1000 FREDERICK LANE, MORGANTOWN, WV 26508 • 304.285.5916

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Executive Summary

On January 24, 2022, a 33-year-old firefighter/EMT (acting company officer), a 37-year-old lieutenant/EMT, and a 30-year-old firefighter/paramedic died in a structural collapse of a 3-story abandoned, derelict row house. Additionally, a 47-year-old firefighter/EMT was seriously injured in the collapse. At 05:51 hours, the city's Fire Communications Bureau (FCB) received numerous calls of a reported structure fire. Several addresses were reported, and one caller stated there were three children trapped inside the home. The FCB dispatched the alarm at 05:53 hours which consisted of Engine 55, Engine 14, Engine 23, Engine 36, Engine 47, Truck 23, Truck 10, Rescue 1, Battalion Chief 6 (BC 6), Battalion Chief 3 (BC 3), and Medic 21. At 05:55 hours, Engine 14 arrived on-scene and established a water supply. The officer reported fire showing on the second and third floors of a 3-story row house and assumed command. Truck 23 arrived and was positioned on Side Alpha. Engine 14's pipe firefighter (nozzleman) stretched a 1¾-inch hose line off Engine 14 and entered the front door on Side Alpha backed up by the acting officer (deceased firefighter). They began to knock down the fire on the first floor as they advanced into the structure. The lieutenant of Truck 23 (deceased firefighter) also entered to begin a primary search. Engine 55 and Truck 10 were initiating firefighting operations on Side Charlie. At 05:57 hours, BC 3 arrived, assumed command, and requested a "working fire" dispatch. At approximately 06:00 hours, a total collapse of all interior floors of the fire building occurred. Three firefighters from Engine 14, one firefighter from Truck 23, and two firefighters from Engine 36 were inside at the time of the collapse. Engine 36 firefighters were initially trapped but were able to self-extricate. A Mayday was called followed by a request for a 2nd Alarm at 06:07 hours. One firefighter (seriously injured) from Engine 14 was located and extricated by a rapid intervention team (RIT) from Engine 23 at 06:14 hours. The pipe firefighter from Engine 14 was located but was trapped by structural components. He was extricated at 07:39 hours and transported to a local shock trauma facility

Photo 1. Initial fire conditions on arrival of Engine 14.
(Courtesy of the fire department)

where he was pronounced deceased. The Engine 14 officer was located and the RIT continued extrication efforts. At 08:18 hours, the Engine 14 officer was removed from the structure and transported to a local shock trauma facility where she was also pronounced deceased. All operations were stopped due to the lack of structural stability of the building and falling materials. The incident commander (IC) announced a strategy change to transition from a rescue to a recovery operation. At 16:08 hours, the Truck 23 lieutenant was recovered and transported to the Medical Examiner's office. The incident was declared under control at 16:08 hours.

Contributing Factors

- *Standard operating procedures (SOPs)/standard operating guidelines (SOGs) for fighting fires in abandoned, derelict structures.*
- *Training for firefighters, officers, and safety officers on SOPs and SOGs for fighting fires in row homes, with a focus on fire progression and structural collapse safety.*
- *Initial scene size-up and ongoing risk assessment by the first arriving resource.*
- *Resources committed to an offensive interior fire suppression operation with an incomplete risk-versus-gain analysis (offensive vs. defensive).*
- *Incident fire structure in a severe state of neglect, disrepair, with structural instability from a previous fire event.*
- *Arson*

Key Recommendations

Fire departments should:

- *Develop and implement SOPs for an identification/marking system for fighting fires in vacant/abandoned/derelict buildings as part of a comprehensive High-Risk Building program.*
- *Provide comprehensive training for firefighters, officers, and safety officers on SOPs and SOGs for fighting fires and understanding fire development in row houses, while also incorporating structural collapse principles into fire ground incident management.*
- *Ensure the first arriving resource completes an initial scene size-up and risk assessment and reassesses as fire conditions progress.*
- *Consider exterior fire control (defensive strategy) when the initial size-up reveals heavy fire conditions indicating risk of collapse.*

Additionally, governing municipalities (federal, state, regional/county, and local) should:

- *Collaborate with fire departments to develop and implement strategies for the identification and remediation (demolition) of condemned High-Risk buildings.*

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

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

1000 FREDERICK LANE, MORGANTOWN, WV 26508 • 304.285.5916

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Introduction

On January 24, 2022, a 33-year-old acting lieutenant (firefighter), a 37-year-old lieutenant, and a 30-year-old firefighter/paramedic died in a structural collapse of a 3-story abandoned, derelict row house. Additionally, a 47-year-old firefighter/EMT was seriously injured in the collapse. On January 28, 2022, the U.S. Fire Administration (USFA) notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On February 4 – 12, 2022, two NIOSH investigators and a physical scientist conducted a field investigation. The NIOSH investigators returned to Maryland on March 13 – 19, 2022 and July 24 - 27, 2022 to conduct additional interviews and meet with the department's board of inquiry.

The NIOSH investigators met with the fire chief, assistant fire chiefs, and operational officers and firefighters of the local firefighter's and officer's unions. The investigators also interviewed fire officers and firefighters that responded to the fire. The investigators reviewed training records, training requirements, and SOPs. The investigators examined the turnout gear and self-contained breathing apparatus (SCBA) of the deceased firefighters and injured firefighter. Investigators also visited the fire scene and met with fire investigators and personnel from the Bureau of Alcohol, Tobacco, Firearms, and Explosives. NIOSH investigators met and worked with the fire department's Health and Safety Office Incident Review Team.

Fire Department

The fire department involved in this incident provides fire protection and life safety services to an area encompassing 92.1 square miles, with 11.3 miles of waterway, and responds to approximately 270,000 incidents annually. The department operates 32 engines, 3 squads, 17 truck companies, and a heavy rescue company led by 28 battalion chiefs. Additionally, the department has 6 EMS district officers, 24 Advanced Life Support (ALS) transport medic units, and 7 Basic Life Support (BLS) transport ambulances. The city is divided into six operational battalions and one EMS battalion. The fire department is an Insurance Service Office (ISO) Class 1 department. The fire department serves a daytime population exceeding 1,000,000 and a residential population of more than 620,000, out of 39 firehouses.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

A first alarm assignment for a structure fire includes the dispatch of five engine/squad companies, two truck companies, a medic unit, and two battalion chiefs. The heavy rescue also responds in a predetermined area of the city. Utilizing predetermined tactical assignments outlined in SOPs, the first engine/squad secures a continuous water supply and reports to Side Alpha. The second engine/squad covers the water supply of the first engine/squad. The third engine/squad assumes the role of RIT upon their arrival. The fourth engine/squad secures a continuous water supply and report to Side Charlie. The fifth engine/squad then covers the water supply of the fourth engine/squad. The first truck reports to Side Alpha and the second truck company reports to Side Charlie. Assignments may be altered by responding units via the fireground radio channel.

A working fire assignment dispatches an engine or squad company, a truck company, the mobile air supply unit, the on-duty shift safety officer, and the shift commander. A second alarm assignment can add three engine/squad companies, a truck company, and heavy rescue (if outside of predetermined area), a battalion chief, a medic unit, the on-duty fire investigator, and the closest EMS district supervisor. Additional alarms are composed of four engines, a squad company and two truck companies. As the alarms increase at an incident, chief officers and specialty units are also added.

All companies are staffed with four firefighters led by either a captain, lieutenant, or a senior firefighter in an acting lieutenant capacity plus a driver/operator and two firefighters.

The firefighters assigned to an apparatus are identified on the radio by their unit number followed by a specific number designating their rank or position:

- “1” is the officer
- “2” is the driver/operator
- “3” and “4” positions are jump-seat firefighters designated pipe and lead-off
- The tiller of a tractor drawn aerial is designated “3” position.

Training and Professional Development

The fire department maintains an Education and Training Division that designs, develops, and provides training programs and continuing education for probationary and career firefighters of all ranks. Battalion level training is conducted in the field by the respective battalion chiefs. The department operates a training academy, and recruits attend a 10-month non-resident academy. The classes consist of Emergency Medical Technician (EMT) Basic; NFPA 1001, *Standard on Fire Fighter Professional Qualifications*, Fire Fighter I and Fire Fighter II; NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*, HazMat Awareness and HazMat Operations; and an emergency vehicle operations course.

Staffing, Apparatus, and Communications

All companies are staffed with four firefighters led by either a captain, lieutenant, or a senior firefighter in an acting lieutenant capacity, a driver/operator and two firefighters. Every firefighter assigned to a company is assigned a portable radio that corresponds to their riding position.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

The following units were assigned and responded to this incident:

1st Alarm

- Engine 55: Officer, driver/operator, and two firefighters
- Engine 14: Officer (acting lieutenant), driver/operator, and two firefighters
- Engine 23: Officer, driver/operator, and two firefighters, assigned as the RIT
- Engine 36: Officer, driver/operator and two firefighters
- Engine 47: Officer, driver/operator and two firefighters
- Truck 23: Officer, driver, tiller and a firefighter
- Truck 10: Officer, driver, tiller and two firefighters
- Rescue 1: Officer, driver/operator and four firefighters
- Medic 21: Two paramedics
- Battalion Chief 6: Battalion chief IC
- Battalion Chief 3: Battalion chief Safety

Working Fire Dispatch

- Engine 30: Officer, driver/operator and two firefighters
- Engine 13: Officer, driver/operator and two firefighters
- Truck 8: Officer, driver/operator, tiller and a firefighter
- Medic 12: Two paramedics
- Safety Officer 2: Lieutenant
- Car 5: Deputy chief shift commander
- Fire Investigation: Captain arson investigator

Within the FCB, 9-1-1 Specialists are required to complete a 15-week training that includes CPR and emergency medical and fire dispatch classes. The FCB manages over 180,000 incidents per year.

Building Collapse

Pre-Incident Factors:

Two major fires previously occurred in the fire building in 2015 and 2016. These fires resulted in significant structural building damage, with major interior compartment compromise and degradation from both the fire and subsequent fire department activities associated with extinguishment, overhaul, and investigation. The 2015 fire caused a collapse of the rear bedroom's second floor onto the first floor in a lean-to collapse configuration. The lean-to collapse configuration of the back of the second-floor assembly was resting on the first floor just beyond the central stairwell core (s**ee Diagram 1**).

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

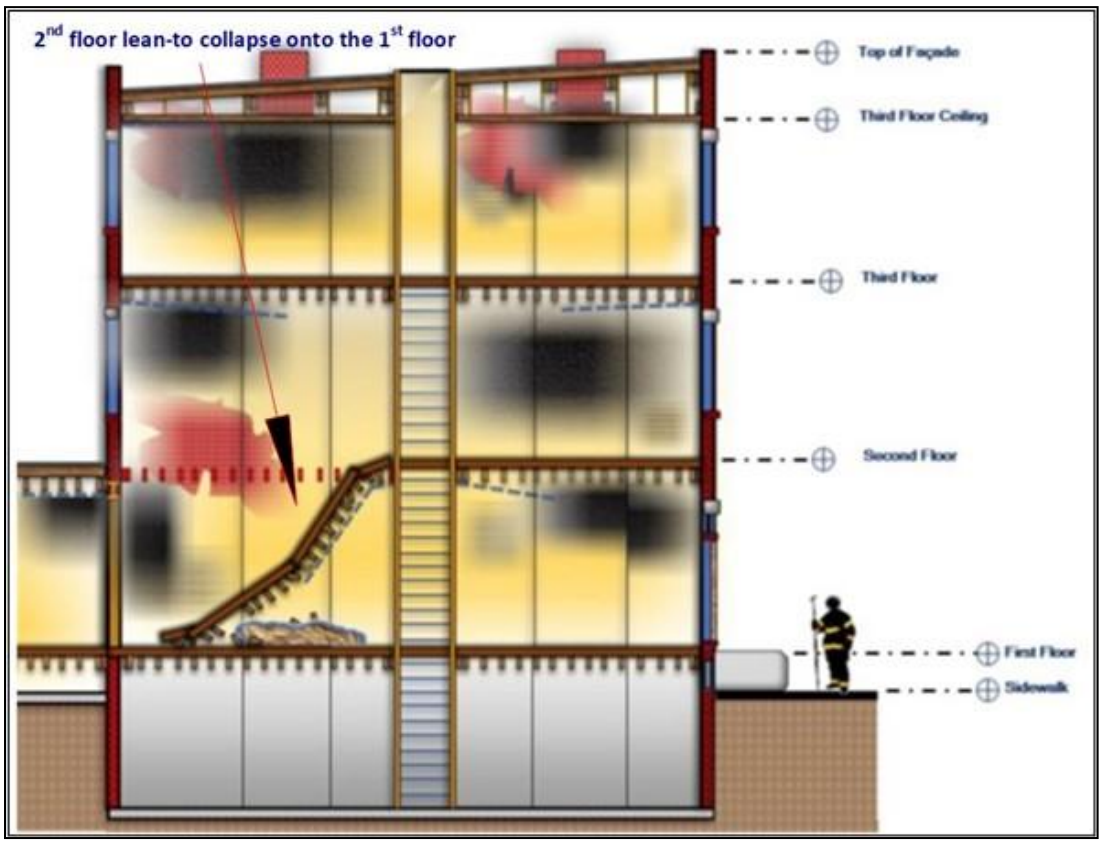

Diagram 1. The cross-section of second floor collapse configuration from previous (2015) fire. ***(Courtesy of Buildingsonfire.com - C.J. Naum)***

Pre-incident fire damage to these areas of the buildings was recorded [Naum 2024]:

- Upper floors and roof cornice in Bravo 1, which is a 3-story abandoned dwelling
- Three-story occupied dwelling in Delta 1, with additional unaffected occupied dwellings along the row
- Open roof scuttle in the fire building from at least 2008 until the fire
- Interior room compartments, wall systems, floors, ceilings, and assemblies in the fire building

Specific damage to the fire building included [Naum 2024]:

- Structural compromise likely from large volumes of water being applied post-fire
- Compromised load carrying capacity of wood floor joists from environmental exposure due to factors such as aging, creep, loss of moisture content, and cyclical exposure to environment elements
- Deterioration of interior rooms due to environmental exposure and the suggested impacts on the building structural components, materials and systems
- Potential interior vandalism and destruction (accidental or intentional) from 2015 – 2022 may have affected structural stability and the integrity of building components.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Incident Factors:

The collapse zone was interior to the fire building's perimeter walls and consisted of the building floor and roof assemblies, systems and components, and building materials. The interior assemblies failed in a pancake-like collapse configuration. The rapid downward momentum and compression of air space between the floors caused a rapid outward release of energy that caused the flames to self-extinguish and diminish in both fire severity and extent. (**see Diagrams 2 and 3**) [Naum 2024].

Diagram 2. The cross-section of the initial fire attack by Engine 14.
(Courtesy of Buildingsonfire.com - C.J. Naum)

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

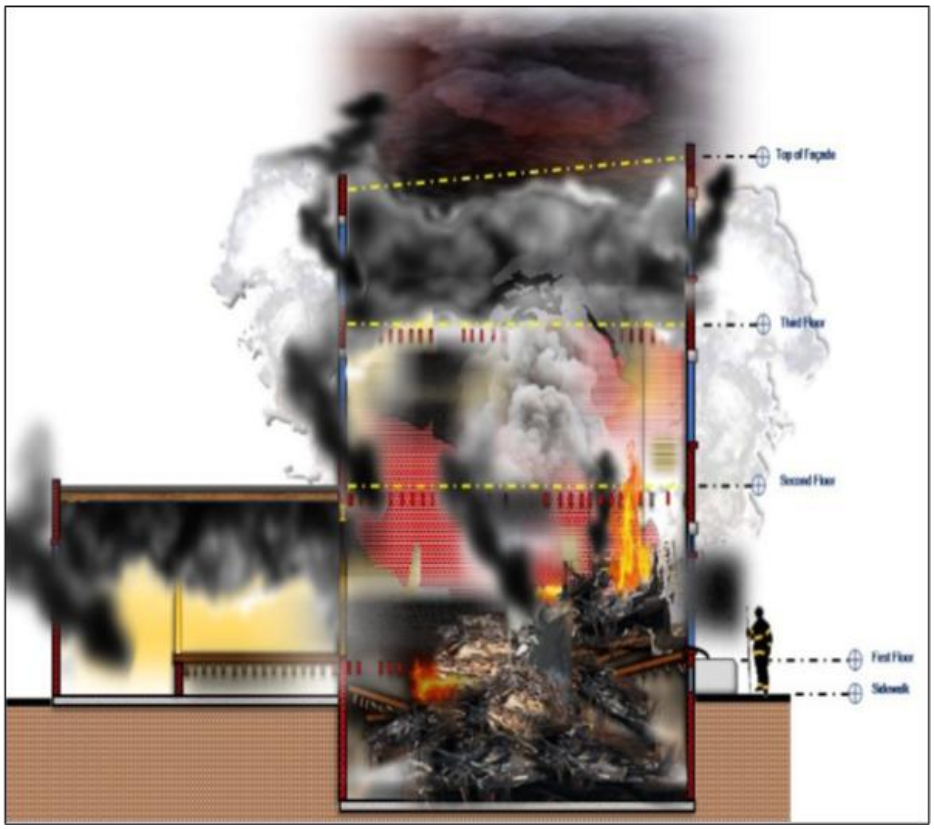

Diagram 3. The cross-section of the interior collapse of the floors in the fire building.
(Courtesy of Buildingsonfire.com - C.J. Naum)

Additional information on the building's construction, characteristics, and history can be found in **Appendix A**.

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.

Time (Hours)	Fireground Operations, Response, and Details
05:51	• Several 9-1-1 calls reported a structure fire with smoke conditions in a vacant building, along with a report of children in the house. Many callers gave an incorrect address.
05:53	• The FCB dispatched Engine 55, Engine 14, Engine 23 RIT, Engine 36, Engine 47, Truck 23, Truck 10, BC 6, BC 3, Medic 21, and Rescue 1.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Time (Hours)	Fireground Operations, Response, and Details
05:54	• An off-duty firefighter from Engine 14, traveling home from his tour, noticed the fire and called 9-1-1 to report a fully involved structure fire.
05:55	• The FCB told responding units they had additional addresses. • Engine 14 arrived on-scene, reporting a 3-story, middle of the group row house, with fire showing on the second and third floors. Engine 14 officer assumed command. • Truck 23 arrived on-scene.
05:56	• BC 3 arrived on-scene. • Truck 10 arrived on-scene, went to Side Charlie, and reported fire showing on all three floors.
05:57	• Engine 14 began an interior fire attack through the front door on Side Alpha of the fire building. • BC 3 told the FCB he assumed IC and reported fire was showing from all three floors and upgraded the incident to a working fire. • Truck 10 reported fire extension to Bravo 1 and Delta 1.
05:58	• Engine 36 took a second hoseline off Engine 14 and requested to have the hoseline charged.
05:59	• The FCB dispatched a “working fire” assignment for Box 55-10 which included: Engine 30, Engine 13, Truck 8, Safety Officer 2, Medic 12, Fire Investigation Bureau (FIB), and Car 5.
06:00	• Engine 36 made a second request to have their hoseline charged. • BC 6 arrived and assumed the role of safety officer. • The lieutenant from Engine 36 told BC 3 (IC) face to face that the interior of the building was in poor structural condition and needed to be evacuated. • A complete collapse of the interior of the fire building and the roof occurred. IC ordered all units to “back out” and declared a mayday.
06:01	• IC said to FCB, “At this time we have at least two firefighters inside the building.” He ordered all units to discontinue radio traffic and activated the RIT.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Time (Hours)	Fireground Operations, Response, and Details
06:05	• Truck 8 reported to IC that they could see the trapped firefighters and was trying to get them out. There was fire around them and needed to get water on them. • IC told the FCB that RIT was bringing the firefighters out through Side Charlie. • IC assigned the Charlie division supervisor (BC 6) to take charge of the rescue.
06:06	• Truck 8 reported they had located trapped firefighters. There are possibly two inside. Truck 8 was attempting to access the building by breaching the wall between Bravo 1 and the fire building. • IC noted to the FCB that there were two firefighters from Engine 14 still inside the fire building.
06:07	• IC requested a 2nd alarm. • Car 5, a deputy chief and the shift commander, arrived on-scene.
06:08	• Car 5 requested the department's collapse unit. • Truck 8 reported they were in the Bravo 1 exposure and reported that the firefighters were trapped between the first and second floors, about 10-15 feet inside the front door.
06:09	• Truck 10 reported they had the "pipeman" from Engine 14. He was trapped by debris. Truck 10 was talking to him. Truck 10 requested spare SCBA cylinders on Side Charlie.
06:10	• Car 5 assumed command of the incident and assigned BC 3 as the Operations Section Chief and BC 6 as the safety officer.
06:11	• The FCB dispatched the 2nd Alarm: Engine 2, Engine 58, Truck 16, Battalion 2, and the public information officer. • Medic 4 and Medic 15 were dispatched by FCB per Command's request.
06:12	• Engine 23 RIT located the Engine 14 officer and was removing him from the building. • Engine 30 had contact with trapped firefighters and reported good progress getting them out.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Time (Hours)	Fireground Operations, Response, and Details
06:15	• Two medic units were requested to the front of building where two firefighters were being brought. • One trapped firefighter was reported to be rescued and the rescue team was working to rescue the other firefighter.
06:17	• IC requested FCB dispatch a full collapse response to include units from the Special Operations Command (SOC): Squad 26, Truck 6, and the Collapse Rescue Unit.
06:18	• IC requested FCB dispatch all remaining squad companies from SOC - Squad 40 and Squad 54.
06:19	• OEM1 (Office of Emergency Management Deputy Chief) arrived and was designated Rescue Branch Director (RBD). • Operations advised no unnecessary firefighters in the building due to the concern for a secondary collapse.
06:20	• Truck 10 reported they were still working on rescuing the trapped "pipeman" from Engine 14. • The RIT conducted a wall breach on the Bravo exposure level 1 to gain access to the trapped firefighters from a lower vantage point.
06:21	• The FCB asked IC if he wanted the Special Rescue Operations (SRO) Team activated.
06:22	• IC told the FCB there were enough SRO firefighters on-scene. • The collapse wagon, part of the department's collapse unit response, arrived on-scene.
06:24	• Command requested FCB dispatch an additional engine company and truck company.
06:25	• A collapse zone was established on Side Alpha of the building. • DC arrived. • FCB dispatched Engine 5 and Truck 25.
06:28	• Operations assigned the BC of EMS as the EMS Branch Director. • Medic units assigned to the EMS Branch were EMS 6, Medic 15, Medic 4, and Medic 12.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Time (Hours)	Fireground Operations, Response, and Details
06:30	• Truck 8 reported one of the trapped firefighters was "on air." Car 11 (Executive Assistant Chief) arrived.
06:32	• Rescue 1 requested a second RIT bag to the rear entrance of the fire building.
06:34	• The Rescue Branch Director (RBD) requested RIT bags be brought to the Bravo 1. • RBD also requested a company be sent to Delta exposure to determine if a breach was possible.
06:38	• Truck 16 said there was fire extension into Bravo 1.
06:41	• Car 5 Aide told Operations to alert companies to an upcoming PAR. • PAR initiated by Car 5 Aide.
06:43	• PAR request: Truck 23 • Truck 23 portable radios 3 and 4 respond with a transmission that was unintelligible.
06:48	• Car 5 Aide believed all companies were PAR, except Engine 14. • Car 5 Aide asked Truck 25 if they were PAR.
06:54	• Truck 10 asked how many firefighters from Engine 14 were still missing. • Truck 10 was with one firefighter of Engine 14 on the first floor.
06:55	• Safety 2 asked how many firefighters were unaccounted for. • Operations requested the total number of missing firefighters from Car 5 Aide. • Car 5 Aide indicated all 3 firefighters from Engine 14 were missing. • Operations said one firefighter from Engine 14 was brought out at the beginning of the rescue operation.
07:00	• Operations ordered all personnel away from front of the building. • SOC1 BC on-scene.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Time (Hours)	Fireground Operations, Response, and Details
07:03	• Engine 5 reported the facade and parapet wall of the fire building and Delta 1 were in bad condition.
07:39	• Rescue 1 said the Engine 14 "pipeman" had been removed from the building. • The other firefighter (acting-lieutenant) of Engine 14 was located but heavily trapped.
08:03	• SOC1 communicated an urgent message for all firefighters to back away from front of the fire building.
08:18	• IC told the FCB that four firefighters were trapped but three had been removed and one was still unaccounted for. • The fire building was evacuated and operations transitioned to recovery.
08:21	• Safety 2 ordered all firefighters out of the fire building except for the crew working in the doorway.
08:26	• Heavy equipment started to arrive on-scene to assist with the removal of the Truck 23 officer.
08:28	• Car 5 Aide ordered all second alarm companies to go back in service as soon as possible.
08:57	• All firefighters on the fireground met with the Chief of the Department.
09:15	• Operations announced and initiated a new incident action plan (IAP) for the recovery process.
09:43	• Operations requested FCB dispatch Tower 1 to the scene (non-emergency).
09:50	• Heavy equipment continued to arrive on-scene and was placed strategically around the fire building.
10:10	• Tower 1 located on Side Alpha in front of Delta exposure building.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Time (Hours)	Fireground Operations, Response, and Details
16:08	• IC told the FCB that the last trapped firefighter (Truck 23 lieutenant) was removed and placed the incident under control.

Personal Protective Equipment

All four firefighters trapped in the structural collapse had properly donned their appropriate turnout gear and SCBA. The turnout gear was not considered a contributing factor to the three fatalities and serious injury.

The fire department used NIOSH Approved® Drager PSS 7000 SCBAs, which were certified to the 2007 edition of NFPA 1981, *Standard for Open Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*. Damage to some of the SCBA was observed, however the damage was likely the result of the collapse. Data was downloaded and showed that all personal alert safety system (PASS) devices activated after the collapse. No further evaluation or testing of the SCBA units were conducted.

Weather Conditions

At 06:00 hours, on January 24, 2022, the weather conditions were mostly cloudy and remained consistent throughout the day. The temperature was 32 degrees Fahrenheit, relative humidity was 69%, winds were from the north northwest at 5 miles per hour with no reported wind gust. The barometric pressure was 29.71 inches. During the incident, the average temperature was 35 degrees Fahrenheit, with a high temperature of 41 degrees Fahrenheit and a low temperature of 29 degrees Fahrenheit [Weather Underground 2022].

Investigation

At 05:51 hours on January 24, 2022, the first of nine emergency calls were received by the fire department's FCB for this incident. The calls reported a building fire with a variety of descriptions of the building and fire conditions. One of the calls reported children in the building and several calls gave an incorrect address. A firefighter traveling home from his shift noticed the fire and contacted the FCB. The firefighter reported a fully involved structure fire with fire spreading to both exposures. The firefighter provided the correct address to the FCB. At 05:53 hours, the FCB dispatched an alarm assignment for Engine's 55, 14, 23, 36, 47, Truck 23, 10, Rescue 1, Medic 21, BC 6, and BC 3.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Engine 14 responded from quarters and approached from the west at 05:55. Although Engine 14 was assigned second due, Engine 14 arrived first and stopped at the hydrant on the corner near the fire building. An Engine 14 firefighter exited the apparatus and proceeded to lead off (the firefighter exits the apparatus at the hydrant and is responsible for connecting the 4-inch supply line to the hydrant). Engine 14 announced that they had arrived and were assuming first due engine company responsibilities. The officer of Engine 14, the acting lieutenant, provided the initial size-up of the building from the front seat of Engine 14 and assumed command. The pipe firefighter on Engine 14 exited the apparatus on the driver's side and proceeded to pull 250-feet of 1¾-inch from the cross-lay. Meanwhile, the acting lieutenant proceeded to the sidewalk to flake out the attack line and don their SCBA.

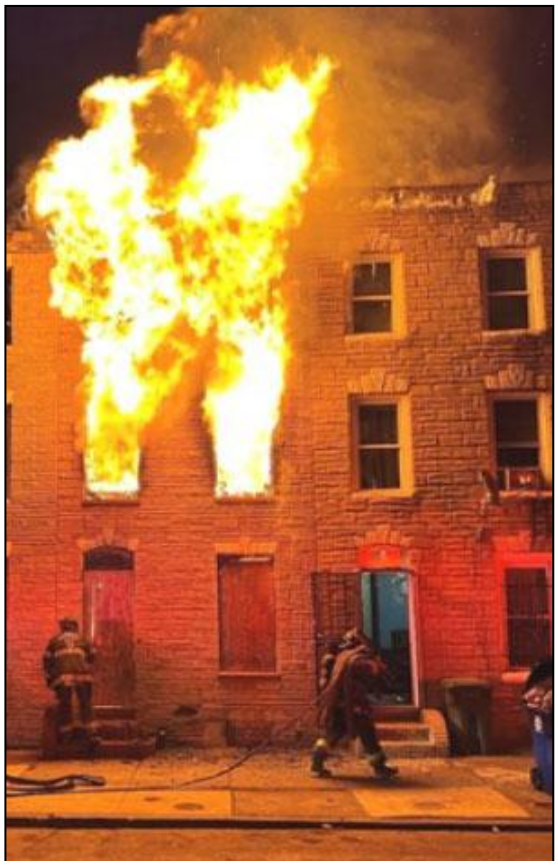

Photo 2. The pipe firefighter from Engine 14 stretching 250-feet of 1¾-inch and off-duty lieutenant cutting plywood off the front door. ***(Courtesy of the fire department)***

A firefighter, relieved from the night shift a few minutes prior to the dispatch of the alarm, responded on Engine 14 as an extra person riding in a jumpseat. He was not included in Engine 14's crew accountability. The lieutenant was wearing turnout gear, but no SCBA when he exited the apparatus. He did not have a portable radio. He proceeded to use Engine 14's portable saw to remove the plywood from the front door of the fire building (**see Photo 2**). After the plywood was removed from the front door, significant fire was showing from all three floors and Engine 14 proceeded with an interior attack.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Truck 23 arrived on-scene at 05:55 hours, positioning the apparatus in the street on Side Alpha. Truck 10 arrived on-scene at 05:56 hours and positioned on Side Charlie (**see Photo 3**). Truck 10 reported fire was showing on all three floors. The officer and pipe firefighter of Engine 14 entered the structure's front door initiating an interior attack. The lieutenant from Truck 23 entered the building following Engine 14 and proceeded to the right conducting a search. A third firefighter of Engine 14 entered the structure to assist his crew with advancing the attack line.

Photo 3. The fire conditions on Side Charlie upon arrival of Truck 10.
(Courtesy of the fire department)

At 05:56 hours, BC 3 arrived on-scene. BC 3 announced his arrival as the safety officer per the assigned dispatch position from FCB. He immediately acknowledged that the assigned IC was not on-scene. BC 3 assumed Command and reported the size-up as a 3-story, middle of the group, row house with fire showing from all three floors. IC requested FCB transmit a "working fire dispatch" for Box 55-10 at 05:57 hours. At 05:59 hours, FCB dispatched a "working fire" assignment. Units dispatched were Engine 30, Engine 13, Truck 8, Safety Officer 2, Medic 12, FIB, and Car 5.

Engine 36, the 4th assigned engine company, covered Engine 14's hydrant. Engine 36's crew retrieved a 250-foot 1¾-inch attack line off Engine 14. Engine 36 prepared to make entry through the Side Alpha front door, backing up Engine 14. Engine 36's officer requested their attack line be charged. The pump operator of Engine 14 was removing kinks in the supply line and wasn't at the pump panel causing a slight delay in charging Engine 36's hoseline. (**see Diagram 4**).

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

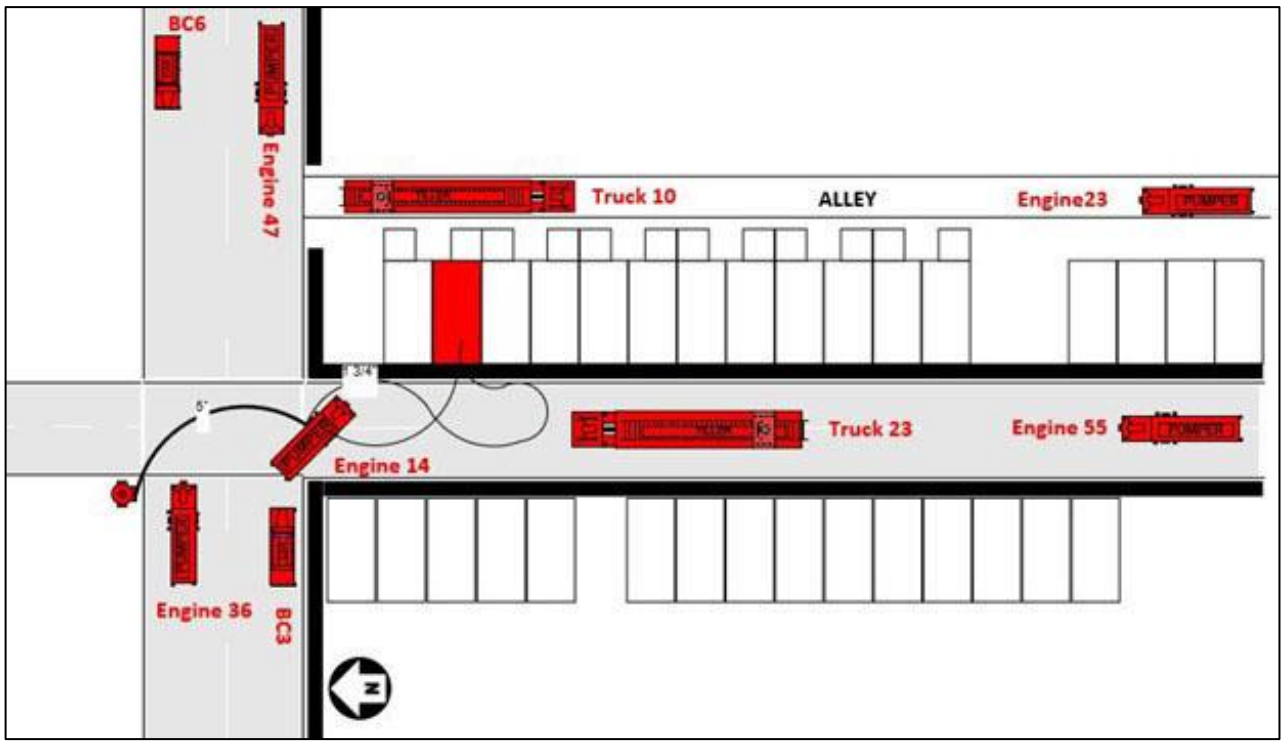

Diagram 4. The position of the apparatus on the 1st Alarm Assignment. (*Prepared by NIOSH*)

The crew of Engine 36 was positioned in the front doorway of the building, waiting for their hoseline to be charged. The delay allowed Engine 36's pipe firefighter time to observe the conditions of the interior of the structure. He became concerned about the deteriorated conditions of the building and relayed this information to his lieutenant. Due to the heavy radio traffic and their proximity to IC, Engine 36's lieutenant approached IC and made him of the deteriorated interior conditions. As the lieutenant was returning to his crew, all three interior floors and the roof collapsed. The time was approximately 06:00 hours.

IC immediately declared a Mayday and ordered all personnel to back out of the fire building. Engine 23 RIT entered the front door and were able to get two Engine 36 firefighters out of the building. At 06:01 hours, IC told FCB that there were at least two firefighters trapped in the structure. Engine 30 and Truck 8 arrived on-scene and proceeded to Bravo 1 to gain access to the trapped firefighters. The Engine 14 lead-off firefighter was located but trapped by large structural members and buried in debris. Truck 8 noted to the IC that a hoseline was knocking down the fire around the trapped firefighters. At 06:05 hours, IC assigned the Charlie Division Supervisor, BC 6, to take charge of the RIT. BC 6 arrived and was initially assigned Charlie Division Supervisor. Once the collapse occurred, IC reassigned BC 6 to RIT supervisor. Once the Shift Commander (Deputy) assumed command, BC 6 was erroneously reassigned to Safety.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

RIT operations were hampered by high heat, limited visibility, and an unstable structure. Simultaneously, crews were trying to knock down the fire as other crews tried to rescue trapped firefighters. Also, the fire was spreading to Bravo 1 and Delta 1 (exposures). At 06:07 hours, IC asked FCB to transmit a second alarm. Prior to his arrival, Car 5 requested the department's collapse unit be dispatched. Car 5 arrived on-scene at 06:08 hours.

At 06:09 hours, the officer of Truck 10 communicated to the IC that they found the Engine 14 pipe firefighter and were talking to him. Engine 14 pipe firefighter was trapped by debris. Truck 10 officer requested a RIT air cylinder, a stokes basket, and a saw to Side Charlie. At the same time, the extrication continued of the lead-off firefighter from Engine 14. The firefighter was trapped under debris, and the interior conditions were extremely dangerous and difficult to navigate. Firefighters working in Bravo managed to breach two areas through the brick party wall, which gave access to the trapped firefighters. At 06:10 hours, Car 5 assumed command and advised FCB that BC 3 was the Operations Section Chief and BC 6 was assigned as Safety. Safety 2 arrived on-scene and assigned himself as Safety.

As the rescue operations continued there was a coordinated deployment of hoselines and requests for an assortment of tools and equipment to assist in extricating the Engine 14 pipe firefighter. At 06:12 hours, the captain of Engine 23 RIT made a transmission stating, "We have Engine 14- Portable 4. We are removing him from the debris." This was the lead-off firefighter from Engine 14 who was located along the Side Bravo wall in the fire building, a short distance from the front doorway. He was conscious, with no helmet, facing the rear of the building. It was unknown if his facepiece and protective hood were still in place. The firefighters worked quickly, using only their gloved hands to free his arm and legs from the large pieces of burning debris. The RIT attempted to pull and drag him out of the rubble by any means possible but were unable to lift him. After several attempts, the Engine 14 lead-off firefighter was pulled free of the debris. At 06:14 hours, the officer of Engine 23 advised IC that Engine 14's lead-off firefighter was successfully removed through the front door (Side Alpha) of the fire building. He was then transported to a local shock trauma center by Medic 21.

At 06:17 hours, IC made a request to FCB to dispatch a full collapse assignment with all squad companies. FCB dispatched Squad 26, Truck 6, and the Collapse Rescue Unit. At 06:18 hours, there was a follow-up request from IC to have Squad 40 and Squad 54 added. As the incident management system was expanded, the OEM1 arrived and was designated RBD at 06:19 hours.

Once the lead-off firefighter from Engine 14 was removed from the building, rescue efforts focused on the Engine 14 pipe firefighter. He was heavily trapped by large amounts of debris. His upper body was quickly uncovered, however, his lower torso remained trapped by the debris from the collapse. The heat and smoke from the fire made interior operations more difficult. Crews operating hoselines were attempting to extinguish the active fire without further complicating the rescue efforts. Hose streams were striking firefighters and dislodging loose bricks from upper portions of the building. There was also concern about flooding void spaces that may be located lower in the pile. At 06:24 hours, the Operations Section Chief identified himself as IC and requested an additional engine company and truck company. At 06:25 hours, operations requested a collapse zone be set up on Side Alpha. At 06:25 hours, FCB dispatched Engine 5 and Truck 25 to respond.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Truck 10, Truck 8 and Rescue 1 were attempting to maintain continuous air supply to Engine 14 pipe firefighter. His air supply was being rapidly depleted. To sustain his air supply, rescuers used RIT bags and SCBA cylinders removed from other firefighters engaged in the rescue. The RBD identified that additional air supplies would be needed for this extended operation. At 06:30 hours, he requested another RIT bag be brought to Side Alpha. Available RIT bags were limited as only truck companies, squad companies, and Rescue 1 carried the RIT bags.

At 06:41 hours, the first PAR of the incident was conducted. The Car 5 Aide announced that all companies should standby for a PAR. Engine 55 reported that they were PAR. The PAR request for Engine 14 was interrupted by other radio transmissions. When Truck 23 PAR was requested, Truck 23 Portable 2 answered, and the message was inaudible. Radio records indicate that there was no response to the PAR by Truck 23 Portable 1, the officer of Truck 23. The PAR continued with numerous radio interruptions. At 06:48 hours, Car 5 aide completed the PAR. The duration of the PAR was 7+ minutes and did not accurately account for all firefighters operating on the scene. Firefighters from Truck 23, Truck 25, Engine 13, and the Collapse Rescue Unit were missed when the PAR was conducted.

Additionally, responding staff chiefs and several off-duty firefighters who were operating on-scene were not part of the PAR. Car 5 Aide identified that Truck 25 was not included in the initial PAR. He initiated contact and determined Truck 25 was PAR. No further PARs were conducted to track companies or firefighters during the incident. At 06:49 hours, the aide stated he believed he had PAR from all units except Engine 14. He thought all three firefighters of Engine 14 were missing, but Operations corrected him. One firefighter from Engine 14 was brought out during the initial rescue operations after the collapse.

At approximately 07:00 hours, a firefighter reported the officer of Truck 23 was not accounted. The firefighter asked if the officer was part of rescue. The officer of Truck 23 was not involved with the rescue and was identified as the fourth missing firefighter later in the incident.

At 07:17 hours, under the guidance of SOC, Truck 23 repositioned their aerial ladder over the center of the fire building. This allowed a Rescue 1 firefighter to lower a stokes basket using a life safety rope from Truck 23's aerial to the awaiting firefighters on the interior. Firefighters on the exterior had assembled a haul system with mechanical advantage using Truck 23's aerial ladder as a high directional. Using this process, Engine 14 pipe firefighter was freed and removed from the building (**see Photo 4**).

Photo 4. Truck 23 aerial ladder being used for the recovery of Engine 14 pipe firefighter.
(Courtesy of the fire department)

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

At 07:27 hours, the RBD took control of the fireground channel by ordering radio silence. This was required due to the challenge of coordinating the lifting operation without a direct line of sight. The lieutenant of Rescue 1 had to oversee the lifting operation from the interior of the fire building, as SOC1 had to direct the hauling operation from the exterior of the building. At 07:38 hours, Squad 26 reported that Engine 14 pipe firefighter has been extricated. At 07:39 hours, Rescue 1 reported that Engine 14 pipe firefighter had been removed from Side Alpha of the building. He was transported to a local shock trauma center and pronounced deceased.

Removing Engine 14 pipe firefighter from the building created access to the officer of Engine 14 (acting lieutenant) who was located partially beneath Engine 14 pipe. At approximately 07:40 hours, Rescue 1 reported that she was also heavily trapped. Firefighters started to dig through the debris by hand. Efforts to remove the Engine 14 officer were similar to those used to free Engine 14 pipe. Many of the firefighters dispatched on the 1st Alarm had been working for more than 90 minutes to remove the trapped firefighters. At 07:47 hours, several requests were made by the RBD to IC to relieve exhausted firefighters. Additional firefighters were sent to Side Charlie for relief. At 07:51 hours, the Rescue 1 lieutenant requested trench shovels to assist in the hand digging and clearing of debris around and off of Engine 14 officer. Firefighters worked for approximately 40 minutes to free the Engine 14 officer. The haul system with the high directional was used again to assist in lifting the Engine 14 officer from the debris pile. She was placed in a stokes basket and removed from the building on Side Charlie. At 08:18 hours, the IC reported that Engine 14 officer had been removed from the building. She was transported to local shock trauma center by Medic 4 and pronounced deceased. IC provided FCB with a status report on the incident. He reported that he had a 3-story brick building which was fully involved. A structural collapse occurred, and four firefighters were trapped. Three firefighters had been removed from the building. One firefighter was still unaccounted for at this time. The building was in the process of being evacuated and the operations were changed to recovery.

Beginning at approximately 10:50 hours, resources were used in the complete removal of the Side Alpha wall of the fire building and the chimney from Delta 1 Exposure. This process took approximately 60 – 90 minutes. Firefighters assisted with hooks in pulling down the final sections of the Side Alpha wall (**see Photo 5 and Photo 6**).

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Photo 5 (left) and Photo 6 (right). Tower 1 firefighters were using 8-foot and 10-foot hooks to remove large sections of the Side Alpha wall. Contractors had made cuts in the Side Alpha wall with a circular saw.
(Courtesy of the fire department)

An excavator was then used to pull back large pieces of debris from the first floor of the original fire building. At approximately 12:06 hours, SOC firefighters deployed a search camera into the void spaces located near the front door to locate the Truck 23 lieutenant. At approximately 14:06 hours, an excavator was used to remove the damaged cornice from Bravo 1 exposure roof. This was done to reduce the overhead hazard in anticipation of search operations resuming in the fire building. Shortly after 15:00 hours, IC allowed firefighters back into the fire building to recover the Truck 23 lieutenant.

At 15:14 hours, the Rescue 1 lieutenant reported they could hear a PASS alarm sounding. Firefighters removed the final layers of debris that trapped the Truck 23 lieutenant. Once completely freed, he was placed into a stokes basket and passed by firefighters to the exterior on Side Alpha. Truck 23 lieutenant was pronounced deceased and was transported to the state's Office of the Chief Medical Examiner by Medic 27. At 16:08 hours, the IC reported the last firefighter had been extricated and advised FCB the fire could be placed under control.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Fire Origin and Cause

The fire was classified as incendiary. The ATF made an arrest in an ongoing criminal investigation.

Contributing Factors

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

- SOPs/SOGs for fighting fires in abandoned, derelict structures.
- Training for firefighters, officers, and safety officers on SOPs and SOGs for fighting fires in row homes, with a focus on fire progression and structural collapse safety.
- Initial scene size-up and ongoing risk assessment by the first arriving resource.
- Resources committed to an offensive interior fire suppression operation with an incomplete risk-versus-gain analysis (offensive vs. defensive).
- Incident fire structure in a severe state of neglect, disrepair, with structural instability from a previous fire event.
- Arson

Cause of Death

At the time of this report, the local medical examiner's office did not yet specify the cause of death. The department reported that the three firefighters died after being exposed to products of combustion and building collapse.

Recommendations

Fire departments should:

Recommendation #1: Develop and implement SOPs for an identification/marking system for fighting fires in vacant/abandoned/derelict buildings as part of a comprehensive High-Risk Building program.

Discussion: The row house involved in this incident was an abandoned/derelict (high-risk) building. It had been abandoned for several years and had sustained extensive damage due to a previous fire, vandalism, and exposure to the elements. The significantly deteriorated condition of the building contributed to the rapid fire spread and subsequent early and violent structural collapse. High-risk buildings pose numerous hazards, and a significant number of fire departments have experienced line-of duty deaths while fighting fires in these structures. Fire departments are faced with difficult and

dangerous decisions on how to effectively fight fires in these structures. Consequently, a community risk assessment and evaluation process are necessary.

Fire service risk management principles are based on assuming greater risk to firefighters when there are lives to be saved and less risk when only property is at stake. Established risk management principles suggest using more caution when operating at an abandoned derelict structure. Additionally, an occupant survivability profile should be fully evaluated prior to committing to offensive operations.

Many fire departments have vacant/abandoned/derelict (high-risk) structures in their jurisdictions. While the terms vacant/abandoned/derelict (high-risk) seem to be used interchangeably across the fire service, it is important to understand the differences between vacant and high-risk buildings and the appropriate firefighting strategic and tactical operations that can be implemented.

To properly develop and implement a high-risk building management program, it is important to recognize that the occupant status and the building status be determined independently of one another. It is impossible to effectively communicate both statuses with a single term. For example, a structure may be vacant, which would typically indicate that it would not be occupied, however vacancy does not guarantee that it is unoccupied. The fire department should determine the occupant and building status as part of an effective risk/benefit analysis.

Not all occupant status and building status terms are clearly defined by NFPA, nor are they utilized uniformly across the fire service. Since these terms are not clearly defined, it is helpful for uniform terminology to be developed and used at a local level [NIOSH 2025].

Occupant Status Terminology – The fire service focuses on two components to determine the civilian life safety profile or status:

- If civilians are present in the structure and their situation (viability assessment)
- If civilians are present, their probability of survival and rescue given the conditions

Evaluating and determining the status of civilian life safety supports an effective risk benefit analysis. The outcome of a risk benefit analysis also drives the development of the IAP and determines if operations should be offensive, transitional, or defensive.

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: No, low, or high

As part of NIOSH's efforts to assist the fire service, four building structural status terms were developed [NIOSH 2025]:

- **Vacant:** A building that is not currently 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. Examples include structures that are actively for sale.

- **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 to medium value.
- **Derelict (also known as blighted or dilapidated):** The building has been abandoned for a long time and sustained substantial damage, such as significant openings in the floors, walls, or roof due to neglect or vandalism. Damage constitutes a significant hazardous condition that poses a high-risk to enter for an offensive strategy and should 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 (AHJ) and declared unsafe for human entry or occupation. These buildings should be demolished as soon as possible because they 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, would be assumed to be in a normal operational status. This building would have appreciable value, and the structure should not pose a significant risk.

Per NFPA 1550, *Standard for Emergency Responder Health and Safety,* in section 10.4 *Risk Management During Emergency Operations*, states "The IC shall determine the life safety profile of the incident and apply the most appropriate level of risk to first responders consistent with the principles in 10.4.2.1". 10.4.2.1 The standard discusses four principles of risk management to be used (consult NFPA 1550 for list of principles), which challenge the IC to address civilian life safety, firefighter life safety, and property conservation as part of a risk/benefit analysis.

The building and occupant status must also be continually evaluated, and conditions routinely found within abandoned, derelict, and condemned buildings can have negative impacts on firefighting operations and can increase the risk profile, include:

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

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

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.

A high-risk building management program can be implemented in three phases to reduce the risks posed in these buildings – discussed in more detail below. The first two phases are conducted proactively as an administrative function. Actions may involve working with strategic partners outside of the fire department such as the building inspection, code enforcement, and legal departments of the local authority having jurisdiction. The final phase is conducted reactively during an emergency response. All personnel that are part of an emergency response may play a role in Phase 3.

Phase 1 – Determination

Identification: Locate and evaluate potential hazardous buildings. This could be done by the fire department, building dept, fire marshal, etc. Personnel capable of doing this will vary based on the local resources and legal requirements (laws, ordinances, regulations, and statutes). A common challenge is legal access to the property, especially in the case of private and residential properties where the fire department does not have the legal authority to access the property outside of an emergency incident. Fire department personnel should work with the local AHJ to legally gain access to properties.

Evaluation: The individuals assigned to evaluate structures must have the necessary subject matter expertise to evaluate the condition of the buildings. That individual must be able to determine if a building has structural integrity defects or conditions that could warrant a formal condemned status. Fire department 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 and hazardous materials. If there are questions as to the structural integrity of a building, outside subject matter experts should be consulted as needed to ensure safe entry and evaluation of the building.

Designation: The status of a building must be designated upon completion of the evaluation. While the fire department can designate this 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 formally condemned so that it can be demolished and removed through the appropriate means.

The status of the building must be effectively communicated to all parties involved (property owner, building dept, fire marshal, fire department, dispatch center, etc.).

Phase 2 - Remediation

Demolition: For a condemned building, the best approach in accordance with risk management principles is to remove the hazard by demolishing the building. The majority of fire departments lack the necessary legal standing or resources needed to carry out the demolition of a building, so it is critical for them to form strategic partnerships with local AHJ.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Marking: Marking primarily benefits responding fire personnel including first due officers. Departments may have personnel knowledgeable about high-risk buildings in the area and recognize a particular building. However, there are times when the normally assigned first-due company is out on another response and the second or third-due apparatus arrive first. Marking buildings ensures that personnel responding, including officers who may be acting up in rank (as in this incident) recognize that a hazard exists. Many localities have dense urban areas (such as row houses) that contain numerous, high-risk buildings that are middle-of-the-block structures making visual identification difficult.

In this incident, there were many abandoned, previously burned row houses in the area where an initial assessment on Side A may not provide sufficient indicators of the dangers or damage from previous fires. In some of those cases, Side C is clearly a high-risk structure. However, with a middle of the block row house, a visual on Side C may be delayed due to access. A building marking system can aid the arriving fire personnel in their size-up by bringing risk assessment to the forefront of the officer's mind, especially when there may be a need to initiate a defensive posture (with no life hazards known or possible).

Several departments/communities have developed their own marking systems. Each locality should understand the importance of marking their high-risk buildings, what resources may be available, and how community participation may be included.

The IAAI/USFA Abandoned Building Project proposed a 2-foot by 2-foot box with a diagonal line to indicate the condition of the building (**see Image 1**). A red box with no lines could indicate that the structure may be vacant, but no hazards are known to exist. One diagonal line could indicate a previous fire, or significant hazards exist, and extreme caution should be used. Another diagonal line forming an X could indicate multiple fires, and/or conditions exist that would indicate no entry advised. The box would commonly be located on Side A and ideally above street level height (to discourage graffiti or vandalism). Some departments further add a circle over the box if the roof is open from a previous fire or dilapidation.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

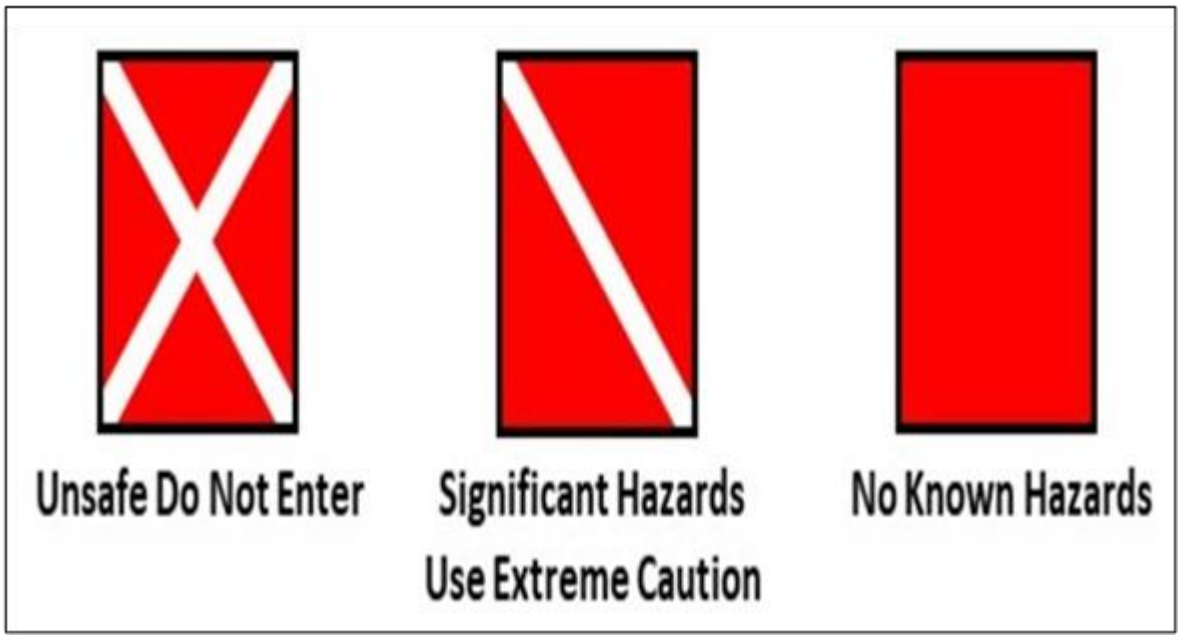

Image 1. IAAI/USFA high-risk building marking system.
(Courtesy of USFA)

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

Alternatively, 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 (**see Image 2**).

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

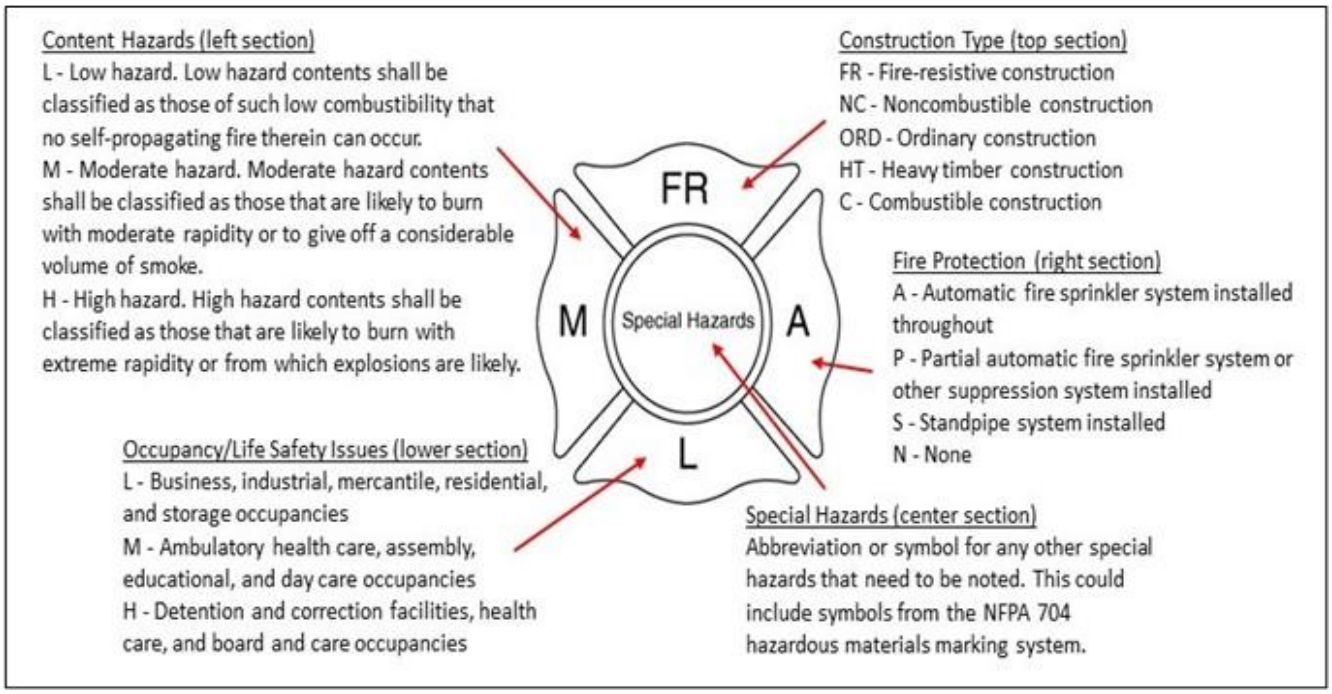

Image 2. IFC/NFPA high-risk building marking system.
(Courtesy of NFPA)

Marking buildings can have a significant benefit in remediation, but there can be challenges to implementing this action. There can be concerns over the negative stigma attached to these markings when they are concentrated in an area or neighborhood.

Fire departments should communicate with local organizations to explain the lifesaving benefits of implementing a marking system. Organizations may be opposed to the use of words such as unsafe, condemned, dangerous or abandoned. Showing these organizations examples of a box sign with an X or a slash through it and noting it would be located above the first floor, may alleviate concerns since the signs/markings will mainly be understood by fire department members and the location will be less prone to graffiti or defacing.

Securing: Preventing unauthorized individuals from entering a building can reduce the risk of a fire igniting. Securing the building can include both physical barriers to deny access and partnering with local building officials, codes and law enforcement agencies, or private security/insurance agencies, to identify and prevent unauthorized access. Fire departments must consider that securing a building can have negative consequences if the fire department needs to enter the building. As such, the fire department should know how to access and remove any security features that have been put in place.

Phase 3 - Emergency Response

Responding fires in a high-risk building poses a significant risk to firefighters beyond the hazards of the fire itself. It is essential to recognize, communicate, and integrate both the occupant and building

status as part of a risk/benefit analysis at these incidents. Utilizing a high-risk building management program provides a means to eliminate, reduce, or manage risks through both proactive and fire ground operations and actions.

Recognition: Through various means available (dispatch information, computer aided dispatch notes, building markings, and/or effective situational awareness), responding personnel must have the ability to proactively recognize the status of a hazardous building as soon as possible. A multilayered system with repetitive information provides back-up if one layer fails. For example, if a building marker is missing, but the information is relayed at dispatch from a computer aided dispatch note, the responders will still be aware of the hazardous building's status.

Risk Management: One of the primary reasons for building marking systems is the ability for the first arriving officer to recognize and react. The first arriving officer may not be from the specific area or may not remember fighting a previous fire in the structure (as was the case in this incident as well).

The International Association of Arson Investigators (IAAI) and the USFA partnered to develop "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" [USFA 2023] (**see Appendix B**).

Another valuable resource is the International Property Maintenance Code. The benefit of the code as stated in section [A] 101.3 Purpose, "This code is to establish minimum requirements to provide a reasonable level of health, safety, property protection, and general welfare insofar as they are affected by the continued occupancy and maintenance of structures and premises. Existing structures and premises that do not comply with these provisions shall be altered or repaired to provide a reasonable minimum level of health, safety, and general welfare as required herein" [ICC 2022].

Recommendation #2: Provide comprehensive training for firefighters, officers, and safety officers on SOPs and SOGs for fighting fires and understanding fire development in row houses, while also incorporating structural collapse principles into fire ground incident management.

Discussion: In this incident, the shift safety officer was not dispatched until the working fire dispatch. Battalion Chief 6 was initially assigned as the safety officer. There was confusion about the role of the safety officer when Safety Officer 2 arrived on-scene based upon command's assignments. Firefighting personnel should understand and recognize the unique challenges of row houses when predicting fire development and growth. When fighting fires in row houses, there are multiple features that present numerous challenges for fire departments. Row houses are a common and often iconic housing style in many large cities but are also present in small towns. The characteristics of row houses that make them unique also pose a challenge to fighting fires. Training in established procedures for fighting fires in row houses will enhance knowledge and skills related to size-up, risk assessment, and strategy for all levels of firefighters. This can also prevent fighting fires with a single strategy focus (i.e. we have always used an offensive attack in this type of situation because we have done so successfully for so long). A sample SOP can be found in **Appendix C**.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Many fire departments have multi-family housing in different styles in their jurisdiction. Many of the general firefighting considerations in multi-family occupancies can be applied to fire development and growth in townhomes, condominiums, and other urban dwelling types. However, there are also considerations and procedures specific to row homes that need to be reviewed and trained on to reinforce understanding [see NIOSH 2020]. Fire departments should conduct a community risk assessment to understand unique features of row houses within their jurisdiction. In cities that have seen a growth in revitalization of their row houses, the modernization efforts may involve refacing the exterior and creating a floor plan that is different than traditional row home construction.

In Chapter 12, *Fire Specific Tactical Considerations* of NFPA 1700, *Guide for Structural Fire Fighting*, specific tactical considerations are provided based on the building construction, building design features, and occupancy types. The initial considerations for multifamily dwellings, such as row houses should include Size-up, Rescue, Evacuation, Water supply, and Laddering [NFPA 1700 2021].

The NIOSH, in collaboration with several partners, developed a factsheet and poster (*Row House Firefighting Tactics*) that fire departments can use in training to reduce and eliminate the risk of firefighter injury and death. They also developed a training video (*Challenges and Tactics for Fighting Row House Fires*) which highlights the tactics to be used when fighting row house fires. The video alerts firefighters to the potential for fire extension based on row houses features [NIOSH 2023]. The publications and video are based upon six tactics to keep firefighters safe during firefighting operations [NIOSH 2022]:

- If interior unit, size-up Sides Alpha and Charlie; locate fire and extent; send resources to Side Charlie
- Hoseline deployment:
  - Fight fire on the level of the fire (exterior attack may be most effective initially)
  - Through a basement window or door
  - On Side Charlie through alley or adjoining house
  - Have a backup hoseline ready
  - Use cellar nozzle to get water into below grade areas
  - Use piercing nozzle to get water into void spaces
- Coordinate ventilation with fire attack
- Send resources inside to Exposure Bravo and Delta
- Send resources and charged hoseline to attic or cockloft to check for extension
- Position ground ladders to all upper floor windows; use caution around utility

The incident safety officer (ISO) can provide a fire department with a higher level of expertise to perform the necessary incident scene functions and assist the IC with fireground safety. Some ICs believe that any fire officer should be able to fill the fire department ISO function at any time under any circumstance, and therefore believe their agency does not need a predesignated ISO. Just as ICs have various levels of knowledge and expertise, so do other fire officers. Likewise, the requirements necessary to be a fire officer may change from department to department, a problem if mutual aid situations arise. Additionally, the emphasis placed on safety may vary from one IC to another. Fire

department ISOs should be trained in how to assist the IC and other officers in fireground operations (not tactics) [Dodson 1999; Sullivan 2012; NIOSH 2013].

ISO's who can function effectively on the fireground with the necessary knowledge, skills, abilities, and experience are extremely valuable resources. While a fire department may use appointed officer(s) as an ISO, they may be delayed in recognizing a hazardous situation or operation. This can be overcome by increased training of all individuals who may be appointed as an ISO, ensuring they have clear understanding of responsibilities and expectations [NIOSH 2013].

Understanding a building's design and structural anatomy, construction methods and materials, and vulnerabilities under fireground conditions directly correlates to safer firefighting operations and improved fire-fighter survivability [NIOSH 2013]. Knowledge of building construction is critical to help ISOs recognize the potential for structural collapse. During the growth stage, the fire consumes combustible structural members. During the decay stage and post-suppression activities, the structure becomes further weakened due to the state of the remaining structural members and the buildup of water. Additionally, the contents of a building, such as furniture or machinery, also contribute to the potential for structural collapse by [IFSTA 2015]:

- Adding fuel load in the structure and generating higher temperatures that weaken structure components.
- Adding weight to the weakened structural members.
- Retaining water which increased weight of contents and applies more stress on the structural members.

ISOs should be trained to recognize these hazards and their potential to contribute to a structural collapse. When incorporated into fireground incident management, the ISO should be able to forecast or reasonably predict a collapse when evaluating the incident. Specifically, the ISO can forecast this potential when evaluating building construction, building contents and fire load, and burn time. Whenever a collapse is forecasted, all interior operations should be halted, and all firefighters removed from the structure immediately. The ISO should communicate forecasted predictions as hazard identification to the IC, allowing time for changes in strategy to be considered and implemented [IFSTA 2015]. When the structure is visibly unstable, a collapse zone should be established. A collapse zone equal to one and a half times the height of the building should be established at minimum. This perimeter size keeps firefighters and other personnel out of imminent danger from the collapse. Whenever a collapse zone is established, the IC should communicate a "no re-entry" strategy until otherwise directed [NIOSH 2008a].

Recommendation #3: Ensure the first arriving resource completes an initial scene size-up and risk assessment and reassesses as fire conditions progress.

Discussion: In this incident, the officer of Engine 14 gave an initial size-up that stated, "I have a middle of the group with fire showing on the 2nd and 3rd floors" at 05:55 hours. The Engine 14 officer assumed command and prepared for an interior attack. Truck 10 responded to the rear of the structure (Side C) and reported fire was showing on all three floors at 05:57 hours.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Battalion 3 arrived at 05:57 hours, assumed command and requested FCB make this a working fire. Engine 14, Engine 36, and Truck 23 entered the first floor of the fire building. The structural collapse in the fire building occurred at approximately 06:00 hours.

One of the most important duties of the first officer on the scene is to conduct an initial size-up and risk assessment. This information lays the foundation for the entire operation. A risk assessment can help determine whether a strategy should be offensive or defensive and help with the tactics development (IAP) to achieve the desired objective(s). Some of the primary considerations in conducting a size-up and risk assessment include fire department assets, life hazard, fire development (and forecasting), time of day, building type/occupancy, and building condition.

Size-up begins when the alarm is received, and it continues through fire control (incident stabilization). Continuous size-up and risk assessment should occur through the transitions to overhaul and incident de-escalation and release of resources. The size-up should include an evaluation of factors such as the fire size and location, length of time the fire has been burning, conditions on arrival, occupancy, fuel load and presence of combustible or hazardous materials, exposures, time of day, and weather conditions. Information on the structure itself including size, construction type, age, condition (evidence of deterioration, weathering, etc.), evidence of renovations, lightweight construction, loads on roof and walls (air conditioning units, ventilation ductwork, utility entrances, etc.), and available pre-plan information can affect whether an offensive or defensive strategy is employed [NIOSH 2008b].

The strategy and tactics of an incident are driven by the initial size-up, risk assessment, and initial situational report made by the first arriving officer. A priority should be to get fire department resources to Side C as quickly as possible. The 360-degree survey is essential to determine the possible location of occupants, fire dynamics, and firefighter safety information [NFPA 1700 2021]. Until the 360-degree assessment is completed, ICs should be cautious in committing fire crews.

NFPA 1700, *Guide for Structural Fire Fighting* discusses in Chapter 9 – *Strategic Considerations* provides information to help make strategic decisions based on the evaluation of overall conditions upon arrival. In Paragraph 9.5.2 there are several arrival factors that should be considered including building height, size, stability as well as fire location, size, and extent [NFPA 1700 2021]. Refer to NFPA 1700, Chapter 9 for more information about IC decisions during fire progression.

Further, a sound risk management plan ensures that risks are evaluated and matched with appropriate actions and conditions. In Paragraph 10.4.2 of NFPA 1550, *Standard for Emergency Responder Health and Safety*, the IC shall determine the life safety profile of the incident and apply the most appropriate level of risk to first responders consistent with the principles in 10.4.2.1. Paragraph 10.4.2.1 states: The concept of risk management shall be utilized based on the following principles [NFPA 1550 2024]:

- Activities that present a significant risk to the safety of members shall be limited to situations where there is a potential to save endangered lives
- Activities that are routinely employed to protect property shall be recognized as inherent risks to the safety of members, and actions shall be taken to reduce or avoid these risks

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

- No risk to the safety of members shall be acceptable when there is no possibility to save lives or property
- In situations where the risk to fire department members is excessive, activities shall be limited to defensive operations

ICs must follow the decision-making model that includes identifying incident critical factors (through a situational evaluation or size-up), considering the standard risk management plan, declaring the strategy (offensive or defensive), and then setting tactical objectives. This model will lead to the development of an IAP. The IAP defines where and when resources are assigned (location) throughout the incident, along with tasks and objectives [NFPA 1550 2024].

When significant fire conditions are present on all floors and areas, and there is no possibility to save lives, a defensive strategy should be considered. This defensive strategy may be different from the first arriving officer's initial risk assessment and strategy and this change of strategy needs to be communicated to all as well as a new IAP supporting the new strategy and tactics. A defensive situation is where the incident problem has evolved to the point that lives and property are no longer savable and offensive tactics are no longer effective or safe. The defensive strategy is based on protecting firefighters.

Defensive incident action planning and corresponding completion benchmarks are [SKCFTC 2023]:

- Identify critical fireground factors
- Determine if additional resources are needed quickly
- Evaluate fire spread/write-off lost property
- Search exposures
- Protect exposures
- Prioritize fire streams, provide big, well placed master streams
- Surround and drown

If defensive operations are conducted from the onset of the incident, the involved structure(s) will not have a primary search. During defensive operations, command will coordinate the rotation of crews for rest and rehydration.

Recommendation #4: Consider exterior fire control (defensive strategy) when the initial size-up reveals heavy fire conditions indicating risk of collapse.

Discussion: During this incident, the initial fire attack crews entered the structure with fire showing on all three floors. While attempting to knock down the fire on the first floor, the structural collapse occurred, trapping four firefighters.

In a strictly defensive operation, the first arriving officer (initial IC) should make a reasonable determination of what the fire will consume and where it can be stopped. Command should acknowledge that if the fire has significantly strengthened, some or all of the building may be lost. This determination should be based on the fire department's capability to extinguish the fire without

placing firefighters in unnecessary risk. Conducting a thorough scene size-up and deploying effective tactics on what can be saved and where the fire can be stopped minimizes losses. Fire officers and firefighters need to understand how to effectively use water to knock fire from the exterior when appropriate [Smith 2021].

A decision for a defensive strategy is based on the incident's hazards outweighing the ability to safely operate inside the structure [NFPA 1700 2021]. NFPA 1700, *Guide for Structural Fire Fighting on Multifamily Dwelling Units* states exposure protection and early fire knockdown should be a tactical priority because:

- Exterior fire communication can occur through interior ceiling openings, and auto exposure through eaves and soffit vents can result in fire spread to the attic
- Common attic areas can facilitate horizontal fire spread [NFPA 1700; UL FSRI 2022]

For departments looking to implement or refresh on effective interior and exterior fire control methods, training in appropriate hose stream mechanics can be found at https://fsri.org/programs/hose-stream-mechanics.

The IC, with the help of the ISO(s), should define, establish, and enforce collapse areas. Once in place, the IC must clearly communicate where the collapse area(s) is/are to all firefighters operating on the fireground. The IC, division/group supervisors, and company officers should ensure firefighters do not enter the collapse areas. Prevention measures for deviance from the strategy need to include communication with everyone on the fireground, including the dispatcher and other responding units.

Clear announcement of the strategy is crucial as it helps all responders understand the IC's goal (control the spread from the outside). If a rescue mode is chosen to search for civilians based on the survivability profile, then the IC (which could be the first arriving resource officer), should announce the actions being taken to make a rescue or support a search.

Governing municipalities (federal, state, regional/county, and local) should:

Recommendation #5: Collaborate with fire departments to develop and implement strategies for the identification and remediation (demolition) of condemned High-Risk buildings.

Discussion: The best way to prevent vacant (high-risk) building fires is to reduce or eliminate vacant (high-risk) buildings. According to the NFPA, fires in vacant buildings are of increasing concern [NFPA 2009].

The National Vacant Properties Campaign describes several strategies to address the problem of vacant properties and provides examples of how these strategies have been used. Strategies include [National Vacant Properties Campaign 2024]:

- Vacant property registration ordinances that provide contact information and may generate fees to cover municipal cost associated with these properties
- Land banks for property seized for nonpayment of taxes
- Rental and point-of-sale inspection ordinances that ensure the property has been maintained when the occupants change
- Rehabilitation programs for owner-occupied housing and home repair programs
- Homeownership and landlord training programs
- Foreclosure prevention
- Information systems capturing data about individual properties and neighborhoods that allow developing problems to be identified, tracked, and addressed
- Code enforcement that is typically complaint-driven but may be institutionalized
- Vacant property coordinators who interact with owners and municipal departments, emphasizing compliance more than enforcement
- Property maintenance codes related to occupied housing that reduce the likelihood a property will fall into serious disrepair and abandonment
- Nuisance abatement authority that allows municipalities to address threats to the general public, typically, through administrative hearings rather than courts
- Receivership, which is legal action that places property in dispute under the control of an independent person

Post-Incident Fire Department Prevention Actions

After this incident, the fire department implemented changes to fireground operations. These changes were based on the department's internal assessment of the incident.

- **Internal Post Incident Analysis**
  The fire department initiated a Board of Inquiry to investigate this incident. This effort required extensive research and review. The data and evidence collected was used to create findings and recommendations that are shared in the main body of this investigation report. The link below is for the Board of Inquiry's final report.
- **SOP/SOG for Abandoned Derelict Structures**
  In this incident, the department did not have an SOP/SOG for fighting fires in abandoned, derelict structures. As part of the department's post-incident prevention actions, an interim manual of procedures regarding firefighting operations in abandoned, derelict structures is being developed.

References

Brunacini AV [2002]. Fire command. Quincy, MA: National Fire Protection Association.

Brunacini AV and Brunacini N [2004]. Command safety. Phoenix, AZ: Across the Street Publications.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Dodson D [2021]. Fire department incident safety officer, 3rd Ed. Burlington, MA: Jones & Bartlett Learning.

IAAI/USFA [2006]. Abandoned Building Project: managing vacant and abandoned properties in your community. Crofton, MD: International Association of Arson Investigators, Inc. Emmitsburg, MD: U.S. Fire Administration.

IFSTA [2015]. Fire and emergency services safety officer. 2nd ed. Stillwater, OK: International Fire Service Training Association.

IAAI [2018]. IAAI field manual evaluation of vacant and abandoned properties. Forest Hill, MD: International Association of Arson Investigators.

ICC [2022]. 2021 International property maintenance code. Washington, DC: International Code Council.

International Fire Code [2020]. Appendix J building information sign. Washington, DC: International Fire Code.

National Vacant Properties Campaign [n.d.]. Strategies and technical tools. Date accessed: July 7, 2024.

Naum C [2015]. What happens when they burn?. Firehouse Magazine.

Naum [2024]. Insights on Building Performance During Fire Operations: Residential Row House Fire & Collapse on January 24, 2022. Analysis Report for NIOSH Fire Fighter Investigation and Prevention Program Investigation Report F2022-01 MD. Christopher J. Naum, SFPE, CUSA, Subject Matter Expert. Syracuse, New York. March 12, 2024.

NFPA [2020]. NFPA 1021, Standard for fire officer professional qualifications. Quincy, MA. National Fire Protection Association.

NFPA [2020]. NFPA 1407, Standard for training fire service rapid intervention crews. Quincy, MA. National Fire Protection Association.

NFPA [2008]. NFPA 1561, Standard on emergency services incident management system. Quincy, MA: National Fire Protection Association.

NFPA [2009]. Vacant building fires. By Ahrens M. Quincy, MA: National Fire Protection Association.

NFPA [2013]. 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.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

NFPA [2021]. NFPA 220, Standard on types of building construction. Quincy, MA: National Fire Protection Association.

NFPA [2021]. NFPA 1700, Guide for structural fire fighting. Quincy, MA: National Fire Protection Association.

NFPA]2024]. NFPA 1026, Standard for incident management personnel professional qualifications. Quincy, MA: National Fire Protection Association.

NFPA [2024]. NFPA 1550, Standard for emergency responder health and safety. Quincy, MA: National Fire Protection Association.

NIOSH [2008a]. Career fire fighter dies when trapped by collapsed canopy during a two alarm attached garage fire – Pennsylvania. By Koedam R, Merinar T, and Kovacevic L. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2007-08.

NIOSH [2008b]. Volunteer fire chief killed when buried by brick parapet wall collapse – Texas. By Merinar T. and 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, Fatality Assessment and Control Evaluation (FACE) Report, F2008-21.

NIOSH [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., Bowyer M., Merinar T., Tarley J., and 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, F2012-13.

NIOSH [2020]. Career captain and career firefighter die after running out of air during a search in a public library – California. By Miles, S., Bowyer M., and Funke J. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, F2020-10.

NIOSH [2023]. Challenges and tactics for fighting row house fires. By Webb S, Marsh S, Loflin M, and Hales T. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2023-101.

NIOSH [2025]. Career firefighter dies in a structural collapse while conducting fire attack in a derelict single-family dwelling – Missouri. By Richardson M. and 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, F2022-04.

NIST [2013]. Report on high-rise fireground field experiments, fire fighter safety and deployment study. By Averill JD, Moore-Merrell L, Ranellone RT, Weinschenk CG, Taylor N, Goldstein R,

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Santos R, Wissoker D, Notarianni K, and Butler KM. Gaithersburg, MD: National Institute of Standards and Technology.

SKCFTC [2023]. Command procedures: structure fires. Kent, WA: South King County Fire Training Consortium.

Sullivan J [2012]. ISO's role when transitioning from an offensive to a defensive attack. FireRescue.

UL FSRI [2022]. Analysis of a near miss in a garden apartment fire – Georgia 2022. Columbia, MD: Underwriters Laboratories, Fire Safety Research Institute.

USFA [2023]. Reducing arson at vacant and abandoned buildings. Emmittsburg, MD: U.S. Fire Administration.

Weather Underground [2022]. Weather history. Atlanta, GA: The Weather Underground. Date accessed: July 09, 2024.

Zevotek, R [2022]. Firefighter safety building marking systems. Quincy, MA: National Fire Protection Association.

Investigator Information

This incident was investigated by Stephen T. Miles (former), Investigator, Matt Bowyer (former) General Engineer, and Murrey E. Loflin, Investigator, with the Fire Fighter Fatality Investigation and Prevention Program, Division of Safety Research, Surveillance and Field Investigations Branch, NIOSH located in Morgantown, WV. This report was written by Jeff Funke, Team Lead, Dr. Wesley R. Attwood, Investigator and Program Advisor, and Dr. Emily J. Haas, Associate Director for Science, with the Fire Fighter Fatality Investigation and Prevention Program, Division of Safety Research, Surveillance and Field Investigations Branch, NIOSH. A subject matter expert review was provided by Jeffrey Tomovcsik, Fire Chief, McKeesport Fire Department, Pennsylvania.

Additional Information

NFPA 1700, Guide for Structural Fire Fighting (2021 edition)
NFPA 1700, *Guide for Structural Fire Fighting*, 2021 edition, is the first NFPA document connecting fire dynamics research and its application to strategy, tactics, and best practices for firefighters in controlling fires within a structure.

Challenges and Tactics for Fighting Row House Fires
This training video highlights tactics that firefighters should follow when fighting row house fires and makes them aware of the potential for fire extension based on features specific to row houses. This video was developed by the NIOSH Fire Fighter Fatality Investigation and Prevention Program.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Row House Firefighting Tactics
The Row House Firefighting Tactics fact sheet highlights tactics, areas for potential fire extension, and typical features of row houses.

Partnering to Reduce the Risk to Firefighters Responding to High-risk Buildings
This NIOSH Science Blog discusses strategic partnerships fire departments and authorities having jurisdiction can develop to create solutions to large community safety issues such as abandoned or condemned structures.

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. *NIOSH Approved is a certification mark of the U.S. Department of Health and Human Services (HHS) registered in the United States and several international jurisdictions*.

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Appendix A

(Courtesy of Buildingsonfire.com - C.J. Naum)

Building Construction

The structure involved in this incident was an abandoned, derelict row house that had sustained significant damage from two previous fires in 2015 and 2016, including a partial floor collapse and other undocumented structural damage.

The row house had not been occupied since 2008 and had fallen into a severe state of neglect and disrepair. The city's Housing Department, Code Enforcement conducted an inspection in 2010, and declared the building unfit for habitation due to deteriorated building conditions. The row house shared a wall, Side Bravo, with a three-story abandoned, derelict row house (also previously burned) and a three-story occupied row house located on Side Delta (**see Photo 7 and Photo 8**).

There were ten occupied row house units present along the row separated by a double open-area lot, followed by three additional attached occupied row house units along this side of the street. There were 12 attached row houses that spanned the city block on the east side of the street. This arrangement is consistent with the original design and construction of the neighborhood and streets between 1880 - 1890. Similar row houses were present across the street (west side of the street) from the residence. Additionally, row houses were located on Side Charlie (rear) the structure along the adjacent city street [Naum 2024] (**see Photo 7**).

At the time of construction, the row house would have been classified as Ordinary Construction likely aligning with the recommendation from developing National Building Codes as recommended by the National Board of Fire Underwriters (1900-1915). This construction aligns with current Type III-building classifications consistent with NFPA 220, Standard on Types of Building Construction [NFPA 220 2021]. The fire building was a three-story, masonry brick structure, built and classified as a single-family residential row house. It was constructed and designed in accordance with the city's row house design [Naum 2024].

Type III, ordinary construction (also referred to as "Brick and Joist" construction) generally refers to a construction system that incorporates masonry perimeter wall construction with both fully supporting masonry bearing and non-bearing wall characteristics, fully dimensioned timber wood construction for structural supporting floor joists, roof rafters, and assemblies. Interior wood framing for wall and room partitions and compartmentation with plaster and lath. Floors are tongue and grove wood planking attached to floor joists spanning between masonry walls. Masonry construction was commonly not reinforced. It is common to have lower floors with higher floor-to-floor heights than upper floors with typical floor joist spans. The width of row houses range in 12 feet to 15 feet with some having maximum unsupported mid-point spans ranging 20 to 25 feet [Naum 2024].

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

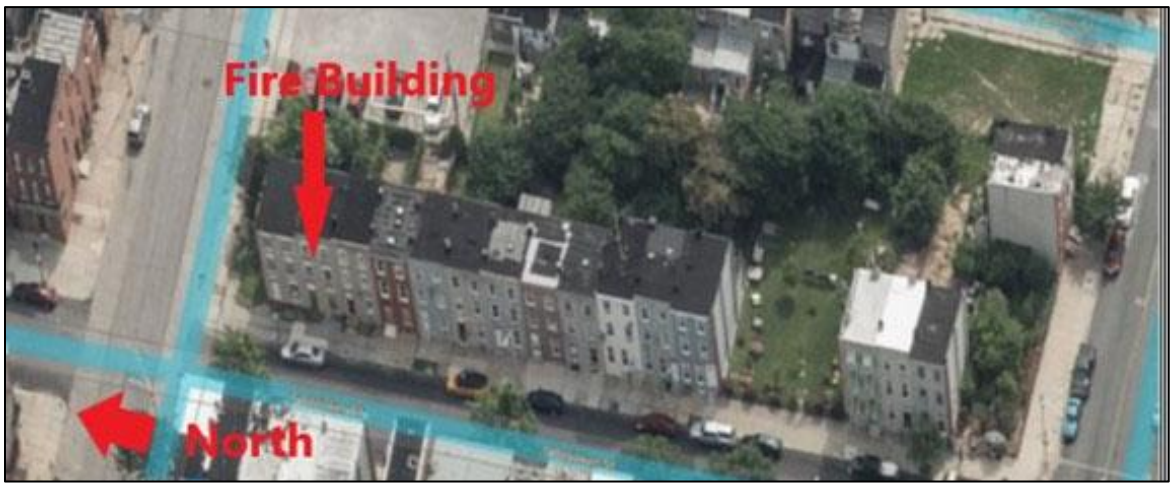

Photo 7. The site plan from an aerial view of the fire building and exposures Circa 2019.
(Courtesy of Google Earth)

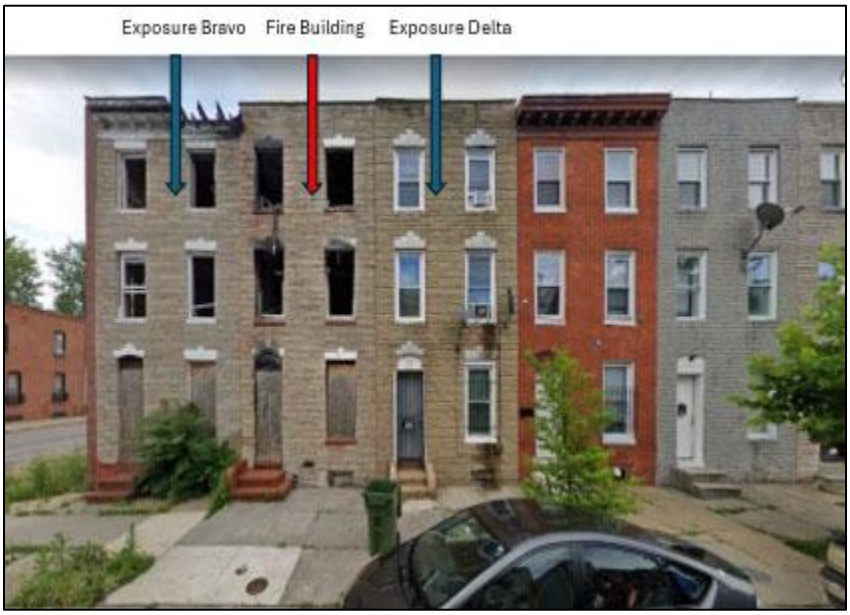

Photo 8. Pre-fire incident photo from 2019 -abandoned, derelict, previously burned structure (red arrow), Bravo exposure (blue arrow). Delta exposure (second blue arrow) was occupied at the time of the photo and during this fire incident.
(Courtesy of Google Earth)

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Fire Building Anatomy and Profile

- Constructed: approximately 1890
- Building Type: Row house
- Occupancy: Single-family
- Occupancy Status: Abandoned, derelict building
- Condition: Deteriorated, damaged, structural compromised, uninhabitable
- Severity of Risk - Critical; may cause severe personal injury, possible death, major property loss or significant degraded conditions
- Construction System: Ordinary Construction
  - Masonry Perimeter Walls: Party Walls; Unreinforced Masonry Brick, Single-Wythe Infill: Front & Rear Unreinforced Masonry Brick (URM), parging and Formstone® treatment Façade. Formstone® was meant to be a maintenance-free alternative to the low-quality brick used in the construction of many early row houses. The brand Formstone® was patented by Baltimorean L. Albert Knight in 1937.
  - Wood Floor Joists: Full dimensioned 3-inch x 8-inch (3 in. x 7.5 in.) was southern yellow pine. Floor joists were double pocketed into the masonry party walls (both sides of party wall-occupancy shared; not off-set) beveled (angled) end-cuts to the joists (typical "Fireman's Cut" reference) Circa 1887 & 1892.
  - Stairwell Area: Single Run Center Core - Enclosed. Basement to 3rd Floor with roof scuttle in stairway.
  - Flooring: Interior flooring; primarily of vinyl, linoleum, or asbestos tile; or carpet over luan plywood underlayment on wooden tongue-and-groove decking. Some areas had a second installation of tile and luan plywood over the original assembly. The finishing on the interior flooring consisted primarily of vinyl, linoleum, or asbestos tile; or carpet over luan plywood underlayment on wooden tongue-and-groove decking. *Luan plywood is often used as an underlayment for vinyl flooring. It is also used as a base for carpet, ceramic tile, and hardwood floors*). Some areas had a second installation of tile and luan plywood over the original assembly.
- Size: Three (3) Stories, with a full basement
  - Height: Curb line to Cornice- approx. 29-feet
- Floor Area:
  - Total Floor Area: 1,570 Square feet (estimate)
  - The interior of the structure was approximately thirteen feet six inches (13'-06") wide (Side Bravo to Side Delta) and twenty-six feet six inches (26'-06") deep (Side Alpha to Side Charlie).
  - One-story kitchen "bump out" on Side Charlie, which was nine feet (9') wide by twelve feet (12') deep.
  - Addition attached to Side Charlie was nine feet wide by nine feet deep (9'-9').
  - Closed - Compartmented Floor Plan: Previous fire damage may have caused open compartments or loss of compartmentation (**see Diagram 5**).
- Interior Compartments: Eight (8)

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

- Roof: Flat roof, sloped from Side Alpha downwards to Side Charlie. Roof assembly: two (2) layers of mineral/tar paper over underlayment paper covering one-half inch by twelve inches (1/2" x 12") solid wood decking on three and one-half inch by four inches (3 ½"x 4") solid wood roof joists. The roof joists spanned from Side Alpha to Side Charlie and were spaced between twenty-two inches to twenty-six inches (22" to 26") on center.
- Unique Features: Evidence of unusual undocumented building modifications were identified during the post fire investigation stages. Specifically, modifications to the concrete masonry units, a partial concrete foundation, and the installation of a steel I-shaped beam extending across the rear Side Charlie Division that "connected-tied" the Side Bravo and Side Delta masonry party walls were identified. Undocumented building modifications to reinforce or stabilize the building collectively due to the collapse of exposure Bravo in 1997, resulted in questionable building stability under normal conditions. Additionally, there was serious damage from a structure fire in 2015 and exposure to the weather causing deterioration [Naum 2024].
- The basement floor consisted of poured concrete and masonry foundation walls. crawlspace floor beneath the Side Charlie kitchen "bump-out" was dirt.
- There was a steel I-beam extending across Side Charlie of the building, which tied into the Side Bravo and Side Delta brick walls. The presence of a steel beam as such is not a common construction feature or assembly found in original vintage row houses of this era. The row house had a past serious fire within the structure that resulted in extensive damage and structural compromise. It was also found to have evidence of physical, material and maintenance neglect, and progressive structure deterioration. The building did not have an operable fixed heating system, roofing and perimeter wall deterioration, and multiple direct open areas (floors and windows) to the environment with direct exposure and susceptibility to seasonal environmental cycles and conditions (**see Photo 9**).
- The building is characteristic of an abandoned, derelict building [Naum 2024].

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

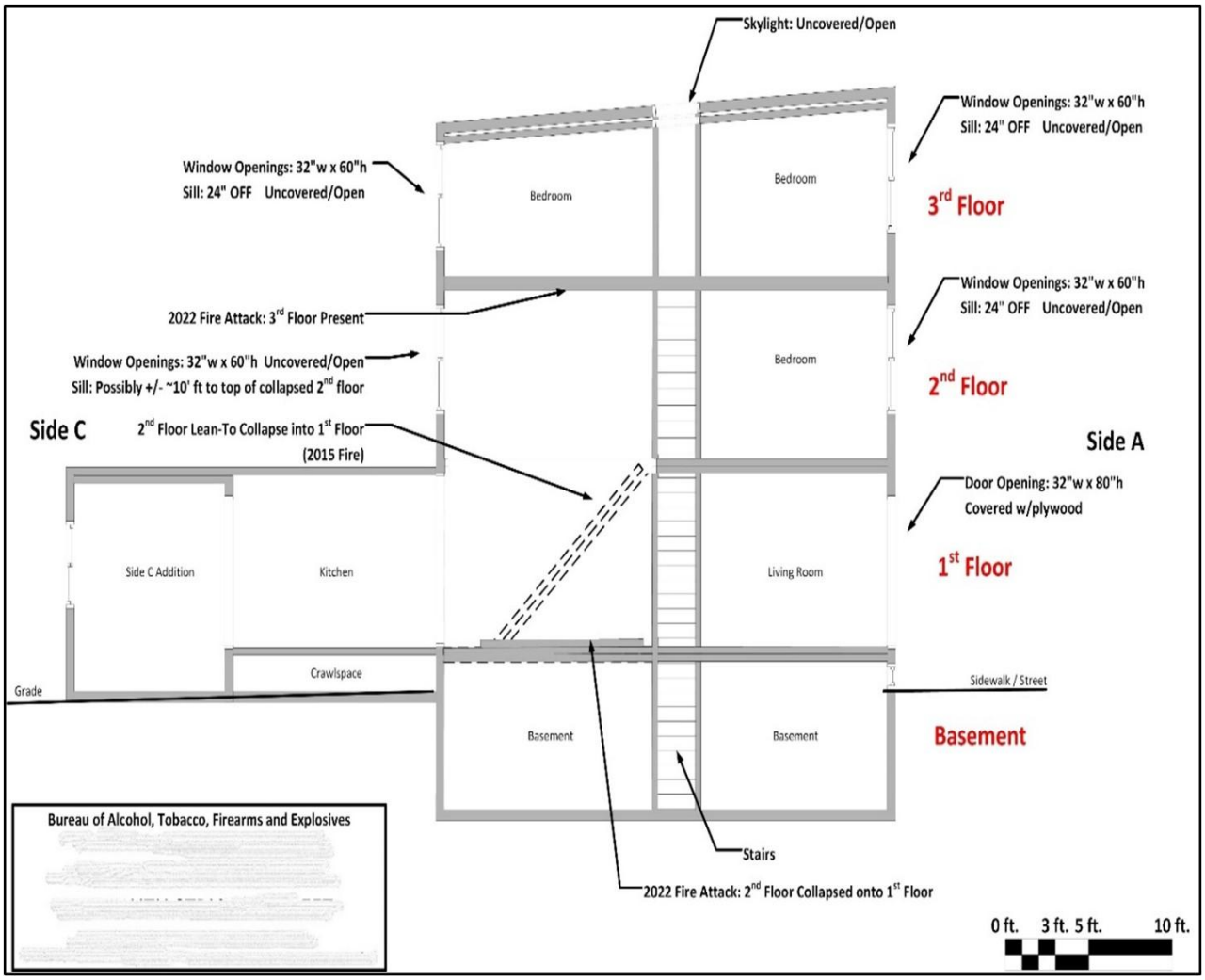

Diagram 5. The elevation of all floors of the row house including the basement and location of previous fires in this building.
(Courtesy of ATF)

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Photo 9. The fire building and exposures (Circa 2007).
(Courtesy of Google Earth)

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Appendix B

(*Courtesy of USFA*)

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 (Windows, Doors, etc.) ☐ Many ☐ Few ☐ Windowless
Structural Members (Beams, Girders, Columns) ☐ Steel ☐ Concrete ☐ Wood ☐ Mixed (*Describe*)
Truss Construction ☐ Roof ☐ Floors
Exposed Structural Members (Beams, Girders, Columns & Trusses) ☐ Yes ☐ No
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 (Valves open, pressure showing on gauges) ☐ Yes ☐ No ☐ System off, but usable if supplied through FD connection
Operational Standpipe System ☐ Yes ☐ No
Fire Department Connection (If Yes, note location on sketch) ☐ Yes ☐ No

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

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

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Appendix C

Sample SOP for Vacant/Abandoned Derelict Structures (*Courtesy of USFA*)

PURPOSE

Firefighters are often killed or injured when fighting fires in abandoned, vacant, and unoccupied structures. These structures pose additional and sometimes unique risks due to the potential for fire fighters to encounter unexpected and unsafe building conditions such as dilapidation, decay, damage from previous fires and vandals, and other factors such as uncertain occupancy status. Risk management principles must be applied at all structure fires to ensure the appropriate strategy and tactics are used based on the fireground conditions encountered. The Vacant and Unsafe Structure Placard Program has been developed to educate the fire and rescue department personnel on the standard marking system used by the <Anytown> Fire Department. This marking system alerts responding fire and rescue personnel of the potential danger and/or associated risks that might exist within a specific structure.

SCOPE

This policy will apply to all vacant and abandoned buildings within the fire department's jurisdiction.

POLICY

It shall be policy that ALL fire department personnel be familiar with the visual appearance and meaning of the "Vacant and Unsafe Structure" placard to improve firefighter safety as well as situational awareness in assisting firefighters in tactical decision making while operating on an incident scene as well as understand the following:

1. Any vacant or abandoned buildings or structures determined to be unsafe pursuant to Section 110 of the International Fire Code (Note: replace this authority reference with the appropriate locally adopted code if it is difference from the IFC) relating to structural or interior hazards shall be placarded.

2. Placards will be applied to the address side of the structure and be visible from the street. Additional placards may be placed at all exterior entry doors and may be applied to other sides of the structure as needed to ensure adequate identification of the structure as being unsafe.

3. The placard symbol shall mean that structural or interior hazards exist to a degree that limits firefighting activity to exterior operations only, with entry only occurring for known life hazards.

4. Placards shall be 24 inches by 24 inches minimum in size with a red background, white reflective "X" stripe and a white reflective border. The "X" stripes and border shall be 2-inch minimum width. The design of the placards shall use the following symbol (**see Image 3**):

Three Firefighters Die and another Seriously Injured During the Collapse of an Abandoned, Derelict, 3-story Row House Fire – Maryland

Image 3. Building placard for exterior operations only.
(*Courtesy of USFA*)

5. Placards shall bear the date of their application to the building and the date of the most recent inspection.

6. The use of this symbol shall be informational only and shall not in any way limit the discretion of the IC.

7. In the event that fire and rescue personnel respond to any structure not already placarded and question its integrity or safety, contact the Fire Marshal as soon as possible so the appropriate actions can be taken to correct any hazards.

8. Personnel shall announce via radio communication the recognition of a placarded building upon arrival to an incident, so all units are aware of the situation.

9. Communications shall broadcast the information over the radio to all responding companies and resources that the building is placarded as a vacant and unsafe building.