1000 FREDERICK LANE, MORGANTOWN, WV 26508 • 304.285.5916

Career Engine Company Officer Dies in Abandoned, Single-Family Structure Fire – North Carolina

Executive Summary

On March 29, 2024, a 53-year-old career firefighter with the rank of captain (E3 captain) died from injuries sustained in an abandoned, single-family, structure fire after becoming lost within the structure on March 26, 2024. E3 captain was the company officer of the first due engine company making an interior fire attack. The single-family residential structure was an approximately 1,400 square feet, one story, wood frame construction. The structure was deemed abandoned by the local housing office and was boarded up prior to the incident. At approximately 0000 hours, the local communications center received a 9-1-1 call reporting a fire in the structure from a bystander. At 0002 hours, the local communications center dispatched a box alarm assignment to the address for a reported structure fire. Engine 3 (E3), Battalion Chief 7 (BC7), Ladder 1 (L1), Engine 1 (E1), and Quint 2 (Q2) were dispatched. At 0005 hours, the communications center advised the responding fire companies that the local police department was on-scene advising the "backside of house is fully engulfed" and that it was "believed everyone is out of the house." E3 arrived on-scene at 0006 hours and reported a working fire. The E3 firefighter stretched a 200' 1¾ - inch attack line to the front door on side Alpha to prepare for an interior fire attack. L1 arrived on-scene at 0007 hours and split their crew of four. The L1 captain and a firefighter reported to side Alpha to meet with the crew from E3 and forced open the front door.

Side Alpha post fire event
(*Courtesy of Fire Marshal Office*)

E3 captain and firefighter along with the L1 captain and firefighter made entry into the structure and observed moderate, lazy, and brown smoke with no significant heat. No immediate fire conditions were encountered as the crew from L1 proceeded to conduct a left-hand search while the E3 crew advanced into the structure. BC7 arrived on-scene and assumed incident command (IC). IC repositioned for a better view of the active fire on side Delta at the side Charlie corner.

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IC requested a water supply be established to E3 from E1 upon their arrival from a nearby hydrant, requested electrical utility services from the communications center, and requested on-scene fire companies switch to the tactical radio channel. The IC assigned Q2 as the rapid intervention crew (RIC) upon arrival and established an offensive strategy which was announced via the radio system on the tactical radio channel. At approximately 0009 hours, E1 was establishing a water supply and informed the IC that a 1¾-inch backup attack line had been stretched to side Alpha at the side Delta corner.

The nozzle firefighter from E3 continued to advance into the structure approximately eight to ten feet before conditions began to change with zero visibility. L1 continued a left-hand search entering a bedroom while E3 captain reported he was going back to the entry door to "get more hose." Both the L1 interior crew and E3 firefighter began to observe changing fire conditions in the interior with decreased visibility and increased temperatures. The firefighter from E3 began to flow water from the 1 ¾ - inch attack line towards side Charlie (rear) of the structure from the inside with no observed changes in fire conditions.

At 0012 hours, the company officer from E1 informed IC that heavy fire was venting out the side Alpha door. IC acknowledged the radio message and observed a second room on side Delta flashover through the exterior windows of the structure. IC announced a change in strategy to a defensive mode and requested a personnel accountability report (PAR). IC was informed that L1 and E3 still had firefighters inside the structure when IC specifically requested that they withdraw from the structure. At 0014:57 hours, the apparatus operator from Q2 informed IC that crews were outside the structure but that E3 captain was unaccounted for.

RIC informed the IC that E3 captain was not located on the exterior of the structure and RIC was deployed to the interior at 0017:24 hours. Approximately two minutes after the RIC deployment to the interior, the RIC could hear an audible personal alert safety system (PASS) device towards the rear of the structure (side Charlie). RIC located the E3 captain in the rear of the kitchen on side Charlie at the Bravo corner at approximately 0021 hours. E3 captain was removed by being drug to the front door on side Alpha.

E3 captain was awake and alert upon removal from the structure with personal protective equipment (PPE) and self-contained breathing apparatus (SCBA) still intact. He was airlifted from the scene to a local burn center where he succumbed to his injuries three days later.

Contributing Factors

- *Vacant and abandoned building marking system*
- *Crew integrity*
- *Two-way portable radio communications*
- *Thermal Imaging (TI) device usage*
- *Fire dynamics in relation to flow path*
- *Strategy and tactics for transitional fire attack*
- *Safety and survival training for self-rescue.*

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Key Recommendations

Fire departments should:

- *Consider working with local officials to develop a vacant/abandoned building management and marking system.*
- *Ensure that crew integrity is properly maintained by visual, direct, or verbal (voice or radio) contact when operating in an immediately dangerous to life and health (IDLH) atmosphere.*
- *Develop policies and ensure that all personnel are trained on the features and use of portable radio operations, particularly as they relate to building muscle memory in daily response habits.*
- *Ensure personnel understand the capabilities, use, and limitations of thermal imaging (TI) devices and utilize them during interior structural firefighting operations.*
- *Develop or revise policies, strategies, and tactics to include modern research of fire dynamics and the movement of air and fire within a structure.*
- *Develop policies, strategies, and tactics related to the exterior extinguishment or resetting of the seat of fire, slowing both vertical and/or horizontal fire spread prior to interior firefighting operations.*
- *Develop training initiatives that focus on the knowledge, skill, and ability of firefighter safety/survival self-rescue training to include emergency egress and low-profile clearance.*

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

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Introduction

On March 26, 2024, a 53-year-old career firefighter, holding the rank of captain, with 19 years in the department died while engaged in an interior fire attack at a single-family, one-story, wood frame structure fire. On April 1, 2024, the U.S. Fire Administration (USFA) notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On April 28 through May 2, 2024, two investigators representing the NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) traveled to North Carolina to investigate this incident. The NIOSH investigators met with the fire chief and staff, training division, inspections and investigations bureau, local city officials, and the 9-1-1 communications center. NIOSH also conducted interviews with fire officers and firefighters that responded to the box alarm incident. The NIOSH investigators inspected and photographed the deceased's PPE and the SCBA. NIOSH investigators also reviewed the training records of specific personnel involved in the incident and reviewed the department's standard operating procedures (SOPs) and professional development model.

Fire Department

The deceased firefighter (E3 captain) was part of a career fire department that has four stations with 50 uniformed personnel. This fire department serves a population of approximately 19,500 within a 20 square mile area and is led by a fire chief who is assisted by a deputy fire chief. The department has three battalion chiefs who oversee each of the three shifts. Each battalion chief also performs ancillary duties at the discretion of the fire chief such as training and safety. The fire chief and deputy chief respond off duty to incidents within the city that require additional support services.

The four fire stations are geographically spread across the city limits and are staffed 24-hours a day. The fire department staffs two engine companies, one mid-mount ladder company, and a 75ft quint company used internally as a truck company. The two engine companies and quint are staffed daily with a minimum of three personnel while the minimum staffing for the ladder company is four personnel. The fire department participates in both automatic and mutual aid responses with neighboring departments throughout the county. Since this incident, the fire department has increased minimum staffing to four personnel on each apparatus daily after being awarded a Staffing for Adequate Fire and Emergency Response (SAFER) grant. The fire department does not provide transporting emergency medical services (EMS) but does respond to cardiopulmonary resuscitation (CPR) and lift assist incidents.

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Training, Education, and Professional Development

The E3 captain had extensive experience volunteering with other local fire departments around the area. He served as a fire instructor at the local community college and was actively involved in training and education within the region. The E3 captain had received International Fire Services Accreditation Congress (IFSAC) certifications in various courses to include Firefighter I and II, Instructor I and II, Inspector I, Fire Officer I and II, Driver Operator pump and aerial, and other courses.

The minimum hiring qualifications for a position within the fire department include national certification in Firefighter I and II as well as Hazardous Material Operations Level. Qualifications for firefighters are largely left to the authority having jurisdiction (AHJ) with certifiable courses available through the Office of the State Fire Marshal. The fire department utilizes third-party software for continuing education and professional development, conducts weekly training, and offers training quarterly, specifically with mutual-aid partners and company officer development. The fire department is recognized by the state as a certified rescue department and conducts an annual hazardous materials drill. The department has a professional development plan to encourage the professional growth, training, and education of personnel looking to advance through the department rank structure.

Apparatus, Staffing, and Communications

Emergency calls are received into a local communications center which dispatches all emergency services for the county. The fire department utilizes an 800-megahertz (MHz) radio system for communications and response which is a part of a statewide public safety telecommunications system. The communications center is staffed with six dispatchers who are trained to a national standard and receive approximately 275,000 calls for service per year. No mobile data terminals (MDT's) are utilized within the department for joint information sharing between units in the field and the communications center. Since this incident though, new technology has been acquired to provide a live stream from a 9-1-1 caller to dispatchers and responding personnel. A third-party notification system is used within the department to assist with dispatch location, hydrant locations, and information. Training is being adopted to incorporate the communication center dispatchers into fire-based scenarios and training. At the time of incident, each individual firefighter in the department was assigned a personal portable radio to be utilized while on-duty.

Tables 1 and 2 below outline the responding apparatus to the box alarm including off duty chief staff to provide incident support.

Table 1 Box alarm assignment

Resource Designation	Staffing level
Engine 3	3
Ladder 1	4

Quint 2	4
Engine 1	3
Battalion Chief 7	1

Table 2 Off duty responding chief staff

Resource Designation	Staffing level
Chief 6 (Deputy Chief)	1
Chief 1 (Fire Chief)	1

Personal Protective Equipment

Upon arrival at the scene and during the incident, E3 captain was wearing his department issued structural firefighting turnout gear including coat, pants, gloves, Nomex hood, helmet, and boots that met the current requirement of NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting* (NFPA 1971, 2018). The SCBA with an integrated personal alert safety system (PASS) device was approved by NIOSH, certified as meeting the 2013 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, by a third-party laboratory (NFPA 1981, 2013). E3 captain was also wearing a fire department t-shirt and carrying a portable radio with a corded remote speaker microphone (RSM).

The NIOSH investigators examined and photographed the PPE at the local Office of the Fire Marshal. Upon visual inspection of the PPE, extensive thermal degradation was noted to the turnout pants and coat, both on the outer shell and moisture barriers. This damage was more specifically to the left side, indicating that the E3 captain was laying prone with his right-side shielded during flashover. The Nomex hood, helmet, SCBA, and boots also suffered extensive thermal degradation to the left side. The SCBA facepiece had severe staining and discoloration with no visibility through the facepiece lens. However, it was intact and operational. The SCBA regulator and supply hose had deformities due to melting. However, both were still intact. Although, the PPE suffered extensive thermal degradation, exposure to extreme temperatures exceeding the PPE's capabilities is not considered to be a contributing factor in this incident.

Weather and Road Conditions

The weather on March 25, 2024, at approximately 2354 hours, was reported as cloudy. This was approximately 8 minutes before the box alarm dispatch. The temperature was 48°F with winds east at 5 mph. The humidity was 50% with no precipitation noted. Weather conditions at the time of incident are not considered to be a contributing factor in the incident (Weather Underground, 2024).

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Structure

This single-family, non-sprinkled, residential structure was situated on a 0.61-acre lot located in an urban environment. Fire hydrant access to the property was available and utilized during the incident. The local government zoning office listed the structure as a 1,436 square foot, single-story residential home. The structure had electricity service from the local electrical grid system through the weather head of the structure. However, the local power company had blanked the electrical meter which prevented any electricity from entering the structure.

Photo: 1 Aerial view of structure with sides of the structure labeled A (Alpha), B (Bravo), C (Charlie), and D (Delta) (*Courtesy of Google Earth*)

This structure had four-bedrooms and two-bathrooms. It was built in 1930 and was wood frame construction with a vinyl siding exterior. It contained 2x4 interior stud walls that were covered with both common drywall as well as lath and plaster interior finishings. The sloping roof structure was constructed of wood roof rafters covered in a metal roof exterior finishing. For this report, side Bravo is orientated to the north followed by side Charlie to the east, side Delta to the south, and side Alpha to the west (s**ee Photo 1**). NIOSH investigators were able to gain access to the structure to take photographs and measurements.

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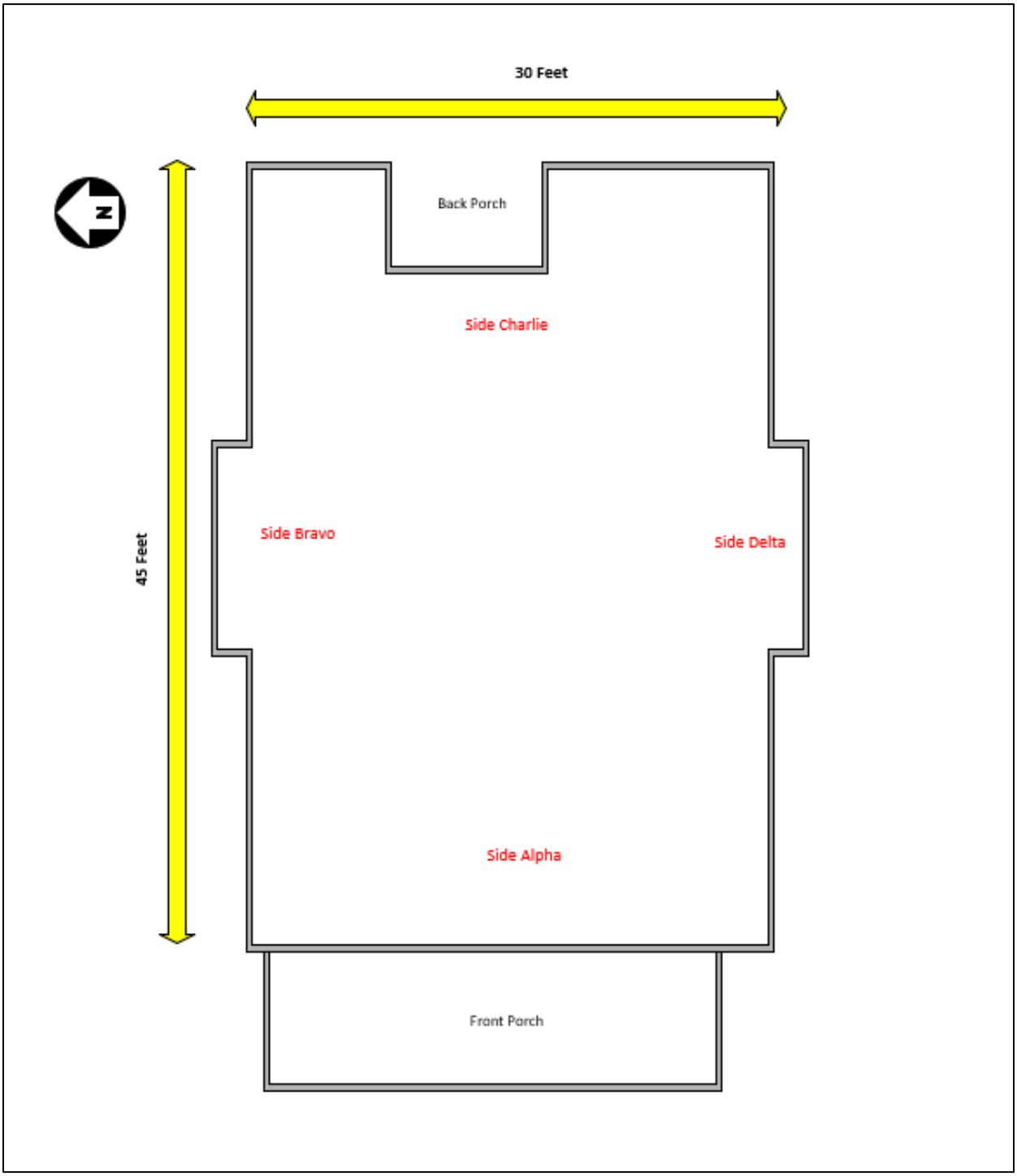

Diagram 1: Structure diagram
(*Courtesy of NIOSH*)

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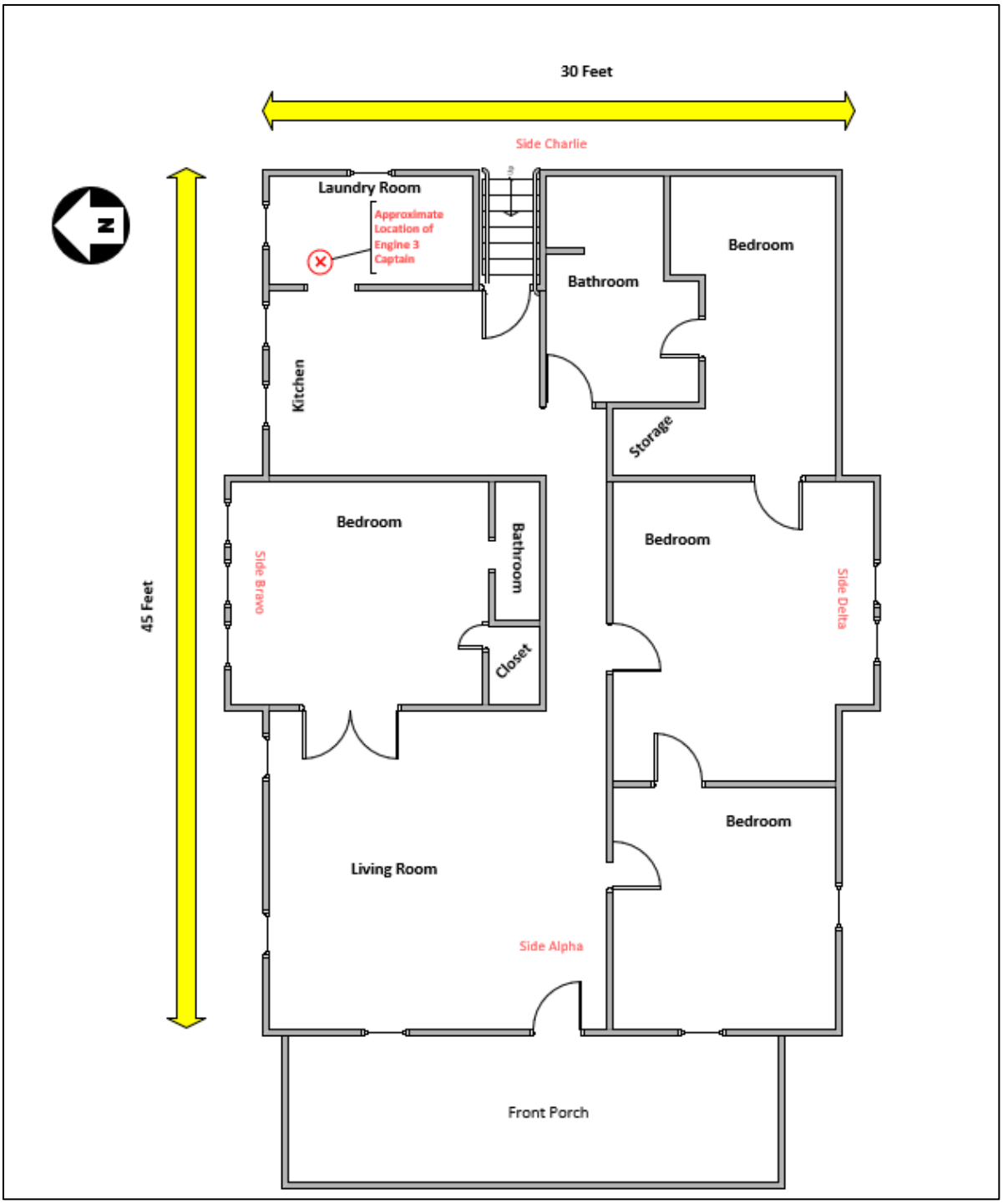

Diagram 2: First floor diagram and approximate location E3 captain was found.
Note: Diagram not to scale.
(*Courtesy of NIOSH*)

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Timeline

The following timeline is a summary of events that occurred as the incident evolved. Not all incident events are included in this timeline. The times are approximate and were obtained by examining the dispatch records, audio recordings, witness statements, and other available information. The timeline is not intended, nor should it be used, as a formal record of events.

Time (hours)	Fireground Response, Operations, and Details
0000	• 9-1-1 call received by communications center indicating a house on fire • Local police discover the house fire and request the fire department for a "fully engulfed" house
0002	• E3, E1, L1, Q2, and B7 dispatched to structure fire
0004	• All fire companies enroute
0005	• Communications center advises responding fire companies that police are on-scene. Police advised backside of structure is "fully engulfed," everyone believed to be out, and several calls received
0006	• E3 arrived on-scene, pulling past the address on side Alpha and advised "working fire" • Visible fire observed on side Delta at the side Charlie corner
0007	• L1 arrived on-scene on side Alpha in front of the structure • L1 split the crew of four into two teams (interior and exterior) • BC7 arrived on-scene, assumed IC, announced an offensive strategy, and requested all companies switch to the tactical radio channel • BC7 repositioned vehicle to have a view of side Delta but doesn't have a clear line of sight to side Alpha. Incident command post (ICP) established inside the BC7 vehicle • IC informed E1 that they need a supply line to E3
0008	• E1 arrived on-scene and stretched approximately 200' of 5-inch supply line from E3 to the hydrant just down and across the street from the scene • IC assigned Q2 as the RIC upon arrival
0009	• E1 to IC – Backup line stretched and charged to side Alpha • E3 and L1 made entry into the structure from the front door on side Alpha

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Time (hours)	Fireground Response, Operations, and Details
0010	• Outside vent firefighter informed IC that live wires were down at the side Bravo/Charlie corner • Q2 arrived on-scene • IC requested electric company response from communications center
0011	• Q2 informed IC that RIC was established • RIC was established at the side Alpha/Bravo corner • E1 company officer requested a 360 degree walk around from the Q2 company officer
0012	• E1 company officer informed IC that heavy fire was venting out the side Alpha door • IC acknowledged and agreed to a defensive strategy • E3 apparatus operator informed IC that a water supply was established
0012:31	• IC announced via the radio a change to a defensive strategy • IC observed a second bedroom on side Delta flashover through the windows
0013:01	• IC inquired via the radio if all on-scene companies were out of the structure • IC's visibility is limited to side Delta with a partial view of side Alpha
0013:10	• IC was informed that L1 and E3 are still interior
0013:20	• IC ordered L1 and E3 via the radio to exit the structure • Fire and smoke conditions began to rapidly change, coming out of the door on side Alpha
0013:40	• E3 apparatus operator confirmed with IC that he ordered an evacuation • E3 apparatus operator began to sound the air horn on the apparatus to signal evacuation • E1 apparatus operator deployed a 200' 2 ½ - inch line on side Delta and requested it be charged
0014:50	• IC asked if all companies were out of the structure

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Time (hours)	Fireground Response, Operations, and Details
	• Visible fire was venting out the front door on side Alpha
0014:57	• Q2 apparatus operator advised command that E3's company officer was still inside • Visible fire venting from the front door on side Alpha was being attacked by a 1 ¾-inch attack line • The interior 1 ¾ -inch attack line was removed from the structure with the nozzle firefighter during the evacuation
0015:30	• L1 company officer called for E3 captain on the radio with no response
0015:39	• L1 company officer asked over the radio if anyone had eyes on the E3 captain
0016:07	• IC ordered the 1 ¾-inch back-up attack line to the front porch on side Alpha • IC left the ICP to gain a better view of side Alpha
0017:08	• RIC advised IC that the E3 captain still had not been located on the exterior of the structure • RIC worked along the exterior of side Bravo, utilizing a TI device and looking into windows trying to locate E3 captain
0017:24	• IC deployed the RIC to the interior from side Alpha • RIC deployed and made entry on side Alpha with a 1 ¾-inch attack line • E1 company officer joined the RIC crew upon entry
0018:03	• IC notified the communications center of a Mayday on the main radio channel • Communications center rebroadcasted the Mayday declaration on the main radio channel
0018:59	• IC requested the next three closest departments respond to the scene
0019:16	• Chief 6 on-scene

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Time (hours)	Fireground Response, Operations, and Details
0019:36	• E1 company officer advised IC they could hear a PASS device in the rear of the structure • RIC encountered several rooms of fire and were searching as they continued firefighting towards side Charlie
0020:51	• RIC confirmed with the IC that they were still working towards side Charlie and could still hear a PASS device • RIC continued to encounter fire throughout the structure while utilizing their 1 ¾-inch attack line
0021:31	• RIC to IC – "I got him, I got him, I got him" • RIC confirmed the E3 captain was breathing and SCBA was functioning. RIC silenced the PASS device on E3 captain's SCBA
0022:19	• RIC announced they had E3 captain on side Bravo at the windows and needed a ladder • RIC was working in zero visibility and attempted to utilize the Rapid Intervention Universal Air Connection (RIC-UAC) J'P-8from the RIC kit
0023:44	• RIC informed the IC to have EMS ready at the door of side Alpha • RIC changed extrication plans when they heard the low air alarm activate on E3 captain's SCBA
0024:28	• L1 company officer confirmed with IC that all companies were outside the structure • E3 captain was awake and talking after the doffing of his SCBA
0024:38	• IC informed the communications center that the missing firefighter had been removed from the structure
0046:08	• E3 captain transported from the scene to the landing zone
0058:53	• Medical helicopter departed the landing zone to transport the E3 captain to a local trauma center

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Investigation

On March 26, 2024, at 0000 hours, the local communications center received a 9-1-1 call reporting a house on fire. The 9-1-1 caller told the communications dispatcher upon questioning that "nobody is inside" and that the "back of the house" was on fire. Simultaneously, a patrol officer from the local police department radioed the communications center to start the fire department for a "fully engulfed" structure fire but was later corrected to the fire being in the rear (side Charlie) of the structure. The communications center dispatcher instructed the 9-1-1 caller to follow standard prearrival instructions to include not entering the structure and to safely keep bystanders free of the area. The communications center entered the information into the computer aided dispatch (CAD) system and initiated the box alarm assignment for the location.

Box alarm fire companies were dispatched at 0002 hours consisting of E3, E1, L1, Q2, and BC7. Assigned fire companies were enroute by 0004 hours (see Table 3). At 0005 hours, the communications center advised the responding fire companies that the local police department was on-scene, and advising the rear of the structure was "fully engulfed" and with everyone believed to be out of the structure. During the fire department response, the local police department worked to gather information from bystanders on the scene and began to control traffic within the area while leaving access for arriving units.

Table 3 On-scene resource assignments

Apparatus	Assignment
BC7	Incident Command
E3	Interior Fire Attack – 200' 1 ¾-inch attack line
L1	Interior search and rescue / outside vent crew
E1	Backup attack line side Alpha – 200' 1 ¾-inch attack line
Q2	RIC – side alpha/bravo corner

E3 (apparatus of the deceased) arrived first on-scene at 0006 hours. E3 pulled past the location to leave access for the ladder company and provided an on-scene report of "working fire." No further information or size-up information was provided by the E3 captain to incoming fire companies. The firefighter from E3 stretched a 200' 1 ¾ -inch attack line to the front door on side Alpha as L1 arrived at 0007 hours. L1 split their four-person crew into two working groups for both interior and exterior operations. The company officer and a firefighter from L1 reported to the front door on side Alpha and utilized traditional forcible entry techniques to force open and control the door while the apparatus operator and firefighter (outside crew) from L1 checked utilities, assisted with the large diameter

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supply line, and prepared L1 for aerial operations. Before making an interior offensive fire attack through side Alpha, E3 captain returned to E3 to retrieve the TI device from the apparatus.

At 0007 hours, BC7 arrived on-scene, assumed IC, announced an offensive strategy via the radio, and requested all on-scene personnel switch to the tactical channel per department policy. BC7 had to reposition his department vehicle to better observe the fire conditions on side Delta but had limited visibility to side Alpha. The ICP was established inside BC7's vehicle. At 0008 hours, IC requested that E1 establish a water supply from a nearby hydrant. E1 stretched approximately 200'of 5-inch supply line from E3 to secure the water source. IC assigned Q2 as the RIC and set up at the side Alpha/Delta corner.

The E3 crew (company officer and firefighter) and L1 crew (company officer and firefighter) made entry into the structure from side Alpha at approximately 0009 hours and observed brown smoke with limited visibility throughout the structure. No visible fire was observed upon entry as L1 proceeded to conduct a left-hand search while E3 pushed forward into the structure. E1 advised the IC that a backup 1 ¾ -inch attack line had been stretched and charged to side Alpha. L1 exterior crew advised IC that live wires were down at the service drop to the structure at the side Bravo/Charlie corner. IC acknowledged this message and requested utility services to the scene.

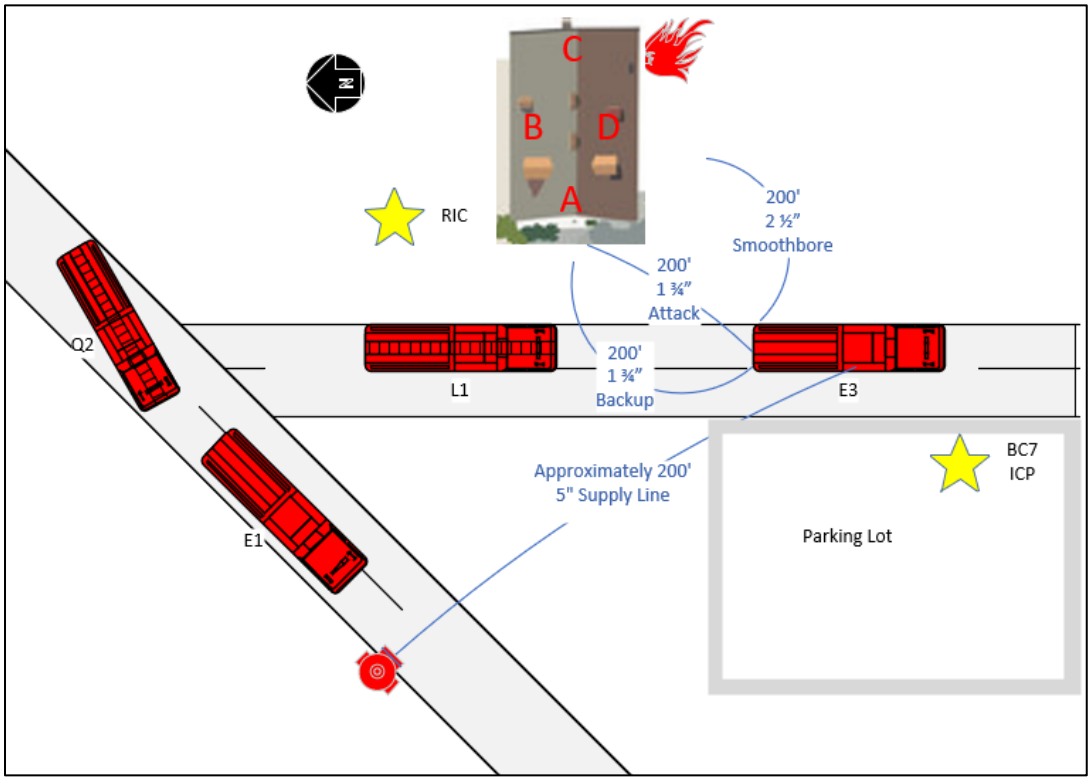

Diagram 3: Apparatus, attack, supply line placement.
Note: Diagram not to scale.
(*Courtesy of NIOSH*)

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At approximately 0011 hours, the company officer from E1 requested the RIC (i.e., Q2) conduct a 360-degree walkaround of the structure which was acknowledged. E3's captain and firefighter continued to advance into the structure a few feet, with both periodically stopping to check for accountability. The E3 firefighter began to experience changes in both smoke and temperatures with visible fire being seen inside the structure. He began to flow water towards the rear of the structure when he heard E3 captain yell that he was going to get more hose.

At 0012 hours, the company officer from E1 advised IC that heavy fire was venting out the side Alpha door. IC acknowledged the message and observed a middle room in the structure on side Delta flashover through the windows. The IC announced a change in strategy on the radio to a defensive operation. This message was acknowledged by the apparatus operator of E3 who began to sound the airhorns to indicate to interior crews that they needed to withdraw from the structure. A 200' 2 ½"-inch smoothbore attack line was then stretched to side Delta. At 0013:01, IC inquired if all companies had exited the structure when he was informed that L1 and E3 interior crews were still inside the structure. IC called both L1 and E3 captains on the radio and instructed them to evacuate the house. However, this message was never acknowledged by E3 captain. As noted in interviews conducted by NIOSH, the fire conditions at this point began to rapidly deteriorate both on the interior and exterior.

At 0014:50 hours, the IC asked again if all companies had been able to evacuate the structure. The apparatus operator of Q2 advised IC that E3 captain was still inside the structure. L1 company officer and firefighter, along with the nozzle firefighter from E3, exited the structure on side Alpha. Personnel from E1 were using the 1 ¾- inch backup attack line to knock back the fire that was coming out the side Alpha door. The initial 1 ¾ - inch attack line was removed out of the structure by the nozzle firefighter upon his exit.

The company officer from L1 called for E3 captain directly on the radio at 0015:30 hours with no answer. L1 company officer then asked all on-scene companies if anyone had E3 captain in their sight. At 0016:07 hours, the IC ordered that the backup line be placed into service at side Alpha and the IC left the ICP to gain a better view of the operations on side Alpha. RIC advised IC that they had scanned the windows alongside Bravo and the exterior of the structure but were unable to account for the E3 captain. IC deployed the RIC including the company officer from E1 to the interior of the structure. RIC deployed with the 1 ¾-inch attack line that was obtained from the E3 firefighter who had exited the structure.

IC notified the communications center on the main fire channel of a Mayday deployment at 0018:03 hours and requested the next closest three fire companies to respond to the scene. E1 company officer (now attached to the RIC) advised at 0019:36 hours that a PASS device could be heard towards the rear (side Charlie) of the structure from the interior. RIC encountered several rooms of active fire as they continued to advance down the center hallway towards side Charlie. RIC provided a status report at 0020 hours to the IC that they were still working their way to side Charlie.

At 0021:31 hours RIC transmitted to IC, "I got him, I got him, I got him." RIC was able to confirm the E3 captain was breathing and awake with his SCBA appearing to be functioning properly. RIC silenced the PASS device on the SCBA and advised they were near some windows on side Bravo. They requested a ladder to the window. RIC was working in zero visibility and attempted to use the

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RIC/UAC in conjunction with the RIC kit. At approximately 0023 hours, RIC drug the E3 captain out of the structure through the hallway and requested that EMS be ready on side Alpha. L1 informed IC that all personnel including E3 captain were out of the structure on side Alpha at approximately 0024 hours.

IC informed the communications center at 0024:38 hours that the missing firefighter had been located and removed from the structure. E3 captain was awake and talking upon being removed from the structure. He was treated by on-scene EMS personnel before being transported to a nearby landing zone at 0046:08 hours. He was air lifted to a trauma center at approximately 0058 hours. Unfortunately, E3 captain later succumbed to the injuries sustained during the incident three days later.

Fire Origin and Cause

At the time of this report being published, the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) field office and investigating partners noted that the origin, cause, and classification were still under investigation.

Cause of Death

The Office of the Medical Examiner listed the cause of death as complications from thermal cutaneous injuries, partial and full thickness burns, anasarca, and cerebral edema.

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 fatality:

- *Vacant and abandoned building marking system*
- *Crew integrity*
- *Two-way portable radio communications*
- *TI device usage*
- *Fire dynamics in relation to flow path*
- *Strategy and tactics for transitional fire attack*
- *Safety and survival training for self-rescue.*

Recommendations

Fire departments should:

Recommendation #1: Consider working with local officials to develop a vacant/abandoned building management and marking system.

Discussion: The local housing authority knew this structure was an abandoned property. The property was boarded up on the exterior to prevent unauthorized access. However, some of the windows had

been broken over the years. The structure had experienced a fire event years before this incident but was structurally intact with intact dry wall and lath and plaster interior finishings. The home was not legally occupied at the time of incident. It contained minimal debris and living furnishings, and it was not serviced by the local electrical utility service. The city government and fire department did not have a collaborative approach to managing and marking abandoned structures.

The AHJ is responsible for training and certifying inspection and code enforcement personnel to ensure that the appropriate fire and building safety codes are utilized and enforced. Based upon jurisdiction, fire and life safety inspection programs may be in the fire, building, or code enforcement departments. In some fire departments, this responsibility is performed by firefighters, fire prevention divisions, or fire officers. When the authority to perform fire inspections and code enforcement is not assigned to the fire department, the fire department should develop a working relationship with the department that has this authority [IFSTA, 2016].

NFPA 1201, *Standard for Providing Fire and Emergency Services to the Public*, Section 6.3 states, "the fire and emergency service organization (FESO) shall seek to establish a good working relationship with the agency or authority responsible for enforcing the building code so that the review of the design, construction, alteration, or demolition of buildings and structures can be monitored to identify fire protection concerns." This includes ensuring the investigation of fires and other emergencies to assist with developing an effective hazard and risk prevention program [NFPA 1201, 2020]. This also includes inspections, permits, code violations, fire protection maintenance and service, and any other vital information. When fire departments and fire leadership maintain a familiarity with their AHJ's local ordinances, this enhances their ability to have input in renovations and use group changes for occupancy types within their jurisdiction.

NFPA 1030, *Standard for Professional Qualifications for Fire Prevention Program Positions*, Chapter 7 provides the job requirements for the position of Fire Inspector. It states that the duties of this position involve conducting fire and life safety inspections, to include enforcement actions, and analyses of new and existing structures and properties for construction, occupancy, fire protection, and exposures. This includes identifying occupancy classifications, evaluating fire protection systems and equipment, and recognizing hazards and deficiencies according to applicable policies, codes, and standards adopted and maintained by the AHJ [NFPA 1030, 2024].

A hazardous building management program may reduce the risks posed by these buildings and ideally composed of three phases to include determination, remediation, and marking.

Phase 1 – Determination: Determination consists of identification, evaluation, designation, and communication.

- **Identification:** Personnel physically locate and evaluate the potential hazardous buildings. A common challenge encountered is the ability to legally access the property, especially in the case of private and residential properties where the fire department would not normally have the legal authority to access the property outside of an emergency incident. It is critical that anyone attempting to access a property fully understands their legal standing to avoid possible

criminal charges and hostile confrontations with property owners. Fire department personnel should work with the local AHJ to legally gain access to the properties as warranted.

- **Evaluation:** Personnel responsible for a building management program must have the subject matter expertise to evaluate the condition of the buildings. Beyond determining if a building is vacant or abandoned, they need to have the necessary expertise to determine if it has structural integrity defects or conditions that could warrant a status of being formally condemned. Fire department personnel must exercise caution and take all necessary preventative measures to ensure their safety during the evaluation process. Hazardous buildings can present several hazards outside of the structure itself, to include the presence of unauthorized people, concealed traps, and hazardous materials. If there are questions as to the structural integrity of a building, the fire department should utilize outside subject matter expertise as needed to ensure that they can safely enter and evaluate the building.
- **Designation:** Personnel determine the status of the building upon completion of the evaluation. The fire department can determine the status of the building for the purposes of their risk/benefit analysis during an incident. However, the fire department may not have the legal authority to formally condemn a building unless it poses an imminent risk to public safety. This is another part of the process where it is critical to work with the local AHJ if there is a need to have a building formally condemned so that it can be demolished and removed through the appropriate means.
- **Communication:** After the status of the building has been determined, it should be effectively communicated to all parties involved (property owner, building dept, fire marshal, fire department, dispatch center, etc.).

Phase 2 – Remediation: Remediation includes demolition, marking, and securing.

- **Demolition:** For a derelict or condemned building, the best approach through risk management principles is to remove the hazard by having the building demolished. If a building remains, it may still be inhabited by unauthorized occupants, and it may still catch fire, forcing a fire department response. Most fire departments lack the necessary legal standing or resources needed to carry out the demolition of a building, so it is critical for them to form strategic partnerships with local agencies who can assist.
- **Marking:** Proper marking benefits the responding fire department in recognizing the building status. There are several references that can be used for guidance when it comes to developing and implementing a building marking system.

As an example, the International Association of Arson Investigators and United States Fire Administration Abandoned Building Project utilizes a simple system consisting of a box with a diagonal line to indicate the condition of the building. The abandoned building project toolbox can be found at http://www.interfire.org/features/AbandonedBuildingProjectToolBox.asp.

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Figure 1. High risk building marking system
(*Courtesy of United States Fire Administration*)

The 2021 International Fire Code (IFC) Appendix J Building Information Sign (International Fire Code, 2020) and the NFPA 1 Fire Code, Annex C - Fire Fighter Safety Building Marking System (Zevotek, 2022) utilize a more elaborate and detailed marking system based on a Maltese Cross that goes beyond just indicating the status of the building.

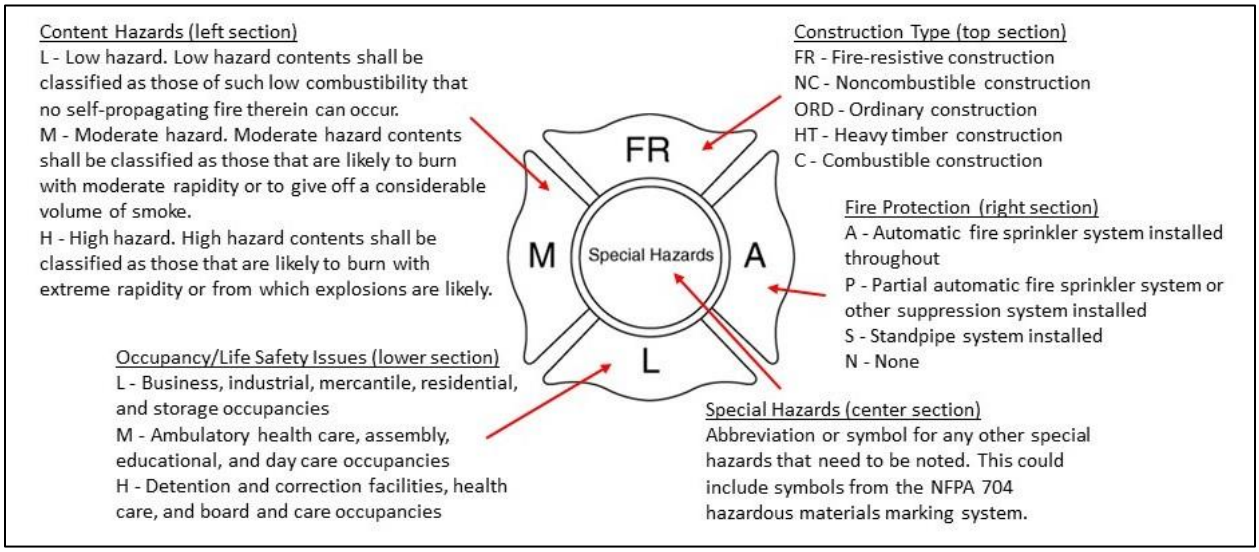

Figure 2. Updated and detailed high risk building marking system
(*Courtesy of NFPA*)

Although marking buildings can have a benefit, there can be localized challenges to implementing this action based on unique circumstances. Some fire departments have run into challenges when trying to implement these programs due to concerns over the negative stigma attached to these markings when they are concentrated in a given area or neighborhood. Therefore, it may be useful to form strategic partnerships with local community partners to explain the lifesaving benefits of implementing a marking system.

- **Securing:** If unauthorized individuals can be prevented from entering the building, it may eliminate the possible ignition source of a fire and prevent the fire department from having to enter for search & rescue operations. Securing the building may include both physical barriers

to deny access and partnering with local law enforcement or private security agencies to identify and prevent unauthorized access. Securing a building can have pros when it comes to preventing unauthorized access; however, it can also have cons if the fire department needs to enter the building. As such, the fire department needs to be aware of how to access and remove any security features established.

Phase 3 – Emergency Response: Emergency response includes recognition and risk management.

- **Recognition:** Through various means available (dispatch information, CAD notes, building markings, and/or effective situational awareness), responding personnel must have the ability to proactively recognize the status of a hazardous building as soon as possible. A multilayered system with repetitive information is best if a failure occurs with one of the layers. For example, if a building marker ends up missing, but the information is relayed at dispatch from a CAD note, the responders will still be aware of the hazardous building's status.
- **Risk Management:** The key decision makers (1st arriving officer, IC, safety officer) need to incorporate the status of the hazardous building into their risk/benefit analysis and IAP. This includes recognizing both the "status" of potential occupants and the building (NIOSH, 2024).

Recommendation #2: Ensure that crew integrity is properly maintained by visual, direct, and/or verbal (voice or radio) contact when operating in an IDLH atmosphere.

Discussion: In this incident, E3 captain chose an offensive strategy that was reinforced and transmitted via the radio by BC7 upon arrival and establishing IC. The crew (captain and firefighter) from E3 proceeded to stretch an interior attack line and made entry with L1 (captain and firefighter) through the front door on side Alpha. During the initial stretch of the 1 ¾-inch attack line, the E3 captain told the nozzle firefighter that he was returning to the front door "to get more hose." As fire conditions changed, the nozzle firefighter of E3 was unable to establish voice communications with E3 captain. During the investigation, NIOSH was unable to find any witnesses who observed E3 captain making it back to the front door.

Additionally, upon the arrival of BC7 and repositioning the BC7 vehicle for a better view of side Delta, the IC was unaware that either E3 or L1 made entry into the structure. There were no radio communications from either L1 or E3 about making entry into the structure. At 0012 hours when E1 informed the IC of changing fire conditions venting outside side Alpha through the door, the IC was unaware that E3 and L1 crews were interior. The IC specifically ordered both L1 and E3 company officers via the radio to exit the structure. The withdrawal order was never acknowledged via the radio by E3 captain. It was later determined through investigation that the portable radio being carried by E3 captain was never turned on during this incident nor did it ever register in the portable radio log from the communications system (see recommendation #3).

Crew integrity is essential to fireground accountability. Fire departments should have personnel accountability policies and procedures in place to track crews and individuals. A department's accountability system should have the capabilities to track and identify who is operating in the hazard zone, their assignment, and location. The collection of personal accountability tags or passports placed

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on an apparatus does not assist in maintaining awareness to the fireground location of crews or individuals. NFPA 1550 *Standard for Emergency Responder Health and Safety, Section 17.7* provides guidance on accountability for all resources, including personnel (NFPA 1550, 2024):

- Specific means (Passport tags, software, etc.) to identify and track responders entering hazardous areas
- Accounting for personnel who arrive on-scene by other means besides apparatus
- Providing a process to rapidly account for all responders on-scene.

Recommendation #3: Develop policies and ensure that all personnel are trained on the features and use of portable radio operations particularly, as they relate to building muscle memory in daily response habits.

Discussion: In this incident, the portable radio issued to E3 captain was never turned on nor did it ever register on the radio log during the incident, preventing him from hearing any of the fire scene audio about rapidly changing fire conditions, change in strategy from offensive to defensive, and the request from the IC to evacuate the structure. There were no radio transmissions made from E3 captain after giving an initial on-scene radio report made from the mobile radio inside the cab of E3.

Two-way portable radio communications are a critical component of the firefighter's complete PPE. Personnel should build muscle memory and consistency in incorporating their portable two-way radio device into the appropriate donning of assigned PPE and turning on the portable radio once on-scene in accordance with department policy. In a position paper written by the International Association of Fire Chiefs (IAFC), they state, "Information from outside can prevent crews from advancing into dangerous conditions inside" (IAFC, 2009). Two-way portable radio communications enhance general situational awareness for first responders, confirm and communicate strategy and tactics, and most importantly, allow for firefighters to transmit distress signals and communications such as declaring a Mayday or an urgent message.

If not already in place, fire department policies should outline response communications and training should be developed so that personnel understand the features and capabilities of two-way radio communications. NFPA 1802 *Standard on Two-Way, Portable RF Voice Communications Devices for use by Emergency Services Personnel in the Hazard Zone* provides examples of features that are incorporated into two-way portable radios that may be helpful to personnel to be aware of and trained on to include (NFPA 1802, 2021):

- Power/volume knob
- Selector knob
- EAB (emergency alert button)
- Time-out timer
- Out-of-range Detection.

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Recommendation #4: Ensure personnel understand the capabilities, use, and limitations of thermal imaging (TI) devices and utilize them during interior structural firefighting operations.

Discussion: In this incident, E3 captain returned to the engine company after the initial attack line was stretched to side Alpha to retrieve the TI device assigned to E3. During the initial fire attack, it is unknown as to whether he ever used the TI device. Following the Mayday and removal of E3 captain to side Alpha, the TI device was discovered just inside the front door on side Alpha. The TI device was not found with the E3 captain, on his PPE, or in the room where he was found.

The Western Fire Chiefs Association noted that TI devices are helpful in many situations while improving both speed and effectiveness (Western Fire Chiefs Association, 2024). While the fire service provides many opportunities for TI device usage such as hazardous materials, search and rescue, fire attack, etc., one of the primary components to TI use is to maintain broad situational awareness to the conditions inside zero visibility environments. The ability to detect changes in fire conditions, flow paths, and egress can all be applicable reasons to use TI during interior firefighting.

Personnel should be trained to specific characteristics, features, modes, and overall capabilities of a department's specific TI device. Fire departments should use caution when selecting TI devices that are incorporated into other PPE components like SCBA and helmets to ensure the technology meets NFPA 1801 *Standard on Thermal Imagers for the Fire Service* if being utilized as the primary TI device. Personnel should be mindful to incorporate the use of TI where available and build the muscle memory needed when TI devices are incorporated into the daily wearing and use of PPE ensembles.

Recommendation #5: Develop or revise policies, strategies, and tactics to include modern research of fire dynamics including the movement of air and fire within a structure.

Discussion: In this incident, E3 approached the scene from the north traveling south and was able to observe sides Bravo, Alpha, and Delta upon arrival. Visible and well-developed fire was observed on side Delta at the Charlie corner. E3 provided an on-scene report of "working fire." The E3 firefighter stretched a 1 ¾ - inch attack line to side Alpha as the E3 company officer chose an interior fire attack. Conditions on side Alpha didn't reveal anything significant to note with only light smoke around the porch area. The crew from E3 met with the L1 crew to utilize traditional forcible entry techniques to gain access to the interior on side Alpha.

The front door on side Alpha remained open as both E3 and L1 made entry into the structure for an interior fire attack. E3 and L1 interior crews had been inside the structure for approximately four minutes when the E1 company officer relayed the message to the IC that fire was venting out the front door on side Alpha. Within this four-minute time frame the fire had been drawn from the side Delta/Charlie corner through the structure and out the front door. Upon investigation, the abandoned structure was largely intact with limited combustible furnishings.

A flow path is "the movement of heat and smoke from the higher pressure within the fire area towards the lower pressure areas accessible via doors, window openings, and roof structures" (NFPA Glossary of Terms, 2021). Flow paths consist of an inlet and an exhaust with the direction of travel being determined by pressure. Heat and smoke in a high-pressure area will travel to an area of lower

pressure. It is possible to have multiple flow paths within a structure dependent upon the size of the building, openings, closures such as fire doors, and overall structure design. Personnel working in the flow path (between the seat of the fire and the exhaust) operate in a significantly risky environment. Coordinated ventilation tactics should be utilized to redirect the flow path from interior operations.

The International Fire Service Training Association notes that firefighters advancing hose lines or ventilating windows create newly formed flow paths between the seat of the fire and ventilation points to the exterior (IFSTA, 2018).

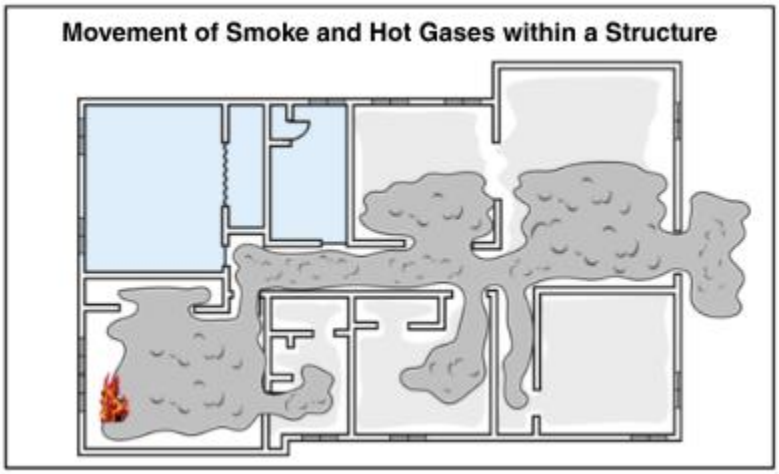

Figure 3. IFSTA Essentials of Firefighting 7th Edition Figure 4.47 (*Courtesy of IFSTA*)

When identifying the flow path within a structure, personnel should be mindful to wind conditions. Wind can create pressure changes within a structure or building which could spread smoke and fire into non impacted parts of the structure or building. Interior firefighting personnel should be mindful to these changes in conditions that place the interior firefighting personnel in the exhaust portion of the flow path. Sudden changes in temperature and smoke are factors that should alert interior personnel of imminent changes to conditions. Water should be applied to the fire as quickly as possible utilizing the reach of an effective fire stream that is delivering an appropriate volume of water that will overcome the heat release rate. In some cases, it may be appropriate to introduce water from the exterior of a structure through a window/door with an attack line or begin the fire attack from the exterior with a coordinated blitz attack flowing 300 gallons per minute or greater before committing personnel to the interior. Fire departments should cool interior spaces from the safest and closest location possible, especially in vent limited spaces.

Recommendation #6: Develop policies, strategies, and tactics related to the exterior extinguishment or resetting of the seat of fire, slowing both vertical and/or horizontal fire spread prior to interior firefighting operations.

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Discussion: In this incident, the fire began inside the abandoned structure and was immediately discovered and reported to the 9-1-1 communications center. A local law enforcement officer on patrol also quickly discovered the structure fire and requested the fire department. Upon arrival of E3, a well-developed fire was burning on side Delta at the Charlie corner that had vented to the exterior of the structure. Both the 9-1-1 caller and local law enforcement officer provided information that the structure was believed to be empty of any occupants and this information was relayed to responding fire companies.

Fires venting from the exterior with both vertical and horizontal spread can present a hazard to arriving fire department personnel. First arriving company or chief officers on-scene should be mindful to the many factors involving fire dynamics when considering the appropriate strategy for the incident. Paraphrased from NFPA 1700 *Guide for Structural Firefighting, Chapter 9* (NFPA 1700, 2021), these include:

- *Smoke and fire conditions* – Read the smoke based on volume, velocity, color, and density
- *Fuel load* – Increased fuel loads may increase higher heat release rates
- *Openings* – Windows, doors, and structural openings that can provide a pathway for fire extension
- *Flow path* – Air and gases move from higher pressure to lower pressure via doors and windows within a structure
- *Weather Conditions* – Wind should be evaluated to recognize the hazards of a wind-driven fire
- *Accessibility of the structure* – Apparatus placement, water supply, and access for fire attack and ground ladders
- *Fire progression* – 360-degree walkaround predictions made to fire spread while considering fire dynamics and outcomes of fire attack and ventilation
- *Fire Control Positioning* – Location of the seat of the fire, survivability profiling, and access.

Consideration should be given to a transitional attack when the first arriving company or chief officers on-scene and observe active and well-developed fire accessible from or involving the exterior of a structure that is spreading vertically, horizontally, or both with survivable space within the structure. Company or chief officers should include the type and occupancy status of a structure and a risk/benefit analysis when making tactical decisions. A transitional attack is “the application of a fire stream from the exterior of a structure to improve conditions prior to interior fire control” (NFPA Glossary of Terms, 2021).

Recommendation #7: Develop training initiatives that focus on the knowledge, skill, and ability of firefighter safety/survival self-rescue training to include emergency egress and low-profile clearance.

Discussion: In this incident, E3 captain made an interior fire attack through the front door on side Alpha. After the nozzle firefighter advanced a short distance into the structure, E3 captain informed the nozzle firefighter that he “was going to get more hose.” E3 captain was never observed returning to the front door on side Alpha nor was any hose advanced into the structure. E3 captain had become lost and disoriented within the structure and was found in the rear (side Charlie at Bravo) corner by the RIC

after a Mayday had been declared by L1 on behalf of E3 captain. It is unknown what actions E3 captain performed to self-rescue. However, two smaller windows were present in the laundry room where he was found by RIC. It can be concluded from interviews and photographs that E3 captain assumed a prone position on the floor and experienced most of the thermal assault to his left side.

Interior structural firefighting personnel should be trained to both recognize and avoid, when possible, the following hazards as listed in the International Fire Service Training Association (IFSTA) Essentials of Fire Fighting (IFSTA, 2024):

- Air emergencies
- Lost/disoriented
- Entanglement
- Rapid fire development
- Collapse/trapped.

Further, the following skills should be incorporated into a firefighter's self-rescue training program. This list is not intended to be all inclusive but serve as general guidance.

- Declaring Maydays – Location, Unit, Name, Air, Resources, and PASS device activation
- Reduced profile maneuvers
- Window egress techniques
- Emergent ladder egress/escape
- Emergency bail out systems
- Disentanglement from debris and wires
- Wall breaches.

The International Association of Fire Fighters (IAFF) (FGS) cadre notes "Fire fighters must be trained to perform potentially life-saving actions if they become lost, disoriented, injured, low on air, or trapped" (IAFF, 2024). Funded in part by a grant from the U.S. Department of Homeland Security and the Assistance to Firefighters (FIRE Act), the IAFF offers both online and on-site training related directly to firefighter survival training and tactics. A 2023 article posted to FireRescue1 provides some realistic training examples and drills that can assist fire departments in training for declaring Maydays, orientation, props, low air emergencies, and trapped firefighter simulations. Andrew Beck, firefighter/EMT and author of this FireRescue1 article notes that readers should "Define your parameters, practice the procedures, and ensure it's realistic. You will prepare your folks to succeed when it's truly life or death" (Beck, 2023).

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Investigator Information

This incident was investigated by Patrick R. Montague (former), Investigator and Louis (Rick) Lago (former), Investigator, both with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH located in Morgantown, WV. The report was written by Patrick R. Montague (former), retired Battalion Chief, and credentialed Chief Fire Officer. An expert technical review was provided by Timothy S. Cowan, Deputy Fire Chief, Dewitt Fire District in Central New York. A technical review was also provided by the National Fire Protection Association, Emergency Response and Responder Safety Division.

Disclaimer

The information in this report is based upon dispatch records, audio recordings, witness statements, and other information that was made available to the National Institute for Occupational Safety and Health (NIOSH). Information gathered from witnesses may be affected by recall bias. The facts, contributing factors, and recommendations contained in this report are based on the totality of the information gathered during the investigation process. This report was prepared after the event occurred, includes information from appropriate subject matter experts, and is not intended to place blame on those involved in the incident. Mention of any company or product does not constitute endorsement by NIOSH, Centers for Disease Control and Prevention (CDC). In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date.