persons operating within the incident management system. While the incident commander is in overall command at the scene, certain functions must be delegated to ensure adequate scene management is accomplished.²⁹ According to NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program*,²⁵ “as incidents escalate in size and complexity, the incident commander shall divide the incident into tactical-level management units and assign an incident safety officer (ISO) to assess the incident scene for hazards or potential hazards.” These standards indicate that the incident commander is in overall command at the scene but acknowledge that oversight of all operations is difficult. Although, the presence of a safety officer does not diminish the responsibility of individual fire fighters and fire officers for their own safety and the safety of others, on-scene fire fighter health and safety is best preserved by delegating the function of safety and health oversight to the ISO.

NFPA 1521 *Standard for Fire Department Safety Officer* defines the role of the ISO at an incident scene and identifies duties such as recon of the fireground and reporting pertinent information back to the incident commander; ensuring the department’s accountability system is in place and operational; monitoring radio transmissions and identifying barriers to effective communications; and ensuring established safety zones, collapse zones, hot zones, and other designated hazard areas are communicated to all members on scene.³⁰ The ISO adds a higher level of attention and particular expertise in analyzing safety hazards, building construction, fire conditions and in the particular uses and/or limitations of protective equipment, which will help fire fighters and fire officers.³¹ Larger fire departments may assign one or more full-time staff officers as safety officers who respond to working fires. In smaller departments, every officer should be prepared to function as the ISO when assigned by the incident commander. When the designated ISO is not immediately dispatched or available at the scene, the IC should appoint an ISO. Line officers should receive sufficient training to act as an ISO where needed, until the designated ISO arrives on scene. This will ensure the presence of an ISO on the fireground at all times. The ISO should also be added to the first alarm of a reported fire and for additional incidents that the fire department sees necessary.

Additionally, the incident commander relies upon fire fighters and the ISO to relay feedback on fireground conditions in order to make timely, informed decisions regarding risk versus gain and offensive-versus-defensive operations. The safety of all personnel on the fireground is directly impacted by clear, concise, and timely communications among mutual aid fire departments, sector command, the ISO, and the incident commander.

During this incident, the ISO was not part of the initial dispatch, arriving more than 20 minutes after the initial dispatch, because the incident occurred after hours, which required the on-call ISO to be requested for his assistance.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Recommendation #6: Fire departments should ensure that a rapid intervention team (RIT) is readily available and prepared to respond to fire fighter emergencies.

Discussion: A RIT should be designated and available to respond before interior attack operations begin and throughout the duration of the incident. The team should report to the IC and be available within the incident's staging area. When standing by, the RIT should monitor radio traffic and size up the incident, but not assist in regular fire fighting activities. NFPA 1500, section 8.8.7 states, "At least one dedicated RIT shall be standing by with equipment to provide for the rescue of members that are performing special operations or for members that are in positions that present an immediate danger of injury in the event of equipment failure or collapse."²⁵ The RIT should have all tools necessary to complete the job, e.g., search and rescue ropes, Halligan bar and flat-head axe combo, first-aid kit, and resuscitation equipment.³² These teams can intervene quickly to rescue a fire fighter who is running out of breathing air, disoriented, lost in smoke-filled environments, trapped by fire, or involved in structural collapse.²⁵

During this incident, E7 who was originally assigned as the RIT, was placed in an operational role prior to E12 being available and staged at the command post to take over RIT duties. Conditions at an incident scene can change at any time and not having an available RIT to assist in monitoring radio traffic and respond to those potential emergencies could be detrimental.

Fire departments should be aware of the recently released 2010 International Association of Fire Chiefs' (IAFC) Rules of Engagement (ROE) of Structural Firefighting. These guidelines recommend that ICs always have a rapid intervention team in place at all working fires.¹⁸

Recommendation #7: Fire departments should consider adopting a comprehensive wellness and fitness program, provide annual medical evaluations consistent with NFPA standards, and perform annual physical performance (physical ability) evaluations for all fire fighters.

Discussion: The degree to which the victims' medical conditions contributed to their deaths is not certain. However, NIOSH investigators believe that the adoption of a comprehensive wellness and fitness program, annual medical evaluations, and annual physical ability evaluations have merit and should be considered by all fire departments. Such programs have the potential to provide early detection and/or reduction of risk factors associated with cardiovascular disease. Worksite health promotion programs have been shown to increase productivity, reduce absenteeism, and reduce the number of work-related injuries and lost work days.³³⁻³⁴ Fire service health promotion programs have been shown to reduce coronary artery disease risk factors and improve fitness levels, with mandatory programs showing the most benefit.³⁵⁻³⁷ The cost effectiveness of these health promotion programs was reported in a study conducted by the Oregon Health and Science University, which reported a savings of more than \$1 million for each of four large fire departments implementing the IAFF/IAFC wellness/fitness program compared to four large fire departments not implementing a program. These savings were primarily due to a reduction of occupational injury/illness claims with additional savings expected from reduced future nonoccupational healthcare costs.³⁸

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Guidance for fire department wellness/fitness programs to reduce risk factors for cardiovascular disease and improve cardiovascular capacity is found in NFPA 1583 *Standard on Health-Related Fitness Programs for Fire Fighters*, the IAFF/IAFC Fire Service Joint Labor Management Wellness/Fitness Initiative, the National Volunteer Fire Council's Health and Wellness Guide, and in *Firefighter Fitness: A Health and Wellness Guide*.³⁹⁻⁴²

Guidance regarding the content and frequency of annual medical evaluations can be found in NFPA 1582 *Standard on Comprehensive Occupational Medical Program for Fire Departments* and in the IAFF/IAFC Fire Service Joint Labor Management Wellness/Fitness Initiative.^{5,40} These guidelines help to determine fire fighters' medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.

NFPA 1500 recommends that fire department members who engage in emergency operations be annually evaluated and certified by the fire department as having met the physical performance requirements identified in paragraph 10.2.3 of the standard.²⁵ This is recommended to ensure fire fighters are physically capable of performing the essential job tasks of structural fire fighting. The physical ability test could be performed as part of the fire department's annual training program.

Recommendation #8: Fire departments should ensure that accountability is maintained and that fire fighters maintain crew integrity when operating on the fireground, especially when performing interior fire suppression activities.

Discussion: The use of an accountability system is recommended by NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program* and NFPA 1561 *Standard on Emergency Services Incident Management System*.^{25,29} A functional personnel accountability system requires the following:

- Development of a departmental SOP
- Training all personnel
- Strict enforcement during emergency incidents

As the incident escalates, additional staffing and resources may be needed, adding to the burden of tracking personnel. At this point, an accountability system should be in place which includes an incident command board that is established and maintained by an assigned accountability officer or aide. A properly maintained incident command board allows the IC to readily identify the location and time of all fire fighters on the fireground. As a fire escalates and additional fire companies respond, a chief's aide or accountability officer assists the IC with accounting for all fire fighting companies at the fire, at the staging area, and at the rehabilitation area. A properly initiated and enforced accountability system on every response, which is consistently integrated into fireground command and control, enhances fire fighter safety and survival by helping to ensure a more timely and successful identification and rescue of a disoriented or downed fire fighter.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Fire fighters should always work and remain in teams whenever they are operating in a hazardous environment.³² Team integrity depends on team members knowing who is on their team and who is the team leader; staying within visual contact at all times (if visibility is low, teams must stay within touch or voice distance of each other); communicating needs and observations to the team leader; and rotating together for team rehab, team staging, and watching out for each other (e.g., practicing a strong buddy system). Following these basic rules helps prevent serious injury or even death by providing personnel with the added safety net of fellow team members. Teams that enter a hazardous environment together should leave together to ensure that team continuity is maintained.⁴³

Fire departments should be aware of the recently released 2010 International Association of Fire Chiefs' (IAFC) *Rules of Engagement (ROE) of Structural Firefighting*.¹⁸ The 2010 IAFC *ROE of Structural Firefighting* states, "Go in together, stay together, come out together."¹⁸ These guidelines also recommend that the IC ensure accurate accountability of every fire fighter's location and status.

Recommendation #9: Fire departments should formulate and institute a heat stress program and a rehabilitation (rehab) program in accordance with NFPA 1584 Standard on the Rehabilitation Process for Members during Emergency Operations and Training Exercises.

Discussion: Emergency medical care and transportation for injured or ill fire fighters should be immediately available on the scene of working structure fires. In order for this to occur, EMS should be included on the first alarm of fire incidents and additional incidents that a fire department feels necessary. Several fire fighters experienced and were treated for heat-related illnesses at this incident. Heat stress is the exposure to heat loads. Sources of heat include the metabolic cost of work, environmental factors (i.e., air temperature, humidity, air movement, and radiant heat exchange), and clothing.³² Heat strain is the overall physiological response resulting from heat stress.⁴⁴ Sudden and severe fatigue, nausea, dizziness, or lightheadedness are symptoms of heat strain and should trigger removal from heat sources. Some common heat-related disorders include heat syncope, dehydration and loss of electrolytes, heat exhaustion, and heat stroke. Heat-related disorders vary in degree of severity, although all but heat stroke resolve with no lasting complications.⁴⁴

The prime objective of heat stress management is the prevention of heat stroke which is life-threatening and the most serious of the heat-related disorders.⁴⁴ The key to managing heat stress is to be familiar with controls used to prevent it and minimize its effect. As recommended by the U.S. Fire Administration's document *Emergency Incident Rehabilitation*, controls for heat stress include (1) fluid intake, (2) work rotation, (3) active cooling, and (4) rest.⁴⁴ Most heat stress illnesses are due, in major part, to a failure to maintain adequate hydration. When dehydrated, the body's ability to thermoregulate is impaired.⁴⁵ Sweating and excreting fluids faster than the body can absorb new fluids is physiologically possible. The likelihood and severity of heat strain experienced by an individual for a given level of heat stress depends on the physiological capacity of that individual to respond to stress.⁴⁴ Over time, humans have the ability to adapt and become more proficient in handling extreme environmental conditions (acclimatization). Personal risk factors such as age, obesity, state of hydration, use of medications and drugs, gender, and state of acclimatization may reduce an individual's tolerance for heat stress.⁴⁴

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

An IC should consider the circumstances of each incident in determining the need for rehabilitation.²⁵ A rehab area should be located sufficiently away from the operation so that members can safely remove their PPE and SCBA, be staffed to include at least basic life support (for medical monitoring of heart rate, blood pressure, temperature, and perceived exertion) and have fluid and food available.⁴⁶ An SOP/SOG should be written that outlines a systematic approach for rehab at incidents and include rehab operations that consider hot weather conditions (i.e., temperature, relative humidity, and direct sunlight) and who will be assigned rehab duties for the incident.

Fire departments should be aware of the recently released 2010 International Association of Fire Chiefs' (IAFC) *Rules of Engagement (ROE) of Structural Firefighting*.¹⁸ These guidelines recommend that ICS always have fire fighter rehab services in place at all working fires.

Recommendation #10: Fire departments should ensure that policies and procedures for proper inspection, use, and maintenance of SCBA are followed to ensure they function properly when needed.

NFPA 1981 *Standard on Open-Circuit Self-Contained Breathing Apparatus for Emergency Services* and NFPA 1852 *Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus* speak directly to the maintenance and use of self-contained breathing apparatus.^{8,47} The fire department has established a preventative maintenance program for their SCBAs. Annual maintenance, testing, and repairs require an individual to receive specialized training from factory-certified technicians and to perform required tasks as outlined by the manufacturer. This requires special tools, equipment, and knowledge to take apart the components of a SCBA, which are normally not available to a fire department. Daily, weekly, and or monthly inspections of a SCBA needs to be documented to include items like air cylinder and remote pressure gauge readings, general state of SCBA components and face piece, PASS device actuation, and regulator flow test and hydrostatic tests. A documented inspection can catch minor issues before they result in a SCBA malfunction or failure.

During this incident, it was discovered that both victims' SCBA cylinders did not have a current hydrostatic test date. Victim #1's SCBA end of service alarm did not actuate when it was supposed to (1,035 to 1,215 psig or 23% to 27% of full pressure). Additional information on the SCBA evaluations can be found within Appendix II.

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Investigator Information

This incident was investigated by Stacy C. Wertman and Virginia Lutz, safety and occupational health specialists, with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH located in Morgantown, WV. This report was authored by Stacy C. Wertman, MS, ISO. Tom Pouchot, NIOSH General Engineer, National Personal Protective Technology Laboratory, conducted an evaluation of the victim's SCBA. An expert technical review was provided by Deputy Fire Chief William Goldfeder of the Loveland-Symmes (OH) Fire Department and editor of FireFighterCloseCalls.com and Dr. Burton A. Clark, EFO, CFO, Chair, Management Science Program, National Fire Academy, U.S. Fire Administration. A technical review was also provided by the National Fire Protection Association, Public Fire Protection Division.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

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IAFF Fire Ground Survival Program

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

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A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

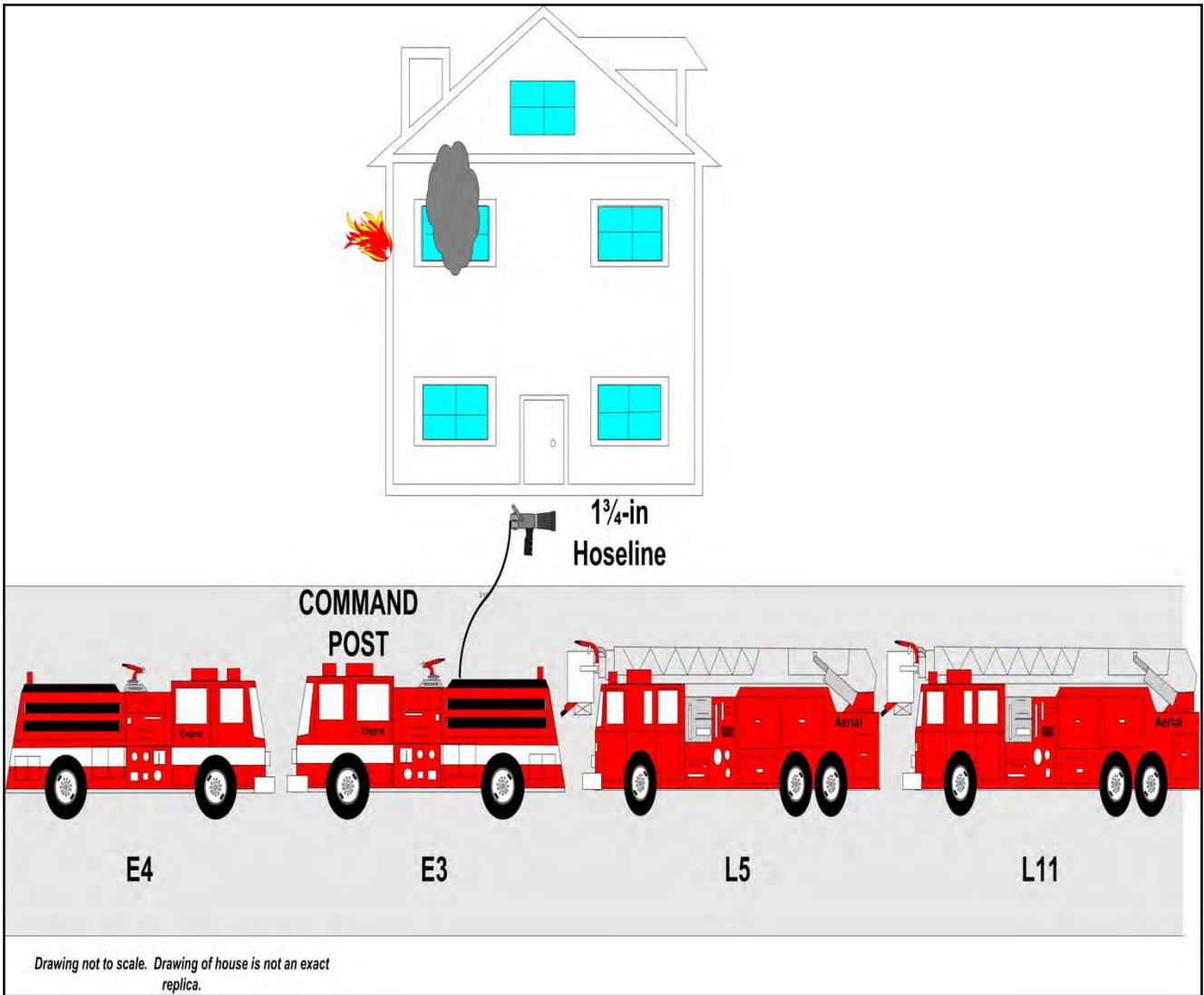


Diagram 1. Initial conditions and fire apparatus on scene. *Note: E4 and L11 arrived on scene after the initial room and contents fire was brought under control.*

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

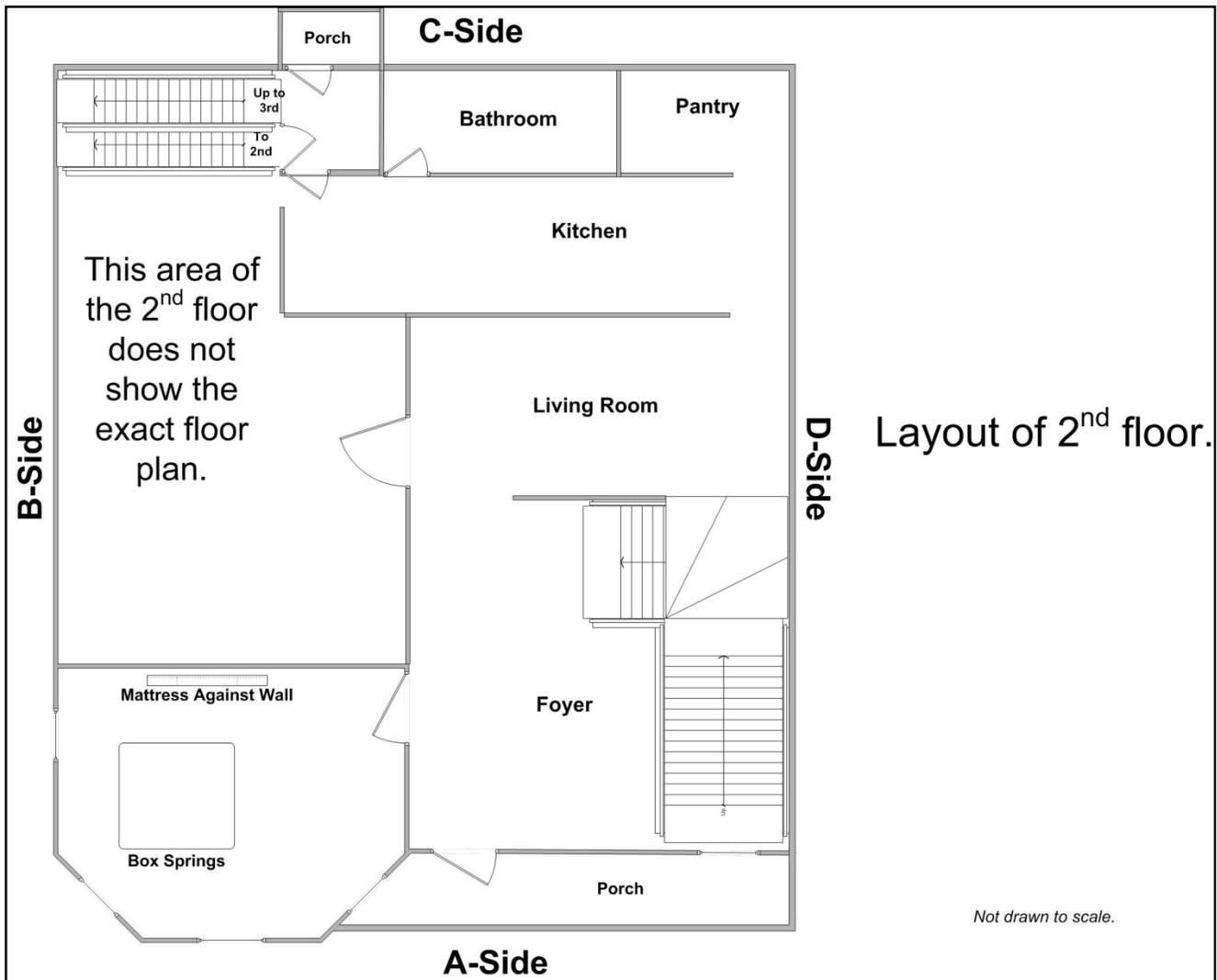


Diagram 2. Second floor.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

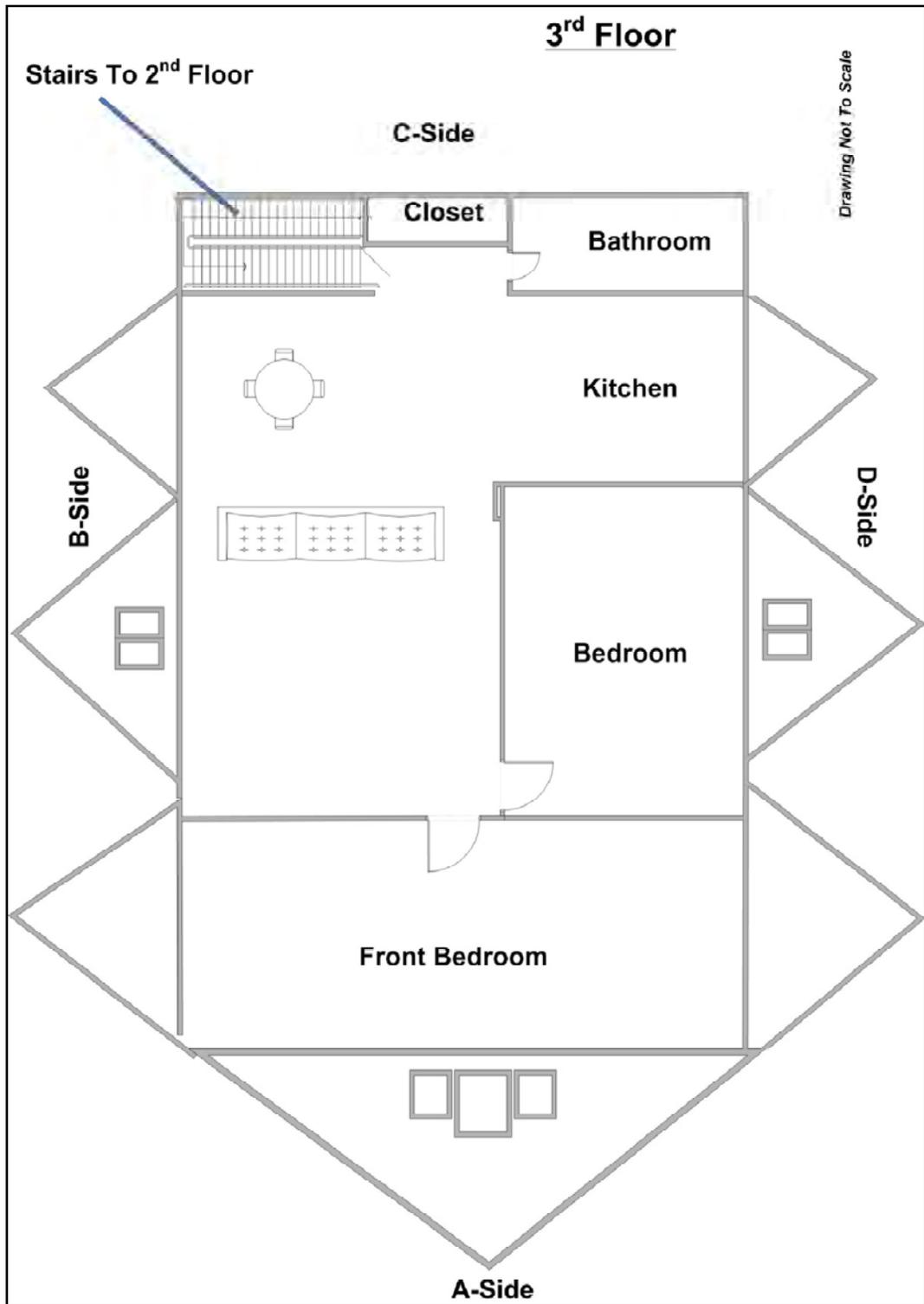


Diagram 3. Third floor.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

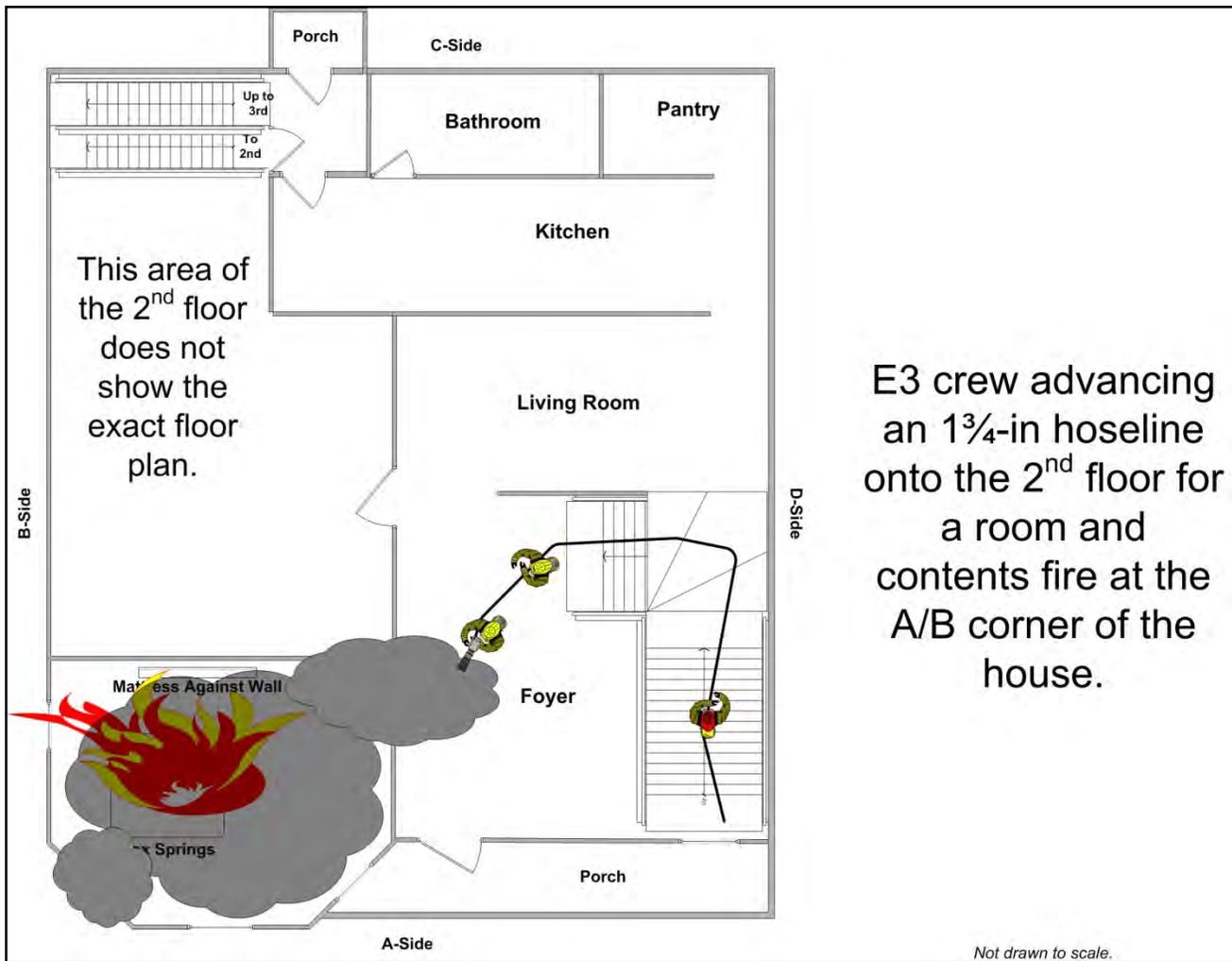


Diagram 4. E3 personnel discovered a room and contents fire on the 2nd floor.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

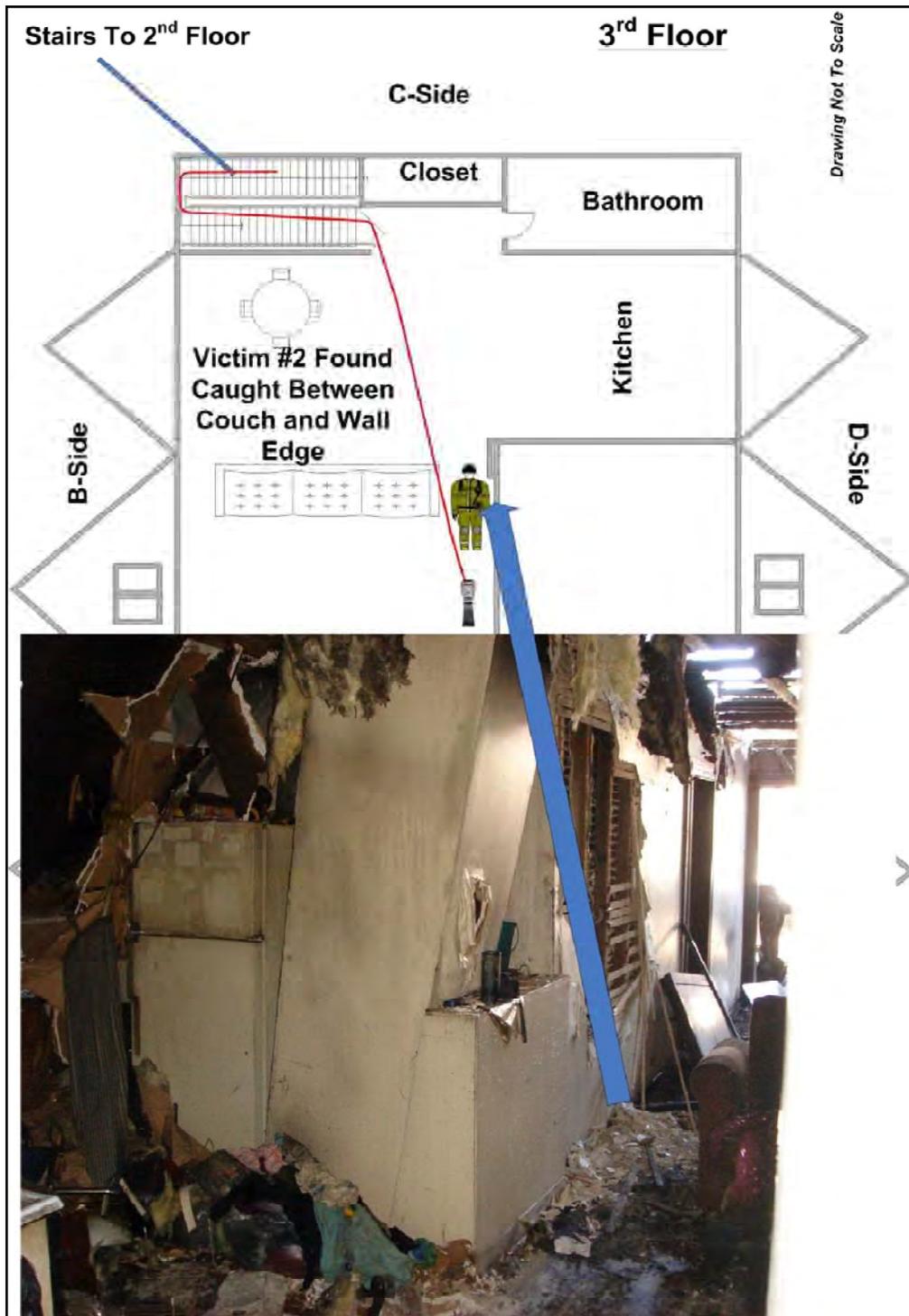


Diagram 5. Shows location of where Victim #2 was found by FF4. *Note: Orientation of the picture differs from the diagram.*

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

APPENDIX I

Summary of Fire Department Mayday SOP

Procedures

- A. Whenever any member is in a situation that they believe to be life-threatening and unable to escape from, they will transmit a Mayday.
- B. Whenever any member sees another fire fighter or fire fighters in a life-threatening situation they will transmit a Mayday.
- C. Fire dispatch will broadcast a Mayday tone over both channel (main dispatch) and the assigned fire ground channel. The tone is a rapid, high to low pitch, chirping sound.
- D. The individual calling the Mayday will repeat the word Mayday three times. Whenever possible, the officer or fire fighter transmitting the Mayday message shall give fire dispatch their last known location, the nature of the emergency, unit designation, and assignment. If calling a Mayday for someone else, give fire dispatch the location of the fire fighter or company in distress and particulars concerning the emergency. The use of the “orange distress button” on the radio should only be used if the member is unable to communicate.
- E. When fire dispatch hears a Mayday message, they will establish “emergency traffic” by sounding the Mayday tone for 5 full seconds. Fire dispatch will then call the company or individual that transmitted the Mayday, seeking the company or individual location and problem. Fire dispatch will then assign a dedicated rescue channel to units assigned to assist in the removal of the member in distress.
- F. Upon confirmation of a Mayday and activation of the RIT team, fire dispatch will automatically dispatch 1 engine company, 1 ladder company, and an additional battalion chief to assist with RIT duties on the fire ground. It will be the responsibility of fire dispatch to automatically dispatch these additional units.
- G. Additional EMS units will be dispatched to the scene if the RIT is activated.
- H. Members must be prevented from rushing frantically around a building looking for a missing member, while not knowing who is missing, how many are missing, or where they may be. Everyone must understand that the life-threatening emergency, to which we were dispatched, still exists. We cannot abandon it and put more people at the scene, at risk. Companies must keep doing the job they were assigned to, and wait for the incident commander to coordinate the search.
- I. Whenever a Mayday message is transmitted, a roll call of companies operating at the scene shall be conducted as soon as feasible. However, the roll call shall not be conducted in such a way as to interfere with the rescue of the trapped or missing fire fighter(s). The roll call will not cause excessive radio traffic. The term PAR (personnel accountability report) will be used when answering a roll call. A “PAR” is an announcement from the officer in charge of a crew given only when all of the members assigned to that officer have been located and accounted for.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

- J. Fire dispatch will advise all stations and fire cars that until an all clear has been received from the incident commander regarding the Mayday, all call will be dispatched over the voice alarm and a channel other than the Mayday channel.
- K. Whenever the term Mayday is transmitted all other communications on the frequency are to cease. Fire dispatch will immediately establish, “emergency traffic” sounding the Mayday tone and call the company initiating the Mayday getting their location and problem.
- L. Whenever a member becomes trapped or lost they shall transmit a Mayday and if physically able place their PASS alarm in the emergency mode. If the member is unable to communicate with fire dispatch, the “orange distress button” on the radio should also be activated.
- M. Members should not wait until the last moment to call Mayday
- N. At the point in the incident that the rescue operation is complete or the incident commander feels that the situation has been stabilized, the incident commander shall transmit an “all clear” to fire dispatch in order to bring Mayday operations to a close.
- O. Whenever a fire fighter is reported as trapped or lost, the incident commander will deploy the RIT. In addition, the incident commander should consider appointing a rescue group officer to coordinate the search and rescue effort. The rescue group officer should be a chief officer, but in the absence of an additional chief officer on the scene, an experienced company officer may be used.
- P. Reference to Emergency Evacuation for Rescue Procedure
- Q. Reference to Rapid Intervention Team
- R. Mayday procedure testing:
 - a. Every first day shift (Monday), a Mayday radio test will be conducted.
 - b. The procedure will be tested in the following manner.
 - i. Immediately following the completion of the radio test and evacuation tone test, fire dispatch will contact the company scheduled to do the test that day, via the red phone. Fire dispatch will inform the company that it is standing by for the Mayday test.
 - ii. A member from the company will then use a department radio to call fire dispatch using the channel designated by fire dispatch.

Note: A practice Mayday call is then transmitted over the radio following the established Mayday procedure.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

APPENDIX II

Status Investigation Report of Two Self-Contained Breathing Apparatus Submitted By the Connecticut State Police for the Fire Department NIOSH Task Number 17565

(Note: Full report is available upon request)

Background

As part of the *National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program*, the Technology Evaluation Branch agreed to examine and evaluate two SCBA identified as Scott Health and Safety model AirPak AP75, 4500 psi, 30-minute, self-contained breathing apparatus (SCBA).

This SCBA status investigation was assigned NIOSH Task Number 17565. The Connecticut State Police Department was advised that NIOSH would provide a written report of the inspections and any applicable test results.

The SCBA units, contained within corrugated cardboard boxes, were delivered to the NIOSH facility in Bruceton, Pennsylvania on January 13, 2011. After their arrival, the packages were taken to building 20 and stored under lock until the time of the evaluations.

SCBA Inspection

The packages were opened initially in the Respirator Fit Test Lab (building 40) on January 20, 2011 and an initial visual inspection was conducted by Tom Pouchot, General Engineer NPPTL. The SCBA identified as Connecticut State Police exhibit 20 was labeled by NPPTL as SCBA Unit #1. The SCBA identified as Connecticut State Police exhibit 26 was labeled by NPPTL as SCBA Unit #2. Also at that time, Scott Health and Safety conducted a downloading of the data loggers for each SCBA. The units were identified as the Scott Health and Safety Company model AirPak AP75, 30 minute, 4500 psi unit, NIOSH approval number TC-13F-0076CBRN. Once initial visual inspection and data logger downloading were completed, the SCBA units were repackaged and placed back in building 20 under lock.

The complete visual inspection of the units was conducted on February 9, 2011. These SCBA units were examined, component by component, in the condition received to determine the conformance of the unit to the NIOSH-approved configuration. The visual inspection process was documented photographically.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

The complete SCBA inspections are summarized in **Appendix I** of the full evaluation report. The condition of each major component of the SCBA that were photographed with a digital camera is contained in **Appendix III** of the full evaluation report.

It was judged that the unit could be safely pressurized and tested using a substitute cylinder provided by Scott Health and Safety. The substitute cylinder was also used for the NIOSH tests that were performed. After testing, at the request of the Connecticut State Police, representatives of Scott Health and Safety traveled to the NIOSH facility to perform maintenance on Unit #2 SCBA to attempt to adjust the End of Service Alarm/Vibra Alert to within the NIOSH requirements. This maintenance was performed on March 10, 2011.

SCBA Testing

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

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

1. Positive Pressure Test [§ 84.70(a)(2)(ii)]
2. Rated Service Time Test (duration) [§ 84.95]
3. Static Pressure Test [§ 84.91(d)]
4. Gas Flow Test [§ 84.93]
5. Exhalation Resistance Test [§ 84.91(c)]
6. Remaining Service Life Indicator Test (low-air alarm) [§ 84.83(f)]

National Fire Protection Association (NFPA) Tests (in accordance with NFPA 1981, 1997 Edition):

7. Air Flow Performance Test [Chapter 5, 5-1.1]

Units #1 and #2 were tested on February 10 and 11, 2011 using substitute cylinders.

Appendix II of the full evaluation report contains the complete NIOSH and NFPA test reports for each of the SCBA. **Tables One and Two** of the full evaluation report summarize the NIOSH and NFPA test results.

In addition, after Unit #2 was tested and found to be out of NIOSH compliance for the end of service alarm, Scott Health and Safety was contacted at the request of the Connecticut State Police to evaluate the out of compliance performance. On March 10, 2011, Scott Health and Safety representatives traveled to the NIOSH facility and inspected, cleaned and adjusted the SCBA unit with NIOSH personnel witnessing the actions. The Scott representatives were unable to bring the SCBA end of service alarm up to a NIOSH compliant level. Scott stated that a more invasive inspection and adjustment would be required at the Scott

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

production facility in Monroe, North Carolina and that adjustment would bring this unit back into compliance. After consulting the Connecticut State Police, the decision was made that this additional adjustment would not be performed on Unit #2.

Summary and Conclusions

Two SCBA units were submitted to NIOSH by the Connecticut State Police Department for the Fire Department for evaluation. The SCBA units were delivered to NIOSH on January 13, 2011 and initially inspected on January 20, 2011. The units were identified as a Scott Health and Safety model AirPak AP75, 4500 psi, 30-minute, SCBA (NIOSH approval number TC-13F-0076CBRN). At that time Scott Health and Safety performed a downloading of the unit data loggers. The complete inspection of the SCBA units was conducted on February 9, 2011. The units suffered minimal heat damage, exhibited other signs of wear and tear and the units were covered lightly with general dirt, grime, foreign particulate material and soot. The cylinder valves as received, Unit #1 was in the open position and Unit #2 was in the closed position. The cylinder gauges read approximately 0 psig. The cylinder valve hand-wheels could be turned. The regulator and facepiece mating and sealing areas on the units were relatively clean and there was no debris on the inside of the facepieces. The rubber face seal on Unit #1 was warped and distorted somewhat. The harness webbing on the units were in good condition with no fraying or tears but the webbing was dirty. The PASS device on the units functioned. The NFPA approval labels on the units were present and readable. Visibility through the lens of the unit facepieces was fair as the lenses had some scratches and other foreign material present.

The air cylinder on Unit #1 had a manufactured date of 1/04. Under the applicable DOT-E-10945-4500 exemption, the air cylinder is required to be hydro tested every 5 years, starting on or before the last day of 1/09. Therefore it appears that the cylinder on this SCBA unit was due for hydro testing before the end of January 2009. There was no re-test label or indication on the cylinder assembly for Unit #1 and therefore it appears that this cylinder was not within the hydro certification when last used. The Unit #1 cylinder also had some light gouges with the outer resin peeling away from the inner composite material in some areas.

The air cylinder on Unit #2 had a manufactured date of 9/98. Under the applicable DOT-E-10945-4500 exemption, the air cylinder is required to be hydro tested every 5 years, starting on or before the last day of 9/03. Therefore it appears that the cylinder on this SCBA unit was due for hydro testing before the end of September 2003 and repeat testing before the end of September 2008. The re-test label indicates that the last hydro test was performed 4/03. There was no re-test label or indication on the cylinder for re-testing during 2008 and therefore it appears that this cylinder was not within the hydro certification when last used. Unit #2 cylinder also had some light scratches and scuffs over the whole assembly.

Replacement air cylinders with a current hydrostatic re-test qualification were obtained from Scott Health and Safety and were substituted for all tests. No other maintenance or repair work was performed on the units at any time.

SCBA Unit #1 met the requirements of the NIOSH Positive Pressure Test, with a minimum pressure of 0.1 inches of water. Unit #1 **met** the requirements of all of the other NIOSH tests.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

SCBA Unit #2 met the requirements of the NIOSH Positive Pressure Test, with a minimum pressure of 0.00 inches of water. Unit #2 **did not** meet all the requirements of all the other tests. This unit failed the End of Service Life Indicator/Alarm test.

Scott Health and Safety personnel traveled to NIOSH on March 10, 2011 and inspected, cleaned and adjusted Unit #2 in an attempt to bring the SCBA back into NIOSH compliance. The Scott representatives were unable to bring the SCBA end of service alarm up to a NIOSH compliant level. Scott stated that a more invasive inspection and adjustment would be required at the Scott production facility in Monroe, North Carolina and that adjustment would bring this unit back into compliance. After consultation with the Connecticut State Police, the decision was made that no further maintenance would be performed on Unit #2.

In light of the information obtained during this investigation, NIOSH has proposed no further action on its part at this time. Following inspection and testing, the SCBA was returned to storage pending return to the Connecticut State Police.

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

PASS Device Data

Table 1 and Table 2 contain information from the PASS devices used by the victims. According to the recorded data, both PASS devices appeared to be functioning appropriately during the incident. Benchmark times, noted with an "X," show the PASS devices being turned off/on, sensing, going into pre-alarm/alarm, and even being reset at different times. The lapse of times between benchmarks may have included the unit being powered off or there was ample movement not allowing the PASS device to sense no movement.

According to the timeline documented by NIOSH investigators, through the use of written and audible radio transcripts/transmissions, the PASS devices' internal clock appeared to be behind by 1 hour. NIOSH investigators cannot account for what was happening within the structure when Victim #1 transmitted a Mayday, or what happened with Victim #2 after Victim #1 was discovered unconscious in the stairs off the 3rd floor.

A Career Lieutenant and a Career Fire Fighter Found Unresponsive at a Residential Structure Fire – Connecticut

Time	Date	Off To Sensing	Sensing To Off	Pre Alarm To Alarm	Manual Alarm	Alarm Reset	Low Battery	Sensing To Pre Alarm
15:52:06	7/24/2010	-	X	-	-	-	-	-
15:52:04	7/24/2010	-	-	-	-	X	-	-
15:38:16	7/24/2010	-	-	-	X	-	-	-
15:36:10	7/24/2010	-	X	-	-	-	-	-
15:36:02	7/24/2010	-	-	-	-	X	-	-
15:35:44	7/24/2010	-	-	X	-	-	-	-
15:35:32	7/24/2010	-	-	-	-	-	-	X
15:34:46	7/24/2010	-	-	-	-	X	-	-
15:28:18	7/24/2010	-	-	X	-	-	-	-
15:28:06	7/24/2010	-	-	-	-	-	-	X
15:22:04	7/24/2010	-	-	-	-	-	-	X
15:17:20	7/24/2010	-	-	-	-	-	-	X
15:12:28	7/24/2010	-	-	-	-	-	-	X
15:08:58	7/24/2010	X	-	-	-	-	-	-
15:01:34	7/24/2010	-	X	-	-	-	-	-
15:01:34	7/24/2010	-	-	-	-	X	-	-
15:01:30	7/24/2010	-	-	-	X	-	-	-
14:47:04	7/24/2010	-	X	-	-	-	-	-
14:46:34	7/24/2010	X	-	-	-	-	-	-

Table 1.
Victim #1
PASS data
log recorder.

Time	Date	Off To Sensing	Sensing To Off	Pre Alarm To Alarm	Manual Alarm	Alarm Reset	Low Battery	Sensing To Pre Alarm
15:51:48	7/24/2010	-	X	-	-	-	-	-
15:51:46	7/24/2010	-	-	-	-	X	-	-
15:49:58	7/24/2010	-	-	X	-	-	-	-
15:49:46	7/24/2010	-	-	-	-	-	-	X
15:49:12	7/24/2010	-	-	-	-	X	-	-
15:49:12	7/24/2010	-	-	X	-	-	-	-
15:49:00	7/24/2010	-	-	-	-	-	-	X
15:48:22	7/24/2010	-	-	-	-	X	-	-
15:27:30	7/24/2010	-	-	X	-	-	-	-
15:27:18	7/24/2010	-	-	-	-	-	-	X
15:18:22	7/24/2010	-	-	-	-	-	-	X
15:17:50	7/24/2010	-	-	-	-	-	-	X
15:17:28	7/24/2010	-	-	-	-	-	-	X
15:16:28	7/24/2010	-	-	-	-	-	-	X
15:03:28	7/24/2010	X	-	-	-	-	-	-
14:49:16	7/24/2010	-	X	-	-	-	-	-
14:48:50	7/24/2010	-	-	-	-	-	-	X
14:48:30	7/24/2010	X	-	-	-	-	-	-

Table 2.
Victim #2 PASS
data log
recorder.



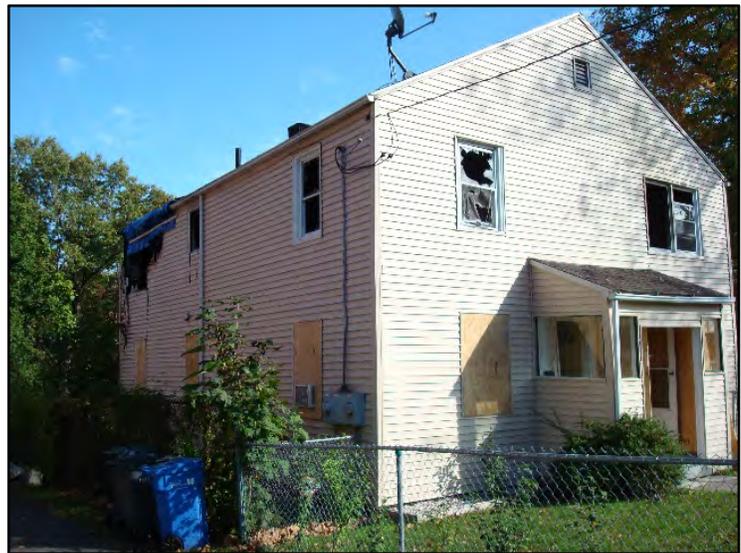
Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Executive Summary

On October 7, 2014, a 48-year-old male career fire fighter died while conducting interior fire-fighting operations in a two-story residential apartment fire. At 1830 hours, Engine 16 was dispatched to a structure fire reported with smoke showing. The lieutenant from Engine 16 conducted a scene size-up and reported heavy fire showing from the second floor on Side Bravo. The lieutenant and right jumpseat fire fighter made entry into the front door with a 1¾-inch hoseline and started up the stairs to the second-floor apartment. The Ladder 4 crew went by them, went to the top of the stairs, and forced the door to the apartment. The Engine 16 crew entered the apartment, and the lieutenant had the hoseline charged.

The apartment was hot with zero visibility.

The lieutenant had his fire fighter pencil the ceiling. Minutes later, the fire fighter's vibra-alert activated, and the lieutenant told him to exit the building. The lieutenant started to exit the apartment but couldn't find the fire fighter behind him. The lieutenant continued to search for the Engine 16 fire fighter and stated that he called a Mayday, but it was not acknowledged by Command. He then tried to radio the fire fighter. A fire fighter from Ladder 4 vented the picture window on Side Alpha of the second-floor apartment. The heat conditions increased in the apartment. Two fire fighters from Tactical Unit 1 were in the living room of the apartment, and due to the heat conditions, they got separated. One of the fire fighters from Tactical Unit 1 had been hit by a hose stream and momentarily lost consciousness, eventually causing him to fall out the Side Alpha picture window. He was transported to the hospital with burns and lacerations. The Engine 16 lieutenant came out of the building and the Engine 16 fire fighter was still not located. Command activated the rapid intervention crew and ordered Engine 5 and Tactical Unit 1 into the apartment. Engine 5 made entry to the apartment and heard a PASS alarm going off to the right of the door. The Engine 16 fire fighter was found lying on his right side near the door with his foot caught in a piece of furniture. The Engine 5 crew brought the fire fighter out of the building, and he was transported to the hospital but pronounced



**Sides Alpha and Bravo of the fire building
(NIOSH photo.)**

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

dead upon arrival. The Engine 16 lieutenant sustained injuries but was treated and released. The Tactical Unit 1 fire fighter who had fallen out the window remained in the hospital for 23 days.

Contributing Factors

- *Fireground tactics*
- *Crew integrity*
- *Personnel accountability*
- *Air management*
- *Mayday procedures*
- *Fireground communications*
- *Ventilation*
- *Personal protective equipment use*
- *Live fire training*
- *Unsprinklered occupancy*

Key Recommendations

- *Fire departments should ensure that risk assessments are conducted prior to initial operations and throughout the incident and that the strategy and tactics match the assessment.*
- *Fire departments should ensure that crew integrity is properly maintained by voice or radio contact when operating in an immediately dangerous to life or health (IDLH) atmosphere.*
- *Fire departments should ensure that fire fighters and officers are properly trained in air management including out-of-air emergencies.*
- *Fire departments should use a personnel accountability system that accounts for all resources assigned to an incident.*
- *Fire departments should ensure that incident commanders incorporate the principles of command safety into the incident management system.*
- *Fire departments should ensure fire fighters are properly trained in Mayday procedures.*
- *Fire departments should provide the incident commander with a Mayday tactical checklist for use in the event of a Mayday.*

The National Institute for Occupational Safety and Health (NIOSH), an institute within the Centers for Disease Control and Prevention (CDC), is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. In 1998, Congress appropriated funds to NIOSH to conduct a fire fighter initiative that resulted in the NIOSH Fire Fighter Fatality Investigation and Prevention Program, which examines line-of-duty deaths or on-duty deaths of fire fighters to assist fire departments, fire fighters, the fire service and others to prevent similar fire fighter deaths in the future. The agency does not enforce compliance with state or federal occupational safety and health standards and does not determine fault or assign blame. Participation of fire departments and individuals in NIOSH investigations is voluntary. Under its program, NIOSH investigators interview persons with knowledge of the incident who agree to be interviewed and review available records to develop a description of the conditions and circumstances leading to the death(s). Interviewees are not asked to sign sworn statements and interviews are not recorded. The agency's reports do not name the victim, the fire department, or those interviewed. The NIOSH report's summary of the conditions and circumstances surrounding the fatality is intended to provide context to the agency's recommendations and is not intended to be definitive for purposes of determining any claim or benefit.

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



Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Introduction

On October 7, 2014, a 48-year-old male career fire fighter died while conducting interior operations in a two-story residential apartment. On October 9, 2014, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On October 14–24, 2014, a general engineer, an occupational safety and health specialist, and an investigator from the NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) traveled to Connecticut to investigate this incident. The NIOSH FFFIPP investigators met with members of the career fire department, International Association of Fire Fighters local union, Connecticut State Police, Connecticut Division of Occupational Safety and Health, and the city dispatch center. NIOSH FFFIPP investigators interviewed the incident commander and fire fighters who were on-scene at the time of the incident. The NIOSH FFFIPP investigators visited the incident site, took photographs, and collected and reviewed training records, standard operating procedures, and medical records. The self-contained breathing apparatus (SCBA) from the Engine 16 fire fighter (Engine 16B) and Tactical Unit 1 fire fighter were evaluated by the NIOSH National Personal Protective Technology Laboratory.

Fire Department

The career fire department involved in this incident serves a city with a population of over 125,000 and has a total area of 17.38 square miles. The fire department employs 395 personnel and averages about 23,053 response calls annually. The fire department is subdivided into two main fields of operation: Emergency Services and Support Services. The Support Services is comprised of the Fire Administration staff and the Employee Assistance Program. Under command of the Support Services Division are the Fire Marshal’s Office, Equipment Maintenance Division, Fire Alarm Communications Technology Division, Fire Training Division, and Special Events Unit.

The Emergency Services Division is comprised of 12 fire stations, which are divided into 2 districts. Each district is commanded by a district chief. Each shift is commanded by a deputy fire chief. The apparatus fleet consists of 11 engines, 5 ladders, 1 tactical unit (Heavy Rescue), and numerous special, support, and reserve units. All front-line apparatus are staffed with a minimum crew of three fire fighters and an officer (captain or lieutenant). The fire department uses the following designations for riding assignments on the fire apparatus: Officer is “A,” right jumpseat is “B,” left jumpseat is “C,” and the engineer operator is “D.”

Emergency medical service is provided by two separate ambulance companies. Each ambulance company is assigned a response area within one of the two districts in the city.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Training and Experience

The fire department involved in this incident requires potential candidates for employment as a fire fighter to have a high school diploma or GED and a valid state driver's license and to successfully pass a background check and an entry-level civil service test.

Once selected as a candidate, the initial step is to attend the 16-week recruit training program at the department's fire academy. The curriculum covers all of the National Fire Protection Association's (NFPA) qualifications for NFPA 1001 *Standard on Fire Fighter Professional Qualifications*. This includes Fire Fighter I, Fire Fighter II, Hazardous Materials Awareness, Hazardous Materials Operations, and emergency medical care [NFPA 2013a].

Upon completion of recruit school, the fire chief assigns the recruit to a station where they become a probationary fire fighter for 1 year. Upon completion of probation, the fire fighter trainee becomes a fire fighter. After 5 years of experience, a fire fighter can take the lieutenant test. A fire fighter can test for an apparatus operator after 3 years in-grade. After being promoted to the lieutenant rank, the officer can test for the next rank of captain, district chief, and deputy chief after 3 years in-grade.

The department's training academy has a full complement of staff. However, due to budgetary constraints, the staff is not authorized overtime and the facilities are in need of repairs. The training academy has a burn building, but it hasn't been used for years and is currently condemned. Also, the fire academy adjoins the police academy with an operational firing range. No fire fighter training can take place outside when the firing range is in use due to rounds ricocheting onto the training grounds.

Table 1. Summarizes the documented training of the Engine 16 right jumpseat fire fighter (Engine 16B), the Engine 16 lieutenant (Engine 16A), and the incident commander (District Chief 2).

Fire Fighter	Training Courses	Years Experience
Fire Fighter B (Engine 16B)	Basic Fire Fighting (Fire Fighter I, Fire Fighter II), Introduction to the Incident Command System (IS-100), ICS for Single Resources and Initial Action Incidents (IS-200), Rail Safety for Emergency Responders, various fire-fighting procedures, and various other administrative and technical courses.	6
Lieutenant (Engine 16A)	Basic Fire Fighting (Fire Fighter I, Fire Fighter II), Pump Operator, Introduction to the Incident Command System (IS-100), ICS for Single Resources and Initial Action Incidents (IS-200), National Incident Management System (NIMS) An	19

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

	Introduction (IS-700.a), and various other administrative and technical courses.	
District Chief 2 (Incident Commander)	Basic Fire Fighting (Fire Fighter I, Fire Fighter II), Introduction to the Incident Command System (IS-100), ICS for Single Resources and Initial Action Incidents (IS-200), National Incident Management System (NIMS) An Introduction (IS-700.a), and various other administrative and technical courses.	26

Note: All fire fighters must complete training equivalent to the NFPA 1001 Standard for Fire Fighter Professional Qualifications, Fire Fighter I and Fire Fighter II [NFPA 2013a].

Structure

The two-story apartment building was built in 1953 and constructed of a wood frame on a poured concrete basement foundation (see Photos 1–4). The two-story structure consisted of 2,016 square feet of total living space between the two apartments. Each floor consisted of five rooms that included two bedrooms, a living room, a kitchen, and a bathroom. The exterior was covered with vinyl siding, and the pitched roof was covered with asphalt shingles. The structure had a front entrance with two doors: the one on the left opened to an interior stairway to the second floor, and the one on the right to the first-floor apartment. At the top of the stairway was a door with a dead bolt and a second door to the right with a normal entry knob. There was a rear entrance to both floors via a covered porch with stairs to the second floor. The structure had an unoccupied third apartment in the finished basement with an exterior entrance in the rear (Side Charlie) of the structure. The building's utilities were electric and natural gas heating.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

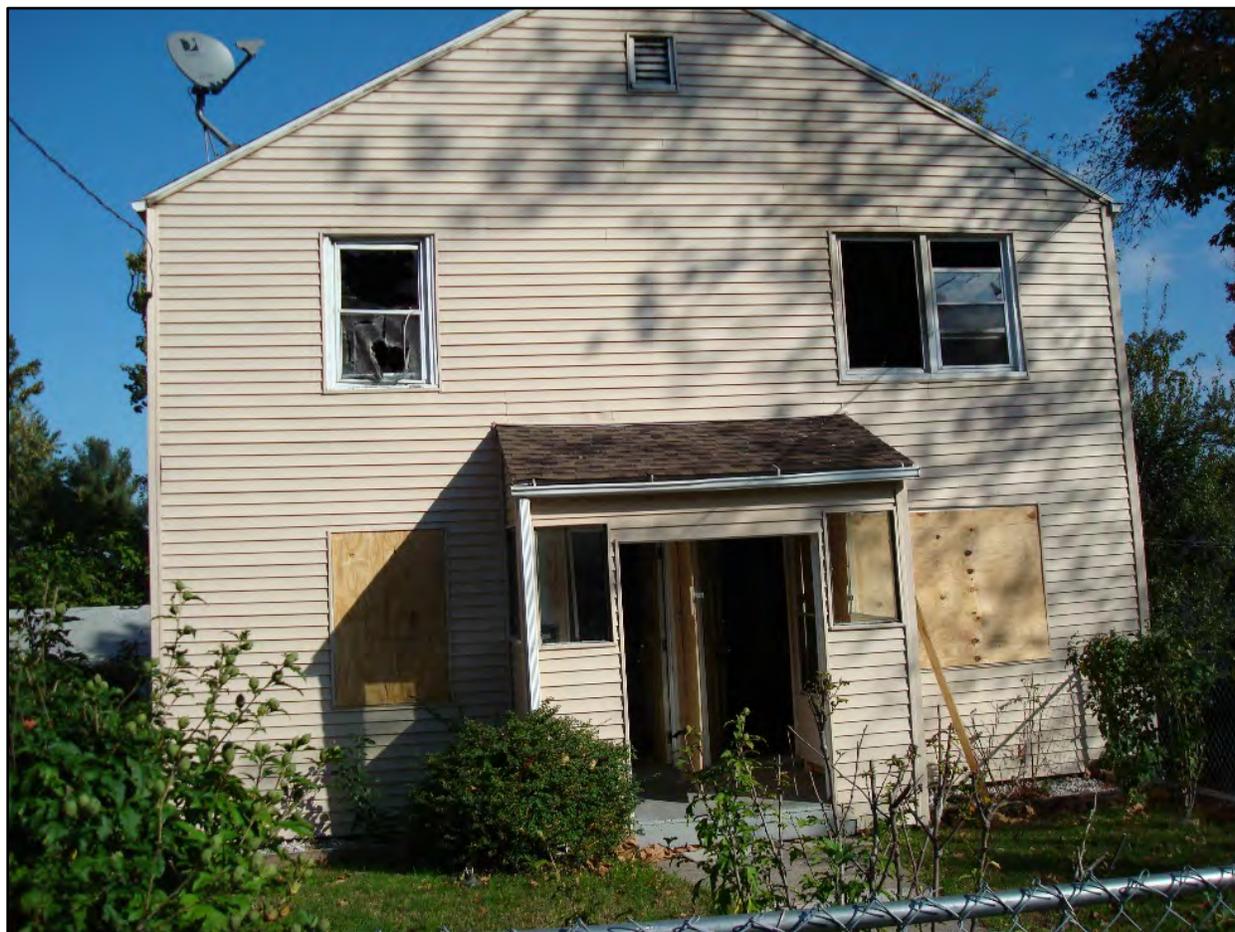


Photo 1. Side Alpha—street view of the duplex. Engine 16 and Ladder 4 made entry into the building through the left doorway.
(NIOSH photo.)

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut



Photo 2. Side Bravo—street view of the duplex. Origin of fire near the Bravo/Charlie corner on the second floor.
(NIOSH photo.)

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

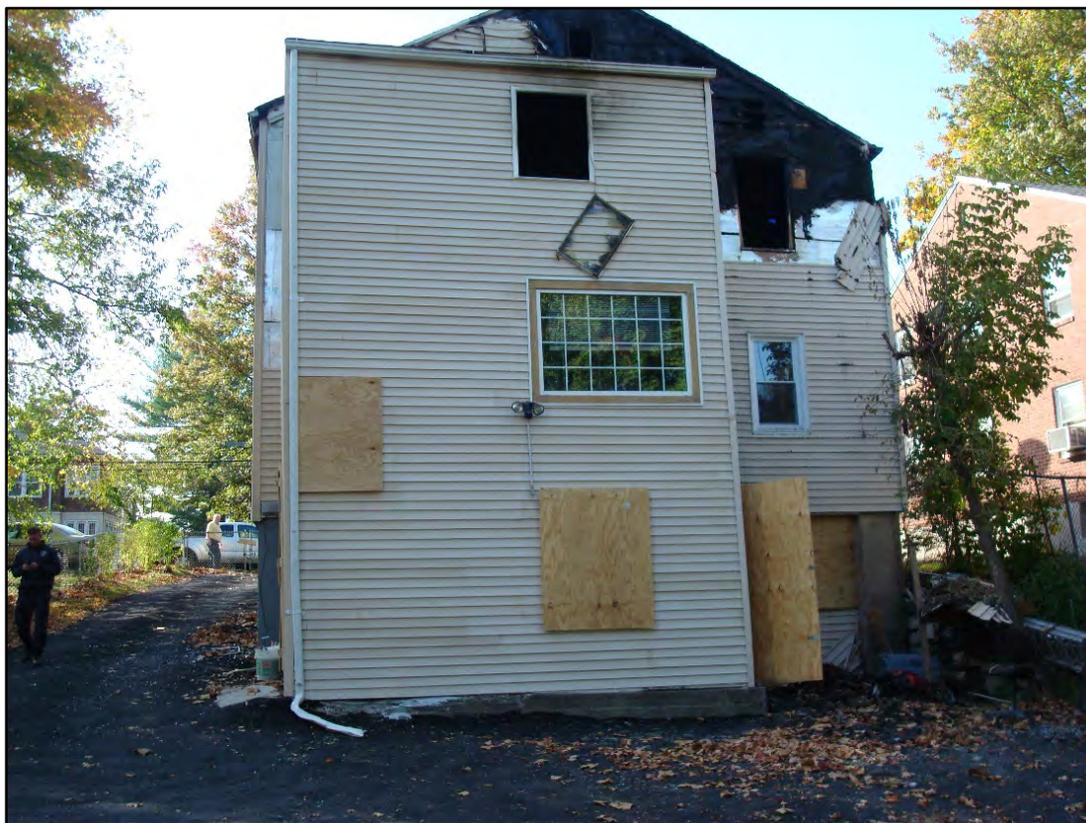


Photo 3. Side Charlie of the structure. An unoccupied apartment was in the basement. The entrance to the basement apartment is on the Bravo/Charlie corner.

(NIOSH photo.)

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut



Photo 4. Side Delta of the structure. A rear entrance leads to the first- and second-floor apartments on the Delta/Charlie corner
(NIOSH photo.)

Equipment and Personnel

On October 7, 2014, the dispatch center transmitted an alarm for a structure fire with smoke showing. The initial units dispatched included Engine 16, Engine 14, Engine 7, Ladder 4, Ladder 3, Tactical Unit 1, and District 2. Upon arrival, Engine 16 advised this was a working fire. This upgraded the alarm to a working-fire dispatch, which added another district chief and two engines. Table 2 identifies the apparatus and staff dispatched on the first-alarm assignment and the working-fire assignment, along with their approximate dispatch times and on-scene arrival times rounded to the nearest minute.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Table 2. First-alarm and working fire equipment and personnel dispatched.

Resource Designation	Staffing	Dispatched (rounded to minute)	On-scene (rounded to minute)
Engine 16	lieutenant, engine operator, and 2 fire fighters	1830 hrs	1832 hrs
Ladder 4	lieutenant, engine operator, and 2 fire fighters	1830 hrs	1834 hrs
Engine 14	lieutenant, engine operator, and 2 fire fighters	1830 hrs	1834 hrs
District Chief 2 (Incident Commander)	district chief and chief's aide	1830 hrs	1834 hrs
Ladder 3	lieutenant, engine operator, and 2 fire fighters	1830 hrs	1836 hrs
Tactical Unit 1	lieutenant, and 4 fire fighters	1830 hrs	1837 hrs
Engine 7	lieutenant, engine operator, and 2 fire fighters	1830 hrs	1838 hrs
Engine 5	lieutenant, engine operator, and 2 fire fighters	1832 hrs	1840 hrs
District Chief 1	district chief and chief's aide	1835 hrs	1840 hrs
Engine 2	lieutenant, engine operator, and 2 fire fighters	1835 hrs	1840 hrs

Timeline

An approximate timeline summarizing the significant events of the incident is listed below. The times are approximate and were obtained by studying available dispatch records, photos, run sheets, witness statements, and fire department records. The times are rounded to the nearest minute. The timeline is not intended, nor should it be used, as a formal record of events.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

- **1830 Hours**
Engine 16, Engine 14, Engine 7, Tactical Unit 1, Ladder 4, Ladder 3, and District 2 are dispatched to a structure fire with smoke showing.
- **1832 Hours**
Engine 5 is dispatched as the rapid intervention team (RIT); Engine 16 arrives on-scene and assumes command.
- **1833 Hours**
District Chief 2 is en route and on the air; Engine 16 reports a 2½-story wood frame with heavy smoke showing. Engine 16 advises this would be a “working fire.”
- **1834 Hours**
District Chief 2 advises the dispatch center that Engine 16 said this would be a working fire; Ladder 4, Engine 14, and District Chief 2 arrive on-scene.
- **1835 Hours**
District Chief 1 and Engine 2 are dispatched to a working fire.
- **1836 Hours**
Ladder 3 arrives on-scene; Engine 14 at hydrant.
- **1837 Hours**
Tactical Unit 1 arrives on-scene; Engine 14 brings hoseline around to Side Charlie.
- **1838 Hours**
Engine 7 arrives on-scene. Engine 16 enters the stairwell to second floor with Ladder 4.
- **1839 Hours**
Engine 5, District Chief 1, and Engine 2 arrive on-scene; District Chief 1 assigned as Safety Officer; Engine 14 and Ladder 3 make entry on second floor rear with a charged 1¾-inch hoseline.
- **1840 Hours**
Engine 16 makes entry to second-floor apartment with a charged 1¾-inch hoseline.
- **1842 Hours**
Engine 14 puts water on fire from exterior of Side Charlie.
- **1844 Hours**
Command requests reports from Engine 16 and Engine 14. Replies are inaudible.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

- **1845 Hours**
Engine 16 calls a Mayday but is not acknowledged by Command or any other personnel.
- **1846 Hours**
Command orders evacuation of the structure and requests medic unit.
- **1847 Hours**
Command requests a status of injuries and a PAR. Ladder 3 requests tone for all companies out of the building.
- **1849 Hours**
Engine 16A tries to radio Engine 16B; Engine 14 has PAR.
- **1850 Hours**
Engine 16A tries to radio Engine 16B; Engine 7 charges their hoseline on Side Bravo.
- **1851 Hours**
Engine 16A tries to radio Engine 16B.
- **1852 Hours**
Command requests second alarm.
- **1853 Hours**
Command orders Ladder 4 to open up the roof. Command contacts Engine 16A, who is changing his SCBA cylinder, and asks where Engine 16B is located. Engine 16A states they are on the second floor in the room on the right; Command activates the RIT (Engine 5 and Tactical Unit 1).
- **1854 Hours**
Engine 5 hears PASS device going off to the right and locates Engine 16B.
- **1855 Hours**
RIT crew moves Engine 16B down the stairway.
- **1857 Hours**
Engine 7 knocks down the fire in the Bravo/Charlie corner, second-floor bedroom.
- **1900 Hours**
Medic unit en route to hospital.
- **1909 Hours**
Engine 2 and Ladder 5 crews complete the extinguishment of the fire on the second floor.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Personal Protective Equipment

The Engine 16B fire fighter was wearing a work station uniform, turnout coat and pants, gloves, boots, helmet, self-contained breathing apparatus (SCBA) with an integrated personal alert safety system (PASS), and a portable radio.

Engine 16B's and Tactical Unit 1's SCBAs were evaluated by the NIOSH National Personal Protective Technology Laboratory and a summary report is enclosed as Appendix I. The evaluation showed that Engine 16B's SCBA failed the Remaining Service Life Indicator Test, in which the secondary bell failed to operate within the parameters but passed all other NIOSH tests. Tactical Unit 1's SCBA did not meet the requirements for the 30-minute minimum duration test but passed all other NIOSH tests. The full report is available upon request.

Weather Conditions

According to data from the Weather Underground, the sky conditions were clear with 10-mile visibility. The temperature was 92 degrees F. Dew point was 73 degrees F. Relative humidity was 78%. Wind speed was 8.1 miles per hour and wind direction was south. Barometric pressure was 29.99 [NOAA 2015].

Investigation

On October 7, 2014, a 48-year-old male career fire fighter died while conducting interior operations in a two-story residential apartment. At 1830 hours, Engine 16, Engine 14, Engine 7, Ladder 4, Ladder 3, Tactical Unit 1, and District 2 were dispatched to a structure fire with smoke showing. Upon confirmation of a working fire, Engine 5, Engine 2 and District 1 were added to the alarm. The Engine 16 lieutenant (Engine 16A) observed heavy smoke in the air from a block and half away. Engine 16 laid into the fire from a hydrant approximately a block and half away from the fire building. A fire fighter (left jump seat) from Engine 16 (Engine 16C) was the hydrant man and made the connection and waited for the order to charge the supply line. Engine 16 pulled past the building to allow space for Ladder 4. A fire fighter from Engine 16 (Engine 16B) pulled a 1¾-inch hoseline while Engine 16A radioed heavy fire was showing on Side Bravo. At approximately 1834 hours, Ladder 4, Engine 14, and the chief from District 2 (District Chief 2) arrived on-scene. District Chief 2 assumed command while Engine 14 laid in from a hydrant two blocks away. Ladder 4 forced the first-floor door to the second-floor apartment. Engine 16A and Engine 16B made entry into the stairwell and started up the stairs to the second-floor apartment. The crew from Ladder 4 went by Engine 16 and went to the top of the stairs. In near zero visibility, Ladder 4 felt a dead bolt on the door at the top of the stairs in front of them but no door knob, then felt a locked door knob on a door to their right, which Ladder 4 forced open. The Engine 14 crew had a back-up 1¾-inch line out front and were redirected by Command to go to the rear (Side Charlie) and make entry up the stairs. The crew from Engine 7 replaced Engine 14 in the front to back up Engine 16. At approximately 1839 hours, Engine 14, with the help of Ladder 3, made entry on the second-floor rear with a charged 1¾-inch hoseline. Engine 5, District Chief 1, and Engine 2 arrived on-scene. Command assigned District Chief 1 as the Safety Officer, Engine 5 as RIT, and Engine 2 as rehab.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Upon entry, Engine 16A reported the apartment was hot with zero visibility. At approximately 1840 hours, Engine 16A had the line charged and had Engine 16B pencil the ceiling. Ladder 4 also reported the second-floor apartment was hot with zero visibility and began a right-hand search on their knees.

Minutes later, Ladder 3 reported to Command that Engine 14 was hitting the fire from Side Charlie. Engine 16C had gone to the rear with Engine 14. About this time, the Engine 16B's vibra-alert sounded and the lieutenant told him to exit. Tactical Unit 1 had made entry from the rear stairwell to the second-floor apartment. They passed Ladder 3 and Engine 14 in the kitchen area. Tactical Unit 1 began pulling ceiling in the living room looking for fire.

A fire fighter from Ladder 4 vented the picture window on Side Alpha of the second-floor apartment. The Ladder 4 lieutenant reported a rapid increase in heat in the apartment and ordered his crew out. Engine 16A headed for the door but lost contact with Engine 16B. Engine 16A found the hoseline with the nozzle shut off near the door. Due to the extreme heat in the room, Engine 16A opened up the nozzle to cool down the room. Three members of Tactical Unit 1's crew who were in the living room near the kitchen pulling ceiling, were struck by a hose stream coming from somewhere near Side Alpha of the living room. The crew became separated. One member of Tactical Unit 1 exited out the rear stairwell through the kitchen. The other two fire fighters reported being hit in the face and chest and momentarily became disorientated. One member made it to the kitchen and located the lieutenant and a fire fighter who had also been hit by a hose stream. Engine 14's hoseline had become loose but they were able to secure it. All the fire fighters who were hit with the hose stream had their helmets knocked off and SCBA facepieces dislodged. An Engine 14 fire fighter became disorientated and confused having been hit twice with the hose stream. He needed assistance exiting the structure.

The third fire fighter from Tactical Unit 1 had taken a direct hit to the face; he lost his helmet, his facepiece was dislodged, and he was knocked down by the hose stream. He stated he was unconscious for a brief period of time. He was unable to locate his helmet and facepiece and stated that his head and eyes were burning from the extreme heat in the apartment. He used his wet gloves to try to cool his head and face. He was unable to locate any fire fighters or use his radio. He ended up at the Side Alpha picture window that Ladder 4 had previously vented. Fire fighters on the ground noticed him at the window and tried to communicate to him that they were getting a ground ladder. At approximately 1846 hours, he lost consciousness and tumbled out the window to the ground. Command ordered everyone out of the structure and requested a medical unit. The EMS crew arrived and he was transported to the hospital. *Note: The Tactical Unit 1 member sustained burns to his head, ears, neck, shoulder, and wrist; he was hospitalized in a burn unit for approximately 23 days.*

Engine 16A continued the search for Engine 16B until his vibra-alert activated. Engine 16A stated that he called a Mayday, but it was not acknowledged; he also tried to radio Engine 16B. Engine 16A crawled out of the apartment with no air left in his cylinder and exited the structure. Upon his exit, Engine 16A had noticed that a fire fighter was being attended to on the ground on Side Alpha. On several occasions, Command tried to contact Engine 16A with no response. For several minutes, the lieutenant tried to locate Engine 16B with no success. At approximately 1856 hours, the lieutenant

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

notified Command that he couldn't find his fire fighter. Immediately, Command tried to radio Engine 16B but got no response.

At approximately 1858 hours, Command activated the rapid intervention crew, which sent Engine 5 and Tactical Unit 1 into the apartment. Engine 5 made entry into the second-floor apartment. The Engine 5 officer looked at his thermal imager and the screen was white, but he heard a PASS alarm going off to the right of the door. Engine 16B was found lying on his right side near the door. The crew grabbed Engine 16B but he appeared to be caught on something. Engine 16B's lower right leg and foot were entangled in a piece of wrought iron furniture (see Diagram 1). The RIC crew untangled him and carried him down the stairs to EMS waiting outside. Engine 16B's SCBA was intact and properly donned on his face but the air cylinder was empty. At approximately 1900 hours, EMS started CPR on Engine 16B. Engine 16B was transported to the hospital but pronounced dead upon arrival. Engine 16B did not appear to have sustained any burns or other life-threatening injuries.

At approximately 1909 hours, Engine 2 and Ladder 5 crews knocked down the fire in the bedroom on the Bravo/Charlie corner.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

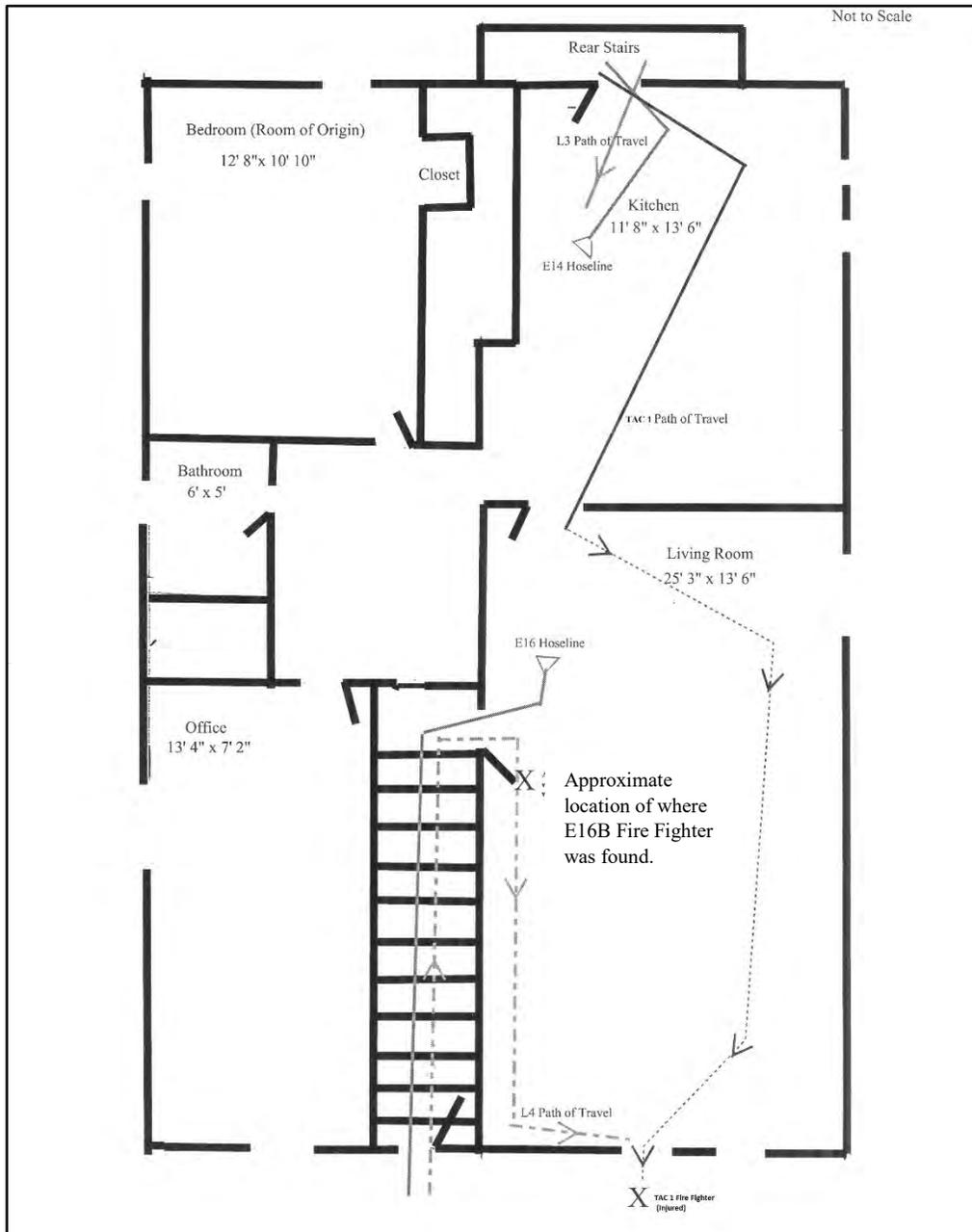


Diagram. Floor plan of second floor, path of attack crews, and location of fire fighters found.
(Diagram courtesy of the fire department.)

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Fire Behavior

The origin and cause of the fire is still under investigation by the Connecticut State Police's Fire and Explosion Investigation Unit. By all accounts, the fire originated on the second floor, in the bedroom on the Bravo/Charlie corner of the fire structure.

Indicators of significant fire behavior

- Smoke on Bravo/Charlie corner upon arrival
- Fire showing on Side Bravo
- Heat and heavy, black smoke throughout the second floor
- Fire self-vents out two windows on Bravo/Charlie corner and extended up the exterior wall
- Heavy fire at Bravo/Charlie corner on second floor and attic
- No vertical ventilation at this time
- Heat and heavy, black smoke continue to fill second floor
- Side Alpha window removed, creating a flow path for the fire
- Fire knocked down approximately 41 minutes after arrival

Contributing Factors

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

- Fireground tactics
- Crew integrity
- Personnel accountability
- Air management
- Mayday procedures
- Fireground communications
- Ventilation
- Personal protective equipment use
- Live fire training
- Unsprinklered occupancy

Cause of Death

According to the chief medical examiner's report, the cause of death of the fire fighter was lack of breathing gas. The report listed cardiac hypertrophy as a contributing factor.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Recommendations

Recommendation #1: Fire departments should ensure that risk assessments are conducted prior to initial operations and throughout the incident and that the strategy and tactics match the assessment.

Discussion: Occupancies define the space inside the class of building. Construction types/classes of construction define how the building is constructed with either combustible or noncombustible materials. Occupancies exist inside the constructed building. Standard operation procedures (SOPs) must consider numerous factors that affect fire-fighting operations. This will ensure essential strategic-, tactical-, and task-level functions are performed by the incident commander, division/group supervisors, and fire fighters. Additionally, this process compliments the defined knowledge, skills, abilities, competencies, and fireground experience to assist:

- The incident commander to plan and implement an effective strategy and incident action plan [NFPA 2014].
- Division/group supervisors to formulate and follow tactics.
- Company officers to successfully carry out assigned tasks.
- The individual members to effectively perform their duties [ULFSRI and FirefightersCloseCall.com, no date].

At any incident, life safety is always the first priority, followed by incident stabilization and then property conservation. Ensuring the safety of fire fighters is a continuous process throughout the incident. A sound risk management plan ensures that the risks are evaluated and matched with actions and conditions. The following risk management principles should be utilized by the incident commander:

- Activities that present a significant risk to the safety of fire fighters should be limited to situations that have the potential to save endangered lives.
- Activities that are routinely employed to protect property should be recognized as inherent risks to the safety of fire fighters, and actions should be taken to reduce or avoid these risks.
- No risk to the safety of fire fighters should be acceptable where there is no possibility to save lives or property [Brunacini 2002].

The strategy and tactics of an incident are dictated by the size-up, initial risk assessment, and situational report by the first arriving officer. The priority is to get a fire department unit to the rear of the structure (Side Charlie). However, unless an obvious life safety issue exists (e.g., visible victims requiring immediate assistance), interior fire-fighting operations should not commence until a report from Side Charlie is received. If physical barriers make the 360-degree size-up impractical for the first arriving officer, the size-up of Side Bravo, Side Charlie, and Side Delta may be delegated to another engine company on the first alarm. Even if a 360-degree size-up can be conducted, the second-due engine company or third-due engine company and the second-due truck company should be assigned to Side Charlie.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

A radio report of conditions, including those on Side Charlie, should be transmitted over the assigned tactical channel to the incident commander and the dispatch center. The transmission should include the following:

- Smoke and fire conditions, with an emphasis on identifying the seat of the fire. The initial radio report from the first arriving unit for a structural fire should include the signal for a working fire, the number of stories, type of occupancy, and location of fire. This lays the foundation for additional reports and serves as notification to responding units as to the type of SOP to implement.
- If there were critical building description information through the critical incident dispatch system (CIDS) for the address, then this information would aid in implementing or adjusting SOPs. CIDS could contain information that would necessitate alternative action to fulfill operational goals.
- Building features—e.g., number of stories (particularly if there is a difference between Sides Alpha and Charlie).
- Basement access and type.
- Other life or safety hazards.

The incident commander must conduct an initial and ongoing situational assessment of the incident [NFPA 2014]. Any change to operational priorities or responsibilities based on the above size-up should be clearly communicated to Command, all responding units, and the dispatch center via the assigned tactical radio channel [Township of Spring Fire Rescue 2013; ULFSRI and FirefightersCloseCall.com, no date]. Command is then obligated to re-broadcast and receive acknowledgement from all operating companies.

Stretching and operating hoselines is the primary function of an engine company. All members must realize the importance of an initial charged hoseline stretched at a structural fire. The majority of structural fires are controlled and extinguished by this initial line. The **first line** is placed between the fire and any persons endangered by it. This is accomplished by stretching the hoseline via the primary means of egress, usually the main stairway. This tactic:

- Provides a base for confining and controlling the fire.
- Allows occupants to evacuate via the stairs.
- Allows fire fighters to proceed above the fire for search operations [FDNY 2013].

In most cases, the first line is stretched via the interior stairs to the location of the fire. The purpose of this line is to protect the primary means of egress for occupants evacuating the building and to confine and extinguish the fire. Prior to opening the door to the fire area for advancement of the line, the engine company officer **must** ensure that no fire fighters will be exposed in the hallway or on the stairs above as the fire attack is initiated. This can be done via portable radio or in person [FDNY 2013].

When the fire attack is being initiated, the engine company officer shall announce via portable radio to Command that “water is on the fire.” This is a significant incident benchmark being met. If the engine

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

company officer can't get water or there is a delay of getting water on the fire, this must be communicated to Command as well [Brunacini 2002].

All members must be alert to fireground communications concerning hoseline placement and the commencement of fire-fighting operations so that crews can avoid opposing hoselines and getting hit with high-pressure water and debris.

At any fire, there are tasks that need to occur regardless of the occupancy: initial on-scene report upon arrival; initial risk assessment; situational report; water supply; deployment of handlines and back-up handlines; search and rescue, ventilation, and rapid intervention crews; ground and aerial ladder placement; fire attack and extinguishment; and salvage and overhaul. Over the past few years, fire fighters have adopted an acronym that details the steps to take when confronted with a fire: *SLICERS*.

- **S**ize up all scenes.
- **L**ocate the fire.
- **I**dentify and control the flow path (if possible).
- **C**ool the heated space from a safe location.
- **E**xtinguish the fire.
- **R**escue and **S**alvage are actions of opportunity that may occur at any time [ULFSRI and FirefightersCloseCall.com, no date].

The “flow path” of a fire is the movement of a fire determined by incoming and outgoing vents for air, since air is what allows a fire to burn. Identifying and controlling the flow path is about knowing where the air comes from and where it's headed. The importance of identifying and using flow path information cannot be underestimated. The identification of flow path is an item that should find its way into every after-action review. While trying to locate the fire, cooling the heated space from a safe location while ensuring for the safety of the fire fighters is important. Once the fire is under control, the fire can be completely extinguished.

The rescue and salvage operations are self-explanatory—if anything can be saved, save it as long as fire fighters are not placed at risk. These two actions are always active, right from sizing up to extinguishment.

Procedures developed for fireground operations should be flexible enough to allow the change in the incident action plan due to:

- Life hazard (must be given first priority).
- Problems with water supply and water application.
- Volume and extent of fire, requiring large-caliber streams.
- Location of the fire, inaccessible for hand-line operations.
- Materials involved in the fire and explosion potential compounding the problem.
- Exposure problems where further fire spread would be a major concern.
- Stability of the structure, which would be dependent on the condition of the structural components of the building and the intensity and duration of the fire [Brunacini 2002].

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

At this incident, the exterior fire on the Bravo/Charlie corner was not controlled by knocking down what fire could be reached due to the limited access to that area prior to sending in interior attack crews. The interior attack crews weren't able to get water on the fire in a timely manner due to several obstacles, and horizontal ventilation took place causing a flow path that affected interior crews. Perhaps a second interior attack crew to back up the first line at the top of the stairs in the door way could have seen Engine 16's crew and assisted them in evacuating.

Recommendation #2: Fire departments should ensure that crew integrity is properly maintained by voice or radio contact when operating in an immediately dangerous to life and health (IDLH) atmosphere.

Discussion: When an engine company enters a structure, the members must remain in contact by visual (eye-to-eye contact), verbal (radio or face-to-face), or direct (touch) contact. NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program*, 8.5.5, states, "Crew members operating in a hazardous area shall be in communication with each other through visual, audible, or physical means or safety guide rope, in order to coordinate their activities," and 8.5.4 states, "Members operating in hazardous areas at emergency incidents shall operate in crews of two or more" [Gagliano et al. 2008]. Additionally, NFPA 1500, 8.5.6, states, "Crew members shall be in proximity to each other to provide assistance in case of an emergency" [NFPA 2013c].

The International Association of Fire Chiefs, Safety, Health, and Survival Section has redefined the *Rules of Engagement for Structural Firefighting*. One of its objectives is to ensure that fire fighters always enter a burning building as a team of two or more members and no fire fighter is allowed to be alone at any time while entering, operating in, or exiting a building. A critical element for fire fighter survival is crew integrity. Crew integrity means fire fighters stay together as a team of two or more. They must enter a structure together and remain together at all times while in the interior, and all members come out together. Crew integrity starts with the company officer ensuring that all members of the company understand their riding assignment, have the proper PPE, and have the proper tools and equipment. Upon arrival at the incident, the company is given a task to perform by the incident commander. The company officer communicates to the members of the company what their assignment is and how they will accomplish their assignment. To ensure that crew integrity is maintained, all the members of a company should enter a hazardous environment together and leave together. If one member has to leave, the whole company leaves [IAFC 2009].

It is the responsibility of every fire fighter to stay connected with crew members at all times. All fire fighters must maintain the unity of command by operating at all times under the direction of the incident commander, division/group supervisor, or their company officer. The ultimate responsibility for crew integrity and ensuring no members get separated or lost rests with the company officer. While operating in a hazard zone they must maintain constant contact with their assigned members by visual observation, voice, or touch. They must ensure they stay together as a company or crew. If any of these elements are not adhered to, crew integrity is lost and fire fighters are placed at risk.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

NFPA 1500, 8.4.4–8.4.6 states:

- The incident commander shall maintain an awareness of the location and function of all companies or crews at the scene of the incident. This can be accomplished using a tactical worksheet/accountability board.
- Officers assigned the responsibility for a specific tactical-level management component at an incident shall directly supervise and account for the companies and/or crews operating in their specific area of responsibility.
- Company officers shall maintain an ongoing awareness of the location and condition of all company members [NFPA 2013c].

If a fire fighter becomes separated and cannot immediately get reconnected with his/her crew, the fire fighter should attempt to communicate via portable radio with the company officer. If the fire fighter and officer do not rejoin after three radio attempts or they are not rejoined within 1 minute, a Mayday should be declared. If conditions are rapidly deteriorating, the Mayday must be declared immediately. As part of a Mayday declaration, the fire fighter must next activate the radio's emergency alert button (where provided), followed by manually turning on the PASS alarm. Similarly, if the company officer or other company member(s) recognize they have a separated member, they should immediately attempt to locate the member by using their radio or by voice. If contact is not established after three attempts or within 1 minute, a Mayday should be declared immediately [IAFC 2009].

In this incident, the Engine 16 fire fighter (Engine 16B) became separated from his lieutenant after his low-air alarm went off and his lieutenant said to exit. The lieutenant searched and tried to contact his fire fighter. He then called a Mayday that went unheard. Also, the Engine 16 fire fighter (Engine 16C) went to the rear with Engine 14.

Recommendation #3: Fire departments should ensure that fire fighters and officers are properly trained in air management including out-of-air emergencies.

Discussion: Chief Bobby Halton, retired chief and editor in chief of *Fire Engineering* notes: “If you run out of air in a working fire today, you are in mortal danger. There is no good air at the floor anymore, no effective filtering methods, no matter what others may say to the contrary” [Gagliano et al. 2008]. The only protection for fire fighters in the toxic smoke environments in today's fires is the air that they carry on their backs. Like SCUBA divers, fire fighters must manage their air effectively and leave enough reserve air to exit in case of unforeseen occurrences while inside a structure fire. Fire fighters must manage their air so that they leave the immediately dangerous to life and health (IDLH) atmosphere before the low-air alarm activates. This leaves an adequate emergency air reserve and removes the noise of the low-air alarm from the fireground [Gagliano et al. 2008].

Air management is a program that the fire service can use to ensure that fire fighters have enough breathing air to complete their primary mission and allow enough reserve air for the fire fighter to escape an unforeseen emergency. Fire departments and fire fighters need to recognize that the smoke in modern construction is an IDLH atmosphere and manage their air along with their work periods so the fire fighters exit the IDLH atmosphere with their reserve air intact. NFPA 1404 *Standard for Fire*

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Service Respiratory Protection Training states that fire fighters should exit from an IDLH atmosphere before the consumption of reserve air supply begins, and a low-air alarm is notification that the individual is consuming the reserve air supply and that immediate action is required by the individual and the fire-fighting team [NFPA 2013b].

Fire fighters and command officers need to recognize and communicate their air status and use air management on the fireground. Air management happens at the individual fire fighter level, the crew level, and the command level. Fire fighters need to ensure their air supply is adequate (full cylinder) at the start of the shift and need to monitor their air usage during an event. They must be able to recognize the 50% HUD light flash and then communicate that information to his/her crew members. Fire fighters need to understand principles of air management, such as the need to exit the IDLH atmosphere before they go into their emergency reserve air and their end-of-service-time indicator (EOSTI) alarms. If they are not out of the IDLH atmosphere and go into their emergency reserve air, they need to immediately communicate with their crew and Command as this can now be considered an emergency. Fire fighters should not wait until their EOSTI alarms or they are out of air to communicate.

Fire-fighting crews need to understand and communicate their air supply status among the crews so they can plan accordingly to notify Command of the need to exit and still have their reserve/emergency air available. One method is to have the first person on a crew who reaches their 50% (flashing yellow light on HUD) notify the crew leader and he/she can then estimate the amount of work period left so they can leave the structure (or IDLH atmosphere) before the person with the least amount of air goes into their emergency reserve air.

Command needs to understand air management at the command level. This means that someone at the command post is monitoring not only accountability of the crews, but how long they have been working (estimating air supply usage) and checking on air status through PAR checks and then rotating crews with enough time to ensure that crews exit the IDLH atmosphere with their emergency reserve air intact.

Too often fire fighters may not pay attention to their air usage and remaining air until they get into their emergency reserve air and their EOSTI sounds or vibrates. This can be due to a number of reasons, including lack of familiarity with a new SCBA (with heads-up display [HUD]) or a different model or a lack of training. Another reason may be the old culture of waiting to take an action based on the old “low-air alarm.” Fire fighters in the past didn’t have HUDs and relied on the “low-air alarm” to warn them of their low air status. It was very difficult if not impossible in some fire-fighting incidents to read the over-the-shoulder gauge. With the addition of HUDs or heads-up displays, fire fighters now have the ability to know their approximate air supply status by reading the lights in their facepiece. The four lights in the facepiece start in the illuminated and green position and then turn off as the air supply decreases. Once the SCBA air supply reaches approximately 50%, the light begins to flash. Some change color to yellow when below 50% then change to red in the EOSTI mode. This is designed to alert the fire fighter to take an action that would ensure they have enough escape time to exit the building with their reserve air intact. Once the air supply reaches the EOSTI level, the SCBA

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

will provide another signal (bell, whistle, and/or vibration signal) that alerts the user they are nearing the end of the usable air in the cylinder. On pre-2013 edition SCBAs, this level was approximately 25% (+/-2), but on the 2013 and newer editions SCBAs, this EOSTI level was increased to 33%.

Repetitive skills training with a SCBA is vital for the safety of fire fighters working inside an IDLH atmosphere. SCBA skills training is an ongoing process that should be performed regularly to ensure that fire fighters "know their SCBA." The benefits of repetitive skills training with a SCBA are an increased comfort and competency level, decreased anxiety, lower air consumption, increased awareness of the user's air level (noticing and using the HUD), and an automatic muscle memory response for the vital function controls, such as the don/doff buttons, main air valve, emergency bypass operating valve, and auxiliary air connections (i.e., rapid intervention crew/universal air connection [RIC/UAC] connection and the buddy breather connection). Repetitive skills training also provide the user with an increased ability to operate these functions and controls in a high-anxiety moment or an emergency. Many times, using these skills will be necessary with gloved hands, limited vision, and reduced ability to hear commands from others. Performed in conditions that are non-IDLH, repetitive skills training helps build the fire fighters' muscle memory so their hands will be able to activate the controls with gloves on and the operation will be a conditioned or second-nature response in case of an emergency [NIOSH 2011, 2012].

The first step in overcoming an SCBA out-of-air emergency is complete familiarization with your specific SCBA and your breathing air requirements and usage. Fire fighters need to understand that many SCBA out-of-air emergencies are caused by fire fighters not recognizing the remaining air supply relative to the mission and then another event occurs, such as becoming separated from their crew or hoseline and becoming lost. There are other events that can challenge a fire fighter's ability to overcome an out-of-air emergency, such as facepiece becoming dislodged, hose entanglement, vomiting in a facepiece, or mechanical issues with the SCBA. A fire fighter's ability to overcome these events is directly related to their repetitive muscle memory skill, which is only achieved through training and experience with their current SCBA.

One helpful hint for departments to understand is that fire fighters need sufficient "cockpit time" with their particular model SCBA so they can operate in fire environments without undue concentration on their SCBA. If a fire fighter has limited experience with a particular SCBA, whether it is because they are a new fire fighter or an experienced fire fighter with a new SCBA model or manufacturer, they may be concentrating so much on using their SCBA that they miss fire environment signs such as fire growth, smoke behavior, orientation of the room, other crew members actions, and other conditions that require attention. This undue concentration on using the SCBA may even be subtle, and when faced with a condition that needs a trained muscle memory response, such as activating the bypass or checking the cylinder wheel, the fire fighter may not have the automatic response necessary to overcome the initial event. In addition, increased anxiety further complicates the steps to overcome the situation. Many uncontrolled SCBA out-of-air emergencies can be overcome by repetitive skills training.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

In this incident, the fire fighter's low-air alarm was going off and his officer told him to exit, but he became separated and ran out of air. During the interview process, investigators were informed that cylinders would often be allowed to go down to 3,800 psi before filling to 4,500 psi, since the stations did not have a cascade system to fill them in-house. It is possible that the fire fighter entered the structure with only 84% of his cylinder air. The fire fighter was found with his mask on and out of air. The medical examiner's cause of death was lack of breathing gas. It is unknown why the fire fighter did not remove his mask and follow the hoseline to the door.

NIOSH investigators have identified air management as a contributing factor on many investigations of fire fighter line-of-duty deaths. Fire departments need to ensure that training on air management occurs at all levels of the command structure [NIOSH 2011, 2012].

Recommendation #4: Fire departments should use a personnel accountability system that accounts for all resources assigned to an incident.

Discussion: The personnel accountability system was designed and is operated to ensure that fire fighters do not become lost or missing in the hazard zone. The system tracks fire fighters by location and function. An integral part of the accountability system is to make sure that the fire fighters who are assigned and operating in the hazard zone are accounted for, starting with the initial operations and throughout the entire incident. Also, a process must be in place to periodically check to make sure that all members operating in the hazard zone are accounted for.

A personnel accountability system readily identifies both the location and function of all members operating at an incident scene [Bachrach and Egstrom 1987; Corbin 2000]. The philosophy of the personnel accountability system starts with the same principles of an incident management system—company unity and unity of command. Unity can be fulfilled initially and maintained throughout the incident by documenting the situation status and resource status on a tactical worksheet.

One of the most important functions of command safety is for the incident commander to initiate an accountability system that includes the functional and geographical assignments at the beginning of operations and until the termination of the incident. It is very important for the first on-scene resource to initiate an accountability system. This initial system allows the passing or transfer of information to the next officer who assumes command upon his/her arrival [Bachrach and Egstrom 1987].

A functional personnel accountability system requires the following:

- Development and implementation of a departmental standard operating procedure.
- Necessary components and hardware.
- Training all members on the operation of the system.
- Strict enforcement during emergency incidents.

Some methods and tools for resource accountability are:

- Tactical worksheets
 - Command boards
-
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Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

- Apparatus riding lists
- Company responding boards
- Electronic bar-coding systems
- Accountability tags or keys (e.g., PASSPORT System) [Bachrach and Egstrom 1987]

Resource accountability should be assigned to personnel who are responsible for maintaining the location and status of all assigned resources at an incident. As the incident escalates, resource status would be placed on the implemented accountability system [NFPA 2014]. This function is separate from the role of the incident commander. The incident commander is responsible for the overall command and control of the incident. Due to the importance of responder safety, resource status should be assigned to a dedicated member as the size and complexity of the incident dictates. A number of positions could function in this role including an incident command technician, staff assistant, chief officer, or other designated member. As the incident escalates and tactical-level management components (e.g., divisions or groups) are assigned, the resource status officer (accountability officer) works with the division or group supervisors to maintain on-going tracking and accountability of members [Bastain 2003]. A properly initiated and enforced personnel accountability system enhances fire fighter safety and survival. It is vital that resources can be identified and located in a timely manner.

An important aspect of a personnel accountability system is the personnel accountability report (PAR). A PAR is an organized on-scene roll call in which each supervisor reports the status of their crew when requested by the incident commander [Bachrach and Egstrom 1987]. The PAR should be conducted every 15–20 minutes or when benchmarks are met.

In order for the personnel accountability system to function, it must include a standard operating procedure that defines each function's responsibility in making this process successful on the fireground. Also a training component—both classroom and practical—should occur to ensure this process operates properly during emergency incidents.

In this incident, accountability was not established until late on the fireground.

Recommendation #5: Fire departments should ensure that incident commanders incorporate the principles of command safety into the incident management system.

Discussion: The principles of command safety provide the incident commander with the necessary resources on how to use, follow, and incorporate safety into the incident management system at all incidents. Command safety is used as part of the eight functions of command developed by Fire Chief Alan V. Brunacini (retired). Command safety defines how the incident commander must use the regular, everyday command functions to complete the strategic-level safety responsibilities during incident operations. Using the command functions creates an effective and a close connection between the safety officer and the incident commander. The eight functions of command are:

- Assumption/confirmation/positioning
- Situation evaluation, which includes risk management

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

- Communications
- Deployment
- Strategy/incident action planning
- Organization
- Review/revision
- Transfer/continuation/termination [Clark 2008; NFPA 2013d]

A major objective of the incident management system is to establish and support an incident commander. The incident commander will direct the geographical and functional needs of the entire incident on the task, tactical, and strategic levels. Issues develop for the incident commander when these three standard levels are not in place, operating, and effectively connected. One of the most important components is to ensure the incident commander operates on the strategic level from the very beginning of the incident and stays on the strategic level as long as fire fighters are operating in an immediately dangerous to life and health (IDLH) environment [Clark 2008; NFPA 2013d]. The incident commander uses the incident management system as the basic foundation for managing the strategic-level safety function. Command safety ensures the highest level of safety for fire department members operating at emergency incidents. The incident commander completes the operational and safety responsibility to the fire fighters by performing the eight command functions. These functions serve as a very practical performance foundation for how the incident commander completes their responsibility as the strategic-level incident manager and the overall incident safety manager [Corbin 2000].

At this incident, several elements of command safety, such as communications, incident action planning, and risk management, needed to be further evaluated and updated.

Recommendation #6: Fire departments should ensure that fire fighters are properly trained in Mayday procedures.

Discussion: It is essential to train fire fighters to recognize when they are in trouble, know how to call for help, and understand how incident commanders and others must react to a responder in trouble [Jakubowski and Morton 2001].

One of the most difficult situations a fire fighter can face is when they realize they need to declare a Mayday. Recognizing that they are (or about to be) in a life-threatening situation is the first step in improving the fire fighters' chances to survive a Mayday event. Many fire departments don't have a simple procedure for what to say when a fire fighter gets into trouble—i.e., a critical situation where communications must be clear [Jakubowski and Morton 2001]. A Mayday declaration is such an infrequent event in any fire fighter's career that they need to frequently train in how to recognize the need for a Mayday, how to declare the Mayday, and what steps to take to improve their chances for survival.

Fire fighters must understand that when they are faced with a life-threatening emergency, there is a very narrow window of survivability, and any delay in egress and/or transmission of a Mayday

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

message reduces the chance for a successful rescue. Knowledge and skill training on preventing a Mayday situation or how to call a Mayday should be mastered before a fire fighter engages in fireground activities or other immediately dangerous to life and health (IDLH) environments.

Fire fighter training programs should include training on such topics as air management, crew integrity, reading smoke, fire dynamics and behavior, entanglement hazards, building construction, signs of pending structural collapse, and familiarity with a self-contained breathing apparatus (SCBA), a radio, and personal protective equipment (PPE).

A fire fighter's knowledge, skill, and ability to declare a Mayday must be at the mastery level of performance. This performance level should be maintained throughout their career through training offered more frequently than annually [IAFF 2010; Sendelbach 2003].

Fire fighters need to also understand that their PPE and SCBA do not provide unlimited protection. Fire fighters 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 manually activating 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.

Presently there are no Mayday standards for fire fighters to be trained on, and most states do not have Mayday standards. Mayday rules and training are not included in the job performance requirements in NFPA Fire Fighter 1 or 2 standards. It is up to each authority having jurisdiction to develop rules and performance standards for a fire fighter to call a Mayday. Fire departments should ensure that any personnel who may enter an IDLH environment meet the standards for Mayday competency for the authority having jurisdiction [IAFF 2010; Clark 2008].

The National Fire Academy has two courses addressing the fire fighter Mayday Doctrine, Q133 Firefighter Safety: Calling the Mayday, which is a 2-hour program covering the cognitive and affective learning domain of the fire fighter Mayday Doctrine, and H134 Calling the Mayday: Hands-on Training, which is an 8-hour course that covers the psychomotor learning domain of the fire fighter Mayday Doctrine. These courses are based on the military methodology used to develop and teach fighter pilots ejection doctrine. A training CD is available to fire departments free of charge from the U.S. Fire Administration Publications office [Clark 2005; USFA 2006]. Also, the International Association of Fire Fighters (IAFF) Fire Ground Survival Program is another resource fire departments can use and was developed to ensure that training for Mayday prevention and Mayday operations are consistent between all fire fighters, company officers, and chief officers [IAFF 2010].

Any Mayday communication must contain the location of the fire fighter in as much detail as possible and, at a minimum, should include the division (floor) and quadrant. When in IDLH environments, fire fighters must know their location at all times to effectively be able to give their location in the event of

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

a Mayday. Once in distress, fire fighters must immediately declare a Mayday. The following example uses LUNAR (Location, Unit, Name, Assignment/Air, Resources needed) as a prompt: "Mayday, Mayday, Mayday, Division 1 Quadrant C, Engine 71, Smith, search/out of air/vomited, can't find exit." When in trouble, a fire fighter's first action must be to declare the Mayday as accurately as possible. Once the incident commander and rapid intervention team (RIT) know the fire fighter's location, the fire fighter can then try to fix the problem, such as clearing the nose cup, while the RIT is en route for rescue [USFA 2006].

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

Fire fighters also need to understand the psychological and physiological effects of the extreme level of stress encountered when they run low on air; become trapped during rapid fire progression; or become lost, disoriented; or injured. Most fire training curricula do not include discussion of the psychological and physiological effects of extreme stress, such as encountered in an imminently life-threatening situation, nor do they address key survival skills necessary for effective response. Understanding the psychology and physiology involved is an essential step in developing appropriate responses to life-threatening situations. Reaction to the extreme stress of a life-threatening situation, such as being trapped, can result in sensory distortions and decreased cognitive processing capability [Grossman and Christensen 2008].

Fire fighters should never hesitate to declare a Mayday. There is a very narrow window of survivability in a burning, highly toxic building. Any delay declaring a Mayday reduces the chance for a successful rescue [Clark 2005]. In the book *Stress and Performance in Diving*, the author notes that while all training is important,

We know that under conditions of stress, particularly when rapid problem-solving is crucial, over-learning responses is essential. The properly trained individual should have learned coping behavior so well that responses become virtually automatic requiring less stop and think performance [Bachrach and Egstrom 1987].

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 it is not as recognizable as an immediate action word that will start a rescue process. During this incident, the fireground radio traffic was busy and many different communications were taking place. A Mayday message transmitted over the radio much earlier in the event may have gotten the attention of command officers and other fire fighters when a rescue attempt might have had a better chance of locating the fire fighter.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

In this incident, the fire fighter never called a Mayday and never activated his emergency button (emergency buttons were inoperable) or PASS device. His officer called a Mayday that went unacknowledged and a second one that was not recorded on the radio transmission log.

Recommendation #7: Fire departments should provide the incident commander with a Mayday tactical checklist for use in the event of a Mayday.

Discussion: When a Mayday is transmitted for whatever reason, the incident commander has a very narrow window of opportunity to locate the lost, trapped, or injured member(s). The incident commander must restructure the strategy and incident action plan (tactics) to include a priority rescue [Bachrach and Egstrom 1987].

Some departments have adopted the term LUNAR—location, unit assigned, name, assistance needed, and resources needed—to gain additional information in identifying a fire fighter who is in trouble and in need of assistance. The incident commander, division/group supervisors, company officers, and fire fighters need to understand the seriousness of the situation. It is important to have the available resources on-scene and to have a plan established prior to the Mayday [Bachrach and Egstrom 1987; Corbin 2000].

A checklist is provided in **Appendix Two, “Incident Commander’s Tactical Worksheet for Mayday,”** which can assist the incident commander in the necessary steps for clearing the Mayday as quickly and safely possible. This checklist serves as a guide and can be tailored to any fire department’s Mayday procedures. The checklist format allows the incident commander to follow a structured worksheet. This process is too important to operate from memory and risk missing a vital step that could jeopardize the outcome of the rescue of a fire fighter.

At this incident, when the Mayday occurred, the incident commander quickly called for additional resources and conducted a personnel accountability report to determine if any companies were lost or missing. Due to the influx of resources, trying to determine the location of companies and identifying crews that were missing, the incident commander was quickly overwhelmed. The intent of this Mayday worksheet, like the tactical worksheet, is to assist the incident commander during a very difficult and stressful time on the fireground operations.

Recommendation #8: Fire departments should develop and implement a fireground communication standard operating procedure that includes a communication protocol and specifies equipment and capacity of the communication system.

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) that outlines the communication procedures for fireground operations. Fire departments should ensure that the communications division and communication center are part of this

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

process. Another important aspect of this process is an effective education and training program for all members of the department.

Radio frequency usually refers to the radio frequency of the assigned channel. A radio channel is defined as the width of the signal depending on the type of transmissions and the tolerance for the frequency of emission. A radio channel is normally allocated for radio transmission in a specified type of service or by a specified transmitter. Fire departments should ensure that an adequate number of radio channels are available. Multiple radio channels are necessary at large-scale or complex incidents, such as a commercial structure fire, mass-casualty incident, hazardous materials incident, or special operations incident [NFPA 2014; FIREScope 2012]. A fire department should provide the necessary number of radio channels for complex or large-scale incidents needing multiple tactical channels. NFPA 1561 *Standard on Emergency Services Incident Management System and Command Safety* states in Paragraph 6.1.4, “The communications system shall provide reserve capacity for complex or multiple incidents.” This would require fire departments to preplan radio channel usage for all incident levels based upon the needs of an emergency incident including large-scale or complex incidents [NFPA 2014].

Fire departments should preplan for not only large-scale or complex incidents, but also for the ability to handle daily operations. Standard operating procedures, radio equipment (e.g., mobile radios, portable radios, mobile data terminals, laptop computers), other hardware (e.g., CAD system), and dispatch and communications protocols should be in place to ensure that these additional channels are available when needed [NFPA 2014].

Every fire fighter and company officer should take responsibility to ensure radios are properly used. Ensuring appropriate radio use involves both taking personal responsibility to have your portable radio turned on and to the correct channel. A company officer’s responsibility is to ensure that all members of the crew comply with these requirements. Portable radios should be designed and carried in a position that allows a fire fighter to monitor and transmit a clear message [IAFF 2010; Varone 2003].

A fire department’s SOP on communications should address issues on what to do if your Mayday transmission is not acknowledged, such as activating your emergency button. If there is a complete radio failure, the fire fighter should evacuate the building as a matter of safety. In this incident, a Mayday was not acknowledged and the emergency button was not functionally activated by the fire department.

When a fire department responds to an incident, the incident commander should forecast for the incident to determine if there is potential for being a complex or long-term operation that may require additional resources, including demands on the communications system. As incidents increase in size, the communication system has to keep up with the demands of the incident. The incident commander must be able to communicate with company officers and division/group supervisors [FIREScope 2012]. Before communications become an issue, the incident commander must consider options for alleviating excessive radio traffic. Several options are:

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

- Assign non-fireground resources (e.g., Staging, “Rehab”) to a separate tactical channel or talk-group channel.
- Designate a “command channel,” which is a radio channel designated by the fire department to provide for communications between the incident commander and the division/group supervisors or branch directors during an emergency incident [NFPA 2014].
- For incidents involving large geographical areas, designate a tactical channel or talk-group for each division.

Communications between the incident commander and tactical-level management units and/or company officers is essential for successful fireground operations. Communication during the fire attack may be difficult at times due to the noise created by the hose stream striking walls, ceilings, and furnishings. However, the engine company officer must monitor the portable radio for critical information that may affect the engine company. This includes ventilation delays, water supply difficulties, collapse potential, and Mayday and/or "urgent" transmissions. The engine company officer can provide the incident commander with vital information that may affect how the fire operation is handled. Messages such as those listed below should be transmitted to the incident commander, other units, or individual members on the scene:

- "Start a 1¾-inch line to the second floor."
- "Start water."
- "We have two rooms knocked down; making progress."
- "Main body of fire has been extinguished."
- "Increase/decrease pressure."
- "We need a back-up line to the second floor" [Brunacini 2002].

In this incident, there were several breakdowns in communication, including transmissions not being understood, a Mayday not acknowledged, and transmissions not getting through.

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

Discussion: The National Institute of Standards and Technology (NIST) and Underwriters Laboratories (UL) have conducted a series of live burn experiments designed to replicate conditions in modern homes and residential structures and to validate previous testing done in laboratory settings. The results of these experiments will enable fire fighters to better predict and react to effects of new materials and construction on fire. The fire research experiments were conducted in cooperation with the Fire Department of New York, Chicago Fire Department, Spartanburg, South Carolina Fire and Rescue, and other agencies. The live burn tests were aimed at quantifying emerging theories about how fires are different today, largely due to new building construction and the composition of home furnishings and products. In the past, these products were mainly composed of natural materials, such as wood and cotton, but now contain large quantities of petroleum-based products and synthetic

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

materials that burn faster and hotter and generate large volumes of fuel-rich smoke. Where a fire in a room once took approximately 20 minutes to “flashover”—igniting all the contents—this can happen with today’s furnishings in as little as 4 to 5 minutes [NIST 2013; ULFSRI and FirefightersCloseCall.com, no date].

In addition, modern living spaces tend to be more open, less compartmentalized and are better insulated than homes built years ago. As a result, interior residential fires can generate an oxygen-depleted, fuel-rich environment within minutes. This fire condition of hot, fuel-rich smoke is highly reactive to the introduction of oxygen. Introducing oxygen to this environment by opening a door or venting a window may result in a rapid transition to flashover. These same conditions can occur in commercial structures as seen in the Charleston, South Carolina, Sofa Super Store fire [NIOSH 2009a].

The NIST and UL experiments evaluated individual and combinations of methods for strategically ventilating and isolating fires to prevent flashover—or at least delay it. In contrast, kicking a door open or breaking a window without knowledge of conditions inside could create a portal for air that can literally fan the flames by introducing oxygen into an oxygen-limited fire environment.

Traditionally, fire suppression operations were conducted from the interior of the structure as a means of reducing water damage and limiting fire damage to structures. These operations must be coordinated with the ventilation operations. Previous research and examinations of line-of-duty deaths have shown that ventilation events occurring with fire fighters in the structure prior to suppression have led to tragic results [Brunacini 2002; FDNY 2013; NIOSH 2009a]. One means of eliminating the possibilities of this occurrence would be a transitional attack, in which water is directed into the structure from the exterior to cool the fire gases and reduce the heat-release rate of the fire, prior to the fire fighters entering the building. The major concern with this type of operation is the potential harm that might occur to people trapped in the structure or the amount of water damage to the structure [NIST 2013].

Based upon the NIST and UL research, the following fireground operations should be considered for implementation.

- **Size-Up**

Size-up must occur at every fire. Consideration must be given to the resources available and situational conditions, such as weather, fire location, size of the fire and building, and the construction features. Ensure a 360-degree size-up is conducted whenever possible. A tactical plan for each fire must be developed, communicated, and implemented.

- **Ventilation**

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 fire fighters due to increased heat release rates within the flow path.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

- **Fire-fighting Operations**

Given the fuel-rich environment that the fire service operates in today, water should be applied to the fire as soon as possible. In many cases, water application through an exterior opening into a fire compartment may be the best first action, prior to committing fire-fighting resources to the interior.

Fire departments should cool the interior spaces of a fire building with water from the safest location possible, prior to committing personnel into spaces with, or adjacent to, fully developed or smoldering (ventilation-limited) fire conditions.

- **Rapid Intervention**

Fire department rapid intervention procedures should be updated to ensure that during fire fighter Mayday incidents, water is provided on the fire as soon as possible and ventilation openings are controlled [FDNY 2013].

This information is presented to educate the fire service and to ensure that fire departments consider a change in fireground tactics based upon the current research presented by NIST and UL. Much of this research has been directed toward developing a better understanding of the characteristics of the modern fire. This modern research provides members of the fire service with the information and knowledge needed to modify essential fire-fighting tactics. While fire-fighting will never be without risk, this research represents a vital contribution to overall efforts to reduce risks and to save lives.

At this incident, coordinated vertical ventilation was not conducted on the second floor in a timely manner.

Recommendation #10: Fire departments should review standard operating procedures regarding the use and operation of thermal imagers.

Discussion: Another valuable tool that enhances situational awareness is the thermal imager. The thermal imager provides a technology with potential to enhance fire fighter safety and improve the ability to perform tasks such as size-up, search and rescue, fire attack, and ventilation. Thermal imagers should be used in a timely manner. Fire fighters should be properly trained in the use of a thermal imager and be aware of their limitations [SAFE-IR 2013; NIOSH 2009b].

The application of thermal imaging on the fireground may help fire departments accomplish their primary mission, which is saving lives. This mission can be accomplished in many ways. First and foremost, in near zero visibility conditions, primary searches may be completed quickly and with an added degree of safety. The use of thermal imaging technology may also be invaluable when fire fighters are confronted with larger floor areas or unusual floor plans [SAFE-IR 2013]. Thermal imagers may provide a method for fire fighters to track and locate other fire fighters in very limited visibility conditions. This can enhance fire fighter accountability before an issue arises [SAFE-IR 2013]. While the use of a thermal imager is important, research by Underwriters Laboratories has shown that there are significant limitations in the ability of these devices to detect temperature differences behind structural materials, such as the exterior finish of a building or outside compartment

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

linings (i.e., walls, ceilings, and floors) [NIOSH 2009b]. The most common misconception about temperature measurement using a thermal imager is that it estimates air temperatures. Thermal imagers do not read air temperatures; they read surface temperatures. Although occasionally a thermal imager may show superheated or cryogenic gases, in general, thermal imagers do not "see" or measure gases. Fire fighters should not be lulled into a mistaken sense of security because the temperature measurement on the thermal imager seems relatively low or has not reached its scale maximum [Corbin 2000].

At a structure fire, the thermal imager may help identify the location of the fire or the extent of fire involvement prior to fire fighters being deployed into a structure. Knowing the location of the fire may help fire fighters determine the best approach to the fire. The thermal imager may provide additional information for a crew making the fire attack that they would not previously have had due to poor visibility and building construction features. Using this information, fire fighters may be able to locate the fire more quickly and may also ensure that the water application is effective. From a ventilation perspective, fire fighters can use the thermal imager to identify areas of heat accumulation, possible ventilation points, and significant building construction features. This helps ensure proper and effective ventilation that successfully removes smoke and heat from a building [SAFE-IR 2013; Bastain 2003].

Per department protocol, the first arriving officer provides a temperature reading as they enter the structure as part of the initial size-up. The thermal imager does not provide an accurate assessment of the total room temperature. In all reality, the temperature readings and color variations that a thermal imager provides are best suited to establish differences of an area being entered, rather than the true atmospheric temperature [SAFE-IR 2013; Bastain 2003].

Additional information is provided in Appendix Three. The intent of this recommendation and the appendix material is to ensure that the fire service clearly understands the concept, use, and limitations of thermal imagers.

In this incident, Engine 16's thermal imager was out of service. Engine 5 did use a thermal imager when they were searching for the missing fire fighter.

Recommendation #11: Fire departments should ensure that proper use of structural fire-fighting protective hoods is enforced.

Discussion: NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program* contains the general recommendations for fire fighter protective clothing and protective equipment [NFPA 2013c]. Chapter 7.1.1 specifies that "the fire department shall provide each member with protective clothing and protective equipment that is designed to provide protection from the hazards to which the member is likely to be exposed and is suitable for the tasks that the member is expected to perform." Chapter 7.1.2 states, "Protective clothing and protective equipment shall be used whenever the member is exposed or potentially exposed to the hazards for which it is provided." Chapter 7.2.1 states, "Members who engage in or are exposed to the hazards of structural fire fighting shall be provided with and shall use a protective ensemble that shall meet the applicable requirements of NFPA

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

1971 *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*” [NFPA 2013d].

NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program* states: “The fire department shall provide each member with protective clothing and protective equipment that is designed to provide protection from the hazards to which the member is likely to be exposed and is suitable for the tasks that the member is expected to perform. ... Protective clothing and protective equipment shall be used whenever a member is exposed or potentially exposed to the hazards for which the protective clothing (and equipment) is provided” [NFPA 2013c].

NFPA 1971 *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting* has established minimum requirements for structural fire-fighting protective ensembles and ensemble elements designed to provide fire-fighting personnel limited protection from thermal, physical, environmental, and bloodborne pathogen hazards encountered during structural fire-fighting operations [NFPA 2013d]. These requirements will assist in protecting fire fighters, but only if they wear the protective ensembles as recommended by the manufacturer.

In this incident, the fire department did not require fire fighters to wear hoods. The fire department has recently changed their policy and now requires fire fighters to wear hoods. A number of fire fighters were hit by a hose stream and had their helmets knocked off. Also, numerous fire fighters were not using their chin straps on their helmets. Proper use of the helmet requires using the chin strap.

Recommendation #12: Municipalities should ensure that an ambulance is dispatched on every working fire.

Discussion: History has shown and numerous NIOSH fatality reports have documented how routine fires can change in minutes and cause critical injuries. When this occurs, seconds count and having an ambulance (preferably advance life support capability) on-scene can make a significant difference in the outcome for the patient. When it is confirmed that there is a working fire, an ambulance should be dispatched along with the additional fire service resources as a general practice.

In this incident, ambulance service was provided by two ambulance companies that cover the city by a north and south divider, and an ambulance was not called until it was needed. However, if an ambulance had been present, it is believed that the outcome may not have changed.

Recommendation #13: Municipalities, building owners, and authorities having jurisdiction should consider requiring sprinkler systems be installed in mixed occupancy structures.

Discussion: Fire development beyond the incipient stage is one of the greatest hazards that fire fighters are exposed to. This exposure and risk to fire fighters can be dramatically reduced when fires are controlled or extinguished by automatic sprinkler systems. NFPA statistics show that most fires in sprinklered buildings are controlled prior to fire department arrival by the activation of one or two sprinkler heads. The presence of automatic fire sprinklers also reduces the exposure risk to fire fighters in rescue situations by allowing the safe egress of building occupants before the fire department arrives

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

on-scene. Finally, by controlling fire development, the exposure to hazards such as building collapse and overhaul operations are greatly reduced, if not eliminated.

In this incident, the structure was not equipped with a sprinkler system.

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Investigator Information

This incident was investigated by Matt E. Bowyer, General Engineer, Stephen Miles, Occupational Safety and Health Specialist, and Murrey Loflin, Investigator, with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH located in Morgantown, West Virginia. An expert technical review was provided by John J. Salka, Jr., Battalion Chief (ret.), FDNY, and Fire Command Training Instructor. A technical review was also provided by the National Fire Protection Association, Public Fire Protection Division.

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Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Appendix I

Self-Contained Breathing Apparatus

National Personal Protective Technology Laboratory Technology Evaluation Branch

Disclaimer

Investigator Information

The SCBA inspection and this report were written by Thomas D. Pouchot, General Engineer, the Technology Evaluation Branch, National Personal Protective Technology Laboratory, National Institute for Occupational Safety and Health, located in Bruceton, Pennsylvania.

The purpose of Respirator Status Investigations is to determine the conformance of each respirator to the NIOSH approval requirements found in Title 42, *Code of Federal Regulations*, Part 84. A number of performance tests are selected from the complete list of Part 84 requirements and each respirator is tested in its “**as received**” condition to determine its conformance to those performance requirements. Each respirator is also inspected to determine its conformance to the quality assurance documentation on file at NIOSH.

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

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

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Status Investigation Report of One Self-Contained Breathing Apparatus Submitted By the NIOSH Division of Safety Research NIOSH Task Number 19908

The National Institute for Occupational Safety and Health (NIOSH) has concluded its investigation conducted under NIOSH Task Number TN-19908. This investigation consisted of the inspection of two Scott Health and Safety AirPak 4.5, 30 minute, 4500 psig, Self Contained Breathing Apparatus (SCBA). The SCBAs in question were packaged inside a paper bag and shipped inside a plastic shipping box and were delivered to the NIOSH facility in Morgantown, WV, on October, 28, 2014. The SCBA units were then transported to Building 20 in Pittsburgh for inspection and stored under lock until the time of the evaluations on November 21, 2014.

SCBA Inspection:

An initial general inspection of the SCBA units was conducted on November 18, 2014. The units were identified as the Scott Health and Safety AirPak 4.5 model. In addition, Scott Health and Safety performed a downloading of the data logger present on one of the SCBA units, with NIOSH personnel present, on November 25, 2014. The other SCBA did not have a data logger.

A complete visual inspection of both SCBA units was conducted on November 18, 2014. The units were examined, component by component in the condition received, to determine conformance to the NIOSH-approved configuration. The visual inspection process was photographed.

Both SCBA units exhibited some signs of wear and tear; and the units were covered lightly with general soot and grime. The cylinder valve as received on the unit was in the closed position. The cylinder gauge could be read and indicated that there was no air remaining in either cylinder. The cylinder valve hand-wheels on both units could be turned.

The regulator and facepiece mating and sealing area on both of the units were relatively clean. The units had only slight scratches on the lenses. Visibility through the facepiece lens of both units was good as the condition of the lenses was fair. The facepiece head harness webbing on the both units was in fair condition with only a slight amount of dirt. The PASS on both units functioned. The NFPA SCBA approval label on Unit #1 and Unit #2 were present and readable.

Personal Alert Safety System (PASS) Device

The Personal Alert Safety System (PASS) device on both Units #1 and Unit #2 were operable and functional. The PASS devices were activated and appeared to function normally. However, the units were not tested against the specific performance requirements of NFPA 1982, *Standard on Personal Alert Safety Systems, (PASS)*, 2007 Edition. Because NIOSH does not certify PASS devices, no further evaluation was performed.

SCBA Compressed Air Cylinder Contents

During the inspection, it was noted that the compressed air cylinders of both units were empty.

SCBA Testing

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

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

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

1. Positive Pressure Test [§ 84.70(a)(2)(ii)]
2. Rated Service Time Test (duration) [§ 84.95]
3. Static Pressure Test [§ 84.91(d)]
4. Gas Flow Test [§ 84.93]
5. Exhalation Resistance Test [§ 84.91(c)]
6. Remaining Service Life Indicator Test (low-air alarm) [§ 84.83(f)]

National Fire Protection Association (NFPA) Tests (in accordance with NFPA 1981, 1997 Edition):

7. Air Flow Performance Test [Chapter 5, 5-1.1]

The testing of both units was conducted on November 21, 2014. SCBA Unit #1 failed the remaining service life indicator test, secondary alarm. Unit #2 failed the positive pressure test and the rated service time test.

Appendix II of the Status Investigation Report contains complete NIOSH and NFPA test reports for both SCBA Units. Tables One through Four summarize the NIOSH and NFPA test results.

Summary and Conclusions

Two SCBA units were submitted to NIOSH National Personal Protective Technology Laboratory (NPPTL) by the NIOSH Division of Safety Research (DSR) for the Connecticut Fire Department for evaluation. The SCBA units were delivered to NIOSH on October 28, 2014 and extensively inspected on November 18, 2014. Both units were identified as a Scott Health and Safety model AirPak 4.5, 4500 psi, 30-minute, SCBA (NIOSH approval numbers, TC-13F-0076, Unit #1 and TC-13F-0076CBRN, Unit #2). Scott Health and Safety performed a downloading of the Unit #2 data logger on November 25, 2014. The units suffered very slight amounts of damage but exhibited other signs of wear and tear and the units were slightly covered with general dirt. The cylinder valves, as received, on Unit #1 and Unit #2 were in the closed position. The cylinder gauges showed no pressure. The cylinder valve hand-wheels could be turned on both units. The regulator and facepiece mating and sealing area on both units were relatively clean. The units had only slight scratches on the lenses. Visibility through the facepiece lenses of Units #1 and #2 were good to fair with the lenses having slight scratches. The facepiece head harness webbing on both units were in fair condition and were slightly dirty with some fraying at the connection points. The NFPA approval label on Unit #1 and Unit #2 were present and readable after some dirt was wiped away. The personal alert safety system (PASS) on both units functioned.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

The air cylinder on Unit #1 had a manufactured date of 01/04. Under the applicable DOT exemption, the air cylinder is required to be hydro tested every 5 years. For the air cylinder on Unit #1, a retest date before the last day of 01/09 is required. The retest label was readable on Unit #1 with a retest date of 4/13; therefore, the cylinder was within the hydro certification when last used. The cylinder on Unit #1 was in fair to good condition with surface scratches and gouge repairs present on the outer coating. There was no air remaining in the cylinder. Although the cylinder was within the hydro testing requirements, it was determined that it may not be safe to pressurize. Another cylinder and facepiece was requested from the Fire Department. The SCBA Unit #1 was tested as it was received as no other maintenance or repair work was performed on the unit at any time.

The air cylinder on Unit #2 had a manufactured date of 01/04. Under the applicable DOT exemption, the air cylinder is required to be hydro tested every 5 years. For the air cylinder on Unit #2, a retest date before the last day of 01/09 is required. The retest label was not present on Unit #2 and could not be pressurized safely. The cylinder on Unit #2 was in fair to good condition with surface scratches and gouge repairs present on the outer coating. There was no air remaining in the cylinder. Another cylinder and facepiece was requested from the Fire Department. The SCBA Unit #2 was tested as it was received as no other maintenance or repair work was performed on the unit at any time.

Unit #1 failed the Remaining Service Life Indicator Test. The secondary bell failed to operate within the parameters. SCBA Unit #1 did meet the requirements of the NIOSH Positive Pressure Test, as the unit did maintain a positive pressure for the 30 minute minimum duration of the unit. The unit passed all of the other NIOSH tests.

SCBA Unit #2 did not meet the requirements of the NIOSH Positive Pressure Test, as the unit did not maintain positive pressure throughout the 30 minute minimum duration of the unit. The unit passed all of the other NIOSH tests.

In light of the information obtained during this investigation, NIOSH has proposed no further action on its part at this time. The SCBA units were returned to the Fire Department.

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

From the information obtained during this investigation, NIOSH proposes no further action on its part at this time. The investigation under task number TN-19908 will be considered closed.

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Appendix II Incident Commander’s Tactical Worksheet for Mayday

INCIDENT COMMANDER’S TACTICAL WORKSHEET FOR “MAYDAY”

- MAYDAY - MAYDAY - MAYDAY Message is Transmitted;**
- Announce *EMERGENCY RADIO TRAFFIC* only;**
- Acknowledge Company/Member transmitting the Mayday – Obtain LUNAR information:**

LOCATION _____
UNIT _____
NAME _____
ASSIGNMENT AND AIR SUPPLY _____
RESOURCES NEEDED _____

- If no answer after two attempts conduct a PAR of all operating companies on the fire ground to isolate company/member;**
- Deploy RIC to reported or last known location/assignment;**
- Request an additional alarm;**
- Request an additional TAC channel for fire operations TAC____**
- Assure that companies not assigned to the rescue or near the rescue change to the new fire operations channel and conduct a PAR;**
- Maintain fire-fighting positions. Withdraw only if necessary;**
- Establish a Rescue Group with a Safety Officer;**
- Review the Building Pre-Plan if available;**
- Establish a Backup RIC to replace the deployed RIC;**
- Establish a forward staging area for the Rescue Group and provide support with adequate staffing and equipment;**
- Request additional EMS Resources/ALS Ambulances;**
- Request Specialized Resources if needed – Technical Rescue;**
- Conduct a PAR if an emergency evacuation is ordered (due to structural stability or fire conditions);**
- Conduct a PAR after the rescue operation is completed;**
- Announce the end of the Mayday;**

Career Fire Fighter Dies From an Out-of-air Emergency in an Apartment Building Fire—Connecticut

Appendix III Use and Operations of Thermal Imagers

The temperature measurement feature on fire service thermal imagers should not be used for interior structural firefighting.

Use of this feature *MAY CAUSE ERRORS IN JUDGEMENT WHICH MAY RESULT IN SERIOUS INJURY OR DEATH.*

Fire service thermal imagers may be equipped with a temperature measurement feature.

Utilizing either a bar indicator or digital readout or both this feature displays the approximate surface temperature of a targeted surface.

The temperature measurement feature is a non-contact solid surface temperature measurement device that is not accurate.

Different materials or the same materials with different composition, surface textures, color and polish will not register temperature readings in the same way resulting in variations in the temperature readings.

Several factors including but not limited to:

- how much heat
- the material being measured and its ability to absorb or reflect heat (emissivity)
- the objects temperature
- the distance from the object being measured as well as
- the angle at which the object is being viewed
- the cleanliness of the lens as a result of steam or smoke;
- the object does not fully fill the center target area then a false reading may be obtained

Users must be aware and understand that the temperature measurement feature in a thermal imager will NOT provide atmospheric or air temperature readings.

Additionally the thermal imaging camera cannot see through walls.

- When attempting to view a source of heat behind a wall or above a ceiling the heat source will not be evident if it does not heat the wall itself. Consideration must be given to the thickness of the wall or ceiling as well as any additional layers of materials that may exist and further insulate or mask the true magnitude of the heat source.

All of these factors may individually or collectively greatly affect the accuracy of the temperature measurement feature during interior structural firefighting situations.

Because interior structural firefighting is a rapidly changing dynamic environment with many unknown and uncontrolled variables the temperature measurement feature on thermal imagers should not be utilized or relied upon by fire fighters to make tactical interior structural fire-fighting decisions.

REVISED 3/27/03

CITY OF WATERBURY
HARASSMENT IN THE WORKPLACE POLICY

SEXUAL HARASSMENT - OTHER FORMS OF HARASSMENT

Harassment of an employee by a supervisor or co-worker on the basis of sex or inclusion in a protected class under law creates a harmful working environment and is illegal under state and federal law. It is the policy of the City of Waterbury to maintain a working environment free from harassment, insults or intimidation on the basis of an employee's sex or inclusion in a protected class. While this policy specifically addresses sexual harassment, the City will not tolerate harassment on any other basis as well (see section B, below).

A. Sexual Harassment

Verbal or physical conduct by a supervisor or co-worker relating to an employee's sex which has the effect of creating an intimidating, hostile or offensive work environment, unreasonably interfering with the employee's work performance, or adversely affecting the employee's employment opportunities is prohibited.

Sexual harassment is a violation of Title VII of the Civil Rights Act of 1964 as well as Connecticut General Statutes, Sec. 46a-60 (a) (8). Sexual harassment is generally defined under both state and federal law as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature where:

1. Submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment;
2. Submission to or rejection of such conduct by an individual is used as the basis for employment decisions affecting such individual; or
3. Such conduct has the purpose or effect of unreasonably interfering with an individuals' work performance or creating an intimidating, hostile or offensive work environment.

Although not an exhaustive list, the following are examples of the type of conduct prohibited by the policy against sexual harassment:

1. Unwelcome sexual advances from a co-worker or supervisor, such as unwanted hugs, touches, or kisses;

2. Unwelcome attention of a sexual nature, such as degrading, suggestive or lewd remarks or noises;
3. Dirty jokes, derogatory or pornographic posters, cartoons or drawings;
4. The threat or suggestion that continued employment advancement, assignment or earnings depend on whether or not the employee will submit to or tolerate harassment; and
5. Engaging in indecent exposure.

Retaliation against any employee for complaining about sexual harassment is prohibited under this policy and illegal under state and federal law. Violations of this policy will not be permitted and may result in discipline up to and including discharge from employment. Individuals who engage in acts of sexual harassment may also be subject to civil and criminal penalties.

Procedures

If any employee believes that he or she has been subjected to sexual harassment, they should immediately:

1. Make their unease and/or disapproval directly and immediately known to the harasser and direct them to stop their behavior.
2. Make a written record of the date, time, and nature of the incident(s) and the names of any witnesses; and
3. Report the incident to the employee's immediate supervisor. In the event that the employee is uncomfortable discussing the matter with the immediate supervisor, the employee should report the incident to the Director of Human Resource or any member of the Human Resource professional staff.

Supervisor Responsibility

Supervisors must deal expeditiously and fairly with allegations of sexual harassment within their departments whether or not there has been a written or formal complain.

- Need to be alert to any sexual harassment and responsible for maintaining a workplace free of harassment and to refrain from harassment at all times;
- Responsible for promptly referring reports or complaints of sexual harassment to the Director of Human Resource.

- Responsible for maintaining complete and thorough documentation of any reports or complaints of sexual harassment.
- The Director of Human Resource or designee will be responsible for the investigation of the reports or complaints of harassment;
- Appropriate disciplinary or other action will be taken based on the circumstances.

Supervisors who knowingly allow or tolerate sexual harassment are in violation of this policy and subject to disciplinary action.

All incidents of sexual harassment or inappropriate sexual conduct should be reported immediately regardless of their seriousness. To the extent permitted by the law, the City will endeavor to keep such reports or complaints confidential, sharing them with others only on a need-to-know basis to enable their investigation and resolution. All reports or complaints of suspected sexual harassment will be investigated. While employees are strongly encouraged to utilize the City's internal complaint procedure, they are not limited to its use. Complaints may be filed directly with the regional office of the Connecticut Commission on Human Rights and Opportunities, 55 West Main Street, Suite 210, Waterbury CT 06702 (TELEPHONE NUMBER (203)805-6530, TDD NUMBER (203)805-6579) and/or the Equal Employment Opportunity Commission, Boston Area Office, John F. Kennedy Federal Building, Government Center, Room 475, Boston, MA 02203 (TELEPHONE NUMBER (617)565-3200; TDD NUMBER (617)565-3204). Connecticut law requires that formal written complaints be filed with the Commission on Human Rights and Opportunities within 180 days of the date when the alleged harassment occurred. Remedies for sexual harassment include cease and desist orders, back pay, compensatory damages, hiring, promotion or reinstatement.

B. Other Forms of Harassment

While this policy generally addresses only sexual harassment, other types of harassment also are prohibited by federal or state law, such as harassment on the basis of sexual orientation, race, color, religious creed, marital status, national origin, ancestry, present or past history or mental disorder, mental retardation, learning disability or physical disability or age.

Therefore, employees of the City should also report situations involving any of these other forms of harassment through the complaint and investigation procedure set forth above. Any questions should be directed to the Director of Human Resource. As with sexual harassment, employees may make inquiries of, or file complaints with, the Connecticut Commission on Human Rights and Opportunities or with the Equal Employment Opportunities Commission.

**City of Waterbury
Family and Medical Leave Policy Statement**

General Provisions

It is the policy of the City of Waterbury to grant up to 12 weeks of family and medical leave during any 12-month period to eligible employees, in accordance with the Family and Medical Leave Act of 1993 (FMLA). The leave may be paid, unpaid, or a combination of paid and unpaid leave, depending on the circumstances of the leave and as specified in this policy.

Eligible Employees

In order to qualify to take family or medical leave under this policy, the employee must meet all of the following conditions:

- 1) The employee must have been employed by the City for 12 months, or 52 weeks.* The twelve months, or 52 weeks, need not have been consecutive. For eligibility purposes, an employee will be considered to have been employed for an entire week even if the employee was on the payroll for only part of a week or if the employee is on an authorized leave during the week.
- 2) The employee must have worked at least 1250 hours during the twelve-month period immediately before the date when the leave is requested to commence.* The principles established under the Fair Labor Standards Act (FLSA) determine the number of hours worked by an employee. The FLSA does not include time spent on paid or unpaid leave as hours worked (only actual hours at work are counted). Consequently, these hours of leave should not be counted in determining the 1250 hours eligibility test for an employee under FMLA.

* National Guard members and reservists returning to civilian occupations after serving in support of President Bush's post-September 11 national emergency declaration are entitled to have their active duty time counted towards their eligibility to take time off work under the Family and Medical Leave Act (FMLA).

If a husband and wife are employed by the City, the total number of weeks of leave to which both may be entitled shall be the amount allowed to an individual eligible employee (i.e., twelve weeks), unless the leave is a medical leave for the serious illness of a child or the employee, then each spouse shall be entitled to the maximum individual leave provided in such period.

Type of Leave Covered

In order to qualify as FMLA leave under this policy, the employee must be taking leave for one of the reasons listed below:

- 1) the birth of a child and in order to care for that child;
- 2) the placement of a child for adoption or foster care, and to care for the newly placed child;
- 3) to care for a spouse, child, or parent with a serious health condition;
- 4) the serious health condition (described below) of the employee.

An employee may take leave because of a serious health condition that makes the employee unable to perform the functions of the employee's position.

A serious health condition is defined as a condition which requires inpatient care at a hospital, hospice, or residential medical care facility, including any period of incapacity or any subsequent treatment in connection with such inpatient care or a condition which requires continuing care by a licensed health care provider.

This policy covers illnesses of a serious and long-term nature, resulting in recurring or lengthy absences. Generally, a chronic or long-term health condition, which, if left untreated, would result in a period of incapacity of more than three days, would be considered a serious health condition.

An eligible employee can take up to 12 weeks of leave under this policy during any 12-month period. The City will measure the twelve-month period as a rolling 12-month period measured backward from the date an employee uses any leave under this policy. Each time an employee takes leave, the City will compute the amount of leave the employee has taken under this policy and subtract it from the 12 weeks of available leave, and the balance remaining is the amount the employee is entitled to take at that time.

Employee Status & Benefits During Leave

While an employee is on leave (for up to a maximum of twelve (12) weeks in a twelve (12) month period), the City will maintain coverage under any group health plan for the duration of the leave at the same level and under the same conditions as if the employee had continued to work. If the employee does not return to work for reasons other than a continued serious health condition of the employee or the employee's family member or a circumstance beyond the employee's control, the City will require the employee to reimburse the City the amount it paid for the employee's health insurance premiums during the leave period.

Currently, the employee pays a portion of the health care premium. While on paid leave, the City will continue to make payroll deductions to collect the employee's share of the premium. While on unpaid leave, the employee must continue to make this payment, either in person or by mail. The payment must be received in the Human Resources –

Benefits Department by the seventh day of each month. Health care coverage will be dropped for the duration of the leave, following a thirty-day grace period, if payment is not received. The employee will be notified 15 days before health care coverage is dropped. Employees may request to discontinue health care benefits during the FMLA period.

Life insurance coverage will be continued for the duration of an employee's leave under the same circumstances as if the employee were not on leave. Supplemental life insurance and disability coverage will also be continued during family medical leave, subject to receipt of employee contributions.

Accumulated seniority, retirement, fringe benefits and other service credits the employee had at the commencement of such leave will be maintained. However, unless otherwise permitted pursuant to City policy or bargaining agreement, during the leave period the employee shall not accrue employment benefits, such as vacation time, sick time, service time for pension purposes, etc.

Use of Paid and Unpaid Leave

If the employee has accrued or earned paid leave, the employee must use paid leave first and take the remainder of the twelve weeks as unpaid leave. The City will notify the employee within two business days in writing or orally (to be confirmed in writing by no later than the employee's next regular payday), whether or not the leave will be designated as FMLA leave.

An employee who is taking leave because of the employee's own serious health condition, must use all paid vacation, personal or sick leave prior to being eligible for unpaid leave, except where an employee is on a worker's compensation leave that is FMLA qualified. A worker's compensation injury that qualifies as FMLA will be designated as such.

An employee who is taking leave for the serious health condition of a spouse, child or parent, or for the adoption or foster care of a child, must use all paid vacation or personal leave prior to being eligible for unpaid leave

Impact of Other Leave Benefits

Federal law determines the maximum number of weeks an eligible employee may be absent. To the extent that the employee is entitled to any other leave or benefits, such as maternity leave, the amount of leave granted under the family and medical leave statute shall be reduced by the amount of such other leave or benefits.

Intermittent Leave

The employee may take FMLA leave in 12 consecutive weeks, may use the leave intermittently (take a day periodically when needed over the year), or under certain circumstances may use the leave to reduce the workweek or workday, resulting in a reduced hour schedule. In all cases, the leave may not exceed a total of 12 workweeks over a 12-month period.

The City may temporarily transfer an employee to an available alternative position with equivalent pay and benefits if the alternative position would better accommodate the intermittent or reduced schedule, for leave for the employee or employee's family member that is foreseeable.

For the birth, adoption or foster care of a child, intermittent leave or working a reduced number of hours is not permitted unless approved by the City.

If the employee is taking leave for a serious health condition or because of the serious health condition of a family member, the employee should try to reach agreement with the City before taking intermittent leave or working a reduced hour schedule. If this is not possible, then the employee must prove that the use of the leave is medically necessary. The City may require certification of the medical necessity as discussed in the next section of this policy.

Certification of the Serious Health Condition

The City shall ask for certification of the serious health condition. The employee should try to respond to such a request within 15 days of the request, or provide a reasonable explanation for the delay. Failure to provide certification may result in a denial of continuation of leave. Medical certification may be provided by using the Certificate of Health Care Provider form prescribed by the Director of Human Resources. Request for a medical certificate must be made in writing as part of the employer response to employee request for leave.

Certification of the serious health condition shall include: the date when the condition began, its expected duration, and a brief statement of treatment. For medical leave for the employee's own medical condition, the certification must also include a statement that the employee is unable to perform work of any kind or a statement that the employee is unable to perform the essential functions of the employee's position. For a family member who is seriously ill, the certification must include a statement that the patient, the family member, requires assistance and that the employee's presence would be beneficial or desirable.

If the employee plans to take intermittent leave or work a reduced schedule, the certification must also include dates and the duration of treatment as well as a statement of medical necessity for taking intermittent leave or working a reduced schedule.

The City may require an additional medical opinion, at its expense, verifying the need for the medical leave. If the first and second opinions differ, a third medical opinion, also at the City's expense, is final and binding on the City and the employee. The employee will be provisionally entitled to leave and benefits under the FMLA pending the second and/or third opinion.

The City may require periodic recertification of a serious health condition while an employee is on leave, which includes a report on his or her medical status and expected date of return. An employee returning from a leave for his or her own serious health condition will be required to provide a fitness-for-duty certification. This fitness-for-duty certification is also subject to verification by the City. In addition, where certain periodic medical treatment is required, employees are required to make a reasonable effort to schedule such treatment so as not to disrupt the operation of the City.

Procedure for Requesting Leave

All employees requesting leave under this policy must provide verbal notice with an explanation of the reason(s) for the needed leave to the Director of Personnel. If the leave is foreseeable, the City may require the employee to provide a written request for leave, including reason(s) for the request, on a form prescribed by the Director of Human Resources. Failure of the employee to provide a written request for leave cannot be grounds to deny or delay the taking of FMLA leave.

The City will provide individual notice of rights and obligations to each employee requesting leave within two business days or as soon as practicable. For employees on intermittent or recurring leave for the same incident, this notice will be provided every six months.

When an employee plans to take leave under this policy, the employee must give the City 30 days notice. If it is not possible to give 30 days notice, the employee must give as much notice as is practicable, usually within no more than one or two working days of learning of the need for leave. An employee who is to undergo planned medical treatment is required to make a reasonable effort to schedule the treatment in order to minimize disruptions to the company's operations.

If an employee fails to provide 30 days notice for foreseeable leave with no reasonable excuse for the delay, the leave request may be denied until at least 30 days from the date the employer received notice. While on leave, employees are requested to report periodically to the City regarding the status of the medical condition, and their intent to return to work.

An employee returning from a leave of absence should provide the Director of Human Resources with at least two (2) week's notice of intent to return to work, where possible.

An employee who returns to work from family leave of absence within or on the business day following the expiration of the leave period shall be entitled to return to the employee's original job from which the leave of absence was provided, or, if not available, to any equivalent position with equivalent pay and other conditions of employment. (Note: If an employee is laid off and would have been even if he/she did not take a leave, the employee is not entitled to restoration.) Reinstatement may only be denied for salaried key employees who are among the highest paid ten percent (10%) of the work force, and whose leave of absence would cause substantial and grievous economic injury to the City.

Failure to return to work upon the expiration of the leave will be considered a voluntary termination of employment.

NOTE: This policy constitutes an overview of the Federal Family Medical Leave Act as currently interpreted by the federal department of labor. Nothing in this policy should be construed as altering or reducing negotiated benefits provided in applicable collective bargaining agreements. Questions regarding this law or the City's policy should be directed to the Director of Human Resources.

AGREEMENT

-between-

THE CITY OF WATERBURY, CONNECTICUT

-and-

LOCAL 1339, IAFF AFL-CIO

FIREFIGHTER UNIT

2017-2021

ARTICLE XXX
SUBSTANCE ABUSE TESTING

¶293. **Section 1.** **Policy**

The City of Waterbury and the Waterbury Firefighters Association, L1339, IAFF, recognize that drug use by employees would be a threat to the public welfare and the safety of department personnel. It is the goal of this policy to eliminate or remedy illegal drug usage through education and rehabilitation of the affected personnel. The use of alcoholic beverages or unauthorized drugs shall not be permitted at the Employee's work sites and/or while an employee is on duty, nor shall an employee be under the influence of alcohol or illegal drugs while on duty.

¶294. **Section 2.** **Informing Employees About Drug & Alcohol Testing**

The City shall inform the employees on how the tests are conducted, what the test can

determine, the consequence of testing positive for drug use, and any drug or alcohol counseling, rehabilitation, and employee assistance programs that are available. All newly hired employees will be provided with this information during their initial period of orientation. No employee shall be tested before this information is provided to him/her. All Fire Department employees who hold a supervisory position will be required to attend training which is mutually accepted by the Union and the City with regard to drug and alcohol use and the physical, behavioral and performance indicators of possible drug and alcohol use that will be used in determining whether an employee is subject to the reasonable suspicion testing as outlined in this article.

¶295. **Section 3. Prior to Implementation of Policy**

- ¶296. A. Any employee that feels that he or she has developed an addiction to, dependence upon, or problem with alcohol and/or drugs, legal or illegal, is encouraged to seek assistance. Entrance into the Employee Assistance Program (EAP) can occur by self-referral, recommendation, or referral by supervisor upon the member's request.
- ¶297. B. Requests for assistance by any of the above will remain confidential between the employee and the employee assistance personnel.
- ¶298. C. The Fire Chief, a designated Assistant Chief or the Medical Control Officer shall be the only member to monitor an individual's progress through the Employee Assistance Program.
- ¶299. D. Rehabilitation itself is the responsibility of the employee. Every attempt will be made by employees to schedule rehabilitation and counseling during non-working hours.
- ¶300. E. To be eligible for continuation of employment, the employee must provide through the Employee Assistance Program that he/she is continuously enrolled in a treatment program and actively participating in that program.
- ¶301. F. Upon successful completion of treatment, and a written statement to that effect to the Department, the member shall be returned to active status without reduction in pay or seniority.

¶302. **Section 3. Basis for Testing**

- ¶303. Administration of screening tests to detect the presence of drugs or alcohol shall occur as follows:
- ¶304. A. Testing may be done for each employee at least once every 24 months.
- ¶305. B. In addition to the above, all employees shall be subject to random testing as defined herein.

- ¶306. C. Testing shall be performed upon reasonable suspicion that an employee is using or is under the influence of illegal drugs, is abusing legal drugs or alcohol, or is reporting for duty under the influence of drugs or alcohol.
- ¶307. In addition, testing may be performed in the event that an employee is involved in a motor vehicle accident on duty, which results in personal injury.
- ¶308. Selection for random testing shall be done with a computer-based random number generator that is matched to an employee's identification number. Random tests will be unannounced and spread reasonably throughout the year. There will be no pattern to when random tests will be conducted and all employees have an equal chance of being selected for testing from the random pools each time random tests are conducted. Employees shall remain in the pool even after being selected and tested. Therefore, an employee may be selected for a random test more than once during a year. The Chief shall provide information to the Union which will enable the Union to verify that all employees who are working, and are not on extended leave, are in the pool for random testing.
- ¶309. An employee may be required to undergo testing based on "reasonable suspicion" when objective facts and observations are brought to the attention of a superior officer and, based upon the reliability and weight of such information, the superior officer can reasonably infer or suspect that the member is using illegal drugs, is abusing legal drugs or alcohol, or is reporting for duty under the influence of drugs or alcohol. Reasonable suspicion must be supported by specific facts which may include, but are not limited to: reports and observations of the member's drug related activities, such as purchase, sale or possession of drugs, associations with known drug dealers or users, observations of the member at known drug or drug related locations; an otherwise unexplained change in the member's behavior or work performance; an observed impairment of the member's ability to perform his or her duties.
- ¶310. If the employee is ordered to submit to a drug and/or alcohol test, the employee shall be given a brief verbal statement of the basis for reasonable suspicion. A verbal directive to submit to a drug and/or alcohol test shall be confirmed in writing, but the testing shall not be delayed pending issuance of such written directive.
- ¶311. **Section 4. Testing Procedures**
- ¶312. All testing shall be administered during an employee's regular work hours.
- ¶313. Testing for alcohol shall be by breathalyzer and, if positive, there shall be a confirming test. Testing for drugs shall be by urine testing.
- ¶314. For urine testing, the sample will be split into two parts. An employee whose drug test results in a positive report may, within forty-eight (48) hours of receiving notification of such result, request in writing to the Chief of the Department that the second part of the sample be made available for re-testing at a licensed or certified laboratory of the employee's choosing. The second part of the sample shall be transferred to that

laboratory in such manner as to ensure proper chain of custody. The second test performed at the employee's request shall be at the expense of the employee. If the second test is negative, the positive test shall be null and void and the City shall reimburse the employee for the cost of the second test.

¶315. **Section 5. Interference With or Refusal to Submit to Testing**

¶316. Any alteration, switching, substituting or tampering with a sample or test given under this Agreement by any employee shall be grounds for immediate suspension and subsequent disciplinary action which may include dismissal. The refusal by an employee to submit to a drug or alcohol screening test pursuant to the provisions of this Article, or to cooperate in providing information needed in connection with the testing, shall result in the employee's immediate suspension without pay and subsequent disciplinary action which may include dismissal.

¶317. **Section 6. Rehabilitation**

The opportunity for rehabilitation (rather than discipline) may be granted once for any employee who is not involved in any drug/alcohol related misconduct and either:

¶318. A. voluntarily admits to alcohol or drug abuse prior to selection for testing or,

¶319. B. tests positive for alcohol or abuse of legally prescribed drugs for the first time or,

¶320. C. prior to submitting to the prescribed random test, voluntarily admits to alcohol or drug abuse.

¶321. Rehabilitation shall be offered through the City's Employee Assistance Program.

¶322. Employees who voluntarily come forward and ask for assistance to deal with a drug or alcohol problem shall not be subject to disciplinary action solely on the basis of that drug or alcohol problem. This program is designed to provide care and treatment to employees who are in need of rehabilitation. Details concerning treatment any employee receives at this program shall remain confidential and shall not be released to the public.

¶323. The employee shall use accumulated sick or vacation leave for the period of any absence for the purpose of rehabilitation. All treatment will be at the sole expense of the employee, to the extent not covered by the employee's health benefits plan. As part of any rehabilitation program, the employee may be required to undergo periodic screening for drugs or alcohol. If, after screening, the employee has tested positive, he will be immediately suspended and will be subject to discharge.

¶324. No employee shall be relieved or transferred to other than his usual duties on the basis of one test result, although the employee may be re-evaluated for his/her duty assignment

¶325. **Section 7.** **Consequences of Positive Test**

¶326. The consequences of a positive test shall be as follows:

¶327. A. For use of an illegal drug - discharge.

¶328. B. For abuse of a legally prescribed drug - one opportunity for rehabilitation, then discharge.

¶329. C. For alcohol (at the level of .04 or above) - one opportunity for rehabilitation, then discharge.

¶330. **Section 8.** **Testing Facility**

¶331. The Chief shall consult with the Union prior to selecting a facility to administer drug and alcohol tests and shall take into consideration the Union's concerns with respect to the procedures followed by such facility.

WATERBURY FIRE DEPARTMENT
STANDARD OPERATING PROCEDURE

<i>Effective Date:</i> April 1, 2016	<i>Number:</i> C-001	<i>Revision:</i> C
<i>Title:</i> ASSUMPTION, TRANSFER, DESIGNATION AND RESPONSIBILITIES OF COMMAND COMMAND		
<i>APPROVED BY:</i> Fire Chief Martin	<i>Reevaluation Date:</i> April 1, 2019	<i>No. of Pages</i> 5

PURPOSE:

To specifically identify who will be in charge at the scene of an emergency and to ensure that unity of command is maintained at all emergency scenes.

To fix responsibility for command on a certain individual through a standard identification system.

To ensure that a strong, direct and visible command is established as early as possible in fire department operations.

To provide a system for the orderly transfer of command at emergency scenes.

To outline the responsibilities of an Incident Commander

SCOPE:

This procedure will apply to all department members and will be used at all emergencies to which the Waterbury Fire Department responds.

In order to clarify terms in this procedure the following definitions have been included:

COMBATIVE COMMAND - An option available to the first arriving officer who is initially in command of the emergency. Officer will take an active role while carrying out required tactical operations. Decision based upon officer's evaluation of incident needs and resources available. Such officer should be prepared to give synopsis of actions and conditions over portable radio upon arrival of chief officer and the establishment of formal command.

FORMAL COMMAND - An option available to the first arriving officer and required of all officers assuming command after the first arriving officer. Officer takes a command position which is fixed and on the outside of the incident. Officer will not involve himself/herself in tactical operations at the scene.

COMMAND RESPONSIBILITIES

Take an effective command position

Assess incident priorities

Determine strategic goal(s) and tactical operations to support

Develop or approve and implement the action plan

Develop command structure appropriate for the incident (divisions, groups, branches, etc.)

Assign appropriate divisions, groups, branches and command staff as required

Assess resource needs

Order, deploy, reinforce, relieve and release resources

Coordinate all emergency activities

Serve as ultimate incident safety officer

Coordinate activities of outside agencies

Authorize information releases to the media

Transfer command when incident is de-escalating

Terminate command

Complete and submit NFIRS fire reports *

*Single company response the officer in charge of the company will make out report.

*Multi-company response - if first arriving officer sends companies back before arrival of the Chief on the assignment, the first arriving officer will

be responsible for the report. If command is transferred to the chief officer on the assignment, this chief officer will be responsible for the fire report.

PROCEDURES:

SINGLE COMPANY RESPONSE:

Whenever a single company responds to an incident, the officer of the responding company will be in command of the incident and will assume full authority and responsibility for all actions conducted at the scene.

When operating at the scene the radio designation of the command officer will be the call number of the apparatus. Example: Engine 2 to Waterbury have E.M.S. respond to the scene.

If after arrival at the scene, the officer requests additional fire department apparatus and personnel, the procedures for the assumption of command as outlined in multi-company response will be followed.

MULTI-COMPANY RESPONSE - ASSUMPTION OF COMMAND

Whenever multiple companies are dispatched to an incident the first arriving officer will automatically assume command. The assumption of command will occur in the following way:

Officer will announce arrival on the scene and report information as specified in EO-005 Emergency Scene Reporting.

If the officer is assuming the combative command role no radio communication designating command is required. The officer will use the call numbers of the company in all radio transmissions.

For Example: "Engine 8 is on the scene at 228 Bunker Hill Ave and I have a two story wood residential dwelling with fire showing from two windows on the first floor. Engine 8 will be stretching a line through the front door. Truck 1 ventilate on side C of the building".

In this example Engine 8 officer is in command and taking a combative role.

If the first arriving officer is assuming a formal command role, the officer will announce this over the radio by designating himself as command and naming command. All formal command will be designated using the street that the incident is on.

For Example: "Engine 8 is on the scene at 228 Bunker Hill Ave and I have a two story wood residential dwelling with fire showing from two windows on the first floor. Engine 8 is Bunker Hill Command.

In this example Engine 8 officer is in command and taking a formal command role.

The first arriving officer at the emergency shall have the authority to terminate the response of any additional responding units if after appropriate assessment the officer determines that the resources on the assignment will not be needed. The chief officer on the initial assignment, at his discretion, shall have the authority to continue on the response. All other units are to follow the instruction of the first arriving officer.

TRANSFER OF COMMAND

Command will automatically be transferred from the first arriving officer to the chief officer on the initial assignment.

If there is no chief officer on the initial assignment command will be transferred to the senior ranking officer.

Once command is transferred from the first arriving officer, command will be Formal and will be designated by the street that the incident is on.

For Example: Using the incident on Bunker Hill Ave. and there is a Battalion Chief on the assignment "Battalion 2 on scene. Battalion 2 is Bunker Hill Command."

Once formal command has been established, all radio communications to or from the incident commander will be made using the term "(Street name) Command"

Once formal command has been established, all command transfers will be made using face to face communications.

For Example: The Deputy Chief responds to the incident on Bunker Hill Ave. "Car 5 on Bunker Hill Ave." Command will not be automatically transferred to the Deputy Chief, Command will be transferred only after the following procedure is completed:

Officer contacts present Incident Commander using face to face communications

Incident Commander being relieved will provide a briefing which includes:

- Situation Status

- Deployment and assignment of resources

- Tactical Needs

Officer assuming command will assign relieved officer to a position or function as required.

As command is transferred the officer who is taking command will announce the transfer over the radio. For Example: Deputy Chief assumes command from Battalion 2 on Bunker Hill Ave., the Deputy Chief will say "Car 5 is now Bunker Hill Command".

Any requests or notifications to Bunker Hill Command will now be answered by the Deputy Chief instead of the Battalion Chief.

When the incident is no longer escalating and command officers will be leaving the incident, command will be transferred back to the Chief Officer on the assignment or the senior officer on the assignment. Command will be transferred by a face to face notification and notification of the transfer will be made via the radio.

When an incident that required a formal command is over, the incident commander will terminate command and return on the appropriate signal.

For example: The incident on Bunker Hill Ave. is over and command will be returning all companies. "Bunker Hill Command to Waterbury, Bunker Hill Command is terminated, Engine 8 and Engine 11 will be continuing to pick-up, Battalion 2 is available."

WATERBURY FIRE DEPARTMENT
STANDARD OPERATING PROCEDURE

<i>Effective Date:</i> April 1, 2106	<i>Number:</i> C-003	<i>Revision:</i> B
<i>Title:</i> <i>ICS ORGANIZATIONAL STRUCTURE FOR INTITIAL INCIDENTS</i> COMMAND		
<i>APPROVED BY:</i> Fire Chief Martin	<i>Reevaluation Date:</i> April 1, 2019	<i>No. of Pages</i> 2

PURPOSE:

To allow for an effective span of control to be maintained at emergency scenes and to standardize terminology to be used when establishing management assignments at emergency incidents.

SCOPE:

This procedure is to be used by department personnel when assigning resources at initial emergency scenes.

PROCEDURES:

Whenever the number of resources operating at an emergency require that a management position be staffed the following terms will be used:

DIVISION:

When multiple resources are assigned to perform tactical functions in a specified geographic area (such as on a specified floor or side of a structure) a division shall be established to provide coordination and control of tactical operations.

In establishing the division the incident commander shall do the following:

Contact the officer who will be assigned to manage the division, notify him of the name of the division and which companies will be under his charge.

Notify the companies assigned to the division whom to report to.

All communications to or from the individual assigned as the division supervisor will be made using the division name.

GROUP:

When multiple resources are assigned to perform the same function incident wide (such as search and rescue or ventilation) a group shall be established to provide coordination and control of tactical operations.

In establishing the group the incident commander shall do the following:

Contact the officer who will be assigned to manage the group, notify him of the name of the group and which companies will be under his charge.

Notify the companies assigned to the group whom to report to.

All communications to or from the individual assigned as the group supervisor will be made using the group name.

BRANCHES:

When multiple divisions or groups are assigned at a scene and the incident commander wishes to reduce his span of control, a branch shall be established to provide coordination and control of established divisions and/or groups

In establishing the branch the incident commander shall do the following:

Contact the officer who will be assigned to manage the branch, notify him of the name of the branch and which divisions and/or groups will be under his charge.

Notify the the group and/or division supervisors of their assignment to the appropriate branch

All communications to or from the individual assigned as the branch director will be made using the branch name.

WATERBURY FIRE DEPARTMENT
STANDARD OPERATING PROCEDURE

<i>Effective Date:</i> April 1, 2016	<i>Number:</i> C-004	<i>Revision:</i> B
<i>Title:</i> <i>ICS ORGANIZATIONAL STRUCTURE FOR MAJOR INCIDENTS</i> COMMAND		
<i>APPROVED BY:</i> Fire Chief Martin	<i>Reevaluation Date:</i> April 1, 2019	<i>No. of Pages</i> 4

PURPOSE:

To allow for an effective span of control to be maintained at large scale emergency scenes and to standardize terminology to be used when establishing management assignments at said scenes.

SCOPE:

This procedure is to be used by incident commanders when assigning resources at large scale emergency scenes and to department personnel who may be required to fill the positions defined herein.

PROCEDURES:

Whenever the number of resources operating at an emergency or the complexity of the incident is such that additional management positions need to be staffed above the branch, division or group level, the following positions, based upon needs, shall be utilized:

OPERATIONS OFFICER:

When multiple branches, groups or divisions are assigned to perform tactical functions at an emergency scene or the complexity is such that an incident commander cannot dedicate sufficient attention to tactical functions, an operations officer shall be designated.

In establishing the operations officer the incident commander shall do the following:

Contact the officer who will be assigned to staff operations and notify him or her of the divisions, groups or branches that will be under his or her charge.

Notify the divisions, groups or branches assigned to the operations officer whom to report to.

All communications to or from the individual assigned as the operations officer will be made using the term “operations”.

The individual in charge of operations shall be responsible for:

- Reporting to command for briefing

- Directing and coordinating all tactical operations

- Assisting the incident commander in developing strategic goals and tactical objectives for the incident

- Developing operational plans based on incident objectives

- Supervising staging officer. Note: When the incident commander staffs the operations position the staging officer will report to operations.

- Consulting with the incident commander about the overall incident action plan

- Requesting additional resources from command when required

- Updating command on situation and resource status of units assigned to operations

PLANNING OFFICER:

When the incident is of such a nature that the incident commander requires assistance in the collection, evaluation, dissemination and/or use of information the planning officer’s position shall be staffed.

In staffing the planning officer’s position the incident commander shall do the following:

- Contact the officer who will be assigned to staff planning and notify him or her of the units that will be under his or her charge.

- Notify the units assigned to the planning officer whom to report to.

All communications to or from the individual assigned as the planning officer will be made using the term “planning”.

The individual in charge of planning shall be responsible for:

Reporting to the incident commander for a briefing

Providing information to the incident commander to assist in the development or modification of the action plan

Anticipating changes in resource needs and communicating recommendations to command

Preparing alternate strategic options for command

Analyzing the situation and recording all pertinent information about the incident

Recording and tracking the status of resources committed to the incident

Recording/protecting all documents relative to the incident

Ensuring safe orderly and efficient demobilization of units

Working with technical specialists with expertise relative to the incident

Requesting additional personnel from command to assist in performing duties outlined herein when required

LOGISTICS OFFICER:

When the incident is of such a nature that the incident commander requires assistance in acquiring materials, equipment, facilities, or services for the incident the logistics officer's position shall be staffed.

In establishing the logistics officer's position the incident commander shall do the following:

Contact the officer who will be assigned to staff logistics and notify him or her of the units under his or her charge.

All communications to or from the individual assigned as the logistics officer will be made using the term "logistics".

The individual in charge of logistics shall be responsible for:

Reporting to the incident commander for a briefing

Ordering equipment and supplies as requested by the incident commander

Developing and maintaining the communications system for the incident

Establishing a rehabilitation unit for operating personnel

Providing food and drink for personnel involved in the incident as well as feeding areas

Providing sanitation facilities for personnel

Fueling, maintaining and repairing vehicles

Providing transportation for personnel and supplies

Requesting additional personnel from command to assist in performing duties outlined herein when required

FINANCE OFFICER:

When the incident is such that a potential exists for a large financial impact on the department and City of Waterbury the incident commander shall staff the position of finance officer.

In establishing the position of finance officer the incident commander shall do the following:

Contact the officer or individual who will be assigned to staff finance and notify him or her of the resources available.

All communications to or from the individual assigned as the finance officer will be made using the term "finance".

The individual in charge of finance shall be responsible for:

Reporting to the incident commander for a briefing

Record keeping of time for personnel working at the incident

Record keeping of funds spent on incident activities

Record keeping of injuries/compensation claims

WATERBURY FIRE DEPARTMENT
STANDARD OPERATING PROCEDURE

<i>Effective Date:</i> April 1, 2016	<i>Number:</i> EO-005 H	<i>Revision:</i>
<i>Title:</i> EMERGENCY SCENE REPORTING EMERGENCY OPERATIONS		
<i>APPROVED BY:</i> Fire Chief Martin	<i>Reevaluation Date:</i> April 1, 2019	<i>No. of Pages</i> 4

PURPOSE:

To ensure the adequate and appropriate flow of fireground information between all responding units, the WECC and command officers.

SCOPE:

This procedure is to be implemented by the first arriving officer and command officers at an emergency scene.

PROCEDURE:

Initial Reports

The first arriving officer shall size-up the emergency incident and then communicate a description of what is visible. This initial description is not an affidavit of absolute accuracy but the "Best Shot" of what the officer can see from this position.

The initial report should consist of the following:

- **Report arrival (UNIT AND ADDRESS)**
- **Describe building and occupancy (Building construction and use)**
- **Report on conditions**
- **Actions being taken**
- **Instructions to others**
- **Request for additional help if needed**

For the purpose of this standard the following terms should be used to describe building construction:

- **Fire Resistive**
- **Non-combustible**
- **Ordinary**
- **Heavy Timber**
- **Wood Frame**

For the purpose of this standard the following terms should be used to describe conditions:	
Conditions	Verbal Descriptions
Nothing visible upon arrival	"Nothing Showing"
Unable to determine conditions upon arrival	" Investigating"
Smoke showing	"Smoke showing from...(give location)"
Fire showing	"Fire showing from...(give location)"

Upon the first arriving Officer reporting "nothing showing" all remaining companies responding to this incident shall downgrade to a Code "1" response, unless otherwise directed by the first arriving Officer or the Chief Officer on this assignment. Responding companies shall avoid transmitting a Code 1 acknowledgement in order to free up the airwaves for the incident commander to report additional information or changing conditions.

When the WECC receives the first arriving Officers report they will repeat the conditions for the responding assignment.

Officers should communicate the direction and location of attack in order to identify the operational mode which will be assumed at the incident.

Officers shall use plain language to describe conditions and actions being taken. The intent of the report is to key to later arriving units as to what mode is being assumed at the scene and to guide the companies in their operations.

In response to common occupancies throughout the city, such as hospitals, schools, etc., in the initial report the officer need not include a description of the building.

Example: Engine 2, on scene St. Mary's Hospital, nothing showing, Engine 2 will be investigating.

In single company responses to routine incidents, such as dumpster fires, car fires, brush fires, lockouts, etc., the initial report by the officer need not include actions being taken.

Example: Engine 2 on scene, 35 Grand St., car fire.

The chief officer on the assignment shall update and modify the report as necessary.

Progress Reports

Progress reports shall be made by the incident commander at regular intervals or as needed for assistance.

Progress reports shall be given every 20 minutes and shall include:

- **Address**
- **Fire conditions**
- **Progress of truck functions including ventilation, search progress, forcible entry and ladder use.**
- **Personnel Accountability Report**

When operating at an emergency scene and upon completion of the primary search, the incident commander will include in the progress report "all clear". WECC personnel will record the time the report was made.

When command determines that the incident is no longer escalating and that operating forces have taken control of the situation, command will include in the progress report as "under control". WECC personnel will record the time that the report was made.

When command determines that secondary damage has been stopped, command will include in the progress report a "loss stopped". WECC personnel will record the time that the report was made.

After the incident is stabilized the need for progress reports is decreased, command may suspend the periodic reports and communicate information as needed.

In the event that the incident commander fails to communicate any of the information outlined in this procedure, WECC personnel shall contact command and request a report.

WECC personnel will document all reports in the computer aided dispatch system.

WATERBURY FIRE DEPARTMENT
STANDARD OPERATING PROCEDURE

<i>Effective Date:</i> December 1, 1998	<i>Number:</i> S-013	<i>Revision:</i> A
<i>TITLE:</i> <i>Accountability for Personnel at Emergency Incidents</i> SAFETY		
<i>APPROVED BY:</i>	<i>Reevaluation Date:</i> December 1, 2001	<i>No. of Pages</i> 5

PURPOSE:

The Personnel Accountability System is a procedure used provide for the tracking and accountability of all members operating at an emergency incident. The system provides for a rapid accounting of all personnel at an emergency incident in the case of a hazardous event or emergency evacuation. This procedure is designed to comply with National Fire Protection Association Standard (N.F.P.A.) 1500 Chapter 6, Section 3 - Personnel Accountability System and N.F.P.A. 1561, Section 2-6 Personnel Accountability System.

SCOPE:

This procedure shall be used by command personnel, personnel operating at or reporting to the emergency scene, staff personnel reporting to the emergency incident and the personnel assigned to the Waterbury Emergency Communication Center.

The following identify the responsibilities of personnel in regards to this procedure:

The **Incident Commander** (IC) is responsible for the management of the Personnel Accountability System as it applies to emergency incidents. The IC shall be aware of:

- Each Branch, Division, Group and company location and assignment;
- The status of the assignment;
- The need for additional resources.

The IC shall use and maintain a status sheet of incident activities. This sheet shall be submitted along with the Fire Report for all structure fires.

The **Branch Officer** shall be responsible for the companies/groups/divisions assigned to the branch. The Branch Director must understand the IC's action plan and communicate conditions and completion of the assigned task(s) at the assigned location(s).

The **Group Supervisor** shall be responsible for the companies assigned to the Group. The Group Supervisor must understand the IC's action plan and communicate conditions and completion of the assigned function(s) at the assigned location(s) as required.

The **Division Supervisor** shall be responsible for the companies assigned to the Division. The Division Supervisor must understand the IC's action plan and communicate conditions and completion of the assigned function(s) at the assigned location(s) as required.

The **Company Officer** shall be responsible for the fire fighters assigned to the company and shall be aware of each members location and condition throughout the incident.

The **Firefighter**, during emergency operations, may work with his/her assigned company or be assigned to a team. Firefighters shall operate with that team or company and are responsible to remain in voice, visual, or physical contact with the members of the Company or team.

Staff Personnel (Safety Officer, BFP, BAMS) who arrive on the scene are responsible for reporting to the IC prior to taking any action.

Waterbury Emergency Communication Center (WECC) personnel shall be responsible for keeping track of the time during an emergency incident and shall notify the IC when a Personnel Accountability Report (PAR) shall be conducted. The results of the PAR will be reported to them by the IC and shall be documented on the appropriate forms and in the Computer Aided Dispatch System.

PROCEDURE:

The procedure for accounting for personnel at an emergency incident will

be through the use of Personnel Accountability Reports (PAR).

A Personnel Accountability Report is a report given to and by the Incident Commander at specified intervals during an incident. The report is generated by officers as requested by the IC and communicated to the WECC.

The WECC will make note and document the time when the first arriving company reports that there is smoke or fire showing.

The WECC will contact the incident commander every twenty-(20) minutes and request a status update. This update will include a fire progress report and a Personnel Accountability Report (PAR). When requested, or if a need is determined for a PAR, the following shall occur :

- The IC will notify every Branch Officer, Group Supervisor, Division Supervisor, and Company Officer and request a report.
- The Branch Officer, Group Supervisor, Division Supervisor or Company Officer shall account for the branch, group, division or crew through visual, voice, or radio contact.
- The Branch Officer, Group Supervisor, Division Supervisor or Company Officer will confirm the following information to the IC :
 - That all members/companies accounted for
 - The general location of the branch, division, group or company
 - The progress of the assignment
- If a firefighter is on assignment separate from the crew that fact shall be communicated and noted. Another company that is aware of that firefighter's location will report that they have seen that firefighter and report the firefighter's location, activity and condition.
- When staff personnel are operating at the scene and a PAR is requested the IC shall request such from any staff personnel.
- All staff personnel reporting to an emergency incident shall report to the IC. If any of these persons are needed on the fire ground the IC will notify the Branch Officer, Group Supervisor, Division Supervisor or Company Officer the staff person will be working in their area.

- The Incident Commander shall document the PAR, taking note of location, incident conditions, and task completion.
- The Incident Commander shall report to the WECC that “PAR complete. All personnel accounted for.” The IC shall give a Progress Report at this time.
- The WECC shall document the PAR and Progress Report, as reported to them by the IC, on the appropriate forms and in the Computer Aided Dispatch System.
- If any personnel are unaccounted for a second PAR shall be requested by the IC.
- The IC may activate the rapid intervention team to assist in a systematic and complete search of the entire incident scene.

THE FOLLOWING INSTANCES DURING AN INCIDENT SHALL REQUIRE A PAR:

- After 20 minutes of elapsed time of a working fire (commencing with the initial report of smoke/fire) and every 20 minutes thereafter until the incident is stabilized.
- If, during the transfer of command, the IC is unsure of the location and/or assignment of a company.
- The IC feels there is a need to confirm the location and assignment of any company at an incident.
- Any report of a missing or trapped firefighter.
- Whenever a company reports an “ALL CLEAR” after completing a primary search. That officer shall ensure a PAR of their company and report such when reporting the all clear.
- When an Emergency Evacuation is ordered.
- Any change from an offensive to defensive mode.
- Any sudden hazardous event at the incident (collapse, flashover, explosion etc.)

The Incident Commander shall still give reports whenever other benchmarks have been achieved. (ALL CLEAR, FIRE UNDER CONTROL, LOSS STOPPED).

Waterbury Fire Department
Fire Worksheet
Life Safety Takes Priority Over Other Operations

Incident Number _____

Location _____

OPERATIONS CHECKLIST

1st Attack Line by _____

Primary Search by _____

Water Supply by _____

Back-up Line by _____

Line Above Fire by _____

Horiz. Vert/ Lad. by _____

Vertical Vent. by _____

Protect Exposure by _____

Salvage by _____

Overhaul by _____

SAFETY CHECKLIST

Full Turnouts SCBA/PASS On

Apparat. Position Powerlines

ReHab Utilities Off

Structural Condition of Building
 SAFE / DETERIORATING / UNSAFE

BENCHMARK COMMUNICATION

ALL CLEAR Time: _____

UNDER CONTROL Time: _____

LOSS STOPPED Time: _____

UNITS AT INCIDENT

Command Officers _____

Safety Officers _____

Engines _____

Trucks _____

Rescue _____

RIT assignment _____

Other _____

20 MINUTE PAR

Time _____ Results _____

Time _____ Results _____

Time _____ Results _____

Time _____ Results _____

Building Evacuation PAR

Time _____ Results _____

NOTES: _____

Command Officer _____

Signature: _____

Incident Date _____