1000 FREDERICK LANE, MORGANTOWN, WV 26508 • 304.285.5916

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Executive Summary

On January 13, 2022, a 33-year-old career firefighter assigned to Truck 13 (T-13) died while conducting fire suppression activities in a derelict single-family residential structure.

Photo 1. Conditions on the arrival of Truck 13 showing post flashover fire conditions throughout the second and third floors. *(Courtesy of FD)*

Prior to the fire being reported, T-13 was out of quarters and noticed a large column of smoke. While enroute to investigate the origin of the smoke, a still alarm was dispatched at 11:45 for a fire in a residential structure. T-13, which was operating on reserve Engine 33, arrived on the scene at 11:46. On arrival, the T-13 acting officer (T-13A) provided his initial radio report as “heavy fire on the 2nd floor, exposure on the D side, one line off, 1st alarm.″ The firefighter on Truck 13 riding in the C position (T-13C) checked the Side Delta exposure, which was an occupied single-family residence. It was determined that all occupants were out of that residence. The Side Bravo exposure was an empty lot. The T-13C firefighter deployed a 4-inch supply line approximately 130 feet to the hydrant at the end of the block for water supply. T-13A and the firefighter in the B-position (T-13B) deployed a 1¾" preconnected handline to the front door of the building. The front door of the structure was boarded over, and forcible entry was required to gain access. T-13A and T-13B made entry into the structure at approximately 11:48 with an uncharged hoseline for initial fire attack and primary search. Approximately one minute after entry, T-13A made a visual gesture from the front door to the Truck 13 apparatus operator (T-13D) to charge the 1¾” handline. T-13C and T-13D completed the connection to the hydrant and stretched a 2½” hoseline to protect the exposure on Side Delta at approximately 11:50.

Next to arrive on the scene at approximately 11:50 was Hook & Ladder 5 (H&L-5), Engine 28 (E-28), and Engine 24 (E-24). The officer of Engine 28 (E-28A) assumed command of the incident and reported *"We've got one house fully involved, exposure on Side Delta, 13's leading off with a big line."* H&L-5 positioned for a defensive operation to protect the Side Delta exposure and began to set up their aerial ladder. Members of H&L-5 and E-28 focused their efforts on the search and protection of

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Side Delta exposure. Members of E-28, who were not aware that members of T-13 had entered the original fire building, then noticed a 1¾" hoseline from T-13 going into the front door of the original fire building. They decided that they would use that hoseline for the Side Delta exposure as they did not see any point of it being used on the original fire building given the significant volume of fire and the operations towards it would be defensive.

Fire Alarm Dispatch reported hearing an open mic from the T-13B portable radio with no response at 11:52. Evidence from the investigation supports that a structural collapse of the area above the second floor occurred just prior to this time and it trapped T-13B on the second floor. At the time of the collapse, T-13A was also pushed back down the stairs to the landing between the first and second floors. At approximately 11:53 T-13A met E-28A at the front door and advised what just happened. Upon observing this interaction, the captain of Engine 24 (E-24A) immediately transmitted *"E-24A, firefighter trapped inside the building, give me a second alarm with the second squad."* Car 805, the first due Battalion Chief, arrived on the scene at 11:54 and assumed command from E-28A. A second alarm was dispatched at 11:55. Numerous crews worked for approximately the next 45 minutes to locate and extricate the downed firefighter (T-13B) who was trapped in the collapse on the second floor. The downed firefighter (T13-B) was deceased when located.

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. Below are key contributing factors that led to the line of duty death and recommendations to prevent similar events from occurring:

- *Personnel staffing*
- *Professional development for acting fire officers*
- *Speed of the incident development, and the resulting impact on critical factors that are part of a risk/benefit analysis*
- *Derelict high-risk structure, susceptible to rapid fire spread and structural collapse*
- *Situational awareness at the task, tactical, and strategic levels*
- *Incident management, including risk assessment and management*
- *Mayday operations*
- *Communication equipment and procedures.*

Key Recommendations

- *Ensure formal written guidance and leadership oversight is available and utilized for personnel staffing*
- *Develop and utilize a professional development program for acting fire officers that includes competency verification at the appropriate level(s) of responsibility*
- *When completing a risk/benefit analysis, evaluate the speed at which an incident is developing and how the speed may impact critical incident factors*
- *Develop and implement a High-Risk Building Management Program (HRBMP)*

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

- *Develop and utilize a professional development program for situational awareness and ensure that effective situational awareness is utilized at all emergency incidents*
- *Utilize formal guidance for incident management which incorporates risk assessment and management principles*
- *Consistently utilize formal guidance for calling, responding to, and managing a Mayday*
- *Take necessary actions to address the five critical elements for effective fireground communications: professional development, necessary equipment, ability to function in varying environments, written guidance, and effective leadership at all levels.*

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).

1000 FREDERICK LANE, MORGANTOWN, WV 26508 • 304.285.5916

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Introduction

On January 13, 2022, a 33-year-old career firefighter assigned to Truck 13 (T-13) died while conducting fire suppression activities in a derelict single-family residential structure. On January 13, 2022, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident; however, NIOSH was not requested by the FD to investigate the LODD until later that year. In November 2022, NIOSH Fire Fighter Fatality Investigation and Prevention Program investigators traveled to Missouri to investigate this incident. A site visit to the structure involved in the incident was not conducted given the structure had been demolished. However, the NIOSH investigators:

- Met with fire department (FD) officials, including the chief officers, company officers, and firefighters involved in the incident.
- Met with representatives of the International Association of Fire Fighters local 73.
- Obtained a copy of the incident fireground communications.
- Reviewed the FDs policies and training records.

The FD had completed an internal investigation and content from that investigation was used directly in this report.

Fire Department

The career FD consists of approximately 856 personnel that includes firefighters, EMT-Basics, EMT-Paramedics, and civilian employees. The rank structure of the FD is as follows: fire commissioner/chief of department, deputy chief (A, B, C shifts and fire marshal), battalion chief, captain, firefighter, and probationary fire private. The FD protects a city that is approximately 62 square miles and has a population of about 319,294 full-time residents and a daytime population of approximately 2 million. The FD responds to approximately 125,000-130,000 calls per year.

The Fire Suppression Bureau operates three shifts, each commanded by a deputy fire chief. The firefighters respond from 30 fire houses, located throughout the city, organized into seven districts. Each district is commanded by a battalion chief. Members of the Fire Suppression Bureau work a modified Kelly schedule. The Fire Suppression Bureau operates 15 engine companies, 12 truck companies (75-foot quint), 5 hook & ladder companies (100-foot aerial), 2 heavy rescue squads, 12

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

ambulances, 3 hazardous materials apparatuses, 1 USAR apparatus, 2 fireboats, 4 rescue boats, 7 battalion chiefs, and 4 deputy chiefs. The engine and truck companies are staffed with a company officer, driver/operator, and two firefighters. The heavy rescue squads are staffed with a company officer, driver/operator, and four firefighters. The medical units are staffed with a paramedic and EMT. Each chief officer responds on their own without an incident technician.

The FD utilizes Clear Text for all radio communications. Radio call signs for personnel are A-Alpha (company officer), B-Bravo (leadoff/nozzle firefighter), C-Charlie (hydrant firefighter), D-Delta (driver/operator), E-Echo (5th member of the rescue squad), F-Foxtrot (6th member of the rescue squad).

- Still alarm assignment consists of three companies (engine or truck), one hook & ladder, one rescue squad, and a battalion chief.
- First alarm assignment adds two additional engine/truck companies, one additional battalion chief, and a medic unit. A Deputy Chief is also dispatched on a first alarm at key target hazards or when civilians are trapped.
- Second alarm assignment adds an additional three engines/truck companies, one hook & ladder, one battalion chief, one deputy chief, unit 821, and unit 900. A second rescue squad may be dispatched on a second alarm involving structures with a large life threat.

These additional units are also notified of second alarms:

- CFD (Commissioner/Chief)
- All Deputy Chiefs / Unit 810 (A/B/C)
- Unit 824 (Information Technology)
- Unit 819 (Deputy Fire Marshal)
- Fire Alarm 1
- Unit 817 (Lead Instructor)
- Unit 827 (PIO)
- Unit 830 (Fire Department Photographer)
- Unit 815 (Health and Safety Officer)
- Unit 813 (Chief Instructor)
- Unit 816 (Homeland Security Officer)
- Unit 825 (Research and Development/Special Ops)

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Training and Experience

T-13 Personnel	Date hired	FD recruit training completion	Certifications
Acting captain T-13A	December 14, 2015, as EMT-Paramedic with Bureau of EMS January 8, 2018, transferred to Bureau of Fire	April 2018	- State of Missouri Fire Fighter I & II - Hazardous Materials Awareness & Operations - Missouri EMT-Paramedic
Leadoff/nozzle firefighter T-13B	November 12, 2019	March 2020	- State of Missouri Fire Fighter I & II - Hazardous Materials Awareness & Operations - Missouri EMT-Basic
Hydrant firefighter T-13C (temp. assigned)	January 20, 2014	April 2014	- State of Missouri Fire Fighter I & II - Hazardous Materials Awareness & Operations - Missouri EMT-Basic
Diver/Operator T-13D	November 19, 2019	March 2020	- State of Missouri Fire Fighter I & II - Hazardous Materials Awareness & Operations - Missouri EMT-Basic

Personal Protective Equipment

The personal protective equipment (PPE) from the affected firefighter was acquired from the Medical Examiner's office and the chain of custody was maintained by the Office of Investigations. The PPE suffered extensive thermal damage from intense heat while the down firefighter was trapped under the structural collapse. PPE was not considered a contributing factor in this incident.

The self-contained breathing apparatus (SCBA) worn by the down firefighter was recovered by members of Squad 2 and given to Battalion Chief 805. The battalion chief transferred custody of the

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

SCBA to the chief investigator for documentation and examination. On March 29, 2022, at the request of the operations deputy chief and approval of the Chief and Commissioner, the SCBA was taken to the Scott SCBA technicians at engine house #1, to check for the possibility of recoverable data. After further inspection, it was determined that too much damage had occurred to the SCBA to permit any data recovery.

Cause of Death

The rescuers reported that the victim was deceased when he was located. The victim was formally pronounced deceased on the scene after recovery from the structure by an EMS supervisor. A death certificate and medical examiner's report was issued by the Medical Examiner's Office. The findings from the report listed the manner of death as accidental and the immediate cause of death was smoke inhalation with his carboxy hemoglobin level being 50% saturated.

Weather Conditions

At approximately 11:51 on January 13, 2022, the temperature was 45 degrees Fahrenheit, relative humidity was 65%, winds were west at 8 mph, and the sky was mostly cloudy with no precipitation.

Fire Behavior

Due to the extensive fire damage to the structure and the advanced fire conditions found on arrival, it was not possible for the fire investigators to determine the exact point of origin and cause of the fire. On arrival there were post flashover fire conditions visible on the 2nd and 3rd floors of the structure. On entry into the structure, limited amounts of fire were also located on the 1st floor. There was no fire located in the basement. Due to the deteriorated condition of the structure, there were multiple openings throughout the floors and walls, which allowed the fire to rapidly grow and spread. There was an adequate fuel load present to support the rapid-fire development, including the contents throughout the structure and the combustible structural elements.

Timeline

See Appendix A.

Structure

The structure involved in this incident was a derelict 2½ -story single-family residence (see photos 2-5 and diagrams 1-2). It was built in 1895 and was constructed of Type III Ordinary Construction. It consisted of a basement, first floor, second floor, and third floor/half story with all 4 levels accessed via interior stairs. The structure had been abandoned for several years during which time it had sustained significant damage from vandalism and exposure to the elements. It had also sustained damage from a previous fire. The structure had been identified by the local authority having jurisdiction as being abandoned and the utilities to it had been disconnected. There were numerous

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

openings to the outside environment with windows being broken out and a section of the exterior wall missing on the 1st floor Side Charlie (see photo 5). The front door of the structure had been covered over with a piece of plywood.

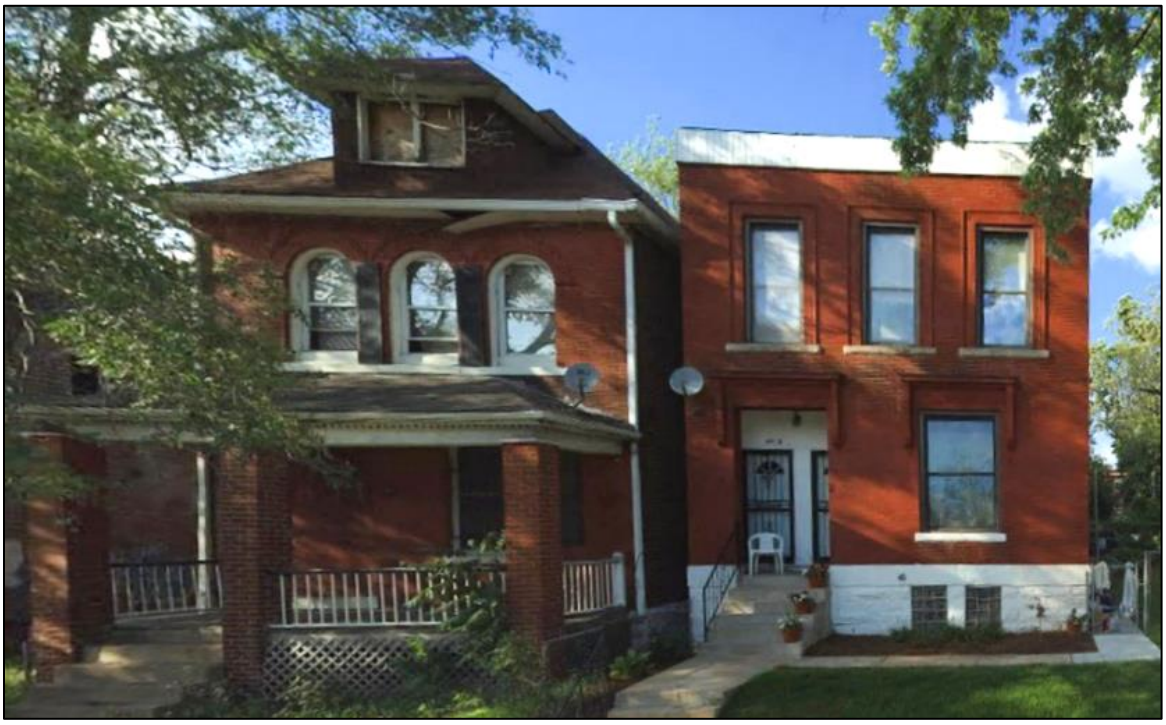

Photo 2. Fire building on the left, and the Side Delta exposure on the right, showing pre-fire conditions. Note indications of the fire building being a derelict structure with deteriorated conditions. ***(Photo from Google Earth)***

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Photo 3. Side Alpha post fire conditions. ***(Courtesy of FD)***

Photo 4. Side Bravo post fire conditions. (*Courtesy of FD)*

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Photo 5. Side Charlie post fire conditions showing the missing wall section on the 1st floor and the basement window used to access the basement by a member of RS-2. ***(Courtesy of FD)***

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

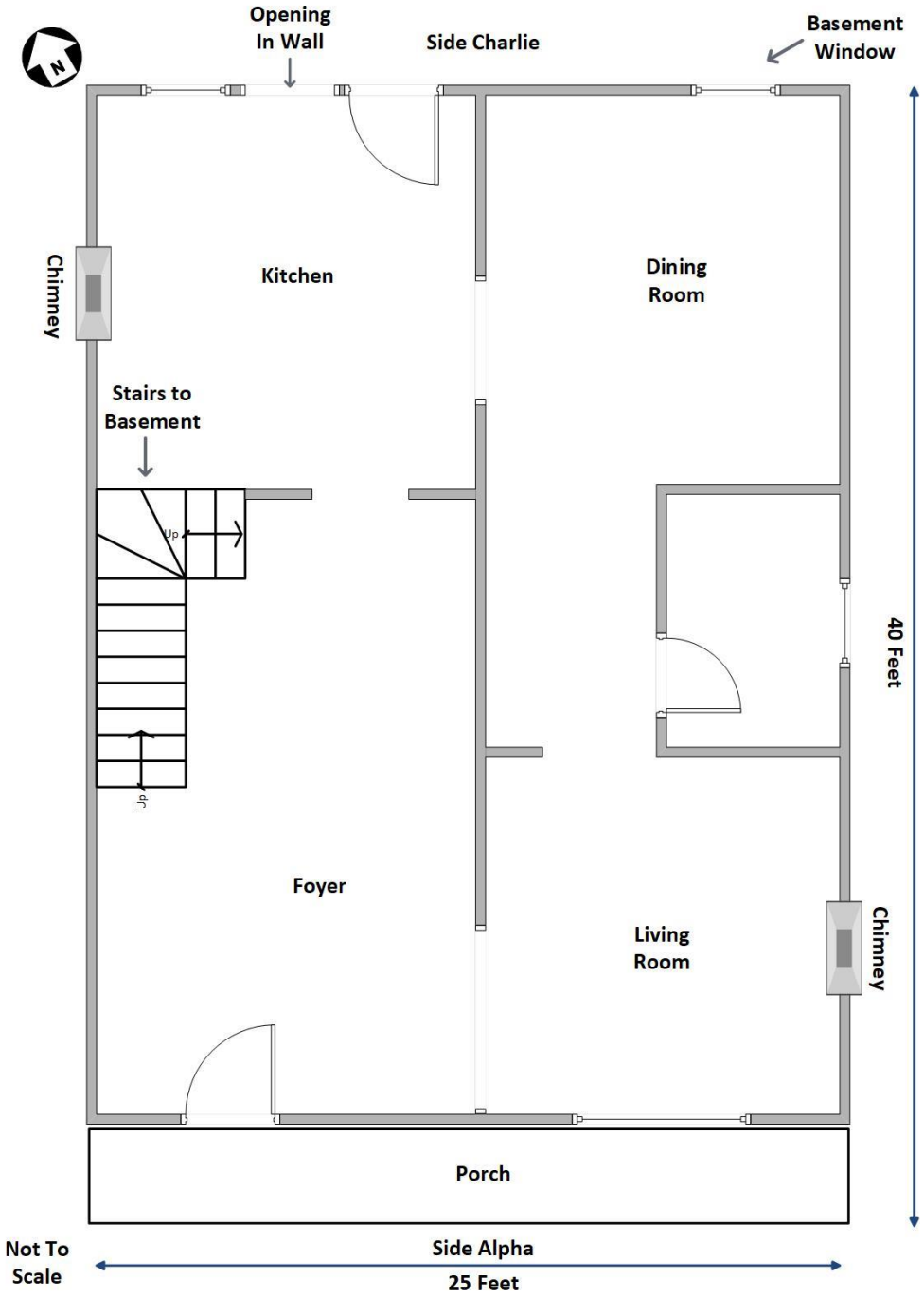

Diagram 1. First floor interior layout based on witness statements. The unfinished basement had the same exterior foundation footprint as the first floor. ***(NIOSH)***

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

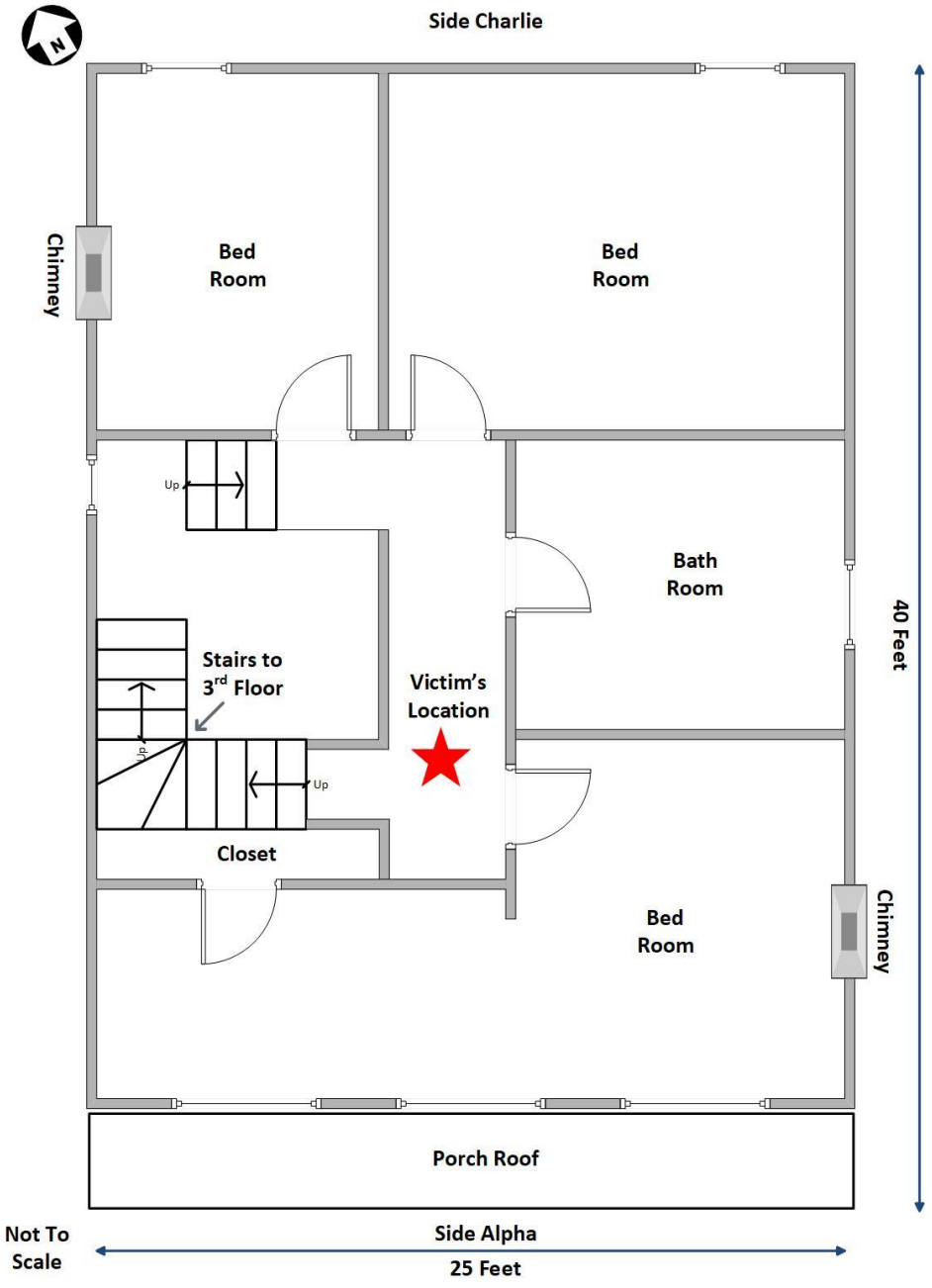

Diagram 2. Second floor interior layout based on witness statements. Layout of the half story above the second floor is unknown. ***(NIOSH)***

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Incident Investigation

On January 13, 2022, at 11:40 Truck 13 (T-13) was on the road returning from a previous call. They noticed a large column of smoke to the west and believed that it was coming from the County Fire Academy or the Utilities Fire School. The crew determined that they should investigate the source of the smoke since they estimated it to be farther north than the Fire School location. As they got closer to the source of the smoke, they heard the still alarm dispatch for a structure fire and responded to the still alarm with lights and sirens.

At approximately 11:43 the Fire Department's communication center received a 9-1-1 call reporting a house fire. A second call was received at 11:44 followed by a third call at 11:45 stating, “It's a home. Looks like it can be vacant, but it's engulfed in flames from the roof and thick black smoke.” At 11:45 Fire Alarm dispatched a still alarm assignment consisting of T-13, Engine 24 (E-24), Engine 28 (E-28), Hook & Ladder 5 (H&L-5), Battalion Chief 805 (BC-805), Rescue Squad 2 (RS-2), and Mutual Aid 2615. A fourth 9-1-1 call was received at 11:45 with the caller stating that he could see T-13 arriving at the incident.

At approximately 11:46, T-13 arrived on the scene with a full crew of four personnel. The acting captain (T-13A) reported, "Heavy fire on the second floor, exposure on Side Delta, 1st Alarm." Firefighter T-13C observed that the structure fire building was boarded up and appeared to be abandoned, so he turned his attention to the Side Delta exposure building which was being impinged by flames. The T-13C firefighter yelled to the T-13 crew that they needed to protect the exposure building since it was occupied and the main fire building was boarded up and appeared to be abandoned. The T-13C firefighter walked over to the Side Delta exposure building and checked it for occupants with no response. Hearing civilians across the street make the statement that everyone was out of that exposure, he went to his next task. On his way back to the apparatus, the T-13C firefighter reiterated to the T-13 crew that “they would definitely need to protect the Side Delta exposure building.”

Members of T-13 then initiated the following tasks:

- T-13C firefighter deployed a four-inch supply line to the hydrant with assistance from the T-13D driver/operator.
- T-13B firefighter deployed a 1¾” pre-connected hoseline to Side Alpha of the main fire building.
- T-13A acting captain and T-13B firefighter donned their SCBA facepiece on the porch stairs and forced entry through the boarded front door.
- T-13A entered the structure to evaluate the conditions and check for civilian victims.

While returning from making the water supply connection, the T-13C firefighter was able to get a full view of Side Bravo and observed flames coming from the second floor and what he considered to be the third floor (half story) dormer windows. He also observed T-13A and T-13B on the front porch at that time with a 1¾” hoseline preparing to make entry. When he made it back to the apparatus, he informed T-13D that they would "have to prepare to protect the Side Delta exposure, possibly fight the

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

fire from the outside, and maybe use the deck gun on the main building." The T-13C firefighter then deployed a 2½" attack line towards the Side Delta exposure assisted by T-13D with plans to leave the line for the next company to utilize. His plan was to join the other members of T-13 in the main fire building after fully donning his gear, but he was delayed because he had to add additional hose to the 2½" attack line to reach the Side Delta exposure.

Returning to the front doorway, T-13A instructed T-13D to charge the 1¾" attack line. T-13B then began to attack a small amount of fire on the first floor. After extinguishing the small amount of fire on the first floor, T-13A and T-13B repositioned the 1¾" attack line to advance to the second floor. T-13B made it to the top of the second-floor stairs while T-13A was helping maneuver the attack line around the landing on the stairwell.

At approximately 11:49, as E-28 neared the scene, a radio communication was received from E-24A regarding the assignments of the apparatus, to which E-28A responded that they were acting as a truck company.

At approximately 11:50, H&L-5, E-28, and E-24 arrived on the scene, with H&L-5 and E-28 positioning in front of the structure, and E-24 laying a supply line from H&L-5 out to a secondary water supply (See diagram 3). Each apparatus was fully staffed with 4 personnel.

Diagram 3. Position of 1st Alarm Units. ***(Image from Google Earth, additional content NIOSH)***

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

The H&L-5 captain (H&L-5A) reported that he observed fire venting from the roof or front gable, as well as fire from the rear window on Side Charlie, and the second floor was fully involved. He stated that he saw an attack hoseline spraying water on the Side Delta exposure, which he believed to be a 2½" attack line in place for an exterior defensive operation.

E-28 assumed the role of truck company based on the previous radio conversation with E-24. The E-28 captain (E-28A) also assumed the role of initial incident commander. E28-A stated that he gave a size up report of "a two-story brick, heavy fire, going through the roof, and a heavy exposure on Side Delta." He observed T-13's apparatus position on the street and a 2½" attack line deployed towards the Side Delta exposure. He was under the impression that T-13 was transitioning or setting up for an exterior fire attack and made a radio call that T-13 was leading off with a 'big line' (i.e., 2½" hoseline).

E-24 assumed the role of engine company based on the previous radio conversation with E-28. They entered the scene from the west side to have better access to a secondary water supply. While approaching on the street behind the incident scene, they observed the rear of the building, and noted heavy fire with significant impingement on the Side Delta exposure. Based on those observations, E-24A and his crew did not anticipate an interior attack in the original fire building and thought the operations would be defensive to protect the exposure. E-24 arrived on the scene and began to back into the scene.

At approximately 11:51, While T-13B was attacking the fire on the second floor, T-13A realized that a continued fire attack was going to be unsuccessful due to the heat and volume of fire and T-13A decided to back out of the building. T13-A stated that while they were backing out, the roof collapsed and trapped T-13B on the second floor.

The structural collapse pushed T-13A from the top of the stairs to the landing between the first and second floors. T-13A then noticed that the hose was not being operated and began to call out for the T-13B firefighter. T-13A secured the nozzle and began to spray water and search the area where he last saw the T-13B firefighter. He continually called for him with no response. While actively spraying water and searching, he stated that the hose line was pulled from his grasp and went to the front door to investigate what was going on.

While waiting for the 2½" attack line to go into operation E-28A noticed the 1¾" attack line going into the front door of the original fire building and decided that they were going to use it for the Side Delta exposure. He stated that the line was charged, and he was able to pull approximately five feet of the line freely from the building. He stated that no one was "on the line," but he could not see the nozzle tip as it was inside the structure and he "felt that no water was flowing." He stated that he did not know where the line went to in the structure past the front door. Based on the extensive fire conditions he observed upon arrival, he perceived no one would be in the building and that it would be a defensive operation.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

E-28A stated that T-13A then appeared inside the front door as they were pulling out the 1¾" attack line from the building. He was shocked to see T-13A inside the building based on the conditions upon his arrival. T-13A advised him that firefighter T-13B was still inside the building. Captain E-28A attempted to clarify with T-13A that firefighter T-13B was still in the building.

At approximately 11:53, as the captain E-24A made his way to the front of the building, he observed T-13A on the porch with E-28A who was instructing him to come off the porch. E-24A stated that T-13A was gesturing up the steps indicating that another firefighter was still inside. E-24A then made a radio call to Fire Alarm via his portable radio, "E-24A, firefighter trapped inside the building, give me a second alarm with the second squad."

T-13A then manned the 1¾" attack line while E-28A and E-28B attempted to make it up the stairs to the second floor. The E-28A captain stated that he had not donned his SCBA facepiece and used firefighter E-28B's radio to communicate that there was a member trapped inside the building. He did not hear any PASS device activation or calls for help. The E-28A captain stated that there was a heavy fire load, and the stairs and landing were both burned out.

T-13A stated to E-28A that the second floor was burned out. The members began to search the first floor for the missing member T13-B. The E-28B firefighter attempted to make it to the top of the stairs leading to the second floor but was unable to do so with the damage to the stairs and a tremendous volume of fire on the second floor. E-28B deemed his search clear from the location that he could reach on the stairwell, but also incomplete.

At approximately 11:54, Battalion Chief 805 (BC-805) arrived on the scene and positioned in front of the structure (see diagram 3). While enroute he had observed heavy black smoke to the west, with no change in color indicating that no water had been placed on the fire. He heard the radio exchange between the captains of E-24 and E-28 about apparatus roles and E-28A reporting defensive operations. As BC-805 approached the scene, he heard Fire Alarm announce, "T-13B you have an open mic, T-13B you have an open mic." He estimated that it was approximately four minutes from dispatch to the open mic broadcast. He stated that before he arrived on the scene it was announced on the radio that a firefighter had been trapped.

Upon arrival, BC-805 had a face-to-face interaction with E-24A, who informed him of a firefighter being trapped in the original fire building. E-24A stated to BC-805 that a firefighter was trapped and BC-805 replied "in there," pointing to the structure where the fire originated. BC-805 stated that he contacted Fire Alarm to activate the rapid intervention crew (RIC) but meant to call for an all-hands rescue because the RIC had not yet been established. BC-805 then ordered firefighter T-13C to extinguish the fire in the exposure building using the 2½" attack line, which was deployed off of T-13.

At approximately 11:56, Rescue Squad 2 (RS-2) arrived on the scene. At the time of the incident, RS-2 was short-staffed, only having five of the recommended six personnel. Firefighter RS-2F recalled hearing the size up from E-28A of "two-story brick, fully involved, T-13's stretching a big line," and

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

immediately after that transmission, E-24A called for a second alarm with a firefighter trapped. After hearing all that information, members of RS-2 discussed tactical and equipment changes.

The RS-2 driver placed the apparatus close to the scene for ease of access to tools and equipment (see diagram 3). Upon arrival the rescue squad split into multiple groups and entered different parts of the structure to conduct searches for the missing firefighter.

RS-2F and his partner proceeded along Side Bravo of the building to the rear to observe the building and conditions. After observing three sides of the building, they returned to Side Alpha and made entry through the front door where they encountered members of E-28 and H&L-5 on the stairs to the second floor. They placed a ladder along the damaged stairs to allow access to the second floor. Squad 2F recalled observing heavy fire conditions on the second floor as they made access via the ladder. When they reached the second floor one member immediately began a search down the Side Delta wall while his partner searched the opposite side of the room. They encountered isolated pockets of fire, burning debris, and limited visibility. They reached the back of the first floor Charlie-Delta corner and thought that the floor had collapsed, but when they reached that area, it turned out to only be a pile of flaming debris. They threw the flaming debris into areas they had already searched, searched the rear of the house, listened for a PASS device, and searched for indications of the down firefighter. While digging through the debris Squad 2F overheard on the radio that the down firefighter was in the basement. He then proceeded with his partner back down the ladder to exit via the front door. RS-2F stated that he learned from his captain, who had been informed by Chief 805, that they were searching for firefighter T-13B.

At approximately 11:58, H&L-5 had completed a primary search of the Delta Exposure, reporting the results on the radio as being negative. As the H&L-5A captain exited the Delta Exposure he began hearing that there was a member of T-13 trapped inside the original fire building. At that time, the H&L-5D driver/operator was raising the aerial ladder for a defensive fire attack.

Upon hearing that a member was trapped, H&L-5A took the H&L-5B firefighter to the rear door of the original fire building and began a search of the first floor at the Bravo-Charlie corner. They found a partial structural collapse approximately five feet inside the rear room and a more significant collapse and fire load in the Charlie-Delta corner.

RS-2F had exited the structure via the front door and proceeded along Side Delta of the building looking for basement access but did not find any. He met back up with his partner in the rear who had looked along Side Bravo for basement access. On Side Charlie, they encountered members of H&L-5 and another Rescue Squad member who had removed his SCBA and entered the basement via a window on Side Charlie. RS-2F was preparing to enter the window also but was told to wait because there was another member who had entered the basement via the interior stairs located in the kitchen.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

The H&L-5C firefighter had deployed a second 1¾" line from T-13, entered the first floor of the original fire building via the front door, and knocked down the fire on the first floor while searching that floor for T-13B.

E-24A and E-24B went back around to the front of the building to receive another assignment when BC-805 instructed T-13C to direct the 2½" attack line into the doorway of the Delta exposure building. T-13C extinguished a small fire at the base of the stairwell in the Delta exposure building. Then, E-24A and E-24B went into the Delta exposure to search for further fire extension and observe the condition of the original fire building. They could not see anything due to the amount of fire and smoke coming from the initial fire building and decided a hoseline was needed inside the Delta exposure for further fire attack.

The last known location of the downed T-13 firefighter had not been communicated at this time to all the personnel who were looking for him.

At approximately 12:00, two members of RS-2 entered and conducted a search of the basement. One member entered the first floor of the structure from Side Charlie, worked his way through the collapsed debris, and accessed the interior basement stairs located along Side Bravo (see diagram 1). The other Rescue Squad member worked with a firefighter from H&L-5 to remove security bars from basement window located on Side Charlie. Once the security bars were removed, he entered the basement via that exterior window. Both members searched the basement, finding that it was empty with no fire conditions. They also found no indications of the missing firefighter T-13B.

E-24A and E-24B then took an extension ladder from H&L-5 and carried it to Side Charlie of the fire building. They extended the ladder to the second-floor window located towards the Charlie-Delta corner. While positioning the ladder, the captain E-24A sustained an injury to his shoulder. Due to the injury, the crew never entered the structure.

At approximately 12:03, after updates from multiple companies, BC-805 contacted Fire Alarm stating, "Primary search of the basement and first floor is clear." Deputy Chief-810B (DC-810B) arrived on the scene and assumed incident command from BC-805. BC-805 then assumed the role of Safety Officer for the remainder of the incident.

After the search of the basement was deemed negative, the Squad members returned to the first floor and began searching through the collapse debris in the Bravo-Charlie corner.

At approximately 12:05, unclear communications resulted in DC-810B ***mistakenly*** reporting that the downed firefighter, T-13B, had been located. This was one of the numerous times throughout the incident when there was confusion over the downed firefighter being located.

At approximately 12:07, Fire Alarm advised the Incident Commander DC-810C that they had reached the first 20-minute mark and progress report was requested.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

At approximately 12:15 members operating on the first floor had observed that an ax was partially protruding through the second floor, so they were searching the area to confirm the down firefighter had not fallen through the second floor and was trapped in a debris pile on the first floor.

Members of the Rescue Squad then traversed the hallway towards Side Alpha of the building. RS-2F stated that not much progress was made at this point extinguishing the fire, but the fire progression had slowed. Entering the front door, RS-2F ran into members standing by on the stairwell and advised them to clear the stairwell if they were not going to move up to the second floor to search that area. RS-2F made his way up the stairs and met a member of T-27 at the top and inquired about the situation. The member of T-27 informed him that firefighter T-13B was the missing firefighter.

RS-2F realized that the member of T-27 was a former classmate of T-13B. RS-2F instructed them both (T-13B and member of T-27) during recruit training. After observing his facial expression, RS-2F did not think that the member of T-27 would be effective or appropriate and advised him to leave the building. RS-2F then encountered the captain of T-27 who stated that he thought firefighter T-13B was on the second floor, but they did not hear any PASS device. He advised the captain of T-27 to step aside and let them begin a search. At the top of the stairs, he was met by a member of T-0 who had a hoseline in operation. RS-2F encountered burning flooring, structural members, and roofing materials which limited his ability to access the area. RS-2F stated that there had been a total collapse of the area above the second floor. RS-2F called for a roof ladder to traverse the landing and the area covered in the debris. The ladder was put into place at the top of the landing and RS-2F and his partner used it to traverse over the collapsed area and debris.

RS-2F and the member from T-10 alternated using the 1¾” attack line to push back the fire while conducting a search. While conducting the search they began to clear the area by throwing debris into a burned-out room on Side Charlie of the building. After moving enough debris, they were able to start moving towards Side Alpha of the building. At this time, they heard a report that the downed firefighter had been located but RS-2F knew this was false because they had not encountered anyone who had located the downed firefighter. RS-2F related to RS-2A that the downed firefighter had not been located. During the search, RS-2F was using a thermal imaging camera which he said was ineffective due to everything in the area being the same temperature, so he discontinued using it. He continually had to advise members to clear the stairwell so they would have swift egress in the event that firefighter T13-B was located. He eventually encountered T-13A on the stairs who informed him that T-13B’s last known location was at the top of the stairs towards Side Alpha. RS-2F crawled to search that area along with his partner and a member from T-10.

They encountered multiple holes in the floor and burning debris throughout the area. They were also experiencing low air. RS-2F stated that they nearly fell through holes in the floor while searching. He called out to the member of T-10 who was searching closer to the Alpha-Bravo corner, “You have to be close, he has to be in there." The member of T-10 then replied back "I believe that I've got a [unintelligible]." His partner then crawled up and said, "We've got him!" RS-2F requested

confirmation that it was the downed firefighter and not a civilian victim. They were able to recognize T-13B's turnout boot confirming that it was the down firefighter.

Despite the intense heat and unstable conditions RS-2F, and his partner from T-10 continued to dig out the down firefighter. RS-2F communicated to members on the first floor that they would need a Stokes basket for extrication. The crews on the first floor advised that a rotation would be implemented for the extrication, but RS-2F and his partner did not respond to it and continued the recovery effort. RS-2F stated that T-13B was found in the second-floor hallway approximately three feet from the stairs leading to the third floor, supine with his right arm pinned under debris (see diagram 2). Shortly after extrication there was a secondary collapse on the second floor. This caused the members on the second floor to slide down the ladder to rapidly egress the area, and another member partially fell through the second floor ending up on the first floor.

At approximately 12:37 T-13B was removed from the structure and taken to a waiting ambulance where he was pronounced deceased by EMS.

Contributing Factors and Recommendations

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. Below are key contributing factors that led to the line of duty death and recommendations to prevent similar events from occurring.

Contributing Factor #1 – Personnel staffing

Discussion: On the day of this incident, several temporary staffing changes were in place:

- The normally assigned company officer for T-13 was on leave. Per FD policies & procedures, when a company officer is on leave, a senior crew member serves as the acting officer. However, the senior member on T-13 who would have normally served as the acting company officer in the captain's absence, was also out of the firehouse at the time of the incident to attend a training class outside of the FD. This resulted in another crew member serving as the acting company officer.
- The T-13 crew member who assumed the role of acting officer was cleared at the shift level to act in that role; however, he only had 3 years on the job as a firefighter and had minimal professional development to act in that role (also see contributing factor #2). This was the first time that this crew member served as an acting officer without being under the direct supervision of another senior crew member.
- Due to five personnel attending a training class outside of the FD, including the senior member on T-13, several temporary changes were made to staffing assignments and levels. T-30, which would have responded to this incident, was taken out of service, and its crew members were temporarily reassigned to cover the personnel who were attending the outside training. This required another truck to be dispatched in its place. Two additional companies that responded

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

to this incident also had staffing levels temporarily reduced from four members to three members.
- The training class outside of the FD that five personnel were attending was not approved in accordance with department policy & procedure.
- Several of these temporary staffing changes did not follow the department's policies & procedures and not approved by the full chain of command on duty at the time of the incident.

Recommendation #1 – Ensure formal written guidance and leadership oversight is available and utilized for personnel staffing.

Discussion: Formal written guidance, which includes policies, procedures, and guidelines all serve as a foundation for day-to-day administrative and operational actions in the fire service. The International Fire Service Training Association (International Fire Service Training Association, 2019) provides the following definitions:

- Policy: template for decision-making within an organization used to set boundaries and establish standards of conduct.
- Procedure: written plan that lists specific, detailed steps to approach a given problem or situation.
- Guideline: broad principles to guide actions in order to achieve a desired outcome.

Policies and procedures are intended to direct actions without any interpretation or deviation. They typically use the verbiage of "shall." Guidelines, on the other hand, are generally considered more flexible and allow for some degree of interpretation and deviation when reasonably justified. They will typically use the verbiage of "should." There can be situations where strict adherence is required, as well as situations where allowance for deviation is justified, so it is important to have both types of documents. It is critical for all personnel to understand the intent behind the development of their guiding documents and exactly how they be applied. Failing to do so can lead to a misunderstanding and misapplication, producing unintended negative consequences.

If a decision is made to deviate from a policy or procedure, as was the case in this incident, the following is important to consider:
- The justifications for deviation are clearly identified and evaluated
- Potential consequences of deviating from a policy or procedure have been identified and evaluated as part of a risk/benefit analysis
- Personnel who may be negatively impacted by deviating from a policy or procedure have been identified and notified
- Additional personnel in a supervisory role have been involved in the decision-making process to deviate from a policy or procedure
- Outcomes from similar past practices or experiences where a policy or procedure was deviated from have been identified and considered.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Written policies, procedures, and guidelines can be used to incorporate critical lessons learned into a FD's organizational knowledge base. FDs can also incorporate lessons learned from other organizations to help make operations safer and more effective. FD's must recognize and respond to frequent or significant deviation from existing documents. Frequent deviation could indicate:

- The document is not correctly understood, indicating a lack of communication and/or professional development
- The document is not functional, indicating it may need to be revaluated and rewritten
- A lack of accountability and discipline, which could be leading to normalization of deviance.

Written policies, procedures, and guidelines are critical for ensuring consistent, effective, and safe operations. But, simply having them is not enough, leadership is responsible for ensuring:

- Needs analysis are conducted on a regular basis to identify gaps in policies and procedures
- Current documents are evaluated when warranted and updated as needed
- New and ongoing, education and/or training is provided around a policy, procedure, or guideline as the situation dictates
- Deviations from written policies, procedures, and guidelines are consistently investigated and personnel are held accountable when applicable.

Formal written guidance may not be the best option for every possible situation, especially when it comes to very diverse and rapidly changing situations, but they can form a critical foundation for day-to-day FD operations.

Contributing Factor #2 – Professional development for *acting* fire officers

Discussion: There were several factors related to professional development for personnel who were acting including:

- The acting company officer of Truck 13 had received some education and on the job training related to the role of company officer. They had acted in the role of company officer a limited number of times in the preceding year, and it was under the direct supervision of a senior member who could step in as needed. However, that professional development and competency verification did not meet all the requirements as outlined in NFPA 1550 or NFPA 1021.
- The FD did not have a formal written policy or procedure to clear firefighters to act as a company officer. Clearance of acting company officers was carried out informally at the shift level.

Recommendation #2 – Develop and utilize a professional development program for acting fire officers that includes competency verification at the appropriate level(s) of responsibility.

Discussion: In 2004, the National Fallen Firefighters Foundation (NFFF) gathered more than 200 individuals to focus on how to prevent line-of-duty deaths and injuries. This first Firefighter Life Safety Summit developed the "16 Firefighter Life Safety Initiatives." In 2014, the initiatives were

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

reaffirmed as being relevant to reduce line-of-duty deaths and injuries by more than 300 fire service leaders at the second Firefighter Life Safety Summit. Initiative #5 identified the need for professional development based on national standards:

> (5) Develop and implement national standards for training, qualifications, and certification (including regular recertification) that are equally applicable to all firefighters based on the duties they are expected to perform (National Fallen Firefighters Foundation, 2004).

An effective and comprehensive professional development program consists of:

- Education to develop cognitive knowledge
- Training to develop psychomotor skills
- Experience to develop and apply knowledge and skills at real world incidents
- Self-development to advance physical and emotional attributes.

There are several professional development fire service standards, references, and best practices that are further reviewed below:

- National Fire Protection Association (NFPA) Standards:
  - NFPA 1550 Standard for Emergency Responder Health & Safety, Chapter 7 – "Training, Education and Professional Development"
  - NFPA 1021 Fire Officer Professional Qualifications
- International Association of Fire Chiefs (IAFC) – Officer Development Handbook
- United States Fire Administration (USFA) – National Professional Development Model
- International Society of Fire Service Instructors (ISFSI) Professional Development Matrix.

NFPA 1550 Standard for Emergency Responder Health & Safety [2024]

**Note – at the time of this incident, NFPA 1500 would have been the applicable standard. NFPA 1550 is being referenced given that it is the current applicable standard and it is also representative of the content contained in the original NFPA 1500 standard.*

NFPA 1550 states in appendix A.7.1.1, The primary goal of all training, education, and professional development programs is the reduction of occupational injuries, illnesses, and fatalities. As members progress through various job duties and responsibilities, the department has a responsibility to ensure the introduction of the necessary knowledge, skills, and abilities to members who are new in their job titles, as well as ongoing development of existing skills. Such programs include information to ensure that members are trained prior to performing individual duties, as well as ongoing professional development to ensure competency. (National Fire Protection Association 1550, 2024) provides additional details to inform an effective professional development program. Consult NFPA 1550 Section 7.1 for detailed information about professional development programs.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

NFPA 1021 Fire Officer Professional Qualifications [2020]

4.1.2 General Prerequisite Skills. The ability to effectively communicate in writing utilizing technology provided by the authority having jurisdiction (AHJ); write reports, letters, and memos; operate within an information management system; and effectively operate at all levels in the incident management system utilized by the AHJ.

4.6 Emergency Service Delivery. Supervise emergency operations and deploy assigned resources in accordance with the local emergency plan according to the following job performance requirements:

> 4.6.1 Develop an initial action plan, given size-up information for an incident and assigned emergency response resources, so that resources are deployed to control the emergency.
> 4.6.2 Implement an action plan at an emergency operation, given assigned resources, type of incident, and a preliminary plan, so that resources are deployed to mitigate the situation.

A.1.3.5 – The committee recognizes the importance of formal and continuing education and training programs to ensure the fire officer has maintained and updated the necessary skills and knowledge for the level of qualification. Continuing education and training programs can be developed or administered by local, state/provincial, or federal agencies as well as professional associations and accredited institutions of higher education. The methods of learning can include areas of technology, refresher training, skills practices, and knowledge application to standards.

It is recognized that higher education provides the knowledge, skills, and abilities that can help develop competent leaders and managers. The technical committee acknowledges that the Fire and Emergency Services Higher Education (FESHE) model serves as a professional development and career path template for aspiring fire officers. Further, these educational milestones are included only as recommendations for the development of fire officers and should not be viewed as requirements (National Fire Protection Association 1021, 2020).

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

IAFC Officer Development Handbook [2010]

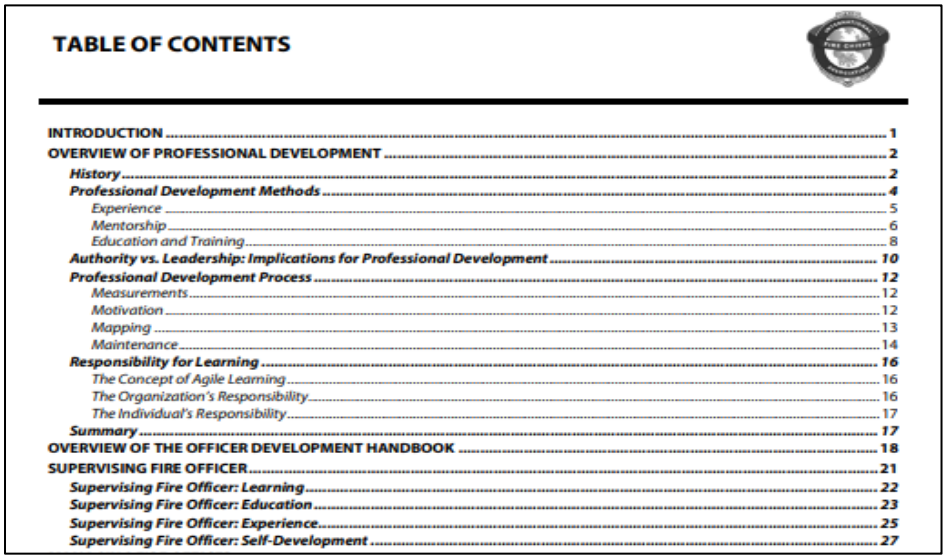

TABLE OF CONTENTS

Image 1. IAFC Officer Development Handbook *(Courtesy of IAFC)*

The IAFC handbook provides clear guidance for fire officer professional development, covering necessary education, experience, and self-development. This includes guidance for all levels, to include company officer and chief officer. It is an effective resource when it comes to implementing the requirements in NFPA 1021 (International Assosication of Fire Chiefs, 2010). Refer to the IAFC Officer Development Handbook for more information about the need for professional development.

US Fire Administration – National Professional Development Model

At the annual Fire and Emergency Services Higher Education (FESHE) conferences, efforts have been made to address professional development by creating a model that integrates professional development and certification. Since then, the National Fire Academy (NFA) has brought FESHE representatives together to create the National Professional Development Model (NPDM) that can be referenced to maintain professional development opportunities.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Image 2. USFA Professional Development Matrix *(Courtesy of USFA)*

The NPDM is designed for training academies, certification agencies, and academic fire programs to assist the emergency services personnel they serve in their professional development. The NFA has produced a template that has streamlined Fire Officer I – IV competencies with "national" level courses that include NFA resident courses, FESHE model associate's and bachelor's courses, and general education courses recommended in the handbook. The NFA encourages states and fire departments to customize this template by adding their own standards and job performance requirements (JPRs) (United States Fire Administration, 2024).

ISFSI: Professional Development Matrix

The International Society of Fire Service Instructors (ISFSI) defines professional development as "the planned and progressive life-long process of education, training, experience and self-development."

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

What is Professional Development?

"KSAA" COMPETENCIES	LEARNING DOMAINS	DEVELOPMENT METHODOLOGY	EVALUATION
Knowledge	Cognitive	Education	Written Testing
Skill	Psychomotor	Training	Practical Skills Testing
Attitude	Affective	Self-Development	Role Playing
Ability	All 3 Domains	Experience	Scenario Based Evaluations

Image 3. ISFSI Professional Development Matrix *(Courtesy of ISFSI)*

The professional development matrix provides a broad range of resources. Individuals can utilize the matrix as a roadmap for advancement within the fire service and a template for professional development. Organizations can utilize the matrix to redefine roles and expectations of current and future employees as well as incorporate accomplishments and competencies into staff training and development offerings. Fire academies can utilize the matrix to structure educational offerings and provide networking opportunities customized to and highlighting elements of the professional fulfillment framework (International Society of Fire Service Instructors, 2024).

Contributing Factor #3 – Speed of the incident development, and the resulting impact on critical factors that are part of a risk/benefit analysis

Discussion: There were several critical fireground factors which would have been part of an effective risk/benefit analysis which were negatively impacted by the rapid speed of the incident development including:

- Due to T-13 being out of quarters in the vicinity of the incident location, and them seeing a smoke column, they responded to the incident prior to additional units being dispatched. This rapidly placed T-13 on the scene approximately 5 minutes prior to the arrival of the additional responding units. This negatively impacted the critical fireground factor of resource availability.
- Due to the condition of the derelict structure to include:
    - Numerous openings in the floors, walls, and roof
    - Readily available fuel load to include the contents and exposed structural elements those conditions allowed for the rapid development and spread of the fire. At the time T-13 was making entry into the structure, the 2nd floor, and the half story above it, were already fully involved with post flashover conditions. This negatively impacted the critical fireground factor of fire behavior.
- Due to the rapidly developing fire conditions, the post flashover conditions on the second the floor, and the half story above it, were not compatible with human life. At the time T-13 made entry for search, the only remaining survivable space would have been on the first floor and basement. This negatively impacted the critical fireground factor of civilian life safety.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

- Due to the structural integrity issues of the derelict structure, and the rapid-fire progression within the structural elements, this contributed to a rapid structural collapse within approximately 5 minutes of T-13 arriving on the scene. This negatively impacted the critical fireground factor of structural integrity.

Recommendation #3 – Evaluate the speed at which an incident is developing and determine how it will impact the critical fireground factors incorporated into a risk/benefit analysis.

Discussion: The speed of incident development at a structure fire can vary greatly, with rates of change occurring by the second, minute, or hour. This variation in speed will have a significant impact on the critical fireground factors that make up an effective risk/benefit analysis. Some of the critical fireground factors impacted include resource availability, fire behavior, civilian life safety, and structural integrity. The speed at which those factors are impacted should be considered in how frequently a risk/benefit analysis is conducted.

Resource Availability – Some of the critical resource availability factors that could be evaluated as part of a risk/benefit analysis include:

- How many personnel will be needed to address the initial incident action plan (IAP) and provide a strategic reserve?
- How many personnel will be needed to provide relief for the initial personnel operating?
- How many, and what types of apparatus or equipment will be needed to support the IAP?
- How quickly can those needed resources respond and arrive on the scene?

NFPA 1710, Standard for Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments, and NFPA 1720, Standard for Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments, provide guidance on the necessary resources and timelines (National Fire Protection Association 1710, 2020).

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

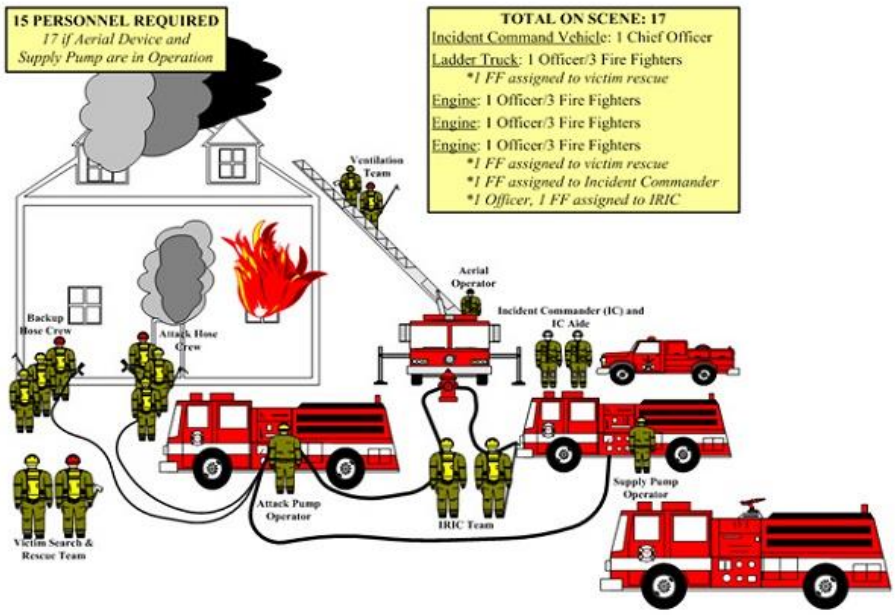

Image 4. Initial resources recommended for a structure fire. *(Courtesy of NFPA)*

Fire Behavior – Some of the critical fire behavior factors where the speed at which things are occurring that could be evaluated as part of a risk/benefit analysis include:

- How quickly is the fire developing in terms of size and location?
- What stage is the fire in, ignition/incipient, growth, flashover, fully developed, or decay?
- How quickly will it transition to the next stage in growth?
- What model of fire behavior best fits the fire, is it fuel, or ventilation controlled?
- What is the potential for a hostile fire event such as a flashover or backdraft?
- Given the extent of the fire conditions, how quickly can the FD locate, access, confine, and extinguish the fire?

In A Review of Modeling and Simulation Methods for Flashover Prediction, the variations in fire behavior and the speed of development are identified. Fuels encountered in today's fires can result in higher energy release rates and an increase in the fire development rate. On the contrary, changes to new building construction can limit the availability of air which can slow the fire development rate. As noted in Image 5, these variations can produce drastically different fire behavior conditions and this information is a critical risk component of the risk/benefit analysis (Cortés, 2020).

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

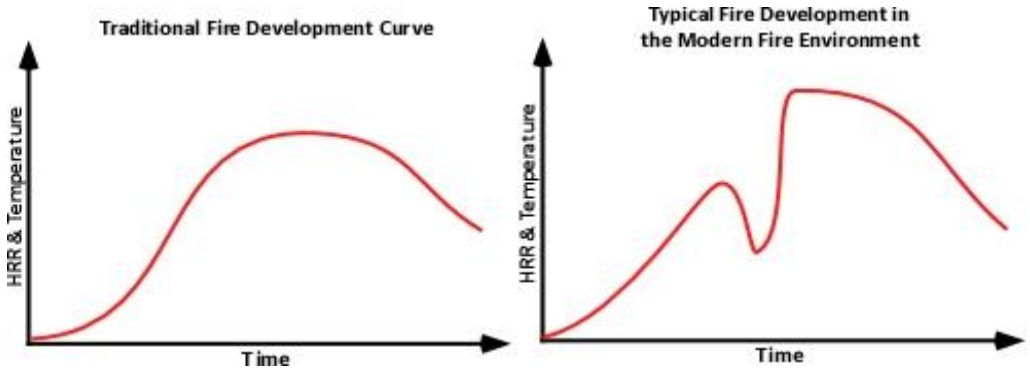

Image 5. Fuel and Vent Limited Fire Behavior Models *(Courtesy of NIST)*

Civilian Life Safety – Some of the critical civilian life safety factors that could be evaluated as part of a risk/benefit analysis include:

- How quickly will the conditions deteriorate to a point where there will no longer be survivable conditions for civilian victims?
- Is the immediate threat to civilian life safety smoke conditions, fire conditions, structural collapse, and/or some other hazardous condition?
- How do the threats to civilian life safety vary throughout the structure or incident scene?
- Is the best strategy to eliminate the hazards, remove the victim, or shelter the victims in place?
- How quickly can those hazards be confined, reduced, or eliminated?

Research projects conducted by UL/FSRI provide information on victim survivability probabilities and timelines. In "Impact of Fire Attack Utilizing Interior and Exterior Streams on Firefighter Safety and Occupant Survival: Full Scale Experiments," research determined the Fractional Effective Dose (FED) for victim exposures. Both temperature exposure and toxic gas exposure can be quantified using an FED concept where the FED is equal to the dose received in a given time divided by the effective dose required for a specified endpoint, be it incapacitation or death. The higher the FED, the less chance of survivability; the lower the FED, the higher chance that a victim would survive. This information is a critical benefit component of the risk/benefit analysis (Fire Safety Research Institutue, 2018).

Table 6.1: Time to LC_{50} FED (Minutes) - Delayed Intervention

Experiment	Victim	Time to Fatal FED (minutes:seconds)	Driving Factor
Experiment 1	Victim 1	8:10	Toxic Gases
	Victim 3	6:58	Toxic Gases
Experiment 12	Victim 1	6:30	Toxic Gases
	Victim 3	5:14	Toxic Gases
Experiment 17	Victim 1	3:08	Total Flux
	Victim 3	3:06	Toxic Gases

Image 6. A comparison of victim locations and time to a FED. *(Courtesy of UL/FSRI)*

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Structural Integrity – Some of the critical structural integrity factors that could be evaluated as part of a risk/benefit analysis include:

- How quickly is the fire impacting structural integrity, and how quickly could that impact lead to a structural failure?
- Is the fire contained to the inside of a compartment or has it gained access to void spaces or exposed key structural elements?
- Based on the extent of the fire, and the type(s) of building construction involved, how long can key structural elements last before failing?
- Will a structural failure most likely be a localized event such as a hole forming in a floor, or will it be a much larger event such as the full collapse of a floor or roof?

Multiple research projects conducted by UL/FSRI and NIST provide valuable information on structural collapse timelines. This research shows the variability that can exist in how quickly different types of building construction can fail. This information is a critical risk component of the risk/benefit analysis (Underwriters Labratory, 2012).

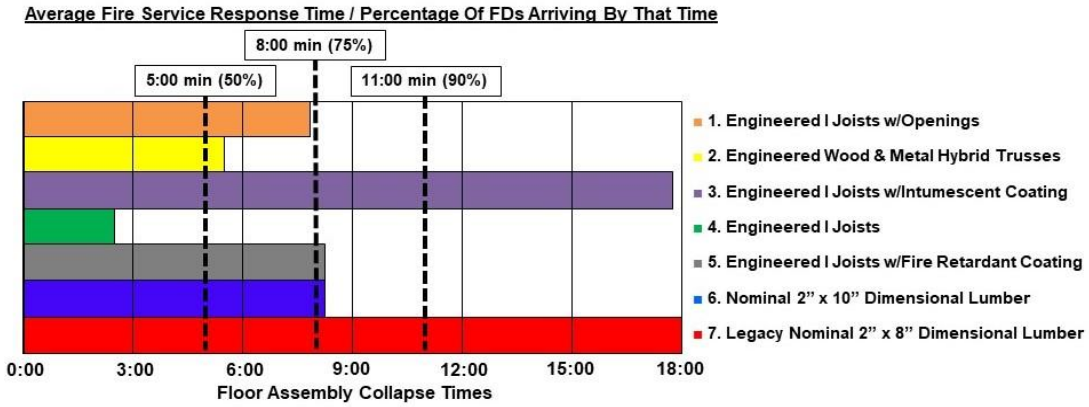

Image 7. A comparison of structural collapse times and FD arrival times. *(Courtesy of UL/FSRI)*

The first arriving company and/or chief officer is responsible for taking the necessary actions to gather and analyze as much information as possible on all critical fireground factors through means such as effective situational awareness (also see contributing factor #5). They also evaluate the speed on the incident development and how it may negatively impact those factors. From these observations an incident can be categorized as (Dodson, 2021):

- Stable or Unstable
- Slowly or Rapidly Changing
- Predictable or Unpredictable

Categorizing the incident can help with rapidly deciding on an appropriate IAP. For incidents that are stable, slowly changing, and/or predictable, the risk profile is likely substantially lower, allowing for rapid offensive actions when warranted by potential benefits. For incidents that are unstable, rapidly

changing, and/or unpredictable, the risk profile will be substantially higher, and great effort is often necessary by key decision makers to determine if the potential benefits justify an offensive operation. It is also critical to ensure the incident is closely and continually monitored to determine if any of the categorizations are changing. Evaluating the speed of how the incident is evolving and how quickly critical resources are arriving, is critical to developing an effective IAP that includes a risk/benefit analysis (also see contributing factor #6).

Contributing Factor #4 – Derelict high-risk building, susceptible to rapid fire spread and structural collapse

Discussion: The house where the fire started at this incident was a derelict building. It had been abandoned for several years and had sustained significant damage due to vandalism and exposure to the elements. The structure had also sustained damage from a previous fire. Due to the condition of the derelict structure, with numerous openings in the floors, walls, and roof, the fire was able to develop rapidly attacking the structural elements resulting in a rapid structural collapse. The abandoned and derelict condition of the building was obvious during size-up based on several indicators such as the boarded front door, broken out windows, and the large opening in the wall on Side Charlie.

Recommendation #4 – Develop and implement a High-Risk Building Management Program (HRBMP).

Discussion: Fire Engineering Editor David Rhodes noted that one of the most hazardous situations that firefighters can find themselves in is a fire at a derelict structure. Years of abandonment combined with leaking roofs, previous fires, urban miners, and vandalism make for a modern-day death trap. Firefighters have battled this problem for well over a century (Rhodes, 2024). The NFPA estimates that 6,000 firefighters are injured while fighting fires in these properties every year. NFPA statistics also show that more firefighters are injured while operating at fires involving vacant or abandoned properties than in any other property classification (International Association of Arson Investigators, 2018). NIOSH line of duty death investigations conducted from 1998 – 2024 included 15 incidents involving a high-risk building where 26 firefighers perished. For a list of those NIOSH LODD reports see Appendix B.

To properly develop and implement a HRBMP, the occupant status and the building status are determined independently. It is impossible to effectively communicate both statuses by using a single term. For example, a structure may be vacant, which would typically indicate that it would not be occupied, however just because it is vacant does not guarantee that it is unoccupied. As such, the FD must determine both statuses and communicate them in a way that everyone understands. Defining both the occupant status and building status is critical to conducting an effective risk/ benefit analysis.

Not all occupant status and building status terms are clearly defined by the NFPA, nor are they utilized uniformly across the fire service. Since these terms are not clearly defined, the development and use of uniform terminology at a local level may be helpful. This will ensure everyone has a shared

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

understanding to make effective risk management and operational decisions. The following occupant and building status terminology represents the most common terms utilized in the fire service.

Occupant Status Terminology – There are several ways that the fire service determines the civilian life safety profile or status. They focus on two primary components:

- If civilians are present in the structure and their situation
- If civilians are present, the probability of survival and rescue given the conditions.

Evaluating and determining the status of civilian live safety is critical for conducting an effective risk benefit analysis. The outcome of that risk benefit analysis can help inform the development of the IAP and determine if operations should be offensive, transitional, or defensive.

The following approaches have been used in developing a civilian life safety profile:

- **Rescue Profile** – Utilizes low, moderate, high, and urgent profile (Bricault, 2006).
- **Rescue Profile** – Utilizes zero, marginal, and high profile (Dodson, 2021).
- **Survivability Profile** – Recognizes a no, low, or high survival probability (Marsar, 2009).
- **Life Safety Profile** – Utilizes the viability of lives and property (National Fire Protection Association 1550, 2024).
- **Occupant Tenability** – Utilizes a fractional effective dose (FED) in relation to time to express the potential of survivability (Fire Safety Research Institute, 2018).
- **Victim Profile** – Utilizes low, moderate, high, and confirmed profile (Kastros, 2021).

Having multiple approaches in use throughout the fire service can lead to confusion when it comes to determining and communicating the civilian life safety status. While the term occupied has been used to describe the presence of civilians, it does not provide a clear understanding of the actual circumstances. The occupant statuses below are based on the condition of civilians in a building. These occupant statuses may also be correlated to an appropriate civilian life safety profile as defined above.

Possible occupant statuses are:

- **Evacuating**: There are civilians remaining in the building, but they are capable of, or are in the process of, evacuating on their own. An example would be civilians evacuating on their own via a protected stairwell in a high-rise building. This indicates a high civilian life safety benefit. An offensive strategy would be warranted to support the evacuations.
- **Rescues**: There are civilians remaining in the building who are not able to leave on their own and need FD assistance. This could include civilians trapped by fire conditions or overcome by smoke conditions. This indicates a high civilian life safety benefit. An offensive strategy would be warranted to support search and rescue operations.
- **Sheltering in Place**: There are civilians remaining in the building in a location that provides protection from fire and smoke hazards. An example would be civilians remaining in a separate area, or on an additional floor, in the building that has fire rated barriers. A prime example would be civilians in a skilled care facility or hospital who cannot be immediately evacuated

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

due to their medical condition. This indicates a high civilian life safety benefit. An offensive strategy would be warranted to protect the civilians in these areas.

- **Unoccupied**: There is a report from dispatch, or someone on the scene, that no civilians remain in the building. This indicates a low civilian life safety benefit. Given the potential for error or uncertainty, this indicates no life safety benefit until the status is verified firsthand by the FD, at which time it would transition to an all-clear status. A deliberate risk/benefit analysis is conducted to determine the appropriate strategy. That analysis weighs the risks posed to firefighters conducting search operations to the potential of rescuing civilians given the circumstances.
- **Unknown**: The FD has no actionable intelligence to the status of civilians in the building. The FD should work quickly and effectively to determine the actual occupant status. This indicates medium/moderate civilian life safety benefit. As with an unoccupied status, a deliberate risk/benefit analysis is conducted to determine the appropriate strategy.
- **All-Clear**: The FD has verified firsthand via searches that no civilians are in the building. This indicates no civilian life safety benefit. An ongoing deliberate risk/benefit analysis is conducted to determine if offensive operations are warranted for property conservation and incident stabilization.
- **Nonsurvivable**: There may be civilian victims present in the building, however the conditions are not compatible with human life. For example, the conditions inside of the structure are post flashover or a significant structural collapse has occurred. This indicates no civilian life safety benefit. Defensive operations are warranted.

Assuming every building is occupied until a primary search is conducted may place firefighters in a situation where they are exposed to a high level of risk without knowing if there is a civilian life safety issue present. Over a 19-year period, there were 32 LODDs within the Fire Department City of New York with no civilian deaths at those same incidents. (Marsar, 2009) When the occupant status is unknown, a risk/benefit analysis is conducted to assess the degree of risks present against the possible benefits of conducting offensive interior operations.

It is also very important to determine if the occupant status may be different in certain parts of a building. It is common for the occupant status to vary throughout the building and for the status to change throughout the incident. Everyone operating on the fireground is responsible for constantly determining the occupant status where they are operating and communicate it to their immediate supervisor and the incident commander.

Building Status Terminology – This is based on the condition of the building and includes:

- Risk: Low, medium/moderate, high, or unacceptable level of risk to responders
- Property value: None, low, or high

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Possible high-risk building statuses are:

- **Vacant**: A building that is not currently being occupied or used, but there is a plan to reoccupy and reuse it in the future. These buildings typically pose a low risk to enter for an offensive strategy. This type of building has a medium to high property value.

- **Abandoned**: A building that is currently not occupied or in use and will not be reoccupied or reused in the future. Due to the state of abandonment, the structure could be negatively impacted, such as windows being broken out, which could pose a ventilation hazard that impacts fire development. These buildings typically pose a medium risk to enter for an offensive strategy. It may meet the criteria for a defensive strategy if there is no civilian life safety concern. This type of building has a low value.

- **Derelict** (also known as blighted or dilapidated): The building has been abandoned for a long period of time and sustained substantial damage, such as significant openings in the floors, walls, or roof due to neglect or vandalism. That damage constitutes a significant hazardous condition. This would typically pose a high-risk to enter for an offensive strategy and would indicate a defensive strategy if there is no civilian life safety concern. This type of building has no value.

- **Condemned**: The building has been formally evaluated by the local authority having jurisdiction and declared unsafe for human entry or occupation. These buildings should be demolished as soon as possible. This would pose an unacceptable level of risk to enter and would indicate a defensive strategy. This type of building has no value.

Describing a building based on its occupancy and not using one of the terms above would indicate that it is in a normal operational status. For example, if the building is described simply as a residential structure, it is assumed to be in a normal operational status. This building would have appreciable value and the structure should not pose a significant risk.

The NFPA 1550 Standard for Emergency Responder Health and Safety, Section 10.4 Risk Management During Emergency Operations outlines the role of the incident commander to address civilian life safety, firefighter life safety, and property conservation as part of a risk/benefit analysis. As part of that, building and occupant status is continually evaluated and updated throughout the incident so the IAP can be adjusted as warranted by the incident commander.

The conditions routinely found within abandoned, derelict, and condemned buildings can have negative impacts on firefighting operations due to factors that can increase the risk profile, including:

- Openings in floors, walls, ceilings, windows, and roofs that can expedite the development and spread of fire conditions.
- Structural elements that are weakened and prone to rapid failure due to acts of vandalism, a lack of maintenance, aging, or exposure to the natural elements.
- Compromised structural elements due to previous fires.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

- Openings in structural components such as floors, stairs, and roofs that could be missed in zero visibility conditions and lead to firefighters falling into a hazardous condition.
- Buildings that have been boarded up to prevent unauthorized access can pose both ingress and egress issues, potentially resulting in firefighters being trapped when their primary means of egress has been blocked by the fire or collapse.
- Changes to the normal layout and flow of the structure, due to damage or modifications, which could result in firefighters becoming lost, disoriented, and trapped.

An HRBMP has three phases and can reduce the risks posed in these buildings. It is critical that all three phases of the program are fully implemented to have the best opportunity for success.

The three phases of a HRBMP are:

Phase 1 - Determination

- Identification: Someone must physically go out to locate and evaluate the potential high-risk buildings. This could be the FD, building department, fire marshal, etc. The personnel capable of doing this will vary based on the local resources and legal requirements (laws, ordinances, regulations, and statutes). A common challenge encountered is legal access to the property, especially in the case of private and residential properties where the FD 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. FD personnel work together with the local AHJ to legally gain access to properties.

- Evaluation: Someone must have the necessary subject matter expertise to evaluate the condition of the buildings. That individual determines if a building has structural integrity defects or conditions that could warrant a formal condemned status. FD personnel must exercise caution and take all necessary preventative measures to ensure their safety during the evaluation process. Buildings can present several hazards outside of the structure itself, to include the presence of unauthorized people who may be hostile, booby traps, and hazardous materials. If there are questions as to the structural integrity of a building, outside subject matter experts are used as needed to ensure safe entry and evaluation.

- Designation: The status of a building is determined upon completion of the evaluation. While the FD can determine the building status for the purposes of their risk/benefit analysis during an incident, they may not have the legal authority to formally condemn a building unless it poses an imminent risk to public safety. It is critical to work with the local AHJ if there is a need to have a building formal condemned so that it can be demolished and removed through the appropriate means.

- Communication: The status of the building is effectively communicated to all parties involved (property owner, building dept, fire marshal, FD, dispatch center, etc.). For fire departments

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

that communication can include hard copy preplans carried by responding units, electronic data shared via mobile data terminals, and marking buildings.

Phase 2 - Remediation

- Demolition: For a derelict or condemned building, the best approach per risk management principles is to remove the hazard by having the building demolished and eliminating the potential for it to catch fire. Many fire departments will 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 AHJ who can assist.

- Marking: this 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.

  The IAAI / USFA Abandoned Building Project, utilizes a simple system consisting of a box with a diagonal line to indicate the condition of the building.

Image 8. IAAI/USFA high-risk building marking system *(Courtesy of USFA)*

The Abandoned Building Project Toolbox can be found at the website: http://www.interfire.org/features/AbandonedBuildingProjectToolBox.asp

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 detailed marking system based on a Maltese Cross that includes those outlined in Image 9.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

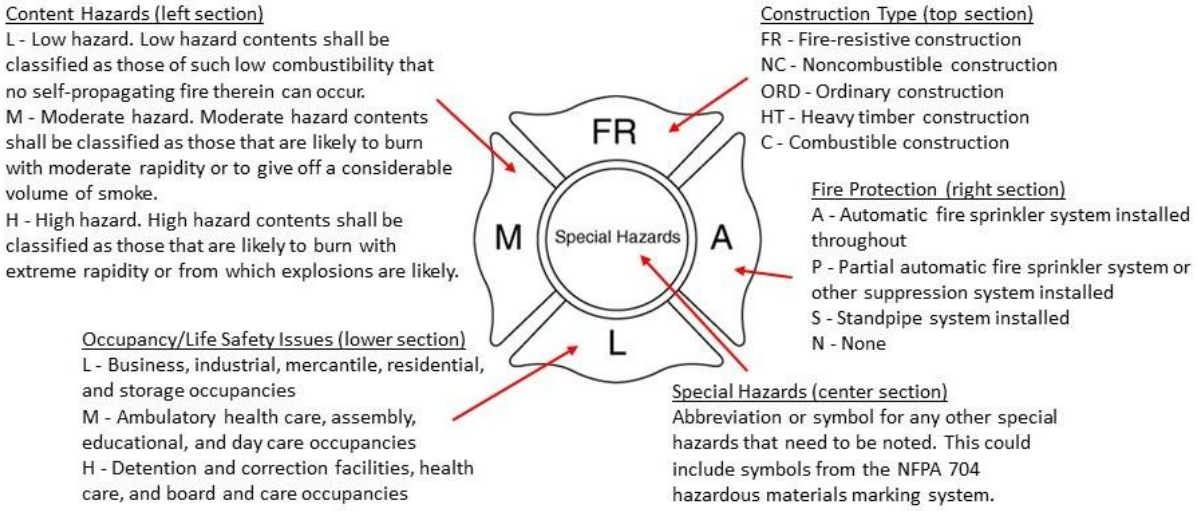

Image 9. IFC/NFPA high-risk building marking system *(Courtesy of NFPA)*

Marking buildings can have a significant benefit in remediation, but there can be many challenges to implementing this action based on unique local circumstances. For example, here can be concerns over the negative stigma attached to these markings when they are concentrated in a given area or neighborhood. Therefore, it is very important to form strategic partnerships with the local social and political parties to explain the lifesaving benefits of implementing a marking system.

- Securing: If unauthorized individuals can be prevented from entering the building, this can eliminate the possible ignition of a fire. Securing the building can include both physical barriers to deny access and partnering with local law enforcement or private security agencies to identify and prevent unauthorized access. FDs can consider that securing a building can have cons if the FD does need to enter the building. As such, the FD needs to be aware of how to access and remove any security features that have been put in place.

Phase 3 - Emergency Response

- Recognition: Through various means available (verbal radio dispatch information, dispatch notes shared via a mobile data terminal, building markings, and/or effective situational awareness), responding personnel must have the ability to proactively recognize the status of a high risk building as soon as possible. A multilayered system with repetitive information provides back-up if a failure occurs within one layer. For example, if a building marker is missing, but the information is relayed via a note in the dispatch system, the responders will still be aware of the high-risk building's status.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

- Risk Management: The key decision makers (1st arriving officer, IC, safety officer) need to incorporate the status of the high-risk building into their risk/benefit analysis and IAP. This includes determining and incorporating both the occupant and building status.

The International Association of Arson Investigators and the US Fire Administration partnered to develop the *"Basic Evaluation Procedures for Abandoned and Vacant Buildings."* This provides guidance on how to evaluate hazardous buildings and includes a *"Vacant/Abandoned Building Evaluation Form"* (United States Fire Adminstration, 2023) which is included in Appendix C.

Another resource that can be utilized to address this issue is the International Property Maintenance Code. The benefit of the code if adopted by an applicable AHJ is that it can be utilized to legally address the numerous issues with hazardous buildings.

Responding to a fire in a high-risk building poses a significant risk to firefighters beyond the hazards of the fire itself. It is critical to recognize, communicate, and integrate both the occupant and building status as part of a risk/benefit analysis at these incidents. Utilizing a HRBMP provides a means to eliminate, reduce, or manage those risks through both proactive and reactive actions. This approach provides the best chance for a successful outcome while addressing both civilian and firefighter life safety.

Contributing Factor #5 – Situational awareness at the task, tactical, and strategic levels.
Discussion: There were shortcomings with all three situational awareness levels throughout the incident.

- At Level 1, Perception – There were multiple failures throughout the incident to conduct effective ongoing 360 size ups.
- At Level 2, Comprehension – There were multiple failures throughout the incident to understand the significance of the fire conditions and the integrity of the structure.
- At Level 3, Prediction – The impact of the fire conditions on the structure was not accurately predicted, resulting in firefighters operating in the building at the time of structural collapse.

Recommendation #5 – Develop and utilize a professional development program for situational awareness and ensure that effective situational awareness is utilized at all emergency incidents.

Discussion: Situational awareness is an ongoing process; all personnel need to maintain SA to make effective decisions throughout the emergency incident. SA has been defined as, *"The ability to perceive and understand what is happening in the environment around you, in relation to how time is passing, and then using your understanding of the situation to accurately predict future events in time to prevent bad outcomes."* (Gasaway, 2019). As hazards rapidly increase and change as an incident progresses new stressors may emerge, requiring the need to reestablish situational awareness.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Compromised Situational Awareness → Ineffective Decision Making → Increased Firefighter Injuries and LODDs

Situational awareness is an ongoing process at all three levels (International Fire Service Training Association, 2019):

Level 1 – Perception: The ability to sense and subsequently perceive the situation. Perception is deliberate, and continual for success. In the fire service, perception is often correlated with size-up. Size-up usually focuses on visual observations; however, if safe to do so, personnel may use hearing, taste, touch, and smell in addition to sight.

- *Perception quick tip:* When possible, personnel may use technology to enhance perceptual cues (e.g., a thermal imaging camera may enhance sight in certain scenarios such as heavy smoke or darkness).

Level 2 – Comprehension: The ability to fully understand the meaning of the situation. Personnel have the proper knowledge and ability to effectively apply that knowledge, which comes from education and past experiences.

- *Comprehension quick tip:* Given the broad and dynamic range of incidents that firefighters respond to, departments may consider establishing an ongoing professional development program that provides a range of education and hands-on experience to aid comprehension during stressful situations.

Level 3 – Prediction: Also referred to as forecasting or projecting, prediction is the ability to form an understanding of a situation and determine what actions are appropriate to mitigate future negative outcomes. The fireground is constantly changing and evolving. Inaccurate predictions occur when the ability to consistently reestablish situational awareness and keep pace with the speed at which the incident is developing becomes too difficult.

- *Prediction quick tip:* Seeking input from someone else who has more extensive education and experience in similar incidents may be useful to support accurate forecasting.

Intentional & Ongoing Perception + Full Comprehension + Timely Prediction = Effective Situational Awareness

Effective situational awareness may be supported by several activities, some of which are adapted from Gasaway (Gasaway 2013, 2019). Considerations for fire service management to support incident response:

- Provide ongoing professional development that includes education and hands-on experience.
    - *Example:* Use the three situational awareness levels as a tool to work through case examples of emergencies. This may include professional development on critical

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

hazards to identify, how those hazards inform an understanding of the event, and possible outcomes based on what is known. Over time, a list of optimal response strategies for a variety of scenarios can be developed.
    - *Example:* During realistic professional development using simulated or mock fire scenarios, fire instructors can work through the three levels of situational awareness with personnel to understand decision making during immediate or high-risk actions and discuss how decision making could be impacted.

While there is a significant reliance at most incidents on the Incident Commander and the Incident Safety Officer to maintain situational awareness, it is critical that everyone maintain situational awareness at their respective levels and within their areas of operation. Considerations for personnel while responding to an incident:

- Take periodic, brief intentional opportunities to reassess and evaluate incident cues and mentally document what is changing in real time. Any unexpected changes in the incident's progression might alter future decision making.
- Employ relevant stress management techniques (e.g., controlled breathing) and operational techniques (e.g., workload management utilizing Field Incident Technicians to assist the IC during fire ground operations) to support ongoing awareness.
- Use technology and other vetted procedures to ensure that all messages are received and understood.
- Ensure personnel within the incident management system at the task, tactical, and strategic level are not deviating from assignments or failing to execute assignments.

In summary, all personnel should strive to maintain situational awareness throughout an incident response, effectively communicate their findings with key personnel throughout the response and seek to establish and reestablish shared situational awareness as the incident evolves to support effective decision making.

Contributing Factor #6 – Incident management, including risk assessment and management
Discussion: An offensive interior operation for fire attack and search & rescue was the strategy and tactics chosen at this incident. There were significant hazards and risks present, including advanced post flashover fire conditions on multiple floors and a significantly compromised structure. The rescue profile would have been low due to it being an abandoned structure and the searchable space being limited to the first floor. There was no significant chance of preserving valued property in the structure of origin. Advancing the fire attack and search & rescue efforts to the second floor in the structure of origin created a situation where the risks significantly outweighed any potential benefits.

Recommendation #6 – Utilize formal guidance for incident management which incorporates risk assessment and management principles.

Discussion: The International Association of Fire Chiefs (IAFC) developed the Rules of Engagement for Structural Firefighting that can improve risk assessment and safety for firefighters. The rules of

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

engagement serve as a best-practice model procedure for fire departments to adopt in their written guiding documents such as policies, procedures, and guidelines. These rules integrate several nationally recognized safety-related programs and principles. They include risk-assessment principles from NFPA 1500 (*currently 1550) and 1561. The rules of engagement align with the concepts in the IAFF's Fire Ground Survival Program. They also are supported by the contributing factors and recommendations from numerous NIOSH LODD investigations. The rules recognize that firefighters and company officers operating in the hazard zone are at significant risk from many hazards. Those hazards are integrated into a risk/benefit analysis and risk management plan, which is part of the IAP. They are considered to be a nationally accepted best practice for the fire service (International Association of Fire Chiefs, 2010).

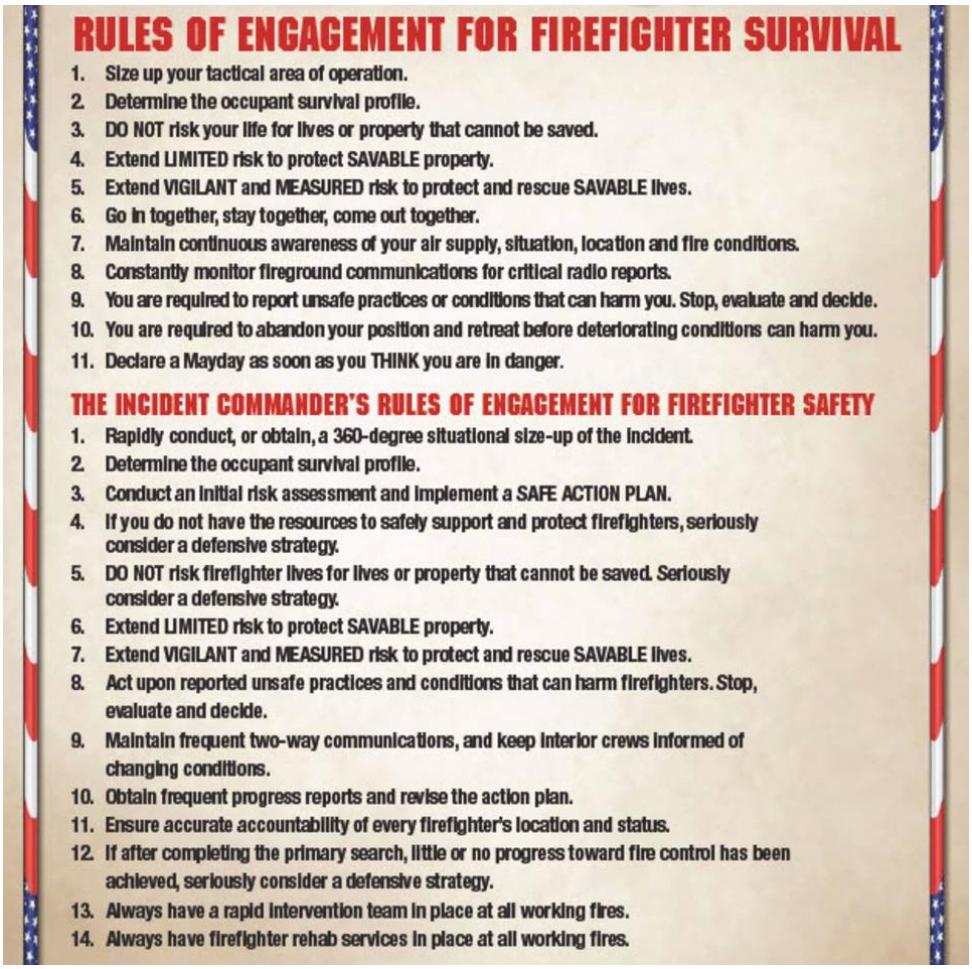

Image 10. IAFC Rules of Engagement *(Courtesy of IAFC)*

If a single fire company arrives on the scene without a chief officer on scene to act as the incident commander, the first arriving Company Officer develops an IAP. The initial IAP needs to include an

effective risk/benefit analysis and risk management strategy for any actions taken. Components of the IAP address the priorities of civilian life safety, incident stabilization, and property conservation, and balance those potential benefits against the risks posed to firefighter life safety from the hazards present. In previous LODD investigations, numerous first arriving company officers failed to complete any of those incident command duties and strictly focused on taking offensive firefighting actions. That led to offensive actions with negative outcomes, when the risk/benefit analysis clearly indicated that a defensive operation was warranted due to the severe risks that clearly outweighing any benefits.

Contributing Factor #7 – Mayday operations

Discussion: There were several factors related to the Mayday operations including:

- The initial Mayday radio transmission was incomplete and did not identify exactly which firefighter was trapped and their last known location. It is possible that the trapped firefighter was not able to make a Mayday transmission. However, there were other personnel who were aware of the situation who did not immediately provide an effective Mayday transmission.
- There was not a clear plan developed and executed to locate and access the trapped firefighter at their last known location. Due to several miscommunication errors, initial search operations were carried out on the first floor and basement of the structure. Personnel did not immediately access the second floor and conduct a focused search at the firefighter's last know location until more than 20 minutes after the Mayday was called.
- There was not a clear chain of command and IAP established and followed for the Mayday operations. Many actions carried out during the Mayday response were taken at an individual level and were not part of an overall coordinated plan.

Recommendation #7 – Consistently utilize formal guidance for calling, responding to, and managing a Mayday.

Discussion: There are several components and key steps that are included in written guidance for calling, responding to, and managing a Mayday.

The first critical step is ensuring that all personnel can initiate a Mayday response. Calling a Mayday is a complicated behavior that includes the cognitive, affective, and psychomotor domains of learning and performance. Given the infrequency with which most firefighters will experience a Mayday as part of an actual emergency incident, it is challenging to gain the necessary competencies through firsthand experience alone. As such, it is critical for all personnel to participate in effective professional development and competency verification (Clark, 2005).

Firefighters are required to understand the psychological and physiological effects of the extreme stress encountered during a Mayday event such as becoming trapped or running out of air. However, many fire training programs do not cover both the mental and physical impacts that occur in an imminently life-threatening situation.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Reaction to the extreme stresses of a life-threatening situation can result in motor skills deterioration, sensory distortions, and decreased cognitive processing ability. Those impacts can occur with the individual who is experiencing the life-threatening situation firsthand, as well as those who are responding to the emergency. A failure to develop the necessary competencies needed to deal with the psychological and physiological impacts of dealing with a life-threatening situation is a frequent contributing factor to failures, injuries, and deaths (Grossman, 2008).

As soon as it has been determined that a firefighter needs assistance, it is critical that a Mayday call is effectively communicated to everyone on the fireground. The steps for a Mayday include:

1 – Activate the Emergency Alert Button (EAB).
If the radio is equipped with one, the EAB is activated by pushing the button for 1 to 3 seconds. This is done to:

- Notify dispatch and others on the fireground that there is a Mayday
- Give the firefighter priority over any other unit that is transmitting
- Activate other features on the radio as programed by the FD.

For additional information on EAB use, see the NIOSH Safety Advisory "The Importance of Understanding and Training on the Portable Radio Emergency Alert Button (EAB) during a Mayday."

2 – Declare the Mayday
The firefighter in distress should activate the radio transmit button, and calmly and clearly declare the Mayday by announcing *"*Mayday, Mayday, Mayday.*"* There are several mnemonics that can then be utilized to ensure that all critical information is relayed such as:

- 3 Ws – Who, Where, What
- LUNAR – Location, Unit, Name, Assignment/Air Status, Resources Needed

The location is critical for the RIC to be able to rapidly move to the downed firefighter. Who is calling the Mayday is critical so the RIC can be sure that they have located the correct firefighter. The conditions and needs are critical so the IC and RIC can formulate an effective IAP for the rescue efforts. Previous LODD investigations have shown failures to provide all necessary information when calling a Mayday. These failures are frequently related to the physiological and psychological impacts that come from the stress brought on by a Mayday event. These failures were also frequently impacted by the lack of effective training repetitions needed to ensure the required Mayday actions are a stored muscle memory.

3 – Confirm the Mayday transmission was acknowledged.
Previous LODD investigations have shown that Mayday calls can be missed, especially by the personnel on the fireground who are dealing with high levels of noise and distractions. If their call is not acknowledged, they should continue repeating the call until it is acknowledged. If the firefighter did not activate the EAB function on their radio, or if that function is not giving them priority over all other radio traffic, their transmission may not make it through the radio system due to other transmissions blocking it. They should also be prepared to respond to the acknowledgment with additional details as requested.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

4 – Manually activate the PASS Alarm.
A critical way to locate a downed firefighter is to follow the sound of an activated PASS. Previous LODD investigations have shown that a downed firefighter's PASS was not activated manually, and it did not activate until they had gone unconscious and stopped moving. This delay in the PASS sounding, is a loss of critical time where rescuers could use that sound to locate the downed firefighter. As such, a downed firefighter must remember to activate it as soon as they have completed their initial radio transmissions. While the PASS can lead rescuers to the downed firefighter, it can also interfere with the ability to make and hear future radio transmissions. As such, firefighters may have to deactivate their PASS if they need to communicate on the radio again.

5 – Evaluate the best course of action.
In previous LODD investigations it has been determined that firefighters who had made the choice to move after calling the Mayday moved away from the nearest egress point and the location where rescuers were looking for them. If a downed firefighter does move, they need to provide updates on their location as frequently as circumstances will allow. Further, the firefighter can consider if the best option is to remain in the place where the Mayday was called or if it would be to move to another location to attempt self-rescue. If the conditions and air supply will allow it, the best option is to remain in place once the Mayday has been called. This ensures that rescuers will be able to work towards, and find the downed firefighter, at the location given in the Mayday. If the conditions or air supply will not allow the downed firefighter to remain in place, any movement needs to be purposefully considered and executed.

6 – Manage Air Supply.
Previous LODD investigations have shown that firefighters may remove their facepiece in a panic when they run out of air, which then requires the RIC to put a facepiece back in place potentially extending the time that it takes to get them back on air. The firefighter can utilize techniques such as skip breathing to try and extend their remaining air supply for as long as possible. They should also do their best to manage their heart and breathing rates. If they run out of air, they need to remember to leave their facepiece in place, and either disconnect their regulator, or pull their facepiece out enough to gain access to air. They should also get as low to the floor as possible and utilize something such as their hood to breathe through to try and filter out the products of combustion.

While most training related to initiating a Mayday will focus on a firefighter needing emergency assistance for themselves, they also need to recognize the importance of being prepared to facilitate a Mayday for another firefighter who is in distress. For numerous reasons, such as being physically trapped or rendered unconscious, a firefighter may not be able to make their own Mayday call. Any delay in making a Mayday notification reduces the survival chances for the firefighter in distress and it can greatly increase the risk to the firefighters attempting to rescue the downed firefighter. Therefore, it is critical that a Mayday is immediately called by the first person who recognizes that any firefighter needs assistance.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

The final critical step is ensuring that the IC, along with other members of the incident management team, can manage both the incident and Mayday response. This includes recognizing the need for actions to be taken at the strategic, tactical, and task levels. Those actions include:

Task Level

- Ensure that an effective Mayday transmission has been made and acknowledged.
- When possible, ensure that the downed firefighter continues to actively communicate.
- Maintain radio discipline. Attempt to shift as much of the communications as possible to face-to-face to keep the radio free for traffic related to the Mayday.
- If in direct contact with the downed firefighter, relay any pertinent information as warranted.
- Continue given assignments/tasks until directed by a company officer, chief officer, or the incident commander to take other new actions.
- Listen and look for any indications that the firefighter in need of assistance may be nearby. This could include a PASS alarm sounding, something making an obvious noise, or a flashing light.

Tactical Level

- Company Officers should evaluate their current assignments and the positive or negative impacts they may have on the Mayday operations and communicate any warranted changes to the appropriate supervisor.
- Ensure all personnel at the crew/company and/or division/sector level are accounted for.

Strategic Level

- Evaluate the current critical factors, risk management plan, and overall strategy, making appropriate changes as needed to support the Mayday.
- Ensure there are adequate on-scene resources, to include personnel and equipment, available to respond to the Mayday.
- Assign additional company or chief officers to key command and control roles to include, but not limited to, Mayday Operations Officer, Mayday Safety Officer, Mayday Logistics Support Officer.
- Ensure effective communications are taking place to support the Mayday.
- Request additional alarms or specialized responses to support the Mayday and ensure that a personnel reserve is available as warranted.
- Ensure that adequate Advanced Life Support EMS resources are available to treat and transport the downed firefighter once rescued. This May include requesting a medivac when warranted.
- Continually evaluate both the incident operations, and Mayday operations, to ensure that they are both making adequate progress and are not conflicting with one another.

For an example of a Mayday management guide see the IAFF Firefighter Mayday Checklist in Appendix D.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Contributing Factor #8 – Communication equipment and procedures

Discussion: There were several factors related to communications including:

- The FD uses a Bluetooth system that wirelessly links a mic in the firefighter's facepiece to their portable radio. When this feature is active, the mic on the portable radio is not operational and communications are conducted through the facepiece. There were several times when firefighters did not have their facepiece on or with them, so they were not able to immediately communicate via their portable radio without taking additional steps.
- As identified in contributing factor #7, communication issues related to the Mayday (see above) to include:
    - The firefighter trapped in the initial collapse was not able to transmit a Mayday.
    - The initial Mayday transmitted was missing critical information.
    - A number of firefighters operating during the Mayday were not aware of the last known location of the trapped firefighter.
    - A number of inaccurate radio transmissions related to the location of the missing firefighter were made during the Mayday causing significant confusion.

Recommendation #8 – Take actions to address the five critical elements for effective fireground communications: professional development, equipment, environment, written guidance, and leadership.

Discussion:

- Professional Development – Per the discussion in recommendation #2 on the components that make up an effective professional development program, all personnel are required to receive:
    - Education that provides the knowledge necessary to address the human and technical aspects of effective communications. Many communication challenges can be solved through critical thinking and problem solving, which are translated through effective education programs.

    - Training that addresses the skills necessary to operate the equipment for effective communications. As outlined in the article "Radio Messaging Under Warlike Conditions," firefighters will need to effectively operate a portable radio under realistic conditions (Newcombe, 2020). Many physical challenges exist when it comes to operating a portable radio in full PPE in a zero-visibility environment. It is critical to conduct realistic hands-on training to ensure that those skills are developed. Image 11 identifies some of those skills.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Familiarity of Radio Operations with Gloves and No Visibility

Locate	Skills demonstrated
ON/OFF	Turn on, adjust volume up and down
Volume Switch on remote microphone	Turn volume up and down
Channel selector knob	Adjust the channel selector to desired operating channels strictly by feel Rational: Background noise is a factor in hearing the voice prompt of radio
Repeater/simplex toggle	Adjust to talk around and back to repeater Rational: When the radio is out of range of the repeater, but within communicating distance of another radio
Orange Emergency Buttons (OEB)	Locate OEB on portable and remote microphone Rational: If you know both and one option is unavailable the other still exists
Scan selector	Locate and ensure it is in the Scan A setting
Flash light button	Locate and turn On/Off

Image 11. Critical hands-on radio operation skills *(Courtesy of USFA)*

- First or second-hand experience to develop the ability to identify and effectively respond to communication challenges in emergency responses. It is critical to review communication issues as a part of incident after action reviews. There is no better or more realistic way to evaluate the success of communications then seeing how all aspects perform in actual incident responses. The Plano FD conducts an "Incident Communications Audit" which is included in Appendix E. The information they gain from experience is used to make changes and improvements in their professional development efforts (Reyes, 2019).

- Personal development to ensure the proper understanding and attitude so that they can effectively address the emotional aspects of communicating in all emergency responses. An example of this would be developing the ability to maintain composure in a very stressful situation such as Mayday to ensure that the necessary information in being communicated.

When reviewing communication failures related to human performance, a direct link can be found to be a deficiency in at least one of the four components that make up an effective PDP.

- Equipment – There are two critical parts related to effective communications when it comes to the equipment component. The first part is directly related to the function of the equipment. Equipment can experience several issues ranging from a malfunction to a complete failure. The second part is related to the human interaction with the equipment. Equipment operators must have the ability to recognize and effectively manage a malfunction or complete failure.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

- Environment – To ensure effective radio communications, FDs must consider all the potential manmade and natural environmental conditions that can impact radio communications.

- Written Guidance – Per the discussion in recommendation #1 on guiding documents, the FD is responsible for determining what policies, procedures, and guidelines are necessary to ensure effective communications. Examples of this would include:
    - Policy – Per the IAFC Position Statement: "Assignment of Portable Radios/Two-Way Communications Devices to Every Firefighter on the Fireground," every firefighter operating on the fireground is equipped with a portable radio/two-way communications device (hereafter referred to as "portable radio"), preferably with an attached lapel microphone. Having a portable radio allows each firefighter to immediately report, or be notified of, hazardous conditions or emergencies such as a missing or injured firefighter or potential or impending structural collapse (International Association of Fire Chiefs, 2009).
    - Procedure – Per recommendation #7, FDs should have a clear procedure that outlines all of the necessary steps, the exact sequence of those steps, and why each of those steps are critical to follow without deviation.
    - Guideline – While there are requirements on all emergency responses, each emergency response can have unique variables that requires the flexibility to adjust operations as needed. An example would be determining the appropriate number of radio channels that would be needed to communicate effectively at an incident. Also determining which units are assigned to each of those channels. This is where the FD can provide guidance for best practices, but it would ultimately be up to the leadership running the incident to determine what would be the best course of action and a guideline would give them the needed flexibility to make those decisions.

- Leadership – it is ultimately up to the leadership at all levels within the FD to ensure that all four of the previous components have been addressed as needed. This includes:
    - Conducting performance evaluations and after-action reviews to identify any failures and ensuring appropriate corrective actions are taken to address them.
    - Maintaining accountability and discipline to ensure all personnel are following policies and procedures.
    - Conducting needs analysis to determine where and how future improvements can be made and develop implementation plans to bring about those changes.

While all five components are very important, it is the last component of leadership that ultimately ensures that the other four components are in place and are functioning as needed to ensure effective communications.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

References

Bricault, M. (2006, September). *Rescue Profiles for Residenital Occupancies*. Retrieved from Fire Engineering

Clark, B. (2005, October 19). *500 Maydays Called in Rookie School*. Retrieved June 2024, from Firehouse Magazine

Cortés, D. (2020, August 13). *A Review of Modelling and Simulation Methods for Flashover Prediction*. Retrieved June 2024, from Applied Sciences Journal

Dodson, D. (2021). *Fire Department Incident Safety Officer, 3rd Ed.* Burlington, MA: Jones & Bartlett Learning.

Fire Safety Research Institute. (2018, November 13). *Tactical Considerations Web Series: Ep. 18 - There Can Be Survivable Spaces Upon Arrival at a Single-Family Residential Home*. Retrieved June 2024, from Fire Safety Research Institute

Gasaway, R. (2013). *Situational Awareness for Emergency Response.* Tulsa, OK: Fire Engineering Books & Videos.

Gasaway, R. (2019). *How Smart Workers Use Situational Awareness to Improve Safety.* St Paul, MN: Gasaway Consulting Group LLC.

Grossman, D. a. (2008). *On Combat: The Psychology and Physiology of Deadly Conflict in War and in Peace, 3rd Ed.* Millstadt, IL: PPCT Research Publications.

International Association of Arson Investigators. (2018). *IAAI Field Manual Evaluation of Vacant and Abandoned Properties*. Retrieved June 2024, from International Association of Arson Investigators

International Association of Fire Chiefs. (2009). *IAFC Position: Assignment of Portable Radios*. Retrieved June 2024, from International Association of Fire Chiefs

International Association of Fire Chiefs. (2010, August). *Officer Development Handbook*. Retrieved June 2024, from International Association of Fire Chiefs

International Association of Fire Chiefs. (2010, August). *Rules of Engagement for Firefighter Survival*. Retrieved June 2024, from International Associations of Fire Chiefs

International Code Council. (2022, April). *2021 International Property Maintenance Code*. Retrieved June 2024, from International Code Council

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

International Fire Code. (2020, November). *Appendix J Building Information Sign*. Retrieved June 2024, from International Fire Code

International Fire Service Training Association. (2019). *Essentials of Firefighting, 7th Ed.* Stillwater, OK: International Fire Service Training Association.

International Society of Fire Service Instructors. (2024). *Professional Development Matrix*. Retrieved June 2024, from International Society of Fire Service Instructors

Kastros, B. &. (2021, July). *Civilian Rescue: The Reason We Exist*. Retrieved from Fire Engineering

Marsar, S. (2009, July). *Survivability Profiling*. Retrieved from US Fire Administration

National Fallen Firefighters Foundation. (2004, April). *Firefighter Life Safety Summit Initial Report*. Retrieved June 2024, from National Fallen Firefighters Foundation

National Fire Protection Association 1010. (2024). *NFPA 1010 Standard for Fire Fighter Professional Qualifications.* Quincy, MA: National Fire Protection Association.

National Fire Protection Association 1021. (2020). *NFPA 1021 Standard for Fire Officer Professional Qualifications.* Quincy, MA: National Fire Protection Association.

National Fire Protection Association 1550. (2024). *1550 - Standard for Emergency Responder Health and Safety.* Quincy, MA: National Fire Protection Association.

National Fire Protection Association 1710. (2020). *NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.* Quincy, MA: National Fire Protection Association.

National Fire Protection Association 1720. (2020). *NFPA 1720 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments.* Quincy, MA: National Fire Protection Association.

Newcombe, J. (2020, November 8). *Radio Messaging Under Warlike Conditions*. Retrieved June 2024, from Fire Engineering

Reyes, J. (2019, May 1). *Improving Fireground Communications through Training*. Retrieved June 2024, from Fire Engineering

Rhodes, D. (2024, March 1). *Mr. Incident Commander, Tear Down That Structure! - Derelict Buildings*. Retrieved June 2024, from Fire Engineering

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

The Johnson Foundation. (1966, February). *Wingspread Conference on Fire Service Administration, Education, and Research*. Retrieved June 2024, from Fire Heritage USA

Underwriters Labratory. (2012, January). *Fire Service Collapse Hazard Floor Furnace Experiments*. Retrieved June 2024, from UL Fire Safety Research Institute

United States Fire Administration. (2024). *Fire and Emergncy Services Higher Education*. Retrieved June 2024, from United States Fire Administration

United States Fire Adminstration. (2023, April). *Reducing Arson at Vacant and Abandoned Buildings*. Retrieved June 2024, from United States Fire Administration

Varone, C. (2018, May 1). *Fire Law: Policies, Procedures, Liability & Leadership*. Retrieved June 2024, from Firehouse

Zevotek, R. (2022, July 15). *Firefighter Safety Building Marking Systems*. Retrieved June 2024, from National Fire Protection Association

Investigator Information

This incident was investigated by Michael Richardson and Stephen Miles (Ret.), Safety and Occupational Health Specialist, with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH located in Morgantown, WV. An expert technical review was provided by Scott Yurczyk FDSOA Western Director and Seattle FD Battalion Chief / Health and Safety Officer (Ret.). A technical review was also provided by the National Fire Protection Association, Emergency Response and Responder Safety.

Additional Information

National Institute of Standards and Technology (NIST) and Underwriters Laboratories (UL)
Over the past decade, NIST and UL's Firefighter Safety Research Institute has worked with fire departments and fire service organizations to conduct research on fire behavior, fire safety issues, and fireground operations. Since 2019, UL's website has made available 25 training videos on these, and other topics. They can be accessed at https://training.fsri.org

International Association of Firefighters (IAFF) Fire Ground Survival Program
The IAFF Fire Ground Survival Training addresses Mayday prevention and Mayday operations for firefighters, company officers, and chief officers. Firefighters must be trained to perform potentially life-saving actions if they become lost, disoriented, injured, low on air, or trapped. Funded by the IAFF and assisted by a grant from the U.S. Department of Homeland Security through the Assistance to Firefighters (FIRE Act) grant program, this comprehensive fireground survival training program applies the lessons learned from firefighter fatality investigations conducted by the National Institute

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

for Occupational Safety and Health (NIOSH). It was developed by a committee of subject matter experts from the IAFF, the International Association of Fire Chiefs (IAFC), and NIOSH.

NFPA 1550, Standard for Emergency Responder Health and Safety (2024 edition)
NFPA 1550 marks the integration of NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*; NFPA 1521, *Standard for Fire Department Safety Officer Professional Qualifications*; and NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, into a single standard that addresses emergency responder health and safety. NFPA 1550 maintains the chapter on "Command Safety." This chapter provides a foundation for incorporating the incident management system at all emergency incidents, especially Type V and Type IV incidents. The chapter on Command Safety clearly defines the requirements for the IC, including establishing a fixed command post, personnel accountability, the use of staff aides and rapid intervention crews, and the appointment of a safety officer and assistant safety officer(s) (as needed). The standard addresses the expectations and authority of the safety officer. Annexes cover Functional Assignments for High Rise Building Incidents, Development of Subordinate Officers or Implementing a More Efficient Management System, Incident Management for the Fire Service on Type V or Type IV Incidents, and Structural Fire-Fighting—Risk Assessment and Operational Expectation.

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.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Appendix A
Incident Timeline

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. All times are approximate and rounded to the closest minute. The timeline is not intended, nor should it be used, as a formal record of events.

Unit identifier abbreviations used in the timeline:
E – Engine Company
T – Truck Company (Quint w/75-foot aerial)
H&L – Hook & Ladder Company (100-foot aerial)
RS – Rescue Squad
MA – Mutual Aid Company
CFD – Chief of FD
DC – Deputy Chief
BC – Battalion Chief
U – Specialized or Support Unit

Radio call signs for personnel are A-Alpha (company officer), B-Bravo (leadoff/nozzle firefighter), C-Charlie (hydrant firefighter), D-Delta (driver/operator), E-Echo (5th member of the rescue squad), F-Foxtrot (6th member of the rescue squad).

Time (hours)	Fireground Operations, Response, and Details
11:43 – 11:45	Fire alarm receives 3 phone calls from civilians reporting a building fire
11:45	Fire alarm dispatches a still alarm assignment consisting of T-13, E-24, E-28, H&L-5, BC-805, RS-2 and MA-2615 to a house fire Fire alarm receives a fourth call reporting a building fire, caller sees T-13 enroute
11:46	T-13 arrives on the scene. T-13A provides the initial radio report of heavy fire on the second floor, exposure on the D side, one line off, 1st alarm
11:48	Fire alarm dispatches a 1st alarm assignment consisting of T-13, E-24, E-28, H&L-5, BC-805, RS-2, MA-2615, E-26, T-27, and BC-806
11:49	E-24A calls E-28A • E-24A to E-28A: are you guys a pumper or a truck? • E-28A to E-24A: truck, the hook & ladder is right in front of us • E-24A: that's clear, we're a pumper

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Time (hours)	Fireground Operations, Response, and Details
11:50	E-28A to Fire Alarm: we've got one house fully involved, exposure on Side Delta, 13's leading off with a big line Fire alarm acknowledges E-28A's size up: one house fully involved, exposure on Side Delta, 13's leading off with a big line H&L-5 arrives on the scene MA-2615 to Fire Alarm E-24: on the scene backup water Fire alarm acknowledges E-24A: 24's on the scene backup water
11:52	While dispatching another call Fire Alarm hears an open mic from T-13B E-13B you have an open transmit button, E-13B you have an open transmit button... Fire Alarm to 810
11:53	E-24A to fire alarm: E-24A, firefighter trapped inside the building, give me a second alarm with the second squad BC-805 calling fire alarm
11:54	Unknown transmitter: water as soon as you get it BC-805: BC-805 calling fire alarm, on the scene
11:54	DC-821C: Car 821 responding U-827: I'm on the scene
11:55	Fire alarm dispatches 2nd Alarm consisting of T-10, T-22, H&L-1, BC-801, and Mutual Aid (MA)-4936 Fire alarm: all companies are to respond on command channel bravo
11:56	E-27: 27's on the scene RS-2: RS-2 on the scene U-820: Car 820 Responding T-26: 26's on scene

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Time (hours)	Fireground Operations, Response, and Details
11:57	E-29 to Fire Alarm: 29's from quarters MA-2625 to Fire Alarm: MA-2625 is on the scene
11:58	H&L-5 to BC-805: occupied building exposure Side Delta, second floor nothing found BC-805 to Fire Alarm: we have a report of one firefighter trapped in the original fire building on the second floor, we've got the RIC Team activated
11:59	Unknown transmitter: we've got a line around back to the basement Unknown transmitter: activate your PASS device
11:59	BC-806: 806 on the scene BC-805: 805 to RS-2A
12:00	E-24D to H&L-5D: water is on the way H&L-5D: message received T-10A to Fire Alarm: have the 2nd Alarm companies stage
12:01	RS-2A to the basement: did you… (inaudible) L-6 on the scene DC-810B on the scene
12:03	Unknown transmitter: can anyone confirm there's no fire in the basement? Unknown transmitter: no fire in the basement
12:03	DC-810B to Fire Alarm: Car 810 on the scene BC-805 to Fire Alarm: primary search of the basement and first floor is clear
12:04	RS-2A to BC-805: any updates? We don't hear any PASS devices going off BC-805: that's Clear'
12:05	DC-810B: firefighters have located the downed firefighter trying to access at this time

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Time (hours)	Fireground Operations, Response, and Details
	E-29A to Fire Alarm: staging Unknown transmitter: (inaudible)… with your TIC and hand tools U-820: 820 on the scene
12:06	U-825: 825 on scene
12:07	MA-4930 to Fire Alarm: 4930 responding MA-4900 to Fire Alarm: I'm on the scene Unknown Transmitter: lighten up on the line! BC-801: on the scene staging E28-B to E26-D: can you… (inaudible)… water coming Fire Alarm to DC-810C: you've reached your first 20-minute mark at 12:08 provide a progress report RS-2F to Squad Leader: (no response) DC-810C: standby Fire Alarm Fire Alarm: that's clear RS-2F to RS-2A: second floor is completely collapsed… we hear no PASS device… we have no (inaudible) DC-810A to DC-810C: (inaudible)… on the scene
12:09	RS-1: on the scene
12:10	BC-806 to RS-1A: RS-1A BC-806: bring your truck up… (inaudible)
12:11	RS-1A to RS-1D: can you come around and uh… (inaudible) ... same street MA-4930: on scene
12:13	Unknown transmitter: RS-1A come to the front of the building

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Time (hours)	Fireground Operations, Response, and Details
12:14	U-900: Unit 900 responding
12:14	U-815: 815 responding Fire Alarm: 815 responding
12:15	RS-2A to BC-805: we found his ax… (inaudible)… by the back Unknown transmitter: from there... BC-801: axes… (inaudible)… in front of the building
12:16	T-10A to T-10B: T-10B T-10A: where ya at? T-10B: second floor searching… hey … tell them to stop hitting the second floor Unknown transmitter: that's clear
12:28	U-819 to Fire Alarm: 819 on the scene Fire Alarm: 819 on the scene
12:35	U-900: Unit 900 arriving
12:36	Fire Alarm calling CFD
12:37	CFD: go ahead Fire Alarm to CFD: you're at your second 20-minute mark provide a progress report CFD: fire is under control, Firefighter has been removed, on the way to the ambulance

***** The detailed timeline stops with the removal of the downed firefighter at 12:37, fireground operations continued until 14:42.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Appendix B
NIOSH FFIPPP LODD Investigations Occurring in High-Risk Buildings

- NIOSH F1999-47. (2000). Six Career Fire Fighters Killed in Cold-Storage and Warehouse Building Fire - Massachusetts. By Braddee R., Washenitz F., Mezzanotte T., Romano N., Pettit T. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2002-20. (2002). Two Career Fire Fighters Die in Four-Alarm Fire at Two-Story Brick - Missouri. By Koedam R., McFall M., Tarley J. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2005-09. (2005). Career Fire Captain Dies When Trapped by Partial Roof Collapse in a Vacant House Fire - Texas. By Bowyer M., McFall M., Merinar T. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2007-02. (2009). Career Fire Fighter Injured during Rapid Fire Progression in an Abandoned Structure Dies Six Days Later – Georgia. By Berardinelli S., Tarley J., Bowyer M., Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2007-37. (2010). Two Career Fire Fighters Die Following a Seven-Alarm Fire in a High-Rise Building Undergoing Simultaneous Deconstruction and Asbestos Abatement - New York. By Berardinelli S. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2008-37. (2010). Career Fire Fighter Dies After Being Trapped in a Roof Collapse During Overhaul of a Vacant/Abandoned Building—Michigan. By Miles S., Bowyer M. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2010-38. (2011). Two Career Fire Fighters Die and 19 Injured in Roof Collapse during Rubbish Fire at an Abandoned Commercial Structure - Illinois. By Merinar T., Bowyer M., Loflin M., Miles S. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Appendix B
NIOSH FFIPPP LODD Investigations Occurring in High-Risk Buildings (continued)

- NIOSH F2012-13. (2013). Career Lieutenant and Fire Fighter Killed and Two Fire Fighters Injured by Wall Collapse at a Large Commercial Structure Fire - Pennsylvania. By Miles S., Loflin M., Tarley J., Merinar T. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2013-27. (2016). Career Fire Lieutenant Killed By Roof/Ceiling Collapse During Overhaul - Georgia. By Miles S., Merinar T., Tarley J. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2014-24. (2015). Shift Safety Officer Falls through Hole in Floor into Basement of Vacant Row House and Dies from Smoke Inhalation - Maryland. By Merinar T., Loflin M. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2015-18. (2017). Career Fire Fighter Dies After Falling Down Unsecured Elevator Shaft While Searching for the Seat of a Smoldering Fire - Illinois. By Merinar T., Bowyer M. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

- NIOSH F2019-09. (2020). Paid-On-Call Fire Fighter Becomes Disorientated and Dies Following Stairway Collapse in Two-Story Vacant Structure Fire - Illinois. By Bowyer M., Kline-Field K. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

Ongoing Investigations/Reports (at the time of publishing this report)

- NIOSH F2022-01. 3 Firefighters Killed and 1 Firefighter Seriously Injured During a Collapse in a Three-Story Abandoned/Derelict Row House Fire - Maryland

- NIOSH F2022-04. Career Firefighter Dies in a Structural Collapse While Conducting Fire Attack in an Abandoned Derelict Single-Family Residence - Missouri

- NIOSH F2024-02. Career Fire Captain dies in Abandoned, Single Family House Fire after becoming Lost and Disorientated - North Carolina

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Appendix C
Vacant/Abandoned Building Evaluation Form - Page 1

Date: / /

Building Marking ☐

Vacant/Abandoned Building Evaluation Form

Address: _____

Property Name: _____

Owner Name: _____ Telephone: _____

Owner Address: _____

Answer each of the following questions about the building. Select multiple options, if necessary; explain response.
Draw a simple sketch of the location and explain your observations in a brief narrative.

Building Security
☐ Secure ☐ Open/unsecured ☐ Signs of recent entry

Utilities (Note Entry Points for each active utility on sketch)
Active Utilities ☐ No ☐ Yes **If Yes:** ☐ Gas ☐ Electricity ☐ Oil ☐ Water

Building Use (The original use of the building and how it was last used)

Building Construction
Number of Floors _____ **Basement:** ☐ Yes ☐ Sub-Basement ☐ Multi Sub-Levels
Exterior Walls ☐ Block/Brick ☐ Curtain Wall ☐ Wood ☐ Metal Tie Rods (stars)
Openings in Exterior Walls ☐ Many ☐ Few ☐ Windowless
(Windows, Doors, etc.)
Structural Members ☐ Steel ☐ Concrete ☐ Wood ☐ Mixed (*Describe*)
(Beams, Girders, Columns)
Truss Construction ☐ Roof ☐ Floors
Exposed Structural Members ☐ Yes ☐ No
(Beams, Girders, Columns & Trusses)
Ceiling Type ☐ None ☐ Suspended ☐ Metal ☐ Sheetrock/Plaster ☐ Wood

Condition of Interior Walls and Floors (Integrity of compartmentation)
☐ Good ☐ Deteriorating ☐ Multiple penetrations that would allow fire spread ☐ Walls ☐ Floors
Condition of Roof
☐ Good ☐ Some instability/deterioration ☐ Major deterioration
General Condition of Structure
☐ Good ☐ Minor structural instability ☐ Major deterioration of structural elements

Fire Protection Systems
Operational Fire Alarm System ☐ Yes ☐ No
Operational Sprinkler System ☐ Yes ☐ No ☐ System off, but usable if supplied through FD connection
(Valves open, pressure showing on gauges)
Operational Standpipe System ☐ Yes ☐ No
Fire Department Connection ☐ Yes ☐ No
(If Yes, note location on sketch)

(Courtesy of the IAFF and USFA)

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Appendix C
Vacant/Abandoned Building Evaluation Form - Page 2

Fire Potential

Fuel Packages (Fuel Load)

Quantity	☐ Numerous	☐ Moderate	☐ Limited
Distribution	☐ Concentrated	☐ Spread out	
Housekeeping	☐ Good	☐ Poor	
Interior Finish	☐ Combustible	☐ Non-combustible	☐ Mixed (Describe)
Room Size	☐ Large	☐ Moderate	☐ Small
Potential for a delay in FD notification	☐ High	☐ Medium	☐ Low

Exposures (Note locations on sketch)

Location	☐ **A side**	☐ **B side**	☐ **C side**	☐ **D side**
Separation (ft)	___	___	___	___
Occupied (Y/N)	___	___	___	___

Suppression Operations

Hazards In Building	☐ Holes in Floors	☐ Missing Stairs	☐ Open Shafts/pits	
Building Access:	☐ 4 sides	☐ 3 sides	☐ 2 Sides	☐ Limited
Interior Layout	☐ Complicated	☐ Normal - Walls/Partitions	☐ Open	
Water Supply:	☐ Adequate	☐ Inadequate	(Note Locations on Sketch)	

Hazardous materials located on the site ☐ Yes ☐ None Observed
(If Yes, describe in detail)

Conditions that require immediate correction ☐ Yes ☐ No
(If Yes, describe in detail)

Analysis of the building (provide ***your*** analysis of the building)	High	Moderate	Low
Potential for an exposure fire (extension to another building)	☐	☐	☐
Potential for a Multi-Room fire on arrival of first due company	☐	☐	☐
Potential for structural collapse early in the fire development	☐	☐	☐
Potential for fire fighters to become lost or trapped during operations	☐	☐	☐

Narrative:

Inspected by: Posting Authorized by: Data Entered by:

IAAI/USFA Rev 13.3

(Courtesy of the IAFF and USFA)

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Appendix D
IAFF Firefighter Mayday Checklist

APPENDIX A
FIRE FIGHTER MAYDAY CHECKLIST

❑ Look at screen & document Radio Identifier _____

❑ Transmit: "All units assigned to the _____ incident, clear this channel for a MAYDAY. Unit calling MAYDAY, identify."

❑ Receive & Document:

WHO: Name _____

Unit _____

WHAT: Lost Trapped Injured Out of Air SCBA Malfunction

Other _____

WHERE: Floor _____ , Side _____

Area _____ , Division _____

❑ Transmit: "Fire Fighter _____, I copy your MAYDAY (Repeat WHO, WHAT, WHERE information). RIC is being deployed. Initiate your G-R-A-B-L-I-V-E-S procedures."

❑ Deploy RIC/RIG

❑ Transmit: (On Command and Tactical Channels): "All units on the _____ Incident, we have a fire fighter MAYDAY. Maintain your current assignments and keep this channel clear."

❑ Transmit: "Fire Fighter_____, remain calm, control your breathing, turn on your PASS alarm and shine your flashlight. RIC is coming to get you."

❑ Transmit requests to Dispatch:

- ○ "Requesting _____ additional alarm(s), including _____ ambulances."
- ○ "Requesting _____ Communication plan" OR "Requesting additional tactical channel(s)."

❑ Assign additional companies to RIC and RIC Group Supervisor (RICGS)

❑ Conduct a Roll-Call (PAR) prior to clearing the MAYDAY

IAFF Fire Ground Survival Manual | 105

(Courtesy of the IAFF)

Career Firefighter Killed in a Structural Collapse While Conducting Fire Attack and Search in a Derelict Single-Family Residence – Missouri

Appendix E
Plano Fire-Rescue Incident Communications Audit

PLANO FIRE-RESCUE
INCIDENT COMMUNICATIONS AUDIT

INCIDENT DATE/ TIME: _____ INCIDENT TYPE: _____
INCIDENT/ RMS # _____ LOCATION: _____
UNITS ASSIGNED: _____

A. CALLTAKER			COMMENTS
CRITICAL INFO. OBTAINED FROM CALLER(S)?	Y	N	

B. ALARM & NOTIFICATION			COMMENTS
CORRECT UNITS DISPATCHED ON INITIAL ALARM?	Y	N	
ANY ISSUES WITH INITIAL DISPATCH?	Y	N	
CRITICAL PRE-ARRIVAL INFO. RELAYED TO CREWS?	Y	N	
WIND SPEED AND DIRECTION GIVEN ENROUTE?	Y	N	

C. STRUCTURE	COMMENTS
RESIDENTIAL? (SINGLE FAMILY or MULTI-FAMILY)	
COMMERCIAL?	
# OF STORIES _____ FIRE LOCATION	

D. ARRIVAL (1ST MAJOR UNIT ON SCENE _____)			COMMENTS
SIZE UP GIVEN	Y	N	
QUOTE SIZE UP IN THIS BOX			
360 COMPLETE & ANNOUNCED ON RADIO	Y	N	"WORKING FIRE" ANNOUNCED (UNIT_____)
SITUATION REPORT (TO 1ST DUE BC OR COMMAND)	Y	N	
QUOTE SITUATION REPORT IN THIS BOX			

E. COMMAND (ENG_____ / BATT _____)			COMMENTS
COMMAND CHANNEL USED	Y	N	
IF YES, DID ALL COMMS W/ DISPATCH REMAIN ON COMMAND CHANNEL?	Y	N	
COMMAND FROM THE CAB, OR MOBILE?			

F. FIREGROUND COMMUNICATIONS			COMMENTS
PHONETIC ALPHABET USED	Y	N	
LIST ANY COMMUNICATIONS ISSUES (FEEDBACK, ANY UNITS CONSISTENTLY UNREADABLE?)			

G. COMMUNICATIONS MODEL USED? (3-C'S) Connect, Convey, Confirm
i.e. COMMAND: *"Truck 1 from Command"* TRUCK 1: *"Truck 1"*
ANY UNITS THAT CONSISTENTLY USED CORRECT MODEL?

H. OTHER COMMENTS/ SUGGESTIONS FOR IMPROVEMENT

I. SUPPLEMENT ATTACHED	Y	N	
REVIEWED BY:			

(Courtesy of the Plano FD)