Senior Captain and Two Firefighters of Ladder Company Burned During Primary Search in Garden Apartment Fire – Texas

Executive Summary

On January 7, 2025, a senior captain and two firefighters were injured while performing a primary search in a garden apartment building. At 05:28 hours, the office of emergency communications (OEC) received the first call reporting an apartment fire and subsequently dispatched the first alarm assignment.

District Chief 46 (DC46) arrived on scene with smoke showing in the courtyard. DC46 pulled past Side Alpha to view Side Charlie where fire had self-ventilated through a window. DC46 positioned across the street from the apartment complex facing the courtyard of the building and provided a size up of "District 46 on scene, fire showing on a two-story apartment, establishing command." DC46 updated Engine 35 (E35) that the fire appeared to be on the first floor past the courtyard (**see Photo 1**).

Photo 1: View from the courtyard into the fire apartment, Side Alpha.
(Courtesy of the fire department)

E35 stretched a crosslay and an apartment lay preconnect from the rear of the engine. With the hoseline stretched to the front door of the apartment, E35A called E35D to charge the line repeatedly. Getting no response, E35A headed toward the engine and became involved in a physical altercation with a civilian. This prevented E35A from following Ladder 46's (L46) crew with a hoseline as they made entry into the apartment to conduct a primary search. The altercation between the civilian and E35 continued and subsequently distracted many of the personnel on scene. The door and living room window to the apartment were open with fire venting out when L46 made entry. Fire conditions progressed rapidly while L46's crew was inside conducting the primary search. During the civilian altercation with E35, flames filled the doorway and the door closed to the unit.

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DC46 requested a status update from E35 asking if there was water on the fire at 05:37 hours. E35A said they had water on the fire and were making entry. Less than a minute later E35A requested a medic unit to the front door. Immediately following that request was a Mayday call from L46B using the emergency activation button on the remote speaker mic. At the same time, firefighters from E35 attempted to force the door open and remove the L46 crew. L46A and L46C were removed rapidly once the door was broken down and removed. L46B self-extricated through the Side Alpha door about one minute after the other members of L46.

At 05:41 hours, DC46 began conducting personnel accountability reports (PARs) for operating crews to account for all firefighters and requested a second alarm. Roughly a minute later, the L46 crew showed all in alert on the electronic accountability system. DC46 requested confirmation that all personnel were out of the structure.

DC26 arrived on scene at 05:43 hours and assigned Side Alpha as their area of responsibility. Crews began re-entering the structure and extinguished the fire. At 05:44 hours, OEC updated command that 10 minutes had passed. At 05:55 hours, DC46 declared the incident under control. At 06:02 hours, DC46 updated OEC that three injured firefighters were transported from the scene.

Contributing Factors

- *Fire behavior, dynamics, and tactics*
- *Department culture and risk management*
- *Impact of the personal protective equipment (PPE) on perception and recognition of environmental changes*
- *Delayed water application and responder scene safety*
- *Communication of conditions*
- *Delayed fire department notification*

Key Recommendations

Fire departments should:

- *Ensure firefighters employ tactics aligned with fire conditions when making entry to reduce thermal exposure to PPE.*
- *Ensure personnel identify isolation opportunities from changing fire conditions.*
- *Ensure all personnel are trained on the "GRAB LIVES" fireground survival techniques.*
- *Develop a department culture that balances the life safety mission with proactive risk management.*

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- *Ensure that firefighters understand the capabilities and limitations of selected PPE for the applicable hazards and tactical operations.*
- *Coordinate response procedures with local law enforcement to protect firefighters and prevent interference when working at emergency scenes.*
- *Ensure incident commanders (ICs) immediately establish divisions/groups with a supervisor to communicate conditions, actions, or needs.*
- *Ensure firefighters protect radios and cables by wearing radio straps under their turnout coat.*
- *Educate the community to enhance individual knowledge, attitudes, and behaviors to help reduce risks, injuries, and fires within the community*

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

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Introduction

On January 7, 2025, a senior captain and two firefighters were seriously injured while performing a primary search in a garden apartment building. On January 14, 2025, the fire department notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. From June 9-14, 2025, one investigator representing the NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP), two personnel from the International Association of Fire Fighters (IAFF), and a scientist from the Underwriter's Laboratories Fire Safety Research Institute (UL FSRI) traveled to Texas to investigate this incident. The investigation team conducted interviews with command officers, fire officers, firefighters, fire investigators, and other emergency personnel who were on scene during the incident. The team also inspected PPE, including the self-contained breathing apparatus (SCBA) used by the firefighters and other equipment used at the incident. The team reviewed fire department standard operating guidelines (SOGs), training records, dispatch records, witness statements, photographs, video footage, and other documents.

Fire Department

The career fire department in this incident has around 4,000 uniformed and 100 civilian personnel. About 3,800 of those personnel are assigned to the emergency response division that provides fire protection and emergency medical services (EMS). The department's emergency response division works a 72-day duty cycle. Members work a total of 480 hours that are made up of 18 regular 24-hour shifts and two 24-hour debit day shifts. The shifts, not including debit shifts, typically appear on a calendar as follows: 24 hours on duty, 24 hours off duty, 24 hours on duty, 120 hours off duty.

There are 93 fire stations throughout the city that serve a population of about 2.3 million people across 637 square miles. The fire department divides the city into quadrants: northeast, northwest, southwest, and southeast. These are further divided into 21 districts. The fire department is certified as an Insurance Services Office class 1 department and is accredited through the Commission on Fire Accreditation International as of 2021. The fire department responds to over 395,000 service calls annually.

The emergency response division has two deputy chiefs, three safety officers, three cascade units, one command van, one rehab unit, 21 district chiefs, 88 engine companies, 33 ladder companies, five tower companies, 57 ambulances with an additional five during peak times, 41 medic units, five squads, seven ambulance supervisors, two senior ambulance supervisors, one EMS district chief, three rescue companies, four hazardous materials companies, and 16 aircraft rescue firefighting (ARFF) units. The minimum daily staffing for the department is 849 personnel across all companies. Each engine, ladder, tower, and rescue company is staffed with four personnel. The district chiefs, ambulances, medic units,

and squads are each staffed with two personnel. Each district chief is dispatched with an incident command technician (ICT).

Training, Education, and Professional Development

The fire department hires through a civil service process. Applicants must be between 18 and 36 years old when they take the oath of office, have completed 15 accredited college hours or two years of full-time active-duty military service with an honorable discharge, and have two or less moving violations in the last 36 months. Upon accepting a conditional job offer, the applicant must attend the academy and complete between eight and ten months of daily rigorous physical training and classroom instruction. Upon graduation, applicants have certifications in the Texas Commission on Fire Protection firefighter basic, Texas Department of State Health Services emergency medical technician (EMT) basic, and the National Registry of Emergency Medical Technicians.

Once a candidate successfully graduates from the academy, they are assigned to a fire station. Once assigned to their fire station and shift, all personnel complete a minimum of 24 hours of on-the-job training and continuing education per month. Personnel within the department have a variety of career pathways they may choose to pursue once they reach the rank of engineer operator (EO).

L46A (seriously injured senior captain) had 22 years of experience with the fire department in this incident as well as 17 years concurrently with another fire department. He also had approximately eight years with a local community college as an instructor. He maintained training in various aspects of the fire service including truck company operations, firefighter survival, fire tactics, operational readiness and communications. He held numerous Texas Commission of Fire Protection certifications including Master Structure Firefighter, Instructor II, Fire Officer II, Driver Operator (Pumper and Aerial), Incident Safety Officer, and Incident Commander.

L46B (seriously injured firefighter) had five years of experience at the fire department. He maintained training in truck company operations and held numerous Texas Commission of Fire Protection certifications including Hazardous Materials Operations and Basic Structure Firefighter.

L46C (seriously injured firefighter) had three years of experience at the fire department. He maintained training in truck company operations and held the Texas Commission of Fire Protection certification as a Basic Structure Firefighter.

DC46 (IC) had 31 years of experience at the fire department and served 7 years at another fire department concurrently. He maintained training in building construction, operational readiness, communications, and incident management systems. He held numerous Texas Commission of Fire Protection certifications as a Master Structure Firefighter, Driver Operator – Pumper, Instructor I, Fire Officer I, and Incident Safety Officer.

Apparatus, Personnel, Communications, and Accountability Equipment

OEC calls are received by civilian call takers. The OEC dispatchers for the fire side of the center are sworn personnel at the rank of communications captain or above with a minimum of five years within

the department. The OEC dispatchers use a digital trunking 700-megahertz encrypted system for all radio communications.

The fire department in this incident used a pre-established run card assignment based on information provided by the civilian call taker. A first alarm assignment for an apartment fire with visible smoke or fire included two district chief units, four engines, two truck companies, an ambulance, a medic squad, a rescue, and a safety officer. Table 1 provides the staffing levels and location when the Mayday was transmitted.

Table 1: Initial box alarm assignment and Mayday status

Apparatus	Staffing	Arrival On-Scene	Status and Location at Time of Mayday
DC46	2	05:33	On scene with Command
E35	4	05:34	On scene, Side Alpha, fire attack
E46	4	05:34	On scene, split crew: backup line Side Alpha water supply
L46	4	05:35	On scene, primary search, seriously injured crew
A35	2	05:35	On-scene, split crew, water supply, and staging EMS equipment
HME24	4	05:36	On scene, assigned to assist L46 with primary search
L55	4	05:37	On scene, ventilation
SF24	1	05:37	On scene, arrived just prior to Mayday occurring
E55	4	05:37	On scene, no assignment given
SQ46	2	05:38	Arrived as Mayday was declared
R42	4	05:43	En route to scene
DC26	2	05:43	Arrived after removal of L46 crew

The fire department also has specific callsigns for each position on an apparatus. Table 2 provides the relationship between the position on the unit and the callsign. For example, L46A is the senior captain on Ladder 46.

Table 2: Callsign by riding position

Apparatus Type	Riding Position	Callsign
District Chief	District Chief Incident Command Technician	DC#A DC#B
Engine	Captain Firefighter 1 Firefighter 2 Engineer Operator	E#A E#B E#C E#D
Ladder	Senior Captain Firefighter 1 Firefighter 2 Engineer Operator	L#A L#B L#C L#D

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Apparatus Type	Riding Position	Callsign
Rescue	Captain Firefighter 1 Firefighter 2 Engineer Operator	R#A R#B R#C R#D
Medic/Squad	Engineer Operator Firefighter 1	M#A or SQ#A M#B or SQ#B
Ambulance	Engineer Operator Firefighter 1	A#A A#B
Safety Officer	Safety Officer	Safety# or SF#

The fire department uses an electronic accountability system that transmits the individual firefighter's SCBA and portable radio information to a computer terminal in the command vehicle. The accountability system, known as the SDI terminal, is operated by the ICT that responds with the district chief. This system provides ICs with real-time accountability for on-scene firefighters. It includes digital time stamps, fireground priority reminders, and other critical command tools for managing firefighter Mayday situations. Through multiple audio and visual alerts, SDI bridges communication gaps commonly encountered on the fireground to help ICs organize and manage incidents. The system also facilitates comprehensive handling of Mayday messages, captures radio transmissions, and identifies firefighters in distress.

Building Construction

The fire occurred in a two-story Type III apartment building with exterior walkways and stairs providing access and egress from the apartment entry doors. The building's exterior walls were composed of painted brick. The county central appraisal district records for the property state that the garden apartment building totaled 6,200 square feet and was originally constructed in 1962 with a documented remodel in 2015. Photo 1 shows an exterior view of Side Alpha.

The interior walls were framed from nominally dimensioned 2x4's and the interior finish was ½ inch thick gypsum board. The ceiling of the first floor apartment was finished with ½ inch gypsum board attached to nominally dimensioned 2x10's which also served as the floor supports for the upstairs apartments. The subfloor of the second-floor apartment was plywood. The floor of the fire apartment was non-combustible tile over concrete. The fire apartment was composed of a living room, a kitchen, three bedrooms with closets, and a bathroom. The floor plan of the fire apartment is shown in Figure 1. Based on dimensions measured during a site visit after the fire, the square footage of the apartment was 784 square feet. The apartment was not equipped with an automatic fire sprinkler system, but it had a working smoke alarm.

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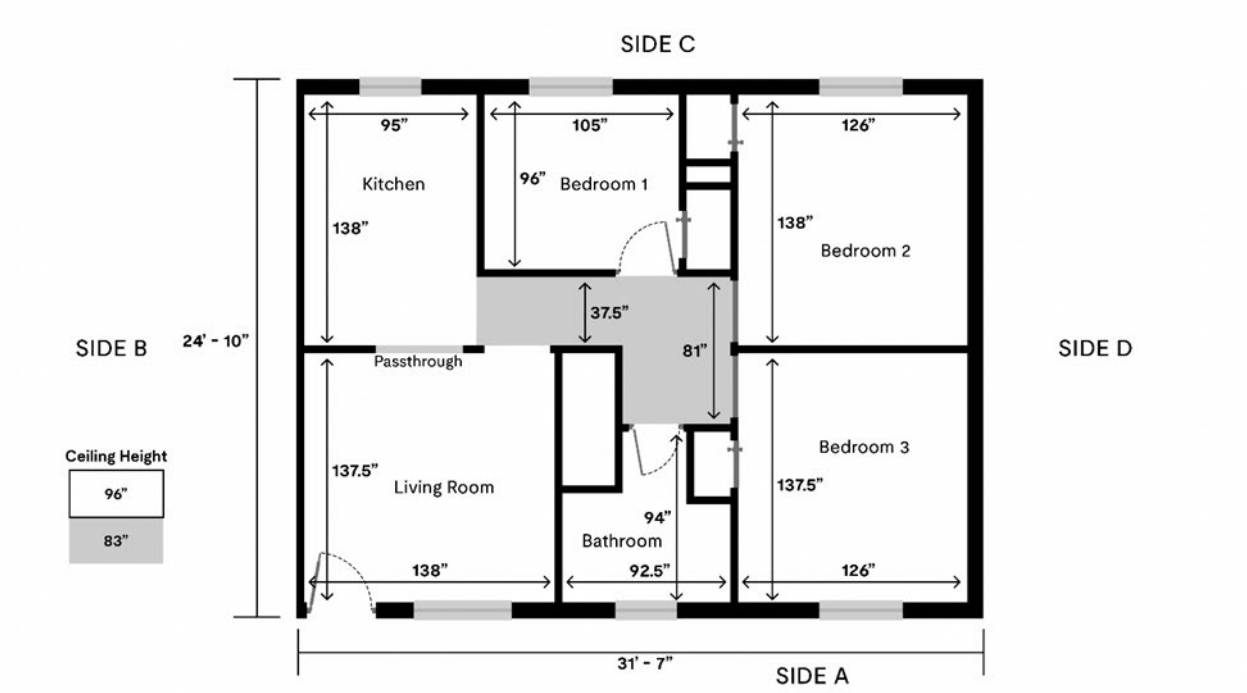

Figure 1: Dimensioned floor plan of the fire apartment. Note that the ceiling height of the hallway is 13 inches shorter than the ceiling height of the rooms. The lowered ceiling height in the hallway provided space for the HVAC duct work. (*Courtesy UL FSRI*)

Incident Timeline

The following timeline is a summary of events that occurred as the incident evolved shortly after 05:28 hours on January 7, 2025. Not all incident events are included in this timeline. The times are to the minute and were taken from the fire department's National Fire Incident Reporting System (NFIRS) fire reports, dispatch log, on-scene accountability documentation, and interview notes.

January 7, 2025	Fireground Operations, Response, and Details
05:28 Hours	• OEC received the first call for an apartment fire.
05:29 Hours	• OEC dispatched the first alarm assignment: DC46, DC26, E35, E46, E55, Haz-Mat Engine 25 (HME24), L46, L55, A35, SF24, R42, and SQ46.
05:30 Hours	• DC46 requested a tactical channel assignment from OEC.
05:31 Hours	• OEC sounded the emergency tone and assigned the box to Southeast Tac 11 (SETAC11).
05:33 Hours	• L55 asked OEC if they had been assigned a tactical channel.

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January 7, 2025	Fireground Operations, Response, and Details
	• OEC requested the status of DC26 and DC46. • DC46 arrived on scene and provided a size up, "DC46 on scene, fire showing on a two-story apartment, establishing command." • OEC acknowledged and repeated the size up. • DC46 called E46 and provided the closest hydrant location.
05:34 Hours	• Command gave the initial orders to the first due engine company. • E35 arrived and confirmed their orders. • Command updated OEC that the SDI was in place. • E46 arrived and was ordered to handle water supply.
05:35 Hours	• L46 arrived and was ordered to handle primary search. L46 confirmed their orders. • E46 split their crew and dropped two crew members off at the incident scene while the other two crew members made the connection to the hydrant to establish the water supply. E46A and E46B were ordered to deploy a second handline to the second floor.
05:36 Hours	• E46A confirmed their orders. • HME24 arrived on scene and was ordered to assist L46 with primary search and confirmed their orders. • E35A called for the line to be charged.
05:37 Hours	• E35A called for the crosslay to be charged two more times. • E55, L55, and SF24 arrived. • L55 was ordered to check ventilation needs. • DC46 asked E35 if there was water on the fire, E35 confirmed and were making entry.
05:38 Hours	• Command requested an update on fire location and was told it was contained to the first floor. Command asked that the second floor be checked for extension. • E46 charged the hydrant. • E35A requested a medic unit to the front door. • SQ46 arrived.
05:39 Hours	• The first Mayday was declared by L46B. OEC confirmed that command heard it. Command confirmed and requested from units on scene who called the Mayday. • E46A answered L46A. • Command ordered Medic 46 and ambulance 35 to the front door.
05:40 Hours	• SQ46 confirmed the order. • Command ordered 3 additional transport units. • E35 called for more water. • Command updated that water supply was established and asked if all firefighters were out of the structure.

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January 7, 2025	Fireground Operations, Response, and Details
05:41 Hours	• DC46 conducted PAR for crews on scene.
05:42 Hours	• L46 crew shows all in alert on SDI system. • DC46 requests confirmation that all personnel are out of the structure. E46A confirms all personnel are out of the structure.
05:43 Hours	• DC26 arrives and is assigned Side Alpha responsibilities.
05:44 Hours	• Firefighting operations continued but were not pertinent to the injuries that occurred. The three injured firefighters had been removed from the structure and were treated on scene, preparing for transport.
05:55 Hours	• DC46 declared the incident under control.
06:02 Hours	• DC46 updated OEC that three firefighters were transported from the scene.

Cause of Serious Injury

All three members of the L46 entry crew sustained serious burn injuries with the following outcomes:

- L46A spent 32 days in the burn treatment center with full and partial thickness burns to the back, buttocks, hands, and left shoulder. The admitting hospital assigned a total burn surface area (TBSA) of 20%. L46A required partial amputation of some fingers.
- L46B spent 24 days in the burn treatment center with superficial, deep, and full thickness burns to left forearm, left side of the torso, buttocks, the front of thighs, calves, and neck with TBSA of 14%.
- L46C spent 27 days in the burn treatment center with burn injuries to almost a quarter of skin area (TBSA of 24%). Both superficial and deep partial thickness burns were observed on hands, upper arms, back, buttocks, legs, and feet.

Personal Protective Equipment

A detailed examination of the PPE worn by the three L46 firefighters was conducted to:

- Determine the effectiveness of the PPE and if any elements of the protective ensemble could have contributed to any firefighter burn injuries.
- Ascertain whether the PPE was worn and deployed per manufacturer's instructions for optimum effectiveness.
- Assess how the PPE may have affected each firefighter's situational awareness of rapidly changing thermal conditions.
- Gain information on the nature of the thermal environment extremes that each firefighter encountered based on the thermal damage of their PPE.

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Description of PPE Worn:

Each firefighter wore a full structural firefighting protective ensemble including protective garments (coat and pants), helmet, gloves, footwear, hood, and SCBA. Specific features unique to these ensemble elements included:

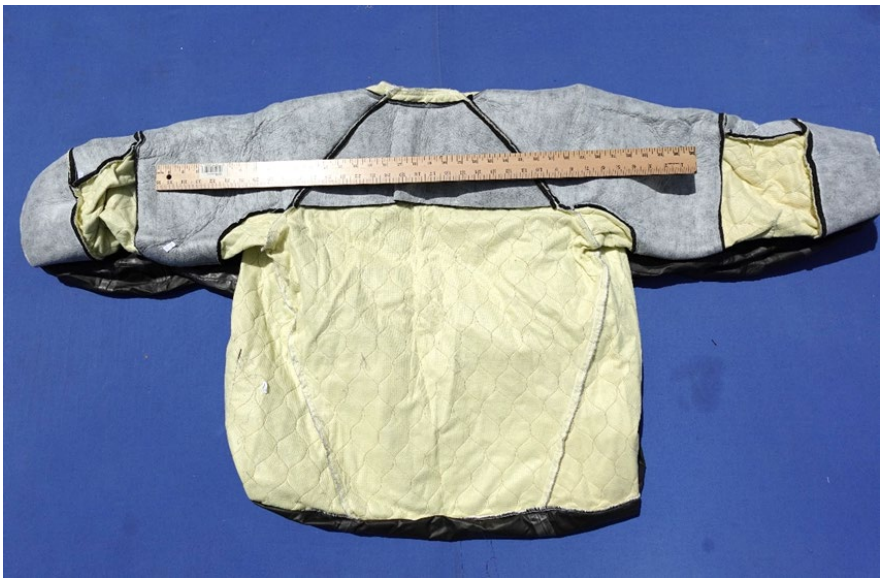

Photo 2: Incident department insulation in upper portion of protective coat. (*Photo courtesy of Jeff Stull*)

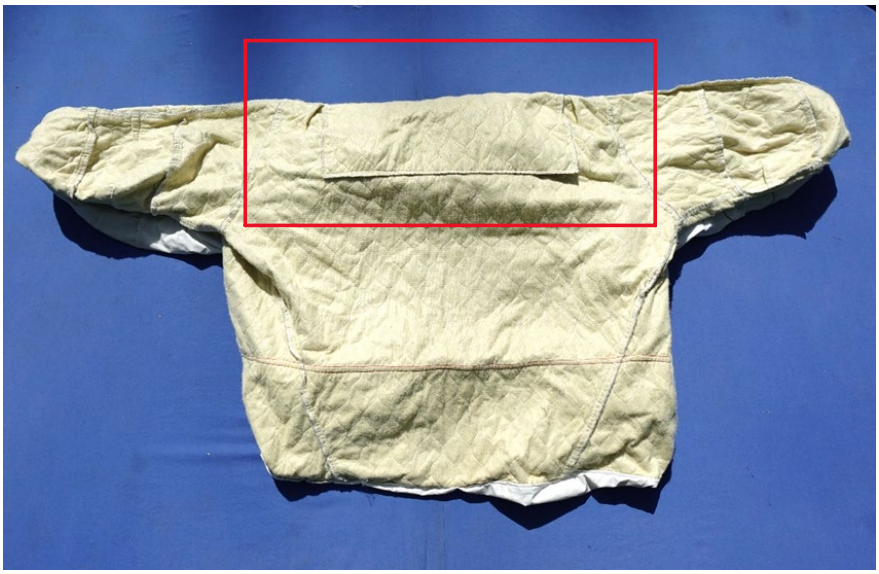

Photo 3: Different fire department protective coat with less insulation in upper portion [where additional shoulder insulation layer would be outlined in red rectangle]. (*Photo courtesy of Jeff Stull*)

- The protective coat had additional insulation throughout the upper back, shoulder areas, upper front, and sleeves. Proportionally, the protective coat had about 20% more coverage with four or more layers compared to the standard three-layer composite that solely consists of the outer shell, moisture barrier, and thermal barrier. **Photos 2 and 3** compare the extra insulation between the coat used by the incident department and a coat from a different fire department.
- The pants did not have any additional insulation beyond knee reinforcements.
- The protective helmets worn by the firefighters used a traditional design with flip down eye shields positioned under the front brim. As specified by the department, these helmets were supplied with ear covers and two-point retention systems. L46C had an older helmet from a different manufacturer and claimed that it had prior damage.
- Two different styles of gloves were observed. The gloves worn by L46B and L46C were a newer version with three-layer construction having a cowhide leather shell, moisture barrier film insert, and thermal lining. These gloves had an extended gauntlet made of an outer shell and fire-

resistant material lining with a take-up buckle at the end of the gauntlet. These gloves also had an additional layer of interior insulation and a leather layer on the back knuckle area. The older gloves worn by L46A also had an extended gauntlet but were made of a different type of animal hide for the shell and body of the glove. The older gloves also had a polymer-based reinforcement material over the knuckle area.

- The fire department had transitioned between styles of protective footwear. Two of the firefighters (L46A and L46B) had one style of boots while L46C wore boots from a different manufacturer. Both styles of footwear were a slip-on design made of leather with a moisture barrier and lining.
- The hood for L46A was not available for inspection. The hoods for L46B and L46C were relatively thick three-layer hoods with knit outer material, moisture barrier material, and a woven liner. These hoods had additional reinforcement materials over the ear portion.

All the provided PPE had been certified to the appropriate edition of the NFPA 1971 for protective clothing, NFPA 1981 for SCBA, and NFPA 1982 for PASS. Except for the pants and footwear of L46C, each firefighter was fitted for their respective protective clothing. During the shift change immediately before the response, L46C accidentally donned pants and boots intended for another firefighter where he later observed the pants to be too large and loosely fitting while the footwear was too small (L46C's boot size was normally a size 13 but ended up wearing size 11).

Post-Fire Condition of PPE:

Nearly all PPE items worn by the L46 firefighters were significantly damaged because of the short duration escalation to extreme fire exposure conditions, particularly over the latter part of the interior operations. Specific observations about the condition of each item are in **Table 3**. **Tables 4 through 9**, located in **Appendix One**, include photographs comparing the PPE of each firefighter. Some notable observations and differences are included in the notes below the photographs.

Relation of Burn Injuries to PPE Damaged Areas:

An assessment of the firefighter burn areas was made relative to the specific areas of PPE damage (**Table 3)**.

Table 3: Relation of Burn Injuries to PPE damage for L46 firefighters.

Firefighter	Burn Injury	PPE Damage
L46A	Sides of back	Coat: Extensive heat penetration on sides of SCBA for upper and lower coat back
L46A	Sides of buttocks	Pants: Heavy charring of seat area
L46A	Hands	Gloves: Portions of leather disintegrated on fingers of remaining glove
L46A	Left shoulder	Coat: Heat penetration observed
L46B	Left forearm	Coat: Heaviest charring on lower arm
L46B	Left side of torso	Coat: Heavy charring with heat penetration

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Firefighter	Burn Injury	PPE Damage
L46B	Sides of buttocks	Pants: Heavy charring and some embrittlement from seat to lower legs
L46B	Front of thighs	Pants: Heat penetration and charring
L46B	Calves	Pants: Heavy charring and some embrittlement to lower legs
L46B	Neck	Hood: Charring/embrittlement on back above bib area and along sides
L46C	Hands	Gloves: Extreme thermal shrinkage
L46C	Upper arms	Coat: Heavy charring, severe embrittlement, and heat penetration along back of both arms and torso
L46C	Buttocks and legs	Pants: Heavy charring, embrittlement, with some penetration up legs and buttocks
L46C	Feet	Boot: Severe exterior charring

A review of the protective clothing worn by the three L46 firefighters did not identify any specific deficiencies or issues of the PPE itself that directly contributed to the reported firefighter injuries. The protective capability of the PPE was overcome by the thermal conditions in the apartment which resulted in extensive damage and burns to the firefighters. Many of the firefighter injuries corresponded closely with lesser insulated areas of the PPE or to firefighter physical orientation as fireground conditions escalated, though some body areas also received burn injuries under reinforced areas of the clothing items.

One firefighter was likely more susceptible to some burn injuries due to the accidental misfit of their gear. Properly fitting gear may provide better protection from burns. L46C wore pants that were too big. The loose fit of the pants allowed hot air to move up the pant leg. The firefighter also wore boots that were too small. This reduced the air gap in the boots between the inner surface and the firefighter's skin and allowed for greater heat transfer from the outside of the boot to the skin.

There were several pieces of the ensemble that were insulated beyond the requirements of NFPA 1970, including the coat, hood, and helmets. Increased insulation has the potential to affect the ability of firefighters to perceive fire environment temperatures or rapidly changing conditions.

Self-contained Breathing Apparatus (SCBA):

At the time of the incident, all three firefighters were wearing NIOSH Approved® Scott Model X3, 45-minute, 4500 psi SCBA. The SCBAs were taken to the NIOSH's National Personal Protective Technology Laboratory (NPPTL) in Pittsburgh, Pennsylvania for evaluation and testing. Testing was conducted on August 7, 2025. No evidence was identified to suggest that the SCBA units contributed to the serious injuries. NIOSH determined that there was no need for corrective action with regards to the approval holder or users of SCBAs manufactured under the approval numbers granted to these products [NIOSH 2025a]. The completed evaluation, NPPTL Report Number TN-27934, is available on the

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NIOSH website. Specific features of the SCBA ensemble worn by the personnel in this incident are listed below:

- Each firefighter had their own assigned SCBA facepiece. The deployed SCBA had the modern features of a high radiant-heat rated facepiece lens, heads-up display, and telemetry.
- Telemetry provided the SCBA air cylinder pressure to the SDI terminal. Although the SCBA had the capability to record breathing rates, this function was not used.

Weather Conditions

At 05:53 hours on January 7, 2025, the outdoor temperature was 33°F, dewpoint was 18°F, the wind was out of the north at 8 mph, there had been no precipitation in the last 24 hours, and conditions were fair [Weather Underground 2025].

Investigation

On January 7, 2025, at 05:28 hours, OEC received the first call for an apartment fire. OEC dispatched the first alarm assignment for a garden apartment fire: DC46, DC26, E35, E46, E55, HME24, L46, L55, A35, SF24, R42, and SQ46. At 05:30 hours, while still enroute, DC46 requested a tactical channel assignment from OEC and was assigned SETAC11. At 05:33 hours, L55 asked OEC if they were assigned a tactical channel. OEC responded SETAC11 and then requested the status of DC26 and DC46.

DC46 arrived on scene with smoke in the courtyard and a crowd of people screaming and pointing. DC46 pulled past Side Alpha of the building to get a view of Side Charlie that had fire coming out of a window. DC46 positioned the command vehicle across the street from the complex. The windshield was facing the courtyard of the building. DC46 gave the size up, “District 46 on scene, fire showing on a two-story apartment, establishing command.” OEC acknowledged the update and repeated it across the channel. DC46 then called E46 and provided the closest hydrant location.

At 05:34 hours, DC46 called E35, “Command to E35, going to be right there through the courtyard, looks like the fire is on the first floor.” E35 acknowledged the order and repeated they were taking fire attack as they arrived. DC46 updated OEC that the SDI system was in place. E46 arrived on scene and was ordered to take the corner and grab the nearest hydrant to establish a water supply.

After a brief discussion, E35B was ordered to pull the crosslay by E35A. E35C asked E35A about deploying the apartment lay, and he was instructed to pull the apartment lay into the courtyard. E35D broke the apartment lay at the second coupling so there was 100 feet deployed from the engine to the manifold and awaited the order to send water to the crew. E35B stretched the crosslay to the fire apartment and had enough hose left to cover the entire unit. When they reached the fire apartment, they had good visibility into the unit. They saw smoke banked down about 25% of the way to the floor and a clear neutral plane. With the front door left open and an open or broken window to the immediate right on their walk-up, they could see fire in the front room. They could also see additional fire in a room towards the Side Charlie wall (this was the room of origin).

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L46 entered the fire apartment by stepping past E35B with the nozzle of the crosslay. The department in this incident typically does not isolate fire units upon entry. L46 entered the apartment as E35 was at the door waiting for the hoseline to be charged. E35A called on the radio, "charge the line." After E35A made two more calls for water with no response, he began to move toward E35. While heading toward the fire engine, a civilian grabbed E35A's SCBA shoulder straps and started a physical altercation with him and other crew members. While the altercation was going on, the E35 crew noticed flames filling the apartment doorway and the next time they looked in that direction the front door to the apartment was closed. The specific manner in how the door closed remains undetermined.

At 05:35 hours, E46 stopped at the corner and let out E46A and E46B to add manpower on scene, and E46 continued to the hydrant. DC46 ordered E46A, "Command to E46A, get a second line and go to the second floor." E46A copied the order and stretched the second line from E35. L46's crew made entry and performed a left-hand wall search through the living room and then split apart. One crew member searched the kitchen while L46A continued to the right to check the bedrooms. As the crew cleared the hallway, conditions rapidly changed and L46A made the decision to exit the structure. Conditions rapidly changed from good visibility with smoke banked down about 25% of the way from the ceiling and moderate heat to smoke banked to the floor and extreme heat. The L46 crew returned the way they had come in, following the right-hand wall. L46B ran into a wall while trying to exit and could feel heat to his left. He went to the right. He ended up in the kitchen where he eventually called his Mayday. L46A and L46C re-entered the living room area and attempted to find the front door which had closed while they were inside.

At 05:36 hours HME24 arrived but was mistaken as SF24. DC46 ordered, "Safety 24, get me a 360 and take care of the utilities." HME24 called command again and it was clarified what unit was on scene. DC46 ordered, "Primary search first floor. Help L46." E35A made an additional call to E35 to charge the line.

At 05:37 hours SF24, E55, and L55 arrived. L55 was ordered to check ventilation needs and vertically vent if necessary. DC46 requested a status update, "Command to E35, do you have water on the fire yet?" E35 responded, "E35 to command, water on the fire, making entry."

At 05:38 hours DC46 requested an update from the engine companies asking if the fire was also on the second floor. E46 responded that it appeared to only be on the first floor, and they were checking for extension. E46 completed their lay from the hydrant and E46D ordered E46C to charge the hydrant. E35A radioed an urgent request for a medic unit at the front door. Command acknowledged the request. It was noted during interviews that each member of L46 attempted to call a Mayday, but only one was heard. This request from E35A was an attempt to call a Mayday for L46's crew.

At 05:39 hours, the first Mayday was declared by L46B, who managed to press the emergency activation button on his remote speaker mic and was given an open mic for 15 seconds. OEC called command to verify they heard the Mayday. DC46 asked E46 who declared the Mayday. E46A responded E35 and requested a medic unit to the courtyard. E46 updated that the Mayday was L46A. DC46 ordered Medic 46 and Ambulance 35 to the front door. L46A and L46C were removed from just inside the front door once the door was broken down and removed by the E35 crew. Members of E35 flowed water through

the Side Alpha doorway as it was forced open to rescue the trapped crew. Members of E46 flowed water through the side Alpha window into the living room area as well.

At 05:40 hours, DC46 requested three more transport units. E35A called E35D for water. DC46 made OEC aware that water supply was established as a benchmark. DC46 then asked if all firefighters were out of the structure. E46A confirmed they were. DC46 ensured all crews that additional ambulances were requested. L46B was directed out of the kitchen about one minute after the rest of the L46 crew.

At 05:44 hours, the three injured firefighters were transported by Medic Squad 46 and Ambulance 35 (L46B) and Ambulance 46 (L46A and L46C). L46B was transported first as they were presumed to be the most critical by on-scene personnel. All three firefighters were transported to the closest burn unit for treatment. At 05:55 hours, DC46 declared the incident under control. At 06:02 hours, DC46 updated OEC that the three injured firefighters had been transported from the scene.

Fire Cause, Origin, and Development

Based on the Arson Bureau's fire investigation report, the area of fire origin was on a bed in bedroom 1 and the fire cause was improper disposal of smoking materials. The fire investigation report also detailed several unsuccessful efforts by the apartment occupants and a neighbor to use fire extinguishers and water to extinguish the fire prior to calling the fire department. After the occupants exited the apartment, a neighbor brought them a fire extinguisher, but it was not effective as flames were coming out of the door. The neighbor called 911 at 05:28 hours. The fire grew during the delay in calling the fire department.

Based on observations from the fire officers, firefighters, and helmet camera video, the fire conditions just prior to entry were as follows:

- Flames extending out of the bedroom 1 window on Side Charlie.
- The neutral plane in the entry door to the fire apartment was about 1 to 2 feet below the top of the open doorway. Small, intermittent flames were flowing out of the top of the doorway.
- The living room window glass was broken.
- A sofa and a wooden chair were on fire in the living room.

As the L46 search crew entered the apartment, the fire in the living room was in the decay stage. This resulted in a high neutral plane in the entry door and visibility in the living room. While there were still contents burning in the living room and in the kitchen, the fire in bedroom 1 became a structure fire. **Photo 4** shows how the structural elements contributed to the fire, indicating a longer burning duration than might have been recognized on arrival. As the crew entered the hallway, the visibility decreased and the heat increased. This was partly from the reduced ceiling height in the hallway and the proximity to the room of fire origin.

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Photo 4: Detail of ceiling construction in bedroom 1. Charring and evidence of mass loss from the joists and bottom of the subfloor of division 2 are shown.
(*Photo courtesy of the fire department*)

While the crew was in the apartment hallway, the fire grew. E46 noticed flame extension from the rear of the structure through the bedroom window. The L46 crew noticed fire growth as flames filled the living room. This increase could be the result of several changes:

1) The heat release rate increased as more structural wood was exposed in bedroom 1.
2) Areas of the wall, between the fire room and the hallway and between the fire room and the kitchen, could have opened up, allowing the flow of fire gases/flames through the walls.
3) The upholstered chair in the living room ignited or reignited.

It is important to note the mattress and other contents in the bedroom generated enough heat release rate, at least 2 megawatts (MW), to flashover the bedroom, contributing to the initial fire growth. As the fire spread to the structural elements, the exposed wood provided enough energy to sustain a post flashover thermal environment in the bedroom.

From the L46 search crew perspective, the living room flashed over. The fire damage in the living room indicates that technically, the living room did not complete the transition through flashover as shown in **Photos 5, 6, 7, and 8**. However, the flames from the chair would have:

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- Increased the pyrolysis rate from the adjacent fuels in the living room, resulting in increased smoke and gaseous fuel.
- Flowed out of the doorway, as observed by the E35 firefighters and others.
- Eliminated the visibility in the living room.
- Caused the firefighters to get down toward the floor from increased heat.

The closed door reduced the flow of fresh air to the living room, which interrupted the transition through flashover (i.e., full room involvement in fire). The closed door reduced the oxygen available for combustion, so flames decreased in the living room. This also trapped heat and smoke in the living room until suppression occurred from the two hose streams. The fire development time from the 911 call to water on the fire was about 10 minutes.

Photo 5, 6, 7, and 8: Vantage points of the living room. Top left - Side Alpha, top right - Side Bravo, bottom left - Side Charlie, bottom right - Side Delta. (*Photos courtesy of the fire department*)

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 injuries or fatalities. The investigators identified the following items as key contributing factors in this incident that ultimately led to the serious injuries:

1. Fire behavior, dynamics, and tactics
2. Department culture and risk management
3. Impact of the PPE on perception and recognition of environmental changes
4. Delayed water application and responder scene safety
5. Communication of conditions
6. Delayed fire department notification

Recommendations

Recommendation #1a: Fire departments should ensure firefighters employ tactics aligned with fire conditions when making entry to reduce thermal exposure to PPE.

At this incident, the first arriving engine company completed the stretch to the fire apartment without a delay and positioned the apparatus in an appropriate location just outside the gated courtyard. The first arriving truck company was assigned search and made their way to the fire apartment. With the nozzle stretched to the door, a truck company typically will make entry ahead of the hoseline, assuming that a charged line will be coming in the door almost immediately after they make entry. In this incident, however, the altercation delayed the hoseline getting charged and water flowing on the fire.

Research conducted by the UL FSRI and the National Institute of Standards and Technology (NIST) has consistently demonstrated the dangers of elevated thermal environments in structure fires. Thermal layering within a fire compartment creates extreme temperature gradients, with the upper levels often exceeding 1000°F (538°C), posing serious risks to firefighter PPE integrity and facepiece failure [FSRI 2024]. Specifically, studies show that staying low within a structure significantly reduces thermal insult and delays the breakdown of protective equipment, providing firefighters with more time to assess interior conditions and locate victims or hazards [FSRI 2020a]. Furthermore, NFPA 1403 [2018] and NFPA 1550 [2024] emphasize the importance of tactical positioning and maintaining situational awareness to reduce risk during interior operations. By remaining low while operating without a hoseline, firefighters not only protect themselves from heat exposure but also maintain greater visibility and orientation—key components to effective and safer fireground decision-making. Firefighters can use NFPA 1700 [2026], Chapter 8 to develop an understanding of the characteristics and limitations of firefighting protective clothing and equipment.

Recommendation #1b: Fire departments should ensure personnel identify isolation opportunities from changing fire conditions.

At this incident, the conditions changed extremely quickly after L46 made entry into the apartment unit. L46B, who took refuge in the kitchen area below the pass-through window into the living room, escaped some of the extreme heat of the flow path between the window near the front door and the fire in bedroom 1. Because he identified the heat to his left when attempting to egress the structure, he decided to go to the right where the environment was ultimately more tenable.

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Fire conditions within a structure can change rapidly. As firefighters advance through a building, they must continuously assess their surroundings to identify potential areas for isolation—such as rooms with doors—that can be used to compartmentalize during deteriorating conditions. This proactive approach, often referred to as mapping the structure, or a search size-up, is critical for both firefighter survival and incident stabilization [FSRI 2023].

The IAFF promotes situational awareness and hazard recognition as essential competencies for interior operations, stressing the importance of understanding building layout, flow paths, and the location of potential isolation points [FSRI 2022a]. Research by the UL FSRI has also demonstrated the profound impact that controlling ventilation and isolating spaces can have on interior tenability. Studies from the "Coordinated Fire Attack" and "Search and Rescue" projects show that closing interior doors and using compartmentalization strategies can significantly reduce thermal insult and improve survivability for both firefighters and trapped occupants [FSRI 2022b, FSRI 2020b, FSRI 2020c]. These findings support the operational need for firefighters to map structures in real-time. NFPA 1700 [2026], states that firefighters should identify and use building features to control the environment, such as doors, to isolate fire compartments. This is a best practice to reduce exposure, improve visibility, and maintain escape routes [NFPA 1700 2026].

Recommendation #1c: Fire departments should ensure all personnel are trained on the "GRAB LIVES" fireground survival techniques.

At this incident, the three trapped firefighters attempted to evacuate the structure when the conditions deteriorated. When it became apparent that they were trapped, they attempted to transmit a Mayday call, attempted to find an exit, and shielded their airways by covering the lenses of their facepieces with their gloved hands.

The ability to react swiftly and effectively during a Mayday situation can mean the difference between life and death for firefighters. The IAFF Fire Ground Survival (FGS) Program uses the mnemonic GRAB LIVES (**Figure 2**), as a nationally recognized framework for self-survival techniques when trapped or disoriented on the fireground. Every firefighter, regardless of rank or experience, should be thoroughly trained in and regularly drill with this system [IAFF 2010a; 2010b].

In high-stress environments, cognitive processing becomes limited; having a trained survival plan like GRAB LIVES can help firefighters fall back on muscle memory and practiced routines rather than reacting in panic. By training all ranks in this method, departments can help increase overall resilience.

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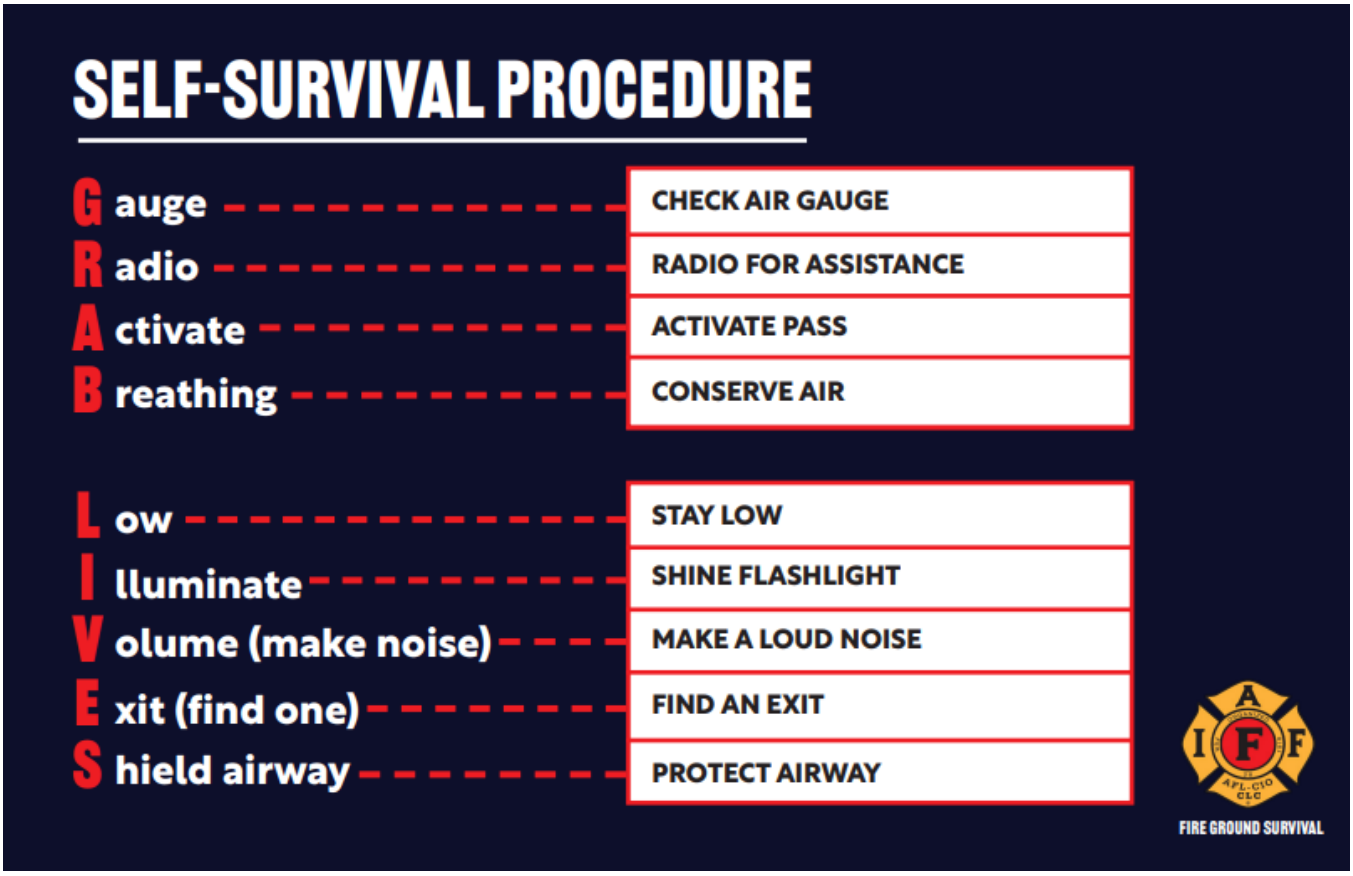

Figure 2: GRAB LIVES chart from IAFF FGS curriculum. (*Courtesy of the IAFF*)

Recommendation #2: Fire departments should develop a department culture that balances the life safety mission with proactive risk management.

At this incident, the personnel involved were experienced in responding to fires. This led to an approach of unwritten rules that may be referred to as "standing orders" that dictate how they should operate on the incident scene.

An organization's culture is broadly defined as the shared values, beliefs, norms, and behaviors that shape how employees communicate and make decisions [Zohar 1980]. Both formal practices and informal traditions passed down contribute to the culture over time, influencing individual and group behavior at various levels of the organization [Haas et al. 2020; Detert et al. 2000]. Broadly, fire departments tend to operate based on the bounds set by standard operating procedures (SOPs) or SOGs (i.e., formal practices). In large departments, such as the one in this incident, each individual firehouse and its separate shifts can have its own culture that deviates from the department policy. These differing values, perceptions, and norms may influence how certain tasks are performed such as forcing doors, conducting a search, or pushing a hallway.

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A department's culture may encourage a consistently aggressive tactical approach, which can result in life-saving outcomes depending on the nature of the emergency. Tactically aggressive does not mean aggressive in a reckless, angry, or always offensive manner; rather, it means to perform with efficiency, intelligence, purpose, and self-reflection [Norris 2024]. Whether the response is offensive or defensive in nature relies on the conditions met on arrival.

Department leadership can foster a supportive culture that is also tactically aggressive. One tangible way to do this is to first develop or update SOPs/SOGs that mirror how the department typically operates during incidents. Failing to develop or update SOPs/SOGs in this way may lead to a normalization of deviance where the policies and standards exist but are not followed [Vaughan 1996]. Consequently, when SOPs/SOGs are developed to reflect the department's core values and support its personnel, staff may feel a greater sense of autonomy, empowerment, and support.

Second, when leaders hold themselves and their crews accountable to SOPs/SOGs, it demonstrates the department's commitment to the safety and well-being of its personnel [Broadribb 2024]. Departments cannot overlook the influence of leadership in each firehouse, including among company officers, who can drive cultural change shift by shift, firehouse by firehouse, and district by district [Caward 2024]. Research has shown that leadership accountability and role modeling can encourage other employees to follow suit. For example, if the company officer or group leader always wears their PPE as described in the SOP/SOG, it sets an expectation among other personnel to do the same and nonverbally communicates the importance of that behavior [Haas and Orstad 2025]. Alternatively, if the company officer does not wear or properly use their PPE but reprimands others for not wearing it, trust in leadership may be compromised.

Leaderships' communication with personnel also plays a role in fostering a positive culture [Haas et al. 2020; Haas 2020]. Communicating with and getting to know personnel can assist in discovering what motivates individual firefighters to perform at higher levels. Eventually, department leaders can leverage these relationships often formed at the crew level, whether between company officers and line personnel or between "rookies" and more senior firefighters, to foster teamwork and support positive culture change [Palumbo 2025].

The fire service is deeply rooted in its traditions and history. Attempts at change can be met with staunch resistance. Anecdotally, some circles within the fire service view a culture of safety as not wanting to do the (risky) job of a firefighter. However, as windows for decision making get shorter during a response, a strong culture is key to preventing a status quo mindset. Consequently, those who are willing to challenge this mentality can help ensure that unnecessary, high-risk actions are not taken prior to conducting a risk assessment [Willing 2020]. By actively assessing risks and employing tactics to mitigate and manage risks, the fire service can still perform at the highest level but do so more safely [Fire Engineering 2019]. Because culture change or sustainment starts at the top, leadership should create a clear, relatable mission and a vision that reflects the organization's values. If members don't support the mission or vision, the organization's culture will not thrive. Leaders who empower their people and support their growth are paramount to developing a culture that can make difficult decisions at light speed.

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Recommendation #3: Fire departments should ensure that firefighters understand the capabilities and limitations of selected PPE for the applicable hazards and tactical operations.

At this incident, the L46 firefighters employed structural firefighting turnout gear whose elements had greater insulation beyond the requirements of specific certification standards. Increased insulation has the potential to affect the ability of firefighters to perceive fire environment temperatures or rapidly changing conditions.

The selection of PPE provides a series of tradeoffs between protection and ergonomic factors such as likelihood for heat stress, mobility, and overall function. Increased thermal insulation provides the benefit of longer staying times and additional protection under extreme thermal exposure conditions. However, increased thermal insulation may also lessen firefighters' ability to judge changes in fireground conditions, particularly if they begin to worsen. PPE with increased thermal insulation, once heated, will store more heat. This means that heated gear with increased thermal insulation can transfer more heat to the firefighter even after being removed from the source of the heat. Fire departments must find a balance between thermal protection and function. While PPE offers a very general expectation of protection, tactical decisions by the department and judgments made on the fireground must account for PPE capabilities well before reaching its limitations to avoid serious burn injuries. Departments are required by NFPA 1550 [2024] as well as NFPA 1850 [2026] to undertake a detailed hazard and risk assessment for the selection of their PPE. The selected PPE should further be accompanied by detailed training to provide department members with a clear understanding of its limitations. NFPA 1700 [2026] Chapter 8 provides information on the thermal testing requirements for firefighter protective clothing and equipment. This chapter provides the design conditions for the gear which should not be exceeded on the fireground.

Recommendation #4: Fire departments should coordinate response procedures with local law enforcement to protect firefighters and prevent interference when working at emergency scenes.

At this incident, the neighborhood was known to have elevated crime levels and a civilian started a physical altercation with E35A. This altercation prevented E35A from calling for water or beginning fire attack. The altercation also distracted the other on-scene personnel which interfered with fire suppression operations at the scene. This delayed water application and resulted in fire growth.

Fire departments not only respond to incidents caused by violence but may also encounter violence at seemingly routine service calls. NFPA 1550 [2024] recognizes the potential for violence, active shooters, unrest, and civil disturbance as threats that firefighters may encounter during incident response. In previous NIOSH firefighter fatality investigations resulting in violence during routine calls for service, NIOSH stressed the importance of ensuring scene safety by partnering with local law enforcement [NIOSH 2018; NIOSH 2021].

NFPA 1550 [2024] recommends that fire departments develop agreements and SOPs with law enforcement agencies to ensure the safety of firefighters working at emergency scenes including [NFPA 1550 2024]:

- Response roles and responsibilities, such as law enforcement securing the scene and firefighters maintaining incident management through unified command.
- Ways to mitigate violent interference before law enforcement arrives on-scene.
- Standard communication methods, such as coded language for firefighters that indicate they are in a life-and-death situation requiring immediate law enforcement intervention. Use of coded language, or a standard phrase only known by responders, can warn other responders to the dangers of the situation without triggering hostilities.
- Next steps when violence occurs after emergency operations have started, such as immediate law enforcement protection or withdrawal of all firefighters to a safe staging area.

Coordinated response procedures should identify which types of calls for service and in what geographic areas law enforcement should respond with the fire department to provide scene safety. Geographic areas can be selected using the fire department's community risk assessment results. This includes areas that experience increased rates of crime and other intentional human-caused hazards [NFPA 1660 2024]. The jurisdiction's public safety answering point computer-aided dispatch system should be updated with the identified types of calls and areas for coordinated response. Any communication methods developed under these joint agreements or SOPs should also become a part of dispatch protocols. Fire departments should routinely train with law enforcement agencies and the public safety answering point to maintain effective joint response procedures. Routine training ensures personnel and resources are prepared to work together and can operate as a functional team [USFA 2017].

Recommendation #5a: Fire departments should ensure ICs immediately establish divisions/groups with a supervisor to communicate conditions, actions, or needs.

At this incident, the IC almost immediately established various groups such as fire attack, search, water supply, and ventilation. As the incident progressed, communications were not made between group supervisors and the IC of actions taken or changing conditions.

Within a division/group, firefighters advise their supervisor of work progress and provide accountability for crew members engaging in task level activities. The IC should assign divisions/groups to a supervisor early. This is especially important when firefighters are operating from tactical positions that the IC has little or no direct control over (e.g., out of sight). All requests for additional resources or assistance within a division/group are directed to the supervisor who is responsible for communicating with the IC. Supervisors can provide ongoing conditions, actions, needs (CAN) reports to the IC of all four sides and the interior of an incident which may influence tactics and strategy [SKCFTC 2025]. Division/group supervisors can also assist in providing PARs when requested by the IC, incident safety officer, or operations. When the IC does not establish divisions/groups with a supervisor, firefighters should follow established fireground operations reporting procedures while operating in the incident and hazard zone [NIOSH 2025b]. This approach supports a more organized response to dynamic conditions such as fire extension, structural instability, or victim removal.

Additionally, guidance from UL FSRI's coordinated fire attack and command studies suggests that fragmented or delayed command assignments contribute to poor information flow, delayed tactical

decisions, and increased risk to personnel [FSRI 2020a]. Implementing divisions or groups early fosters accountability, improves communication across crews, and ensures that developing conditions in all operational zones are continuously monitored and reported.

Recommendation #5b: Fire departments should ensure firefighters protect radios and cables by wearing radio straps under their turnout coat.

The department in this incident provides radio straps for each riding position of each apparatus and allows the individual member to make the personal decision on how they affix their portable radio to use during operations. Many of the department personnel wear their radios in the chest pocket of their turnout coat, microphone cable tucked into their pocket, and the remote speaker microphone (RSM) clipped near their facepiece or in the center of their chest. All three radios examined in this incident had significant thermal damage with one radio having complete burn-through of the cable resulting in the RSM separating from the cable. It was not clear if the thermal damage impacted the personnel declaring Mayday.

Portable radios are an essential safety device on the fireground because each firefighter can immediately report, or be notified, of changing conditions or emergencies that may affect their survival. Firefighters understanding what conditions may cause radio failure and how to best protect their radio is imperative. Between 2004 and 2014, NIST conducted studies to determine the effect of high temperatures (160°C/320°F) on portable radios. Some of these studies demonstrated that direct exposure to high temperatures can melt the RSM and cable, resulting in loss of functionality for interior firefighters and disabled broader fireground communications from unintentional transmissions [NIST 2006]. In these studies, failures occurred most often when portable radios were worn on the exterior of structural firefighting turnout gear with the RSM cable directly exposed to high temperatures [NIST 2006]. NIST findings from user-centered interviews noted that firefighters reported being aware that the RSM cable is known to melt in high temperature environments, with a number of firefighter fatalities related to failure of radios and subsequent loss of communications [NIST 2018]. These studies led to the development of NFPA 1802, *Standard on Two-Way, Portable RF Voice Communications Devices for Use by Emergency Services Personnel in the Hazard Zone*. The standard includes a requirement for portable radios and their accessories to withstand temperatures up to 500°F for five minutes [NFPA 1802 2021].

The first radios to meet or exceed the NFPA 1802 standard were certified in 2022. It is likely that older radios are still in use and may not offer the same heat tolerance as newer radios designed to meet the standard. Firefighters may employ additional protection or other tactics for both new and older radios and cables with PPE.

Proper placement of portable radios entails wearing the radio on straps, under the turnout coat, and with the radio extended below the bottom of the coat with the antenna tilted away from the body to protect the RSM cable from melting [NFPA 1802 2021]. This placement of the portable radio allows the RSM cable to be protected from direct exposure. Additionally, this placement significantly reduces the possibility of an entanglement hazard involving the RSM cable and improves signal strength from the radio antenna. A 2013 report by the Fairfax County Fire & Rescue Department includes diagrams for proper wearing of a radio strap and portable radio for interior firefighting operations [Fairfax County Fire and Rescue

Department 2013]. Fire departments may consider equipping firefighters with radio straps and updating standard operating procedures or guidelines to include proper use during interior firefighting operations. Fire Academies and fire instructors may opt to include radio strap use in both entry level and advanced firefighter training [NIOSH 2025c].

Recommendation #6: Fire departments should educate the community to enhance individual knowledge, attitudes, and behaviors to help reduce risks, injuries, and fires within the community.

The fire in this incident was started accidentally by occupants in an apartment. According to the Arson Bureau investigation, the occupants evacuated the residence after they discovered the fire. They attempted to fight the fire, then left doors open when evacuating, allowing for a flow path (feeding the fire with oxygen), and were delayed in calling 911 to report the emergency. These factors facilitated rapid-fire growth and spread prior to the arrival of the first on-scene firefighters.

Fire and life safety education is a critical element of community-risk reduction. This effort works to enhance knowledge, attitudes, and behaviors among community residents to help reduce risks, injuries, and fires [IFSTA 2015]. Fire departments act on this effort by training firefighters and other personnel as Fire and Life Safety Educators (FLSEs). FLSEs coordinate and deliver educational programs that teach people about a particular hazard and how to reduce or prevent the risks [NFPA 1030 2024]. Such education initiatives can teach community members about fire and injury prevention, including what actions they can take during an emergency. Existing programs include:

- The importance of working smoke alarms
- The proper use of child safety seats
- The need for carbon monoxide detectors and proper use of gas-powered appliances
- Closing bedroom doors while sleeping or closing doors upon egressing during a fire incident

Specific to this incident, an applicable topic could be teaching community members to close doors during an evacuation to limit oxygen ingress and to report fires as soon as possible to get firefighters dispatched immediately. FSRI's 'Close Your Door' encourages those trapped in a room during a fire as well as those who can safely leave a home to close as many doors as possible to limit the growth and spread of the fire [FSRI 2021]. The webpage, Close Before You Doze offers a series of free resources, including videos that fire departments can use to educate the public. These types of initiatives can be provided by fire departments in the form of scheduled lectures at community centers or fire stations, school visits by firefighters for fire prevention week, or informational graphics posted on social media [IFSTA 2015].

Fire Department Actions to Echo

Actions to echo were measures taken by the fire department before and during the incident that may have prevented further serious injuries or fatalities or may help prevent similar incidents. NIOSH investigators identified the following actions to echo:

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Educate personnel to seek out areas of refuge when encountering rapidly deteriorating fire conditions.

In this incident, L46B was leaving the structure as he felt immense heat to his left when he entered the living room from the hallway. When he felt the intense heat to his left, he went right. He sheltered along the floor next to a refrigerator and below a passthrough segment of the dividing wall. This effectively removed him from the flow path between bedroom 1 and the living room window.

Educate personnel to change tactics based on conditions.

When E35 discovered that L46 was trapped in the building, the officer directed the nozzle firefighter from E35 and E46 to begin flowing water on the fire. They directed water from outside the structure into the living room where two L46 firefighters were located. This action deviated from the standard operations of the department. However, the immediate application of water into the room rapidly cooled the environment for the firefighters trapped inside the structure.

Split crews to complete multiple tasks simultaneously.

In this incident the E46 officer made the decision to split the crew. He took one of the backstep firefighters with him to side Alpha to assist with operations while the other two personnel completed the initial task from the IC, securing water supply. This increased operational capacity and made more personnel available to operate earlier in the incident. This allowed firefighters to staff a second hoseline when another engine company was not on scene yet. This second staffed hoseline, or back-up line, allowed firefighters to flow water into the compartment where the L46 firefighters were trapped, and immediately improved conditions inside the apartment unit.

Multiple personnel attempted to declare Mayday.

During incident personnel interviews, multiple people stated that they attempted to declare a Mayday for the personnel they knew were trapped to ensure that command and OEC were aware. The department in this incident has a standing order to dispatch the next alarm level when a Mayday is declared to add additional resources. Ensuring the declaration happens provides an opportunity for the IC to have additional resources enroute and on scene without specifically requesting them allowing on scene personnel to stay focused on tasks at hand.

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Investigator Information

This investigation report was authored by Stephen J. Ringer, Investigator, with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH, Daniel Madrzykowski, Ph.D., P.E., Senior Research Director, with ULRI's Fire Safety Research Institute, Jeffrey Stull, M.S., PPE subject matter expert to the IAFF, and Jeffrey Seaton, B.S., Lead Master Instructor for IAFF Fire Ground Survival.

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Sean Duffy, Firefighter, from the City of Ann Arbor Fire Department, and Justin McWilliams, provided subject matter expert reviews of the investigation report.

Additional Information

Underwriters Laboratories (UL) Fire Safety Research Institute (FSRI)
Evidence-Based Considerations for Your Fireground Playbook. This document is designed to help fire department leadership create a customized fireground playbook tailored to their unique resources, staffing, and operational environments. By using the framework outlined in this guide, departments can implement evidence-based strategy and tactics based on fire research from the Fire Safety Research Institute (FSRI), part of UL Research Institutes, while ensuring alignment with industry best practices such as those in NFPA 1700 [2021]: The Guide for Structural Firefighting. The playbook can be downloaded from https://fsri.org/news/ul-research-institutes-launches-new-playbook-help-fire-departments-integrate-evidence-based

Everyone Goes Home® Firefighter Life Safety Initiatives by the National Fallen Firefighters Foundation (NFFF)
The Initiatives have deeply informed the emerging safety culture in the US fire service and become the bedrock foundation for thousands of fire departments and EMS organizations who have a desire to ensure that their firefighters and medics return home safely after every shift. 16 Firefighter Life Safety Initiatives - Everyone Goes Home

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.*

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Appendix One:

Additional PPE Information

Table 4: Observations of damage to PPE items worn by L46 entry team members.

PPE Item	L46A	L46B	L46C
Coat	• Cut during post-extrication • Highly charred and embrittled on front and back sides except in areas of SCBA coverage • Greatest damage was on left side and shoulders • Liner interior shows heat penetration through all layers at lower shoulders, upper back, and both sides of SCBA location • Moisture barrier layer suffered significant damage to film, primarily on the left side • Some disintegration of additional insulation layer between moisture barrier and thermal barrier was present • Portion of sleeve end separated from coat	• Cut during post-extrication • Highly charred and embrittled on shoulders, back of arms, and sides except in areas of SCBA coverage • Several areas of break-open especially along upper back, lower shoulders, and sleeves • Heat penetration to thermal barrier (skin side) in middle of back along sides • Charring of interior thermal insulation layer	• Cut during post-extrication • Highly charred and embrittled on shoulders, back of arms, sides, and back except in areas of SCBA coverage • Significant amount of break-open on sides along back and shoulders • Heat penetration to thermal barrier (skin side) and back sides of coat • Charring of thermal insulation layer, moisture barrier, and side of thermal barrier
Pants	• Cut during post-extrication • Severe charring on both sides and seat • Worst embrittlement on left upper side • Less evidence of heat penetration to interior lining relative to pants	• Cut during post-extrication • Heavy charring and some embrittlement from seat to lower legs • Minimal heat penetration to thermal barrier side but heavy soiling	• Cut during post-extrication • Heavy charring, embrittlement, and break-open from seat to lower legs

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PPE Item	L46A	L46B	L46C
Helmet	• Significant thermal damage to shell , fiberglass exposed • Front and back brims missing • Portions of eye shield melted away • Thermal damage to retention system • Portions of ear covers burned away	• Thermal damage to shell with breakup of back brim and right-side, fiberglass exposed • Front brim, eye shields, and ear covers missing • Front holder and retention system also missing	• Intact with thermal damage to ribs and back brim • Eye shields fully blackened, crazed, and distorted • Winter liner found in helmet interior • Ear flaps missing.
Gloves	• Outer leather on back and palm side burnt • Large parts of gauntlet missing	• Right gloves torn open on back, potentially post-extrication • Majority of gauntlets intact but charred • Reflective trim on gauntlets heavily damaged • Showed evidence of shrinkage, particularly left glove	• Cut during post-extrication • Heavy charring of gauntlets • Heavy damage to leather shell mainly on palm • Shrinkage of overall gloves
Footwear	• Some thermal damage to foot and outer sole • Little to no damage of upper boot covered by the bottom of the pants • Some melted debris to outer sole	• Moderate thermal damage to lower foot portions of boots • Melted debris on lower side and heel • Damage worse to left boot	• Cut during post-extrication • Boots completely charred • Slight thermal damage to front toe cap • No obvious thermal damage to interior of boots (could not be fully examined)

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PPE Item	L46A	L46B	L46C
Hood	• Not available for examination	• Charring with some embrittlement to top, front face opening, and crown • Additional charring and embrittlement to back of hood above bib area and along sides • Appearance of helmet winter liner section inside hood crown with second separate insulation piece	• Cut during post-extrication • Heavy charring, embrittlement, and some break-open along sides and neck portion • Greatest damage on sides of crown above reinforced ear insulation patch areas • Appearance of prior wear and tear at edge of face opening
SCBA facepiece	• Severely crazed lens • Slightly melted mask-mounted regulator, bypass valve, voice emitter, and exhalation valve cover • Mask mounted regulator melted to facepiece frame	• Heavy soiling on exterior of lens with mild crazing • Light thermal damage to exterior components	• Fully blackened and crazed lens • Slightly melted voice emitter and exhalation valve cover
SCBA with Integrated PASS	• Blackened cylinder • Melted cylinder valve and gauge • Exterior thermal damage to hoses and harness system (straps intact) • Melted and unreadable control console • Portion of labels on interior of back frame unreadable	• Blackened cylinder • Melted cylinder valve and gauge • Slight exterior thermal damage to hoses and harness system (straps intact)	• Blackened cylinder with exposure of loose fiber wrapping • Exterior thermal damage to hoses and harness system (straps intact) • Melted and unreadable control console • Portion of labels on interior of back frame unreadable
Thermal imaging camera	• Signs of minor thermal damage and melted fabric, presumably from a chair melted onto housing • Equipment was functional but screen was heavily soiled and damaged		

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Table 5: Selected photographs for damaged protective coats worn by members of L46 entry team.

L46A Outer Shell Exterior Side		**L46A Liner Interior Side**	
L46B Outer Shell Exterior Side		**L46B Liner Interior Side**	

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L46C Outer Shell Exterior Side		L46C Liner Interior Side	

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Table 6: Selected photographs for damaged protective pants worn by members of L46 entry team.

L46A Outer Shell Exterior Side		**L46A Liner Interior Side**	
L46B Outer Shell Exterior Side		**L46B Liner Interior Side**	
L46C Outer Shell Exterior Side		**L46C Liner Interior Side**	

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Table 7: Selected photographs for damaged protective helmets and gloves worn by members of L46 entry team.

L46A Helmet (Left Side)		**L46A Left Glove (Back View)**	
L46B Helmet (Left Side)		**L46B Both Gloves (Back View)**	

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L46C Helmet (Left Side)	L46C Both Gloves (Back View)
	

Table 8: Selected photographs for damaged protective hoods worn by members of L46 entry team.

L46B Hood (Front View)


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L46C Hood (Front View)	

Table 9: Selected photograms for damaged protective footwear and SCBA facepieces worn by members of L46 entry team.

L46A Right Boot (Outboard View)		**L46A SCBA Facepiece (Front View)**	

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L46B Right Boot (Outboard View)		L46B SCBA Facepiece (Front View)	
L46C Right Boot (Outboard View)		L46C SCBA Facepiece (Front View)	

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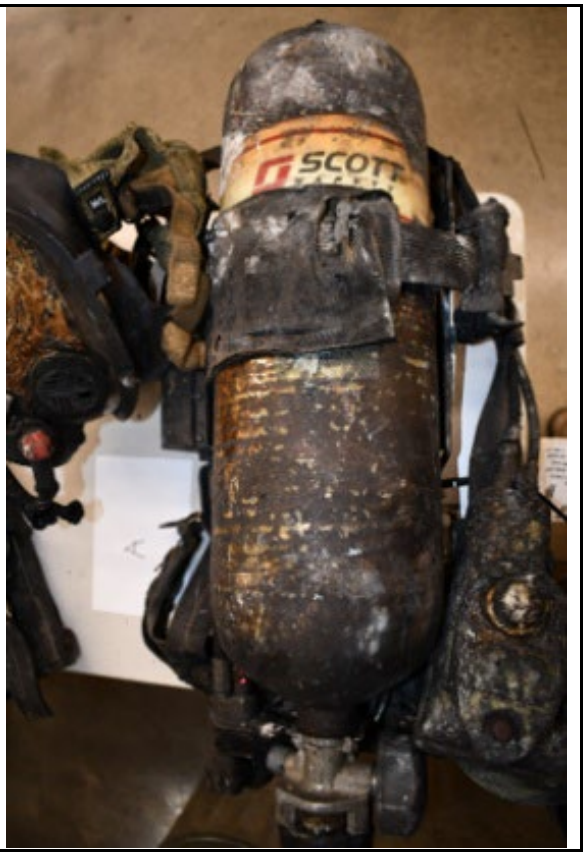
Table 10: Selected photographs for damaged protective SCBA back frames and cylinders worn by members of L46 entry team.

L46A SCBA (Cylinder View)	

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L46B SCBA (Cylinder View)

Senior Captain and Two Firefighters of Ladder Company Burned During Primary Search in Garden Apartment Fire – Texas

L46C SCBA (Cylinder View)