Gresham Fire Department

Serious Injury Incident Investigation

1327 SE 182nd Avenue Duplex Fire
Gresham, Oregon
May 30, 2024

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Incident Overview

On May 30th, 2024, a 33-year-old firefighter, a 28-year-old firefighter, and a 23-year-old firefighter were injured at a residential fire, classified as a 1-or-2 family dwelling. The 33-year-old firefighter sustained burns, over 45% of his body and was in critical condition at the hospital. The 28-year-old firefighter was transported with minor burns to his shoulder and released in good condition. The 23-year-old firefighter was transported for suspected heat exhaustion and released in good condition.

At 2102 hours citizens reported lots of dark colored smoke coming from a house (a converted garage duplex) on 182nd Avenue. At 2103 hours the Bureau of Emergency Communications (BOEC) dispatched E31, R31, C7, E71, T71, E74, E73 to the residential fire. At 2107 E31 arrived along with R31 on scene and reported smoke from the Alpha side of the building, E31's officer established command and directed crews to pull a 1 ¾" to the front door and a backup hoseline.

Arriving at 21:07 firefighters on E31 were met with frantic citizens and a mother yelling her baby is in the house. E31B searched the structure towards the bedroom where they were directed by bystanders. They entered without a hoseline and without radio communication to the Incident Commander. The Incident Commander saw the firefighters enter without a hoseline and redirected R31 to Fire Attack. The order was never acknowledged by R31 who were also distracted by frantic citizens directing the R31 driver to the Charlie side of the building where the citizen convinced the firefighter a child was in the building. He entered alone to search for the child on the Charlie side of the building and exited due to the heat. As E31B was searching for a victim in the Alpha side bedrooms, the heat and intensity of the fire forced them to withdraw from the structure. The team of two firefighters made the hallway, the lead firefighter missed the entrance point and proceeded into the dining room/family room area. Disoriented he then reversed course back to the hallway. He noted a light out the Alpha window and bailed out of a bedroom window on the Alpha Delta Corner. The other firefighter followed the wall on his left and exited the way they had entered, through the front door on the Alpha side. The injured firefighter, who exited from the bedroom window, had fire damage to his mic cord that caused the operations channel to lock up. After exiting he went to the front yard where his officer located him. The officer notified the Incident Commander of the injured firefighter, and he was given immediate medical attention. The other two firefighters came out of the house with minor burns and heat related injuries. They were transported for further evaluation. All injured firefighters were out of the building by 21:10.

The Fire Marshal oversaw the investigation performed by two Investigators. The Primary Investigator met with Incident Command, conducted the initial interviews with the tenant, building owner and witnesses present. The Investigators documented the fire scene by photographing the exterior and moving counterclockwise around the home. After concluding the initial assessment of the exterior, Investigators began processing the interior of the fire scene, working from the least damaged area to the bathroom where the fire originated. The home was determined to be unoccupied at the time of the fire incident. The cause classification of the fire was accidental with the most probable cause being unattended candles.

Executive Summary

After the initial incident response, work began on the serious firefighter injury investigation. Fire Chief Scott Lewis assigned the investigation to Battalion Chief of Safety/Training/EMS Peter Graves to begin collecting statements, developing a team, and completing the investigation. Gresham Fire Department does not have a policy for severe injury incident investigations. For reference the team used the International Association of Fire Fighter Line of Duty Death or Injury Investigation Manual.

The Team worked to acquire initial statements and interviews, Investigation of Cause and Origin, Incident Timeline, Fire Behavior, and Operational Evaluation. Additional help was requested from the National Institute of Safety and Health (NIOSH). NIOSH is an experienced organization that is charged with performing Line of Duty Death for the fire service. NIOSH visited Gresham Fire Department in July of 2024 to interview and investigate the significant injury incident. NIOSH will be producing their own report for distribution to the national fire service. Underwriters Laboratories Fire Safety Research Institute (UL FSRI) was also contacted to recreate various aspects of the fire behavior analysis, testing of materials, and expert analysis. Results of their testing is yet to be available.

It is worth noting that many of the conclusions and recommendations made by the Serious Injury Investigation Team continue to be challenges for the Gresham Fire Department. The National Fallen Firefighter's Foundation identifies four key areas which influence the root causes of line of duty deaths: Leadership, Accountability, Culture, and Knowledge (LACK). Indeed, many of these same factors played a role on this incident specifically:

Leadership- The department should develop a comprehensive leadership program in addition to evaluation of department structure. The department lacks a sufficient span of control of Command Officers (Battalion Chief and above) and safety officers to adequately effect change, build relationships, or manage complex incidents without relying on off-duty personnel or mutual aid agreements.

Accountability- All crews operating on an emergency scene must be assigned and be part of the incident action plan. Personnel operating on the fireground must ensure that they are disciplined and perform actions which are expected and driven by policy. If policy must be deviated from, it must be communicated and approved by the Incident Commander. Accountability requires that supervisors know who works for them, where they are, what they are doing, if they are making progress, and how long they have been operating.

Culture- The city of Gresham should strive for every member to understand the "why" of how we serve the community. The Gresham Fire Department culture must emphasize the importance of firefighter safety, health, and wellness in order to serve those who need us (the public), in the best way possible. This is an inherently dangerous profession requiring every member to help mitigate risk. Culture is driven by shared meaning, including mission, vision, values, and goals.

Knowledge- Knowledge of fire behavior and best practices related to its effective extinguishment are important now, more than ever. Every firefighter and fireground officer must avail themselves to training on this topic.

The goal of this investigation is to identify what happened and why, and what actions should be taken to prevent future occurrences of a similar nature, and to reduce the risk of fire fighter injuries.

Incidents occur because a series of individual circumstances, decisions, and actions occurred in a manner that resulted in a specific chain of events. The chain of events often involves several different combinations of people, making multiple decisions without the benefit of time. While the incident may seem (bread and butter) as described by the firefighters on scene, the outcomes can be tragic if a comprehensive approach to fire department Leadership, Accountability, Culture, and Knowledge are not consistent and planned through training and administrative support.

The document describes the cause and origin, building construction, fire behavior indicators, timeline, and operational review. The document then outlines an outside agency operational review and recommendations by a chief officer of Portland Fire, followed by a description, recommendations, and analysis of contributing factors and key recommendations.

The following contributing factors are directly correlated to the significant injury incident of Spencer Tejedas. As a result, the Investigation Team concluded the following key recommendations.

Contributing Factors

- *Insufficient risk assessment/size up difficulties*
- *Lack of effective Incident Command (IC) and control*
- *Primary search without a hoseline or Fire Attack established (delayed water on the fire)*
- *Lack of critical communications in requesting changes to tactics and tasks*
- *Loss of crew integrity and accountability*
- *Radio/communication difficulties*
- *Rapid fire growth*
- *Lack of effective Standard Operating Guidelines (SOGs), and failure to follow established SOGs*
- *Lack of training (fire behavior, officer development)*
- *Lack of City of Gresham Support for fire department structure and training identified from decades of studies and recommendations.*

Key Recommendations

Fire Operations

- *Develop Operational Policies for fire operations reflecting current best practices (UL Studies)*
- *Ensure the IC clearly identifies the strategy, Offensive or Defensive, on every fire incident.*
- *Outside agencies recommend implementing the Operations Chief Position.*
- *Remove "Rescue Mode" as a strategy available to Incident Commanders.*
- *Ensure all fire incidents prioritize an immediate 360 size up evaluation.*
- *Collaborate with Portland Fire & Rescue on Operational Policies.*
- *Develop an effective transfer of command SOG.*
- *Define the backup line and develop a policy.*
- *Define company tactics and tasks and how to request or advise a change in assignment to Command.*
- *Ensure all responding units stage, notify the IC, and standby until an assignment is given (consider level one staging).*
- *Ensure Ventilation is coordinated with Fire Attack.*
- *Evaluate command and control job aids for function and best practice.*

Communication

- *Develop Standard Operating Guidelines (SOGs) and training to ensure all teams and companies operating on an incident are aware of the overall strategy of the incident, their tactical assignment, and they confirm that information with the Incident Commander.*
- *Develop a communications SOG to correct tactical errors noted by the IC up to and including emergency traffic.*
- *Develop a policy and train companies to ensure radios will be carried to prevent remote mic cord thermal damage. Purchase individual holders and straps for all individuals. Standardize how radios are carried.*
- *Identify the radio call sign of each position on the apparatus. (example E31 nozzle, hydrant)*
- *Ensure the Battalion Chief IC removes as many distractions as possible so they may hear radio traffic. (consider wireless headsets)*
- *Work with BOEC dispatchers to develop a policy to convey critical victim updates in a timely manner.*
- *Work with BOEC to provide a procedure when radio transmissions are blocked by any source to restore communications on scene.*
- *Evaluate the actions of the Emergency Action Button (EAB) on the radio, implement changes and provide training.*
- *Define and train how and when to activate Emergency Tones on all radios.*

Accountability

- *Review and update the department's existing Accountability SOG to include strategic, tactical, and task level accountability. Ensure all GFD members follow the Accountability SOG and know how to conduct a Personnel Accountability Report (PAR).*
- *Ensure crew integrity is properly maintained by voice or personal contact when operating in an atmosphere that is immediately dangerous to life and health (IDLH).*
- *Ensure there is no freelancing on fire scenes by completing a Post Incident Assessment Checklist and following a robust accountability plan.*

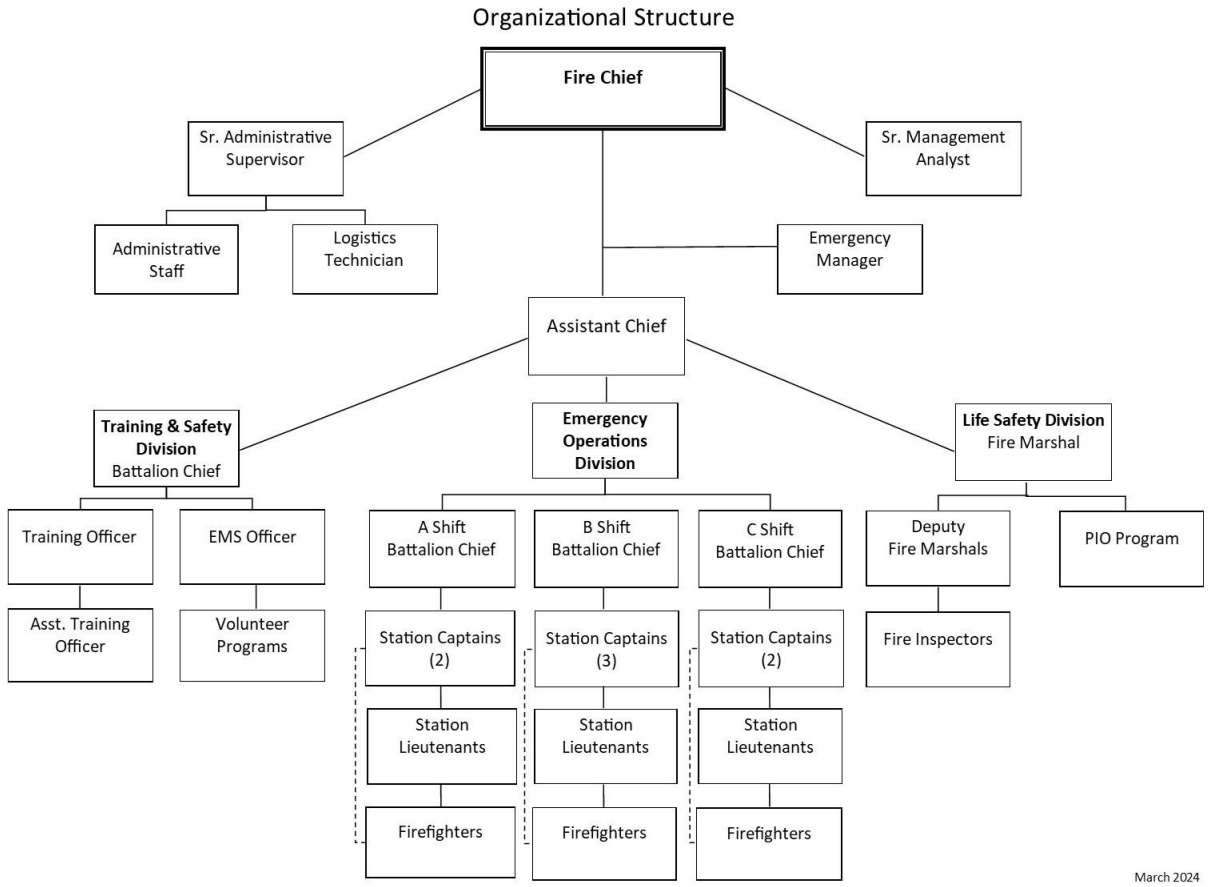
Training

- *Develop and implement training in fire behavior, search, fire extinguishment, ventilation and building construction to include effective situation assessment (reading the fire), and the impact of tactical operations. This training will need to include classroom instruction, small-scale exercises, live fire training and simulation. Effective training in this content area needs to begin in the recruit academy and continue throughout careers.*
- *Invest in early leadership and officer development at the Firefighter, Lieutenant, Captain, and Battalion Chief levels.*
- *Train for operations with four-person companies.*
- *Ensure all personnel know when and how to issue a "Mayday," and/or "Emergency Traffic".*
- *Train to ensure communications are heard and understood (closed loop communications).*
- *Train for emotional and psychological stress and pressure on the fireground.*

Department Organization

- *Define roles and responsibilities of Firefighters, Lieutenants, Captains, Fire Investigators, and Battalion Chiefs.*
- *Correct weaknesses in department structure to provide for effective administration, operations, and training identified by past studies of fire department organizational structure.*
- *Evaluate how to adequately distribute experience throughout the Department. The committee recommendation is to place company officers on Rescues.*
- *Set clear expectations at rollcall, designate B-team leader, or Rescue lead (radio operator).*
- *Apply NFPA 1710 to staffing of Gresham Fire Apparatus which includes four-person staffing.*

Fire Department Organizational Overview



Administration

Fire Administration maintains the department's day-to-day operations by providing overall management, leadership succession planning, mutual assistance plan development, public information, community outreach, contract and grant administration, cost recovery, financial models, and project management. The primary activities of Fire Administration support the front-line functions of the department and include personnel management, development of policies and procedures, assurance that all legislative requirements are met, maintaining Oregon OSHA compliance, information concerning emergency events, administrative support, and departmental payroll and accounts payable. Fire Administration also interacts with city departments and coordinates with state and local government agencies.

Emergency Operations

The Emergency Operations Division is responsible for the initial response to calls for emergency medical or fire suppression services. All firefighters in the department are trained at the minimum level of Emergency Medical Technician (EMT), with many certified as paramedics, to provide patient care in the field. All Gresham engine companies are Advanced Life Support (ALS) units, which means each has a

firefighter/paramedic on board. The Emergency Operations Division provides fire suppression, emergency medical services, and the following specialized responses: technical rescue (confined space, high angle rope rescue, and structural collapse), water rescue, hazardous materials response, and wildland fire.

Training and Safety

Training is provided to maintain response readiness and proficiency at all levels. Emergency medical technician and paramedic training are provided to maintain State certification.

Life Safety

The Life Safety Division applies the fire codes to new construction to ensure appropriate fire suppression access and that the water supply and safety features, such as alarms and sprinkler systems, are code compliant. Fire investigation and determining causes is conducted for known arson fires, those involving significant fire loss and fire fatalities.

Fire Stations

Gresham Fire staffs one of three 24-hour shifts. The station and response vehicles are owned and maintained by Portland Fire and Rescue.

Apparatus	Minimum Staffing
Engine 31	4 personnel
Rescue 31	2 personnel
Water Tender	0 personnel – cross staffed
Total Minimum Staffing	6 personnel

FIRE STATION 71

1333 NW Eastman Parkway, Gresham

Apparatus	Minimum Staffing
Battalion 1	1 personnel
Engine 71	3 personnel
Heavy Rescue 71	0 personnel – cross staffed
Tractor Drawn Aerial 71	4 personnel
Total Minimum Staffing	8 personnel

FIRE STATION 72

500 NE Kane Drive, Gresham

Apparatus	Minimum Staffing
Engine 72	3 personnel
HazMat 3	0 personnel – cross staffed
Total Minimum Staffing	3 personnel

FIRE STATION 73

2301 SW Pleasant View Drive, Gresham

Apparatus	Minimum Staffing
Engine 73	3 personnel
Total Minimum Staffing	3 personnel

FIRE STATION 74

1520 NE 192nd Ave., Portland

Apparatus	Minimum Staffing
Engine 74	3 personnel
Rescue 74	2 personnel
Total Minimum Staffing	5 personnel

FIRE STATION 75

600 SW Cherry Park Ave., Troutdale

Apparatus	Minimum Staffing
Engine 75	3 personnel
Rescue Boat 75	0 personnel – cross staffed
Water Rescue 75	0 personnel – cross staffed
Total Minimum Staffing	3 personnel

FIRE STATION 76

30300 SE Dodge Park Blvd., Gresham

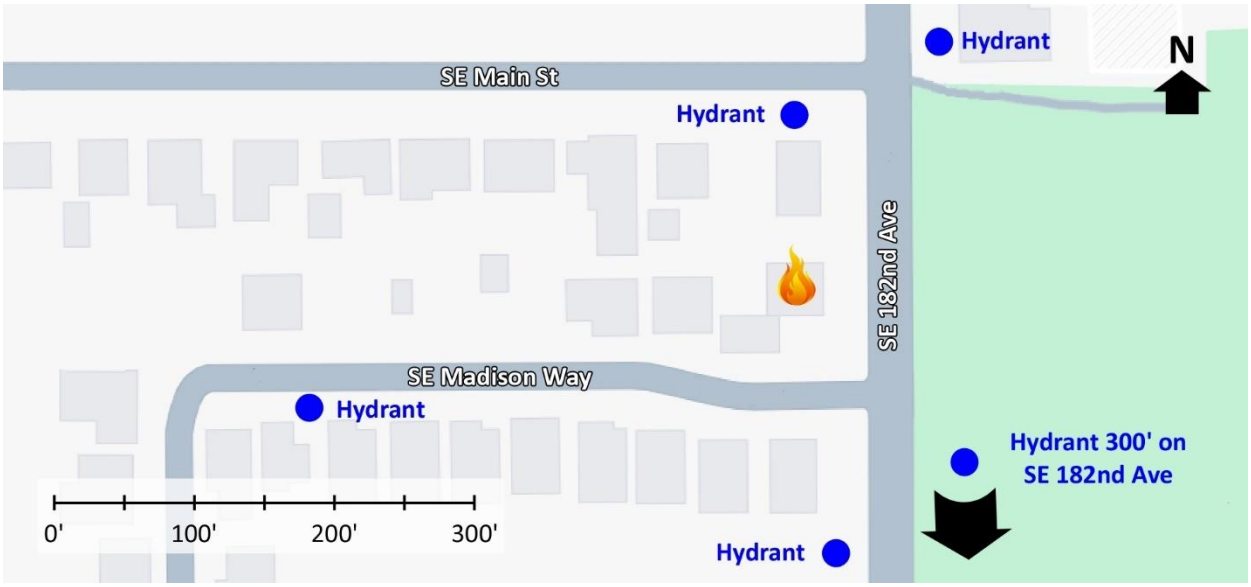
Apparatus	Minimum Staffing
Engine 76	3 personnel
Brush 76	0 personnel – cross staffed
Total Minimum Staffing	3 personnel

Incident Location

This incident occurred at 1327 SE 182nd Avenue in Gresham, OR (Portland mailing address). The fire involved Unit A of the one-story duplex at this address. The fire was confined to Unit A and did not extend to Unit B (the Bravo 1 Exposure).

Map and Aerial Photograph

Figure 1. Map



Note: Adapted from Google (2024). [Map 1327 SE 182nd Avenue, Portland, OR].

Figure 2. Aerial View

Note: Adapted from Google (2024). [Aerial view 1327 SE 182nd Avenue, Portland, OR].

Exterior Pre-Fire Photos

Figure 3. Alpha/Bravo Corner

Trulia. (2024). 1327 SE 182nd Ave #B, Portland, OR, 97233.

Figure 4. Side Alpha

Trulia. (2024). 1327 SE 182nd Ave #A, Portland, OR, 97233.

Figure 5. Alpha/Delta Corner

Trulia. (2024). 1327 SE 182nd Ave #A, Portland, OR, 97233.

Figure 6. Side Charlie (view from Delta)

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 7. Side Charlie (from Bravo)

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

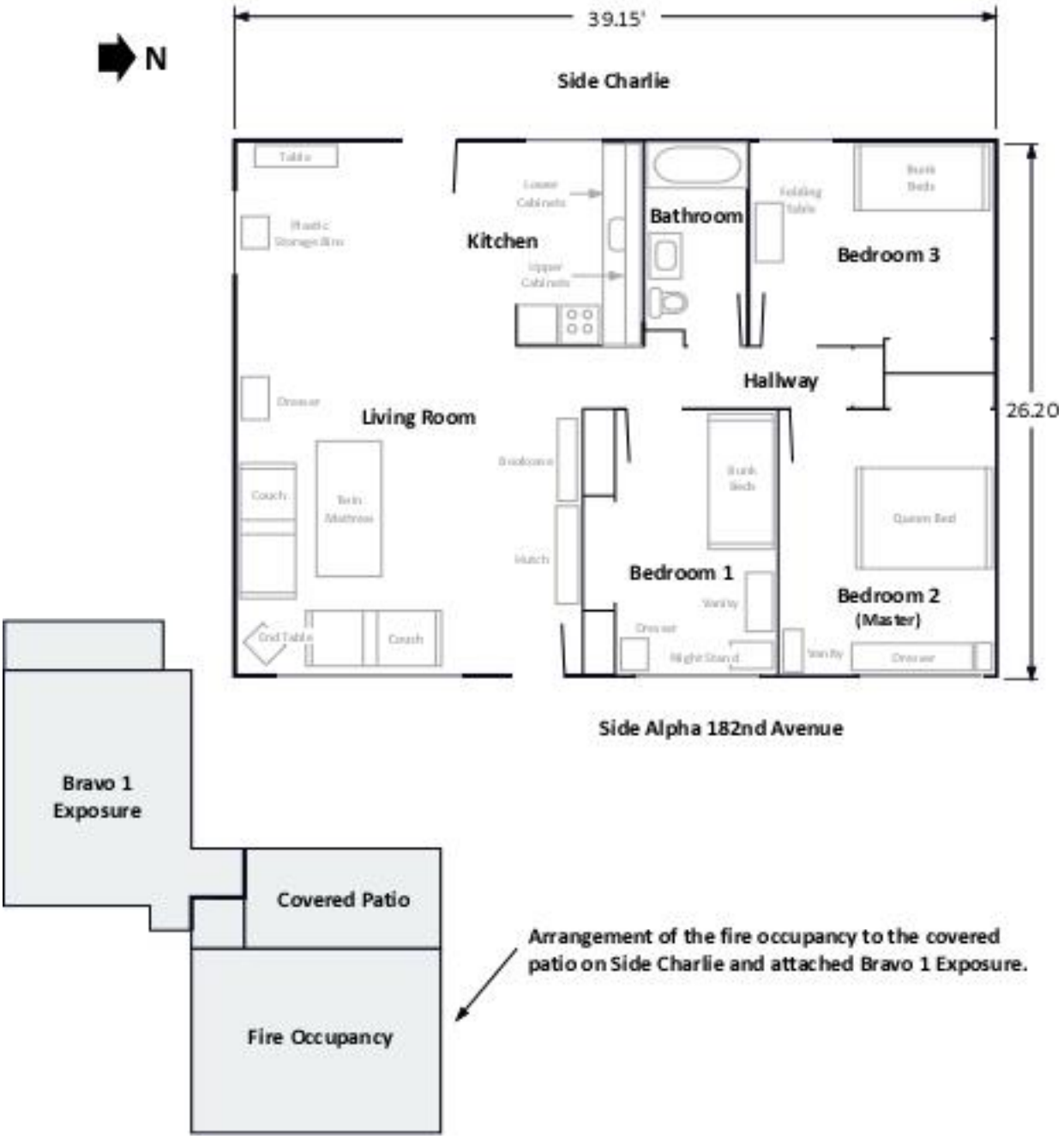
Figure 8. Side Delta

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Floor Plan

Figure 9 illustrates the floor plan of 1327 SE 182nd Ave #A with placement of major items of furniture at the time of the fire and identifies the area of origin as a point of reference. The designations for each room are used throughout this report.

Figure 9. Arrangement and Floor Plan.



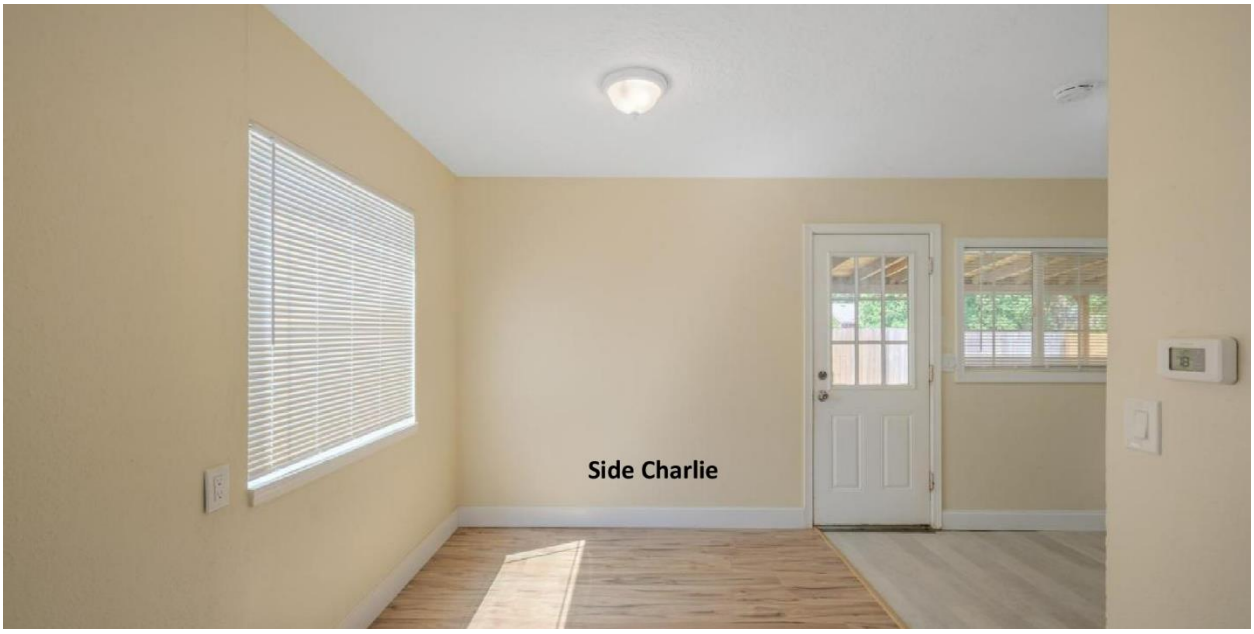
Note: Adapted from Baird, B. (2024a). Fire investigation field sketch. Gresham, OR: Gresham Fire Department.

Interior Pre-Fire Photos

Figure 10. Living Room

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 11. Living Room/Dining Area



Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 12. Kitchen

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 13. Bedroom 1 (looking towards Alpha)

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 14. Bedroom 1 (looking toward the hallway)

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 15. Bedroom 2 (looking towards Alpha)

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

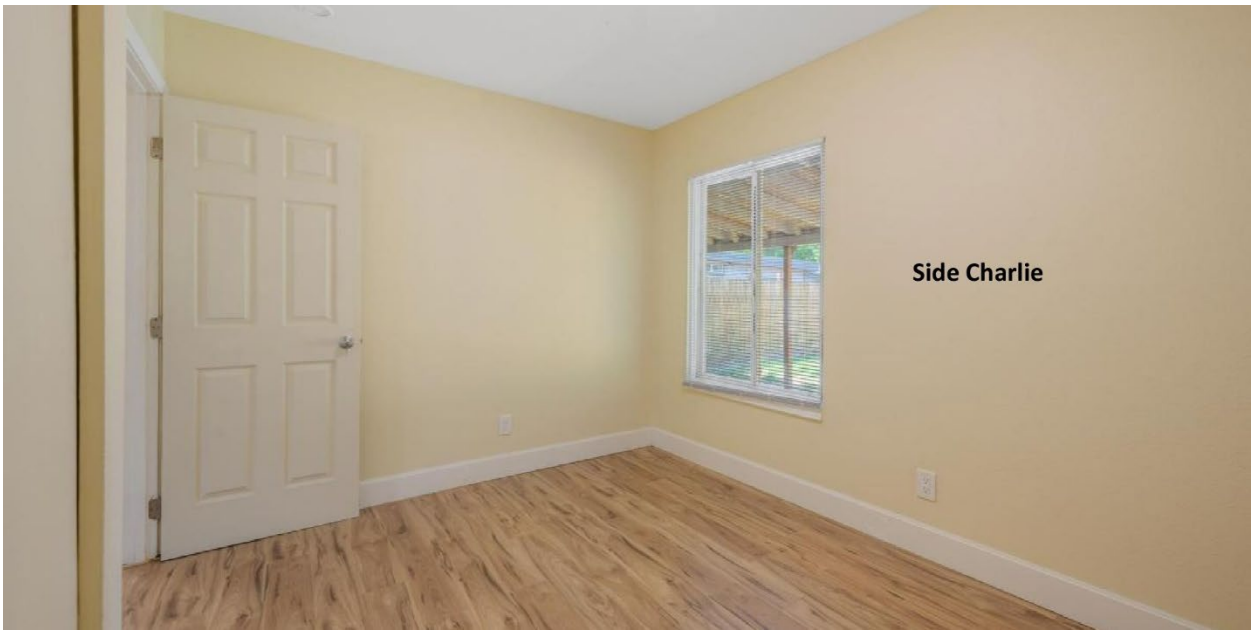
Figure 16. Bedroom 2 (looking towards hallway)

Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 17. Bathroom

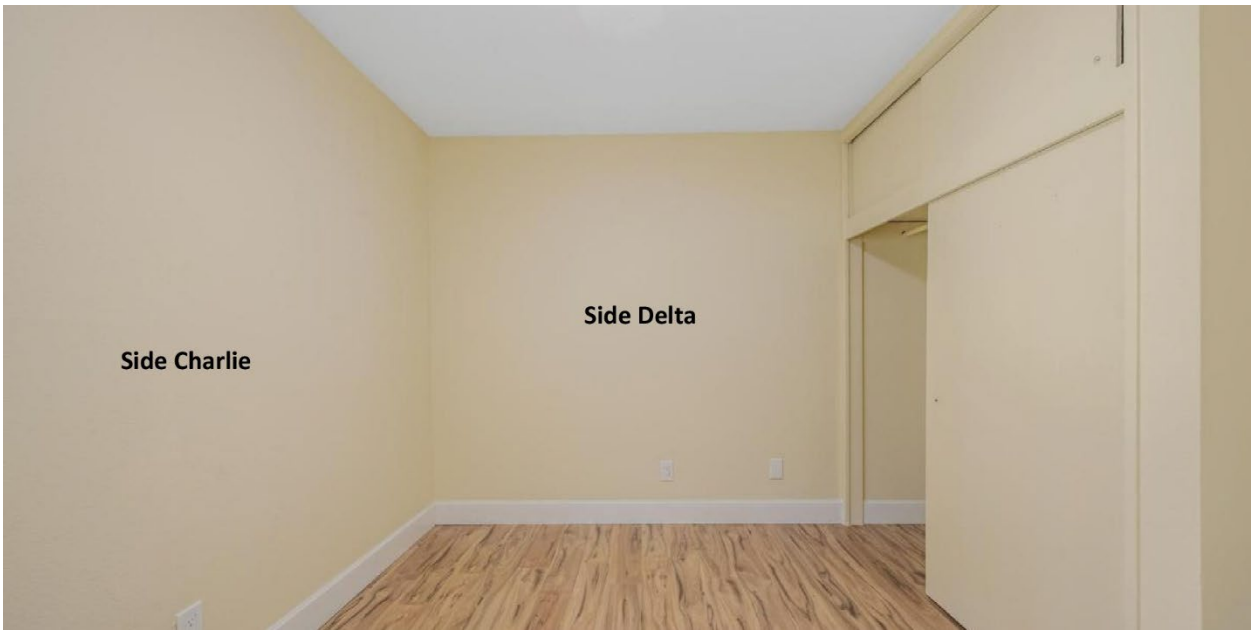
Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 18. Bedroom 3 (looking towards Charlie)



Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Figure 19. Bedroom 3 (looking towards Delta)



Hotpads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Apparatus Positioning

Figure 20 illustrates the position of first alarm companies except for Engine 73 which was parked to the south of the incident location.

Figure 20. Positioning of First Alarm Apparatus

Note: Adapted from Google (2024). [Aerial view 1327 SE 182nd Avenue, Portland, OR].

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Incident Timeline

Methodology

The timeline for this incident was constructed using the following data sources:

- Audio recordings of the 911 calls reporting this incident (BOEC, 2024a, 2024b, 2024c, 2024d).
- Audio recording of the Tapout talk group (BOEC, 2024e).
- Audio recording of the Ops 4 talk group (BOEC, 2024f).
- CAD RG24-11310 (BOEC, 2024g).
- CAD Supplement to RG24-11310 (BOEC, 2024h).
- Broadcastify radio feed (Tapout and Ops 1-10).
- OpenmHz.com (Ops 4 radio feed, with time data).
- Computer aided dispatch (CAD) data. Response and fireground operations data sequence is based on the order of radio transmissions. Time of arrival is based on CAD data (which may differ from radio transmissions due to use of mobile data computers (MDCs) to report arrival as well as radio transmissions.
- Narrative data from interviews with the personnel involved in this incident.
- Fire investigator's report data including narratives from occupants and bystanders.
- Video taken by bystanders during incident operations.

The audio recording of the Ops 4 talk group is correlated with the first three bystander video clips as follows:

- The Ops 4 dispatcher states the time at the conclusion of acknowledging Engine 31's initial (arrival) radio report.
- Engine 31's first update report stating that Engine 31 is stretching an attack line to the door on Side Alpha and Rescue 31 is assigned to the backup line occurs at 0:00:36 elapsed time (ET) in the Ops 4 audio and is audible in Video Clip 1 at 0:00:23 (ET).
- C7 arrives at 0:01:27 ET in the Ops 4 audio and visible on 182nd Avenue (arriving) at 0:00:20 ET in Video Clip 2 and is in place on the Alpha/Bravo corner at 0:00:31 ET in Video Clip 2.
- Truck 71 arrives at 0:00:10 ET in Video Clip 3. Lieutenant Mike Snodgrass, Truck 71 indicated that the truck arrived during the open mike from Engine 31 which occurred from 0:02:10 to 0:03:05 in the Ops 4 audio.
- There is no specific time correlation between the Ops 4 audio and Video Clip 4 other than that it ends prior to Firefighter Spencer Tejedas making his way to the Alpha/Bravo corner.

Timeline

Every effort has been made to ensure that this timeline is as accurate as possible given the limitations of available data. It is important to recognize that many actions at this incident were taken simultaneously, but of necessity are presented in a linear manner within this timeline. Radio and mobile data computer (MDC) times are identified in plain text. Fire behavior indicators, observations, and actions taken by individuals and companies involved in this incident are sequenced based on radio communications and narrative data. Times showing the hour and minutes (no seconds) are estimated and are shown in i*talic text*.

Residential Fire 1327 SE 182nd Avenue
Gresham, Oregon
May 30, 2024, at 21:02

Table 1. Incident Timeline

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
A candle burning in the bathroom ignites the plastic shower curtain which burns and melts. The fire extends to the shower and tub enclosure. Flashover was likely to have occurred in the bathroom due to the small size of the space and substantial fuel load, with flaming combustion extending into the hallway. A hot smoke layer develops throughout the house due to open bathroom and bedroom doors as well as the open plan living, dining, and kitchen area. It is likely that the fire became ventilation limited with a decreasing heat release rate prior to discovery and calls to 911 reporting the fire (additional detail is provided in the fire behavior analysis).		

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
911 caller reports smoke from the house and that the "owner" just arrived.	21:02:43 CAD	***911 Caller:*** (call taker, 911, what's the address of your emergency) Hi, Ah 1327A 181st right across the street from Vance Park. There is a duplex that is on fire right now. I do not live here I am just at the park visiting (call taker indicates this is not a good address and asks if this is off 182nd), 182nd Avenue (dispatcher asks what cross street) cross street is Main Street, in between Main Street and Missouri Way I believe, no, excuse me I think its Madison, Madison like (call taker acknowledges and asks if anyone is inside) I don't know (call taker asks if the caller sees flames), I see that somebody is just getting to the house right now, (call taker again asked if the caller sees flame or just smoke), I just see smoke, the owner just got here (BOEC, 2024a)
911 caller reports people coming out of the house and smoke coming from every window.		***911 Caller:*** (call taker, 911, what's the address of your emergency) Um, roughly 185th and Yamhill, (call taker gets callback number and asked what happened), there's a house on fire, a dark colored house, (call taker ask if it is right in that area right at the intersection), Yes, yes, yes, (call taker asks how many stories), just one that I can see, (call taker asks if it is a single residential home, type of building), ya, it looks like a single residential home, (call taker asks if the caller is at the location, caller indicates they are turning around to return to the location, call taker asks if it is on 182nd or Yamhill), It says 181st and 182nd on the sign and then the cross street is Yamhill, (call taker asks for clarification as another caller placed the incident further to the south, caller indicates that is correct). (Caller is arriving back at the incident location) it looks bad, there are people on the side of the road, there are people coming out [unintelligible], (call taker asks if the caller can tell if there are people or animals trapped inside the building), um, I'm not totally sure… (call taker asks the caller where the fire is) um, its smoke coming out of every window, call taker asks if anyone is injured), not that I can tell, (call taker gets the caller's name) (BOEC, 2024b)

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
911 caller reports smoke from the windows, someone opened the door, followed by an increase in smoke. The caller identifies the smoke color as black.		***911 Caller:*** (call taker, 911, what's the address of your emergency), 1327 SE 181st, there's a fire in the house, (call taker confirms house on fire), yes, there's lots of smoke coming out from windows, the chimney, everywhere, (dispatcher asks to confirm the address) 1327 [unintelligible background conversation] SE 181st (call taker states 182nd and asks what part of the house is on fire), Um, I can't see a physical fire but I see a lot of smoke, a lot of smoke coming from the windows, I don't know if anyone is home, (call taker asks if the caller is there right now), yea I'm in the center lane, [caller yells out is anyone home?], (call taker asks how many floor or stories), one story, someone opened the door, (call taker asks if people are getting out), no, there's a lady [unintelligible] she opened the door [unintelligible] fire, (call taker asks if the caller is seeing flames), no there's way more smoke, black smoke, (call taker again asks if the caller sees flames), no flames, I can't see no flames, (call taker asks if everyone is out), I don't see no one come out, *(continued)*

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
911 caller reports smoke coming from the front door, the windows, the chimney, everywhere and that a female opened a window, later states they opened the windows, not they are breaking windows, no flames but lots of smoke. The caller reports people going inside and that no one has come out.		(Call taker asks if the lady is still inside), no, the lady, I think is like a couple units, she went to the other unit on the back, [caller shouts is anyone home?], (the call taker asks if the female is out of the house, yes or no?), yes, yes, (call taker asks if there are any people or animals trapped in the house), [unintelligible] anyone else come out, (call taker asks where exactly is the smoke), its coming from the front door, the windows, the chimney, everywhere, (call taker asks if it is a duplex), she opened the window, (call taker repeats the question, is it a duplex?), it is a duplex I think (call taker asks if anyone is injured), I don't see anyone, there's now two ladies that came from around the neighborhood, [background conversation …opening the windows, hear knocking or pounding noise, caller shouts everybody get out of the house fire departments on the way], (call taker asks if there is someone still inside), yea there's kids that came out of the duplex, (call taker attempts to confirm if people are still inside), oh my god, no one has come out, maybe they passed out, there's a lot of smoke, (call taker asks so you think there are people still inside?), yes, people going in, people going in, (call taker tells the caller to tell them not to go inside), they already went in, two of them went in, (call taker asks how many people are inside), one, (call taker attempts to confirm), two, two people went in, [unintelligible] it's pretty hard to see, they opened the windows, now there's a lot of fire, now they're breaking the windows, [unintelligible] I don't see any flames. [unintelligible, sounds like someone speaking Spanish], (call taker asks if they are able to leave the house), no, I haven't seen no one come out from inside the house, [unintelligible], [background conversation fire department's almost here]. *(continued)*

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
The 911 caller then reports that he thinks the people who went in the house may have come out.		(Call taker continues to ask if there are people still inside), [siren in the background], no, I think they may have come out, it was really hard to see, fire department's here, call taker gets the (caller's name and phone number) (BOEC, 2024c).
		911 Caller: (call taker, 911 what's the address of your emergency), on the corner of Madison and 182nd, (call taker asks if it is about the house fire from like a duplex), yes, (call taker states we have it just south of ah, we have it right on the corner of Market and 182, (call taker asks if that's what the caller is looking at), yes I think that's the same one, [unintelligible] the closest cross street) (BOEC, 2024d).
	21:03:40 CAD	***Tapout Dispatcher:*** Dispatch calling Box 3118 structure fire, two callers, one says SE 181 and Yamhill for a dark colored house on fire, another caller with a better address 1327 SE 182 Avenue, this is going to be for Engine 31, Engine 74, Engine 73, Engine 71, Truck 71 and C7 on Ops 4. Dispatch calling Box 3118 structure fire, two callers, one address 1327 SE 182 Avenue and a second caller from 181 and Yamhill saying it's a dark colored house, for Engine 31, Engine 74, Engine 73, Engine 71, Truck 71 and C7 on Ops 4, time is 21:04) (BOEC, 2024e)
	21:03:57 CAD	Truck 71 enroute via MDC (BOEC, 2024i) Truck 71 was just arriving in quarters from a previous response and acknowledged responding while still in the cab before getting out and donning personal protective equipment.
	21:05:00 CAD	***C7:*** C7 Responding (acknowledged by the Ops 4 dispatcher) (BOEC, 2024f)
	21:04:45 CAD	***Engine 71:*** Engine 71 responding (acknowledged by the Ops 4 dispatcher) (BOEC, 2024f).
	21:05:11 CAD	***Engine 74:*** Engine 74 responding (acknowledged by the Ops 4 dispatcher) (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
Firefighter Ingram, Rescue 31 Apparatus Operator (AO) believed that the dispatch included information that multiple callers reported victims inside.	21:05:15 CAD	***Rescue 31 (on Ops 1):*** Dispatch from Rescue 31 can you add us to that box. (dispatch acknowledges and advised on Ops 4) (Broadcastify, 2024).
	21:05:36 CAD	Engine 73 enroute via MDC (BOEC, 2024f)
	21:06:03 CAD	***Ops 4 Dispatcher:*** This will be a repeat of Box 3118, structure fire 181 and Yamhill, we had a couple of callers saying it might be more south of it should be a duplex, [unintelligible] dark colored house or duplex on fire we just got an update that there's somebody saying there may be people inside, having a medic start, Engine 31, Engine 74, Engine 73, Engine 71, Truck 71, C7, Truck 7, Rescue 31, Medic 346 on Ops 4 (BOEC, 2024f).
	21:06:32 Radio	***C7:*** C7 copies the update, please continue please continue working on getting a good update (Ops 4 dispatcher acknowledges) (BOEC, 2024f).
Firefighter Ingram, Rescue 31's AO, observed a header visible in the distance while on Main Street approaching SE 182nd Avenue.		
	21:06:15 CAD	***Tapout Dispatcher:*** Medic 346 responding to the house fire with fire on [unintelligible] 1327 SE 182 Avenue it will be Ops 4. Medic 346 responding to the house fire 1327 SE 182 Avenue on Ops 4 (BOEC, 2024e).
	21:06:50 Radio	***Engine 31:*** Command, all units, better address 181 and Madison (BOEC, 2024f).
	21:06:50 Radio	***Ops 4 Dispatcher:*** Exact address should be 1327 SE 182 (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
Video Clip 1 (30 seconds) The front door is open, the Bedroom 1 window on Side Alpha is partially open, it appears that the Bedroom 2 window furthest from the door on Side Alpha is also open. Medium gray smoke exiting at moderate velocity with a bi-directional flow. Neutral plane near approximately 6" below the top of the door opening. Similar smoke conditions from bedroom windows on Side Alpha.	21:07:08 Radio	***Engine 31:*** Engine 31s arrived 1327 181st we have a one-story wood frame house, smoke showing from the Alpha Side, Engine 31'll be command, command is located on 181 (acknowledged by the Ops 4 dispatcher) Captain Chad Freyer was working as the initial Incident Commander from inside the cab of Engine 31 and remained in the cab until after C7 assumed command (BOEC, 2024f).
	21:07	Two occupants tell Firefighters Spencer Tejedas and Jack Pilarski, Engine 31B, that a blind and deaf child is in Bedroom 1 and is unable to get out, indicating the bedroom immediately to the right of the door on Side Alpha. Firefighters Tejedas and Pilarski begin masking up on the sidewalk in front of the door on Side Alpha. Captain Freyer was approached by two bystanders reporting that there were victims inside.
Upon exiting, R31 Firefighter's Ingram and Lunger encountered multiple bystanders reporting kids trapped inside the house.	*21:07*	Rescue 31 arrived while Firefighters Spencer Tejedas and Jack Pilarski, Engine 31B, are masking up on the sidewalk in front of the door on Side Alpha [Video Clip 1 from 0:00:00 to 0:00:05].

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	21:07	Firefighter Ingram, Rescue 31 Apparatus Operator (AO) believed he saw a hoseline being pulled from Engine 31 and two firefighters masking up on Side Alpha. Ingram stated that since a line was being pulled, he made the decision to go to Side Charlie where reports from bystanders indicated the location of the trapped child (a different location than the bystanders on Side Alpha). Firefighter Ingram did not report this action to Captain Freyer (Command) or Firefighter Lunger (the other member of Rescue 31). Firefighter Lunger of Rescue 31 began moving towards Engine 31 in anticipation of being assigned to stretch a backup line (as this was common practice) and was tasked to stretch the backup line while moving towards E31.
A small volume of light gray smoke with limited optical density is visible over the roofline from Side Charlie.	*21:07*	Firefighter Jake Ingram, Rescue 31's AO, goes over the fence on Side Alpha [Video Clip 1 between 0:00:08 and 0:00:09] and proceeded to Side Charlie. Firefighter Ingram encountered an adult male on Side Charlie who pointed to the window of Bedroom 3, indicating that there was a person on the bed in the bedroom, saying "there's a little girl in there, she's deaf and cannot hear you".
	21:07:29 Radio	***Engine 31 (Command):*** Engine 31s pulling an inch and three quarter to the front door, Rescue 31 you are going to be backup line [Video Clip 1 0:00:23] (BOEC, 2024f). Captain Chad Freyer continues working as the initial Incident Commander from the cab of Engine 31.
	21:08:03 Radio	***Medic 346:*** 346 enroute (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
One side of the Bedroom 3 window on Side Charlie was fully broken out with gray smoke from the window with a unidirectional flow (out). The door on Side Charlie had been forced by a civilian bystander prior to Firefighter Ingram reaching Side Charlie Bi-directional flow from the door with the neutral plane down approximately two feet from the top of the door. Smoke on the interior approximately four feet down from the ceiling.	*21:08*	Firefighter Jake Ingram masked up, entered from Side Charlie to search for the occupant reported to be in Bedroom 3.
Bi-direction flow from the door on Side Alpha continues with increased velocity of smoke discharge, color of smoke darkens and goes from light gray to darker gray/black and the neutral plane drops to approximately 30" from the top of the door frame and bedroom windows on Side Alpha prior to entry.	*21:08*	Firefighter Christie Choma, Engine 31's Apparatus Operator (AO), deployed preconnected 1 ¾" hoseline off the right (officer's side) of Engine 31 as the attack line. The attack line was severely kinked due to failure to completely release the webbing that secures the hose in the hose bed during travel. Captain Chad Freyer of Engine 31 (Command) observes the change in smoke conditions on Side Alpha and had a thought that something wasn't right but did not communicate this over the radio.
There are fingers of flame from the hallway in the smoke layer in the living room. The bottom of the smoke layer is approximately 36" down from the ceiling. Visibility is good directly in from the door, likely from tunneling due to air intake through the bottom of the door. The smoke layer is lower in other parts of the living room. There is rollover at the ceiling level throughout the entire hallway.	*21:08*	Firefighters Spencer Tejedas and Jack Pilarski of Engine 31B enter the open front door, proceed along the wall to the right of the door and turn right down the corridor leading to the bedrooms and bathroom [Video Clip 1 0:00:25].
Smoke conditions worsen on Side Alpha with smoke color going from gray to black and the neutral plane at the door on Side Alpha continuing to lower.	21:08:03 Radio	***Engine 31 (Command):*** Correction, Rescue 31 Engine 31s gone in search without a hoseline take a hoseline to the front door start knocking the fire down (BOEC, 2024f). Captain Chad Freyer continues working as the initial Incident Commander from inside the cab of Engine 31.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
		As conditions worsen, Firefighter Jake Ingram (Rescue 31) crawls back to Side Charlie and exits the building, returning to Side Alpha.
		Firefighters Spencer Tejedas and Jack Pilarski of Engine 31B turn right down the corridor leading to the bedrooms and bathroom. Firefighter Tejedas quickly enters Bedroom 1 on the right (Side Alpha), directs FF Pilarski to search bedroom 1. He remains in the hall and glances for search in the hallway and Bedroom 2. Firefighter Pilarski briefly searches Bedroom 1. Firefighter Tejedas quickly returns and says, "we need to get out of here" and continues down the hall towards the exit where he becomes disoriented and reverses course back to bedroom 2.
		Firefighter Noah Lunger starts pulling the backup line, then is re-tasked to fire attack. The attack line was dry but was charged while Firefighter Lunger was masking up.
Smoke from the door on Side Alpha changes from gray to black and a glow is visible below the smoke layer, towards the hallway.		Firefighter Christine Choma, Engine 31's Apparatus Operator charges the attack line. Firefighter Noah Lunger of Rescue 31 advises Captain Chad Freyer that there is no pressure, and Firefighter Choma attempts to correct the lack of pressure by increasing discharge pressure (as she was unaware of the severe kinking at the preconnected hoseline discharge on the right side of the apparatus).
The fire transitions to fully developed in the hallway, living room and Bedroom 3. There is a Bi-directional flow with neutral plane below mid-height in the door, with flames from the top two thirds of the doorway on Side Alpha. Flashover likely occurs between 0:00:14 and 0:00:19 after Firefighters Tejedas and Pilarski enter the fire occupancy through the door on Side Alpha (see the fire behavior analysis for additional detail).		Firefighter Jack Pilarski, Engine 31B exits Bedroom 1 into the hallway, turns left into the hallway following Firefighter Spencer Tejedas.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
Video Clip 2 (46 seconds) Bi-directional flow with flames out the top two thirds of the door on Side Alpha. Flames are visible through the intact window on Side Bravo. Light gray smoke is visible from the windows on Side Alpha. Smoke discharge is traveling horizontally across the first two lanes of 182nd Avenue. Dark gray to black smoke is visible over the roofline from Side Charlie (while not possible to determine the number and location of openings due to the roof overhang, the volume of smoke may be indicative that the kitchen door and Bedroom 3 window may be open). The smoke from Side Charlie is being pushed towards Side Alpha by the wind. The window on Side Bravo is intact and smoke logged (black) with no smoke discharge [Video Clip 2 at 0:00:08-0:00:11]		Firefighter Spencer Tejedas is in the living room. Firefighter Jack Pilarski, Engine 31B turns left into the living room, and quickly duck walks to the door on Side Alpha keeping his left shoulder on the wall.
The window on Side Bravo remains intact, with flames visible through the window. Firefighter Spencer Tejedas is believed to be below the window on Side Bravo and his head may briefly appear in the window [0:00:16 in Video 2]		
	21:08:34 Radio	***C7 (Command):*** C7 has arrived, C7 will assume command, Engine 31 join your crew you'll be fire attack, you'll have Rescue 31 working for you (BOEC, 2024f). C7 reported that he arrived and assumed command while approaching the incident location. Estimated time between this radio transmission and arrival on the Alpha/Bravo corner was approximately 10 seconds [Video Clip 2 from 0:0019 to 0:00:31]

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	21:08	Firefighter Pilarski exits in a standing position [Video Clip 2 at 0: 00:19] Firefighter Spencer Tejedas of Engine 31B does not exit though the door on Side Alpha. Tejedas became disoriented and re-entered the hallway, bumping into the walls, and proceeded towards Bedroom 2 (Alpha/Delta Corner). Firefighter Noah Lunger, Rescue 31 (alone) is on the uncharged attack line on Side Alpha.
The window on Side Bravo fails with unidirectional (out) flaming combustion at the window. The large living room window partially fails, developing a largely unidirectional flow (out) with flames from the top of the window. Dark gray is pushing from the Bedroom 1 and 2 windows on Side Alpha at high velocity with a unidirectional (out) flow.		Firefighter Jack Pilarski of Engine 31B walks towards Side Bravo, along Side Bravo toward the window (which has failed) then returns to Side Alpha. Captain Freyer asks Firefighter Pilarski if Firefighter Tejedas exited, and Firefighter Pilarski stated "yes" (assuming one of the firefighters he observed on Side Alpha was Firefighter Tejedas). Firefighter Pilarski then assists with the attack line as C7 arrives.
Water application from the exterior on Side Alpha is ineffective due to a large kink at the apparatus discharge outlet [Video Clip 2 0:00:38].		
		The attack line is charged but has inadequate pressure. Firefighter Noah Lunger of Rescue 31 signals for more pressure.
	21:08:57 Radio	***Engine 71:*** Engine 71's arrived (BOEC, 2024f). Engine 71 did not receive an assignment from Command (C7). Firefighter Tyson Guillory, Engine 71 Apparatus Operator (AO) told Lieutenant Ray Kellstrom of Engine 71 he was going to backstretch from Engine 31 to the hydrant. Firefighter Jaden Markham of Engine 71 told Lieutenant Kellstrom he was going to take a backup line. Lieutenant Kellstrom advised by a civilian that there was a kid in the bedroom (indicating Bedroom 2 window).
	21:08:57 Radio	**C7 (Command):** Engine 31 do you copy you are fire attack; you have Rescue 31 working for you (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
		Firefighter Jaden Markham of Engine 71 goes to Side Alpha and completed the left (driver's) side preconnected 1 ¾" hoseline as the backup line from Engine 31 and assisted Firefighter Noah Lunger of Rescue 31 with the attack line. Firefighter Tyson Guillory, Engine 71 AO stretches a 3" supply line from Engine 31 to the hydrant on the west side of 182nd Avenue at Main Street.
While driving south on SE 182nd Avenue, Firefighter Nick Boyce, Engine 74 Apparatus Operator (AO), observes a column of smoke in the distance.	*21:08:57*	***Engine 31:*** Engine 31 copies fire attack, Rescue 31 working for us (BOEC, 2024f) Captain Chad Freyer was working from the cab of Engine 31 when acknowledging this tactical assignment from Command (C7).
	21:09	Captain Chad Freyer, Engine 31 exits the cab of Engine 31 and assists with fire attack.
Unidirectional (out) flaming combustion continues at the window on Side Bravo. Window glass at the bottom of the window frame is pushed out.	*21:09*	
Video Clip 3 (24 seconds) Turbulent black smoke pushing at high velocity from the partially failed large window in the living room on Side Alpha. Black smoke and flames pushing from the door on Side Alpha with the neutral plane two feet above the floor. Black Smoke pushing from the partially opened Bedroom 1 and 2 windows on Side Alpha [Video Clip 3 at 0:00:00]	*21:09*	Firefighter Noah Lunger of Rescue 31, Firefighter Jaden Markham of Engine 71, and Firefighter Jack Pilarski of Engine 31B are operating an attack line on Side Alpha, but water application was ineffective due to a large kink at the apparatus discharge outlet. Firefighter Pilarski gives a visual signal for the apparatus operator to increase discharge pressure.
As Engine 74 drove past SE Yamhill Street, Firefighter Nick Boyce, Engine 74's AO, observed flames coming from Side Alpha of the fire occupancy.	21:09:05 Radio	***Engine 74:*** Engine 74's arrived (BOEC, 2024f) Lieutenant Nikki White tasked Firefighter Nick Boyce to stage on SE 182nd Avenue and SE Main Street as hydrants were located on the east side of SE 182nd Avenue and on SE Main Street at 182nd Avenue.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
DP8 entered a computer aided dispatch (CAD) note that 134 (a Gresham Police Officer) reported "for fire-mom was concerned about child being inside but the kid is outside w/mom"	21:09:10 Radio	***C7 (Command):*** Engine 74 give me a 360. Truck 71 you're all in for primary search (BOEC, 2024f) Lieutenant Nikki White and Firefighter Janet Patrick of Engine 74 exited the apparatus wearing their SCBA (seat mounted) and Firefighter Nick Boyce, Engine 74 AO, exited and donned his self-contained breathing apparatus. Lieutenant Nikki White asked Firefighter Nick Boyce to get the thermal imager from the cab of the apparatus.
	21:09:17 Radio	***Firefighter Tejedas Engine 31:*** Unintelligible radio transmission then open mic (BOEC, 2024f). This radio transmission occurs as Firefighter Jaden Markham was masking up on Side Alpha and Truck 71 arrives. Open mic on Ops 4 continues for approximately 55 seconds.
	21:09:52 Radio	***Ops 4 Dispatcher:*** Command from dispatch, Engine 31 has an open mic (BOEC, 2024f)
The fence on Side Delta had several boards broken allowing Engine 74 access on Side Delta.	*21:09*	Lieutenant Nikki White and Firefighter Janet Patrick, Engine 74 proceeded around Side Delta to Side Charlie (counterclockwise) to complete 360° reconnaissance.
Video Clip 3 (24 seconds) Water application is ineffective. Flames are pushing out the top half of the door, on side Alpha with considerable velocity with a bi-directional flow (bottom of the door is the intake), smoke and flames are pushing with a unidirectional flow (out) from the partially failed living room window on Side Alpha. Flames are also pushing from the window on Side Bravo (view partially obscured by position of C7).	*21:09*	Truck 71 arrives (no radio transmission, possibly due to the Engine 31 open mic). Lieutenant Ray Kellstrom of Engine 71 tells Lieutenant Mike Snodgrass of Truck 71 that there is a victim reported in the Alpha/Delta bedroom.
Flames are pushing with a unidirectional flow from the window on Side Bravo and the bottom of the window appears to be pushed out [Video Clip 4 at 0:00:02]	*21:09*	Firefighter Nick Boyce, Engine 74's AO, was slightly behind Lieutenant Nikki White and Firefighter Janet Patrick of Engine 74 as they began their 360° reconnaissance.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
The Bedroom 2 window on Side Alpha was partially open (having been opened from the exterior by an occupant prior to fire department arrival). Smoke from the open window was dark gray to black and pushing at high velocity with a unidirectional (out) flow. When the remainder of the Bedroom 3 was taken by Truck 71, smoke exiting the window transitioned to flaming combustion continuing with a unidirectional (out) flow.	*21:09*	Lieutenant Mike Snodgrass of Truck 71 advised of victim and possible location in Bedroom 3 by Lieutenant Ray Kellstrom of Engine 71. Lieutenant Mike Snodgrass and Firefighter RJ Carranza of Truck 71 proceeded to the Bedroom 3 window on Side Alpha, closest to Side Delta with the intent of performing a targeted search. Lieutenant Mike Snodgrass cleared the window with a hook and based on flames issuing from the window decided to go to Side Charlie. Lieutenant Ray Kellstrom of Engine 71 attached himself to Truck 71, but did not advise Command.
Flames are pushing from the window on Side Bravo and are visible inside the living room as the attack and backup line achieved adequate flow. Within 15 seconds flames are knocked down with a small amount of flaming combustion visible through the living room window and door on Side Alpha.	*21:09*	Firefighter Noah Lunger of Rescue 31 assisted by Firefighter Jaden Markham of Engine 71, and Firefighter Jake Ingram of Rescue 31 are operating the attack line with a straight stream through the door on Side Alpha. Firefighter Jack Pilarski of Engine 31B is operating the backup line at a shallow angle through the partially failed large living room window on Side Alpha [Video Clip 4 at 0:00:13].
Open mic continues from 02:50 until 03:45 in the incident video.	21:10:02 Radio	***Ops 4 Dispatcher:*** Engine 31 you have an open mic. Engine 31 you have an open mic (BOEC, 2024f).
Dark grey smoke is visible from ground level on Side Alpha (possible from Firefighter Tejedas's protective clothing) as well as from the windows in Bedrooms 1 and 2.	21:10	Firefighter Spencer Tejedas exits from Bedroom 2 through the right side window (looking from the interior) on Side Alpha. Exactly what time Firefighter Tejedas exited the window is unknown, but this likely occurred between the time that Firefighter Jack Pilarski returned to Side Alpha (after going to Side Bravo) and the time that Firefighters Lunger, Markham, and Pilarski were operating the attack and backup lines through the door on Side Alpha.
Firefighter Spencer Tejedas was on the Alpha/Bravo corner, bent over with severely burned turnouts (approximately 0:02:30 after entering for search with Firefighter Jack Pilarski). Bystander Photo 6212 and 6213.	*21:10*	Captain Chad Freyer observed Firefighter Spencer Tejedas standing bent over on the sidewalk at the Alpha/Bravo corner of the fire occupancy. Captain Freyer asks Firefighter Tejedas if he is ok and he responds "no".

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	21:10:35 Radio	***Engine 31:*** Command, Engine 31, we've got one firefighter out that needs medical standing right in front of the car right in front of the structure (BOEC, 2024f).
Bystander Photo 6214	*21:10*	Firefighter Nick Boyce, Engine 74's AO, observed Firefighter Spencer Tejedas standing, bent over in the road and went to assist.
	21:10:49 Radio	***C7:*** Engine 31 repeat your traffic (BOEC, 2024f).
	21:10:49 Radio	***Engine 31:*** Command we've got an injured firefighter standing directly on the Alpha Side, needs medical immediately (BOEC, 2024f)
	21:10:49 Radio	***C7 (Command):*** Command copies that, do I have an available engine company to do good medical (BOEC, 2024f)?
	21:10:49 Radio	***Engine 73:*** Engine 73s arrived, we're available for medical (BOEC, 2024f).
	21:10:49 Radio	***C7 (Command):*** Engine 73 you'll have medical, report to the Alpha Side with your medical equipment and dispatch from command, start me a second alarm, base will be Yamhill and 182 (acknowledged by dispatch) (BOEC, 2024f).
	21:11:40 Radio	***Medic 340:*** AMR Medic 340 we are about two minutes away (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
Firefighter Spencer Tejedas was not wearing his helmet, but his self-contained breathing apparatus facepiece was in place and connected to the regulator. Firefighter Spencer Tejedas's turnouts were severely burned, his self-contained breathing apparatus facepiece was completely charred and his personal protective equipment was too hot to touch without wearing firefighting gloves. Firefighter Spencer Tejedas stated that he needed air (repeated), he said he thought he was going to pass out and asked that the members of Engine 73 not remove his gloves and boots as they were fused to his skin. Firefighter Spencer Tejedas asked if Jack [Pilarski] made it out.	*21:11*	Engine 73 parked out of the way and Lieutenant Rob Womack, Firefighter Tyler Mandeville, and Firefighter Paramedic Brent Stewart proceeded to Side Alpha with advanced life support medical equipment. Firefighter Nick Boyce, Engine 74"s AO, obtained a booster line from Engine 31 and applied water to Firefighter Spencer Tejedas's personal protective equipment to cool it down. After cooling, the crew of Engine 73 assisted by Firefighter Nick Boyce, Engine 74 AO removed Firefighter Spencer Tejedas's self-contained breathing apparatus facepiece and breathing apparatus, opened his turnout coat and began cutting off his turnout coat and pants. Firefighter Spencer Tejedas was placed on oxygen by non-rebreather mask while his protective clothing was being removed.
	21:11:55 CAD	**Tapout Dispatcher:** This will be a second alarm for Box 3127, 1327 SE 182, be adding C3, Engine 29, Engine 72, Engine 7, Rehab 74, Base is Yamhill and 182, this is a second alarm for Box 3127 structure fire 1327 SE 182 Avenue, be adding C3, Rescue 74, Engine 29, Engine 72, Engine 7, Rehab 74, Base is Yamhill and 182, Talk Group is Ops 4, Talk Group is Ops 4, time is 21:12 (BOEC, 2024e).
	21:11:46 Radio	***C7 (Command):*** Medic 340 when you get on scene bring your stretcher forward and be ready for medical treatment, you'll be with Engine 73 (Medic 340 acknowledges) (BOEC, 2024f).
	21:12:15 Radio	***Engine 74:*** Command from Engine 74 (command acknowledges) (BOEC, 2024f). Engine 74 is on the Charlie Side; we have a fence dividing an adjoining apartment.
	21:12:38 Radio	***Command:*** Command copies that. Can you have your crew establish a water supply (BOEC, 2024f).
	21:12:51 Radio	***Engine 31 Apparatus:*** Command from Engine 31 Apparatus we have a water supply (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
The fire in the living room was knocked down by exterior water application. When the attack lines pushed into the living room smoke conditions lifted slightly. Fire in the living room and kitchen was quickly controlled by direct water application. Flames were visible in the hallway, bathroom, and bedrooms when the attack line entered the living room (but there were no flames from the windows on Side Alpha at the time of entry).	*21:12*	Firefighter Noah Lunger of Rescue 31, and Jaden Markham of Engine 71, operated a 1 ¾" line operated through the doorway on Side Alpha. At some point during exterior operation of this hoseline, Firefighter Jake Ingram of Rescue 31 returned from Side Charlie and assisted with fire attack. Firefighter Jack Pilarski operated a second 1 ¾" line operated through the living room window on Side Alpha, darkening the fire sufficiently for the line in the doorway to advance into the living room. Once the fire was knocked down from the exterior, Firefighters Lunger, Markham, Ingram, and Pilarski pushed into the living room with both hoselines. Firefighter Jaden Markham left the attack line and attempted to go down the hallway to search, but due to fire conditions withdrew back to the living room and asked Firefighter Noah Lunger to push down the hallway to knock the fire down. After the attack line was repositioned to control the fire in the hallway, bathroom, and bedrooms. Firefighters Markham and Ingram searched Bedroom 1.
	21:12	Captain Freyer of Engine 31, entered through the door on Side Alpha and joined Firefighter Pilarski of Engine 31, Firefighters Lunger and Ingram of Rescue 31, and Firefighter Markham of Engine 71.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
One side of the Bedroom 3 window on Side Charlie was open (broken out and cleared or open). The top of the door in Bedroom 3 was burned away.	*21:12*	Firefighter RJ Carranza of Truck 71 cleared remainder of the Bedroom 3 window and Firefighters Jordan Flikkema and RJ Carranza of Truck 71 entered with 2 ½ gallon water extinguishers and tools. Firefighter RJ Caranza extinguished some burning materials in Bedroom 3 and completed primary search of this room. Lieutenant Mike Snodgrass went to Engine 31 and stretched a 1 ¾" hoseline to Side Charlie. Firefighter Grant Kimble of Truck 71 and Lieutenant Ray Kellstrom of Engine 71 entered the Bedroom 3 window and assisted Firefighters Carranza and Flikkema with search.
	21:12	Firefighters Jordan Flikkema and RJ Carranza of Truck 71 crossed the hallway and searched Bedroom 2 on Side Alpha.
	21:12:59 Radio	***C7 (Command):*** All companies we have a water supply established, we are getting positive effects on the fire building, we've got good smoke change, next due truck you'll be vertical ventilation (Truck 7 acknowledges the assignment for vent) (BOEC, 2024f).
Fire control was achieved in less than 60 seconds after the two 1 ¾" hoselines entered through the door on Side Alpha.	21:13:30 Radio	***Engine 31:*** Command from [unintelligible echo] (BOEC, 2024f).
	21:13:20 Radio	***Engine 31:*** Command, [unintelligible] (Command acknowledges Engine 31) (BOEC, 2024f)
	21:13:20 Radio	***Engine 31:*** Engine 31 has knockdown and pulling ceilings checking for extension (BOEC, 2024f)
	21:13	Captain Chad Freyer and Firefighter Jack Pilarski of Engine 31, Firefighters Noah Lunger and Jake Ingram of Rescue 31, and Firefighter Jaden Markham of Engine 71 pulled ceilings in the bathroom and determined there were no extension into the attic.

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
Temperature and visibility in the hallway were moderate, allowing crews to operate in a standing position. When searching the bathroom, Truck 71 observed that the tub and wall surround had been consumed by the fire.	*21:13*	Lieutenant Ray Kellstrom of Engine 71 and Firefighter Grant Kimble of Truck 71 entered Bedroom 3 and assisted Firefighters RJ Carranza and Jordan Flikkema in searching the remaining bedrooms, bathroom, living room and kitchen.
	21:13:20 Radio	***Medic 340:*** 340 were arriving where do guys you want us (BOEC, 2024f).
	21:13:31 Radio	***C7 (Command):*** Medic 340 come to the front of the building connect with Engine 73, Engine 31 from Command repeat your transmission (BOEC, 2024f).
	21:13:31 Radio	***Engine 31:*** Command from [unintelligible] knockdown, pulling ceilings checking for extension (BOEC, 2024f).
		The crew from Medic 340 arrived on Side Alpha with their gurney, the crew of Engine 73 moved Firefighter Spencer Tejedas to the gurney.
	21:14:21 Radio	**C7 (Command):** Engine 31 you are unreadable. Engine 74 can you connect with Engine 31 and get me better information (BOEC, 2024f).
	21:14:35 Radio	***Engine 74:*** Engine 74 copies, connect with Engine 31 and apartment 1327B the exposure apartment there is nobody inside (BOEC, 2024f).
	21:14:49 Radio	***C7 (Command):*** Command copies that information Engine 74 and all companies we have a report from Truck 71 primary search is complete (BOEC, 2024f).
	21:15:10 Radio	***C7 (Command):*** Engine 73, Medical, do we have a report on our firefighter (BOEC, 2024f)?
	21:15:35 Radio	***Rescue 74:*** Rescue 74's arrived (BOEC, 2024f).
	21:15:41 Radio	***C7 (Command):*** Rescue 74 I'm going to assign you to medical to Engine 73, they are in front of the building, moving towards the ambulance right now (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	21:15	Firefighter Spencer Tejedas was moved via gurney to the ambulance for immediate transport. Firefighter Paramedic Brent Stewart requested a second fire department medic to assist with care during transport.
	21:15:55 Radio	***Rescue 74:*** Rescue 74 copies medical front of the building (BOEC, 2024f). Firefighters Tyler Carlson and Travis Syring of Rescue 74, proceed to Side Alpha to assist with patient care.
	21:16	Firefighter Paramedic Tyler Carlson, Rescue 74 assisted with patient care during transport. Firefighter Travis Syring, Rescue 74 was integrated with Engine 74 for the remainder of the incident.
	21:16:11 Radio	***C7 (Command):*** Engine 74 from Command, can you give me an update from Engine 31 (BOEC, 2024f)?
	21:16:26 Radio	***Engine 74:*** Command, Engine 74 is making contact with Engine 31 (BOEC, 2024f).
	21:16:26 Radio	***Engine 74:*** Command from Engine 74 we need another medic (BOEC, 2024f).
	21:16:38 Radio	***C7 (Command):*** Command copies that, dispatch from Command can you start me two additional code three ambulances (BOEC, 2024f).
	21:16:38 Radio	***Engine 74:*** And C7 from Engine 74, Firefighter Carlson is going with our firefighter [referring to Firefighter Tejedas] to the hospital (BOEC, 2024f).
	21:17:01 Radio	***C7 (Command):*** Command copies that Firefighter Carlson and Firefighter Stewart are going to the hospital and Engine 74 from Command the additional Medic is that for a civilian (BOEC, 2024f)?
	21:17	Firefighters Brent Stewart of Engine 73 and Tyler Carlson of Rescue 74 continued emergency medical care while working to remove Firefighter Tejedas's protective clothing (this was completed at Emanuel Hospital Burn Center).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	21:17:01 Radio	***Engine 74:*** Negative, it is for our firefighters (BOEC, 2024f).
	21:17:24 Radio	***C7 (Command):*** Engine 74 from Command are you saying that we have an additional firefighter injured (BOEC, 2024f)?
	21:17:42 Radio	***Truck 71:*** Command from Truck 71 (BOEC, 2024f).
	21:17:47 Radio	***C7 (Command):*** This is Command, go ahead Truck 71 (BOEC, 2024f).
	21:18:01 Radio	***Truck 71:*** Do you know how many people we are looking for (BOEC, 2024f)?
	21:18:06 Radio	***Engine 74:*** Command from Engine 74 (BOEC, 2024f).
	21:18:08 Radio	***C7 (Command):*** Truck 71 from Command are you asking for any reports of occupants (BOEC, 2024f)?
	21:18:18 Radio	***Truck 71:*** That's affirmative (BOEC, 2024f).
	21:18:23 Radio	***C7 (Command):*** I've not received any reports from occupants. Break. Engine 74 from Command go ahead with your message (BOEC, 2024f).
	21:18:23 Radio	***Engine 74:*** Fire is out inside; we don't have any extensions (BOEC, 2024f).
	21:18:42 Radio	***C7 (Command):*** Command copies that fire is out, no extensions. Engine 74 from Command can your company give me a secondary search. Lieutenant Nikki White, Firefighters, Janet Patrick, Nick Boyce of Engine 74, and Firefighter Travis Syring of Rescue 74 began secondary search (BOEC, 2024f).
	21:19:04 Radio	***Truck 7:*** Command from vent, attic's clear, we're cutting the eaves that have been affected (BOEC, 2024f).
	21:19:15 Radio	***C7 (Command):*** Command copies attic clear, cutting eaves (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	21:19:15 Radio	***Ops 4 Dispatcher:*** Command from dispatch Medic [walked over by Engine 72] (BOEC, 2024f)
	21:19:15 Radio	***Engine 72:*** Command from Engine 72 we're arriving do you want us to come into the scene or assume Base (BOEC, 2024f).
	21:19:30 Radio	***C7 (Command):*** Last unit Engine 2? (Engine 72 corrects unit number) (BOEC, 2024f).
	21:19:30 Radio	***Engine 72:*** That was Engine 72 (BOEC, 2024f)
	21:19:37 Radio	***C7 (Command):*** Engine 72 bring your crew forward, ready for an assignment, next due company assume Base (BOEC, 2024f).
	21:19:47 Radio	***Ops 4 Dispatcher:*** Command from dispatch 11 minutes and Medics 314 and Medic 346 are enroute (BOEC, 2024f).
	21:19:59 Radio	***Engine 7:*** Engine 7 officer will have Base. I'm going to send my crew up to you for an assignment [unintelligible] Engine 7 (BOEC, 2024f).
	21:20:09 Radio	***C7 (Command):*** Last unit from Command, please repeat (BOEC, 2024f).
	21:20:09 Radio	***Engine 7:*** Engine 7 arrived. I'll assume Base here at 182 and Main and I'm sending my crew up for an assignment (BOEC, 2024f).
	21:20:09 Radio	***C7 (Command):*** Command copies that Engine 7 will be Base, crew coming up. Engine 72 from Command you'll be RIT (BOEC, 2024f).
	21:20:35 Radio	***C3(Command):*** C3's arrived; I'll take Safety (BOEC, 2024f).
	21:20:35 Radio	***Ops 4 Dispatcher:*** Command from dispatch did you copy 11 minutes (BOEC, 2024f).
	21:20:44 Radio	***C7 (Command):*** Command copies 11 minutes and I copied Medic 314 and Medic 316 (BOEC, 2024f).
	21:21:27 Radio	***C7 (Command):*** Engine 74 from Command did we complete a secondary search (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	21:22:00 Radio	**Engine 74:** Command from Engine 74, secondary's complete (BOEC, 2024f).
	21:22:07 Radio	***C7 (Command):*** Command copies secondary search complete and Safety from Command once you get on scene and get me a 360 come give me a face to face (BOEC, 2024f).
	21:22:07 Radio	***C3(Command):*** Safety copies I'm doing a 360 now (BOEC, 2024f).
	21:22:51 Radio	***C7 (Command):*** And dispatch from Command just confirming with police we'll have 182 shut down in both directions and can you start Northwest Natural and PGE (dispatch acknowledges) (BOEC, 2024f).
	21:23:30 Radio	***Engine 7 (Base):*** Command from Base if you're having any AMR units arriving, I'm at 182 and Main (BOEC, 2024f).
	21:23:30 Radio	***C7 (Command):*** Command copies that, Dispatch let our Medic Units know to go to Base when they arrive, 182 and Main (dispatch acknowledges) (BOEC, 2024f).
	21:23:30 Radio	***Medic 314:*** 314 we're on Ops 4, we copy 182 and Main (BOEC, 2024f).
	21:23:30 Radio	***Medic 346:*** 346 copies 182 and Main.
	21:25:06 Radio	***C7 (Command):*** Dispatch from Command, can you page C700, have him call C7 cell phone (dispatch acknowledges) (BOEC, 2024f).
	21:25:24 Radio	***C720:*** C720's enroute (command acknowledges) (BOEC, 2024f).
	21:25:55 Radio	***C700:*** Dispatch and Command, C700's arriving (BOEC, 2024f).
	21:26:04 Radio	***C7 (Command):*** Truck 71 from Command can you come to the command vehicle (Truck 71 acknowledges) (BOEC, 2024f).

Fire Behavior Indicators & Conditions	Time	Response & Fireground Operations
	21:26:34 Radio	***C7 (Command):*** And all companies from Command, we have Gresham fire investigator enroute, once he gets on scene we'll start a plan, as of for now let's stay out of the building and protect any evidence, Truck 71 and Command will come up with an additional plan here so, all companies standby, get fresh bottles, get what you need, get some water (BOEC, 2024f).
	21:27:35 Radio	***Medic 314:*** Medic 314 on-scene (Command acknowledges) (BOEC, 2024f).
	21:27:51 Radio	***E7 Officer (Base):*** Command from Base, I have one engine and two ambulances (BOEC, 2024f).
	21:27:59 Radio	***C7 (Command):*** Command copies that Base (BOEC, 2024f).
	21:28:29 Radio	***Ops 4 Dispatcher:*** Command from Dispatch, PGE enroute, Northwest Natural enroute, no ETA available (acknowledged by Command) (BOEC, 2024f).
	21:28:34 Radio	***Medic 214:*** Command 214 do you have patients that we need gurneys to (BOEC, 2024f)?
	21:28:56 Radio	***C7 (Command):*** Last unit repeat your message (BOEC, 2024f).
	21:29:46 Radio	***E7 Officer (Base):*** I have the two medics here with me, they say that there is one more coming, do you want to release the third AMR unit (BOEC, 2024f).
	21:30:00 Radio	***C7 (Command):*** That's affirmative, we can release the third AMR unit (BOEC, 2024f).
	21:31:39 Radio	***Ops 4 Dispatcher:*** Command from Dispatch, 10 Minutes, sorry 20 Minutes. (Command acknowledges) (BOEC, 2024f).
	21:33:20 Radio	***C7 (Command):*** Dispatch and all companies from Command, we're going to place the recall on Box 3127, we're going to keep all first alarm companies working to include Engine 72 all other companies can clear, Base can be released, and AMR units can be released, we will keep Ops 4 with a dispatcher (acknowledged by the Ops 4 Dispatcher) (BOEC, 2024f).

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Fire Behavior Analysis

The Building

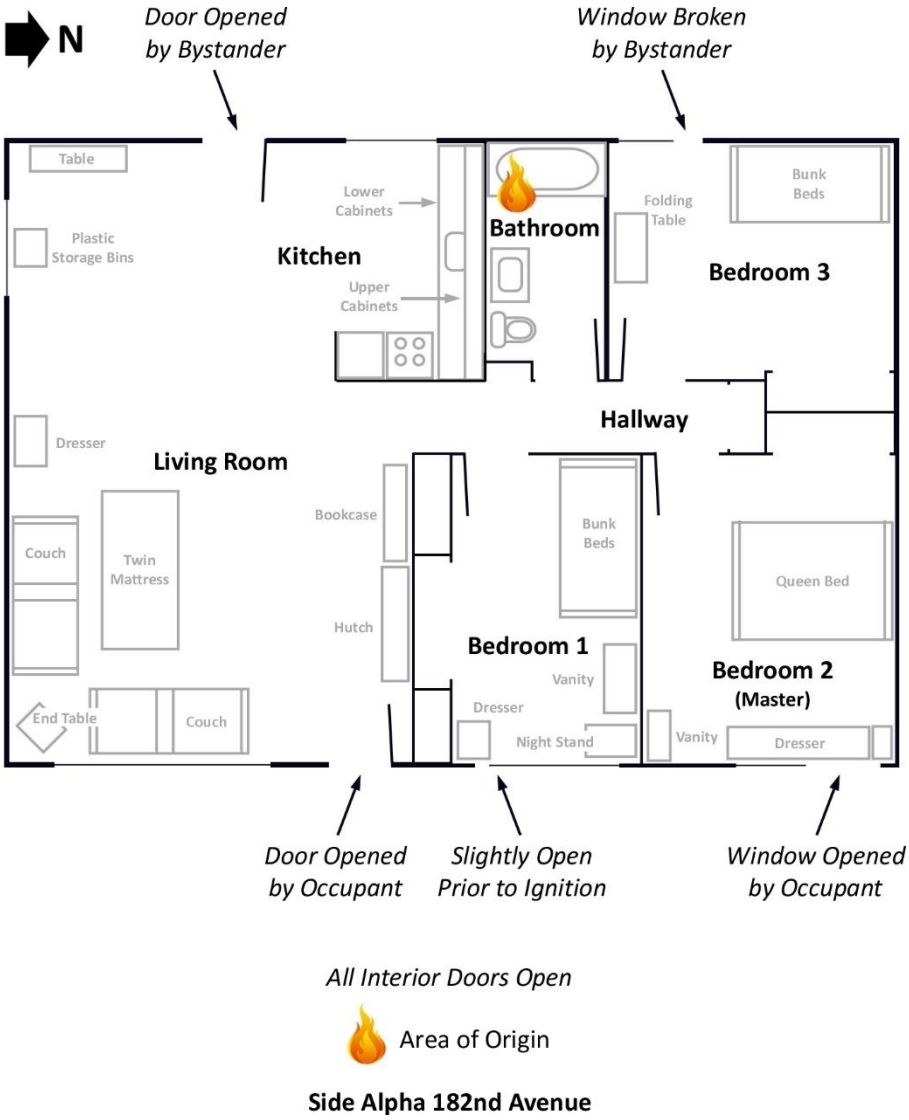
The building was originally constructed as a single-family home in 1956. The garage was converted into a second dwelling unit in 2010. The fire occupancy, 1327 SE 182nd Avenue Unit A was 936 square feet (ft^2) with a 330 ft^2 covered patio (Multnomah County, 2024). Exposure Bravo 1 was attached to the fire occupancy at the Bravo/Charlie Corner and was 992 ft2 (Multnomah County, 2024). Both the fire occupancy and exposure were type five wood frame construction. The fire occupancy contained three bedrooms, one full bathroom, and an open living room, dining area and kitchen. The interior finish was gypsum board with laminate flooring.

Figure 21. Building Exterior 1327 SE 182nd Ave #A.

Note: Adapted from Hotpads. (2023) 1327 SE 182nd Ave #A, Portland, OR 97233.

The fire occupancy, Unit A contained a living room, kitchen, bathroom, and three bedrooms. The fire originated in the bathroom and an occupant and bystanders opened windows and doors prior to the arrival of the fire department as illustrated in Figure 22.

Figure 22. Floor Plan 1327 SE 182nd Ave #A and Ventilation Profile Prior to Rapid Fire Progression



Note: Adapted from Baird, B. (2024). Fire investigation field sketch. Gresham, OR: Gresham Fire Department & Baird, B., Zhiryada, A., & Durham, S. (2024). *Gresham Fire Department special report GFD incident #24-11309.* Gresham, OR: Gresham Fire Department.

Weather

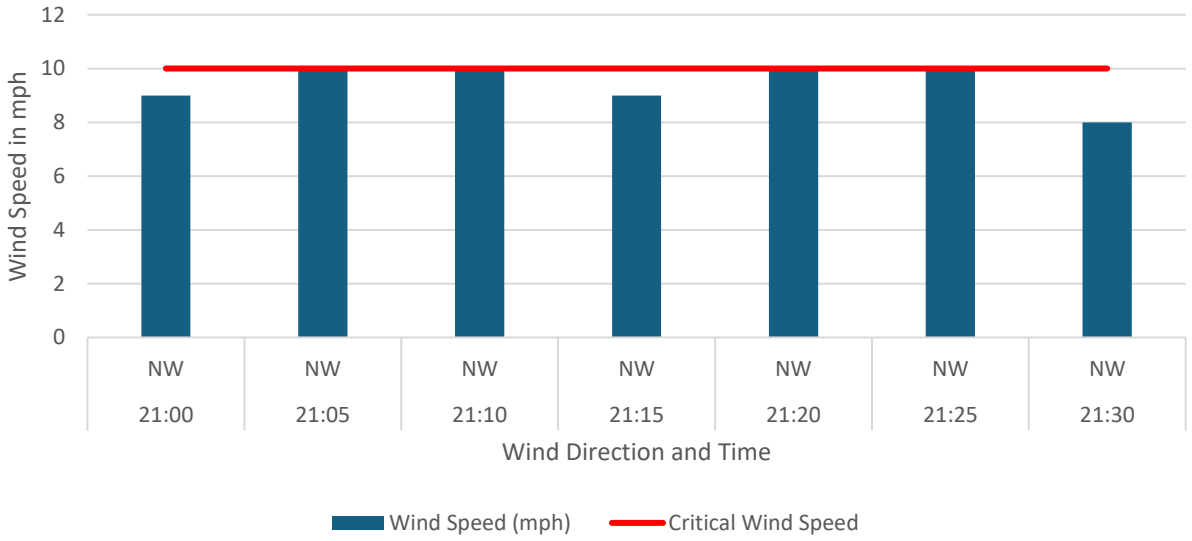
Wind speed and direction has significant potential to significantly influence structural fire behavior depending on wind speed, direction, building configuration, and the location of ventilation (inlet and exhaust) openings.

The weather in Gresham, Oregon on the evening of May 30, 2024, was seasonable with a temperature of between 61° F and 62° F, no precipitation, and a wind speed between 8 mph and 10 mph from the northwest at Portland International Airport as illustrated in Figure 23 (PDX) (Weather Underground,

2024 & National Weather Service, 2024). PDX is located 5 miles to the northwest over relatively flat terrain from the incident location.

With a wind speed of 10 mph, there is potential for a wind driven structure fire event (Madrzykowski & Kerber, 2009a). However, wind effects may have been mitigated to some extent by the patio roof, fence, and tall vegetation to the northwest of the fire occupancy as illustrated in Figure 24.

Figure 23. Wind Speed and Direction May 30, 2024, from 21:00 to 21:30



Note: Adapted from National Weather Service. (2024). Time series viewer May 16, 2024-June 15, 2024.

Figure 24. View from the Patio (Side Charlie) to the North

Note: Adapted from Hot Pads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233.

Cause and Origin

Electrical power had been shut off to the fire occupancy the day prior to the fire and occupants had been using candles for lighting. The adult female occupant identified there had been four candles in the bathroom used earlier in the day with two of these candles in the shower. She thought the candles had been extinguished but stated she may have forgotten to do so. The adult female occupant of the fire occupancy left the premises at 16:00 and no one was home (to the best of her knowledge) from that time until the fire was discovered.

The fire originated in the bathroom located approximately in the middle of the building on Side Charlie (see Figure 21). The bathroom was accessed from the hallway leading from the living room to three bedrooms (two on Side Alpha and one on the Charlie/Delta corner of the house. There was no window in the bathroom.

The fire investigator's report indicated that the area of origin was located at or near the bathtub with the most probable cause being unattended candles (Baird, Zhiryada, Durham, 2024). A likely scenario for ignition and subsequent fire development would be that an unattended candle left burning on the side of the bathtub ignited the plastic shower curtain and extended to the tub and shower enclosure (see Figure 25).

Figure 25. Pre- and Post-Fire Photos of the Bathroom

Note: Adapted from Hot Pads. (2023). 1327 SE 182nd Ave #A, Portland, OR 97233 & Gresham Fire Department Photo P5310686.

The shower curtain was plastic and purchased by the occupant at Dollar Tree. It is likely that the shower curtain was made of polyethylene vinyl acetate (PEVA) and was like that illustrated in Figure 26[1] (Dollar Tree, 2024). PEVA is not listed in the Underwriters Laboratories Fire Safety Research Institute Materials Database.

[1] While the exact brand and model of shower curtain is unknown, the shower curtain illustrated in Figure 25 is the only plastic shower curtain currently offered for sale (online) by Dollar Tree.

Figure 26. Shower Curtain

Note: Adapted from Dollar Tree [printed shower curtain SKU:357192]. Retrieved June 28, 2024, from https://bit.ly/3XPIoeC.

As illustrated in Figure 27, the bathtub and shower enclosure appear to be a Delta Classic 50 in. x 32. In. Alcove Left Drain Bathtub and Wall Surround (Home Depot, 2024). The tub and wall surround are constructed of acrylonitrile butadiene styrene (ABS) plastic with an acrylic finish. While Underwriters Laboratories Fire Safety Research Institute (UL FSRI) has not performed full-scale fire testing on bathtubs and wall surrounds, ABS plastic has been tested and is in the UL FSRI materials database (UL FSRI, 2024), providing a basis for estimating the heat release rate (HRR) and effective heat of combustion for this material.

Figure 27. Delta 500 Bathtub and Surround

Note: Adapted from Home Depot. (2024). *Classic 500 60 in. x 32 in. alcove left drain bathtub and wall surrounds in high gloss white.*

If flames were impinging on the wall panels of the tub surround, at the peak burning rate (heat release rate (HRR) per unit of surface area) they could produce 1800 kW/m^2. Based on the dimensions of the wall surround (Home Depot, 2024), it had a surface area of approximately 4.7 m^2. If all surfaces of the tub surround were burning at once and had sufficient oxygen to support flaming combustion, HRR would be approximately 8 MW more than 4 times what would be needed to transition to flashover based on the doorway ventilation. Even with a lower input heat flux, the HRR/unit of surface area would still be approximately 900 kW/m^2 which could generate a HRR of approximately 4 MW of heat release rate, which is more than enough HRR to flashover the bathroom (D. Madrzykowski, personal communication, June 27, 2024).

ABS has an effective heat of combustion of 35 megajoules/kg. As a reference, the effective heat of combustion of gasoline is 43.7 MJ/kg, and wood is typically in the range of 12 to 15 MJ/kg (D. Madrzykowski, personal communication, June 27, 2024). Given the combustion characteristics of ABS plastic, and other fuel packages in the bathroom (e.g., vanity, floor surface, and gypsum board compartment linings), the acrylic coated ABS plastic bathtub and wall surround were the dominant fuel type in development of fire in the bathroom from ignition to flashover.

Fire Development

Once ignited, the plastic shower curtain melted and burned, igniting the tub and shower enclosure. The fire entered the growth stage with smoke and flames exiting the upper area of the bathroom door and into the hallway. Hot smoke traveled laterally through the hallway into adjacent compartments through open doors, developing a smoke layer throughout the house. Radiant and convective heating from the hot smoke layer, heated fuel packages in the adjacent compartments, resulting in pyrolysis (particularly involving fuel packages located at upper levels within these compartments).

As all exterior doors were likely closed and one window in the bedroom on Side Alpha was slightly open at the time of ignition, the fire would have transitioned relatively quickly from a fuel limited to ventilation limited burning regime. Once vent limited, the heat release rate from the fire would have been reduced and the fire would eventually enter the decay stage due to reduction in oxygen concentration within the building. Smoke production would have continued, filling all compartments within the house with smoke.

The City of Portland Bureau of Emergency Communications (BOEC) public safety answering point (PSAP) received multiple 911 calls starting at 21:02:43 reporting a fire at 1327 SE 182nd Avenue. Prior to the arrival of the fire department, 911 callers reported one or more occupants arrived home and opened 1) the front door, 2) the window in the Alpha/Delta bedroom on Side Alpha (visible to 911 callers on 182nd Avenue).

At some point shortly before or concurrent with the arrival of Engine 31, one or more civilian bystanders kicked in the kitchen door located on Side Charlie, creating an additional ventilation opening. In addition, shortly before or concurrent with the arrival of Engine 31, a hole was broken in the center of one side of the bedroom window on Side Charlie. Light gray smoke was pushing from this ventilation opening.

While wind effects may have been mitigated by the patio roof, fence, and tall vegetation beyond the property line, wind out of the northwest at 10 mph and the west aspect of Side Charlie, likely had some effect on air intake through ventilation openings on Side Charlie. Once opened, the kitchen door may have served predominantly as an inlet immediately after being opened. Limited smoke was visible above the roofline on Side Charlie as Firefighters Tejedas and Pilarski prepared to make entry through the door on Side Alpha which could have been due to timing of opening the door on Side Charlie, wind effects, or a combination of both.

The fire returned to the growth stage with flaming combustion in the bathroom and on the ceiling of the hallway. Flaming combustion had started to extend along the ceiling from the hallway into the living room prior to Firefighters Spencer Tejedas and Jack Pilarski making entry through the door on Side Alpha.

At some point, likely prior to flashover, one side of the window on Side Charlie was fully broken out. It is undetermined if this opening had a unidirectional (out), bi-directional, or unidirectional (in) flow.

Based on video of the incident after Engine 31 arrived, the door on Side Alpha (182nd Avenue) was fully open and the horizontal sliding windows were partially open. There was a bi-directional flow at the door on Side Alpha and unidirectional (out) flow at the windows on Side Alpha. Smoke was pushing from these ventilation openings with moderate but increasing velocity. The neutral plane at the door on Side Alpha was 8" to 10" from the top of the door frame on arrival, but in less than a minute (prior to entry of Firefighters Tejedas and Pilarski for search without a hoseline) had dropped to approximately 30" from the top of the door frame (see Figures 28-30).

Figure 28. Conditions Prior to Entry

Note: Adapted from [Bystander Video Clip 1 at 0:00:00].

Figure 29. Conditions Prior to Entry

Note: Adapted from [Bystander Video Clip 1 at 0:00:05].

Figure 30. Conditions Prior to Entry

Note: Adapted from [Bystander Video Clip 1 at 0:00:10].

The volume of smoke from the building increased dramatically after entry and was pushed across SE 182nd Avenue by the northwest wind at 10 mph (see Figure 31).

Figure 31. Conditions Immediately Post Entry (Parallel to Side Alpha Looking North on 182nd Avenue)

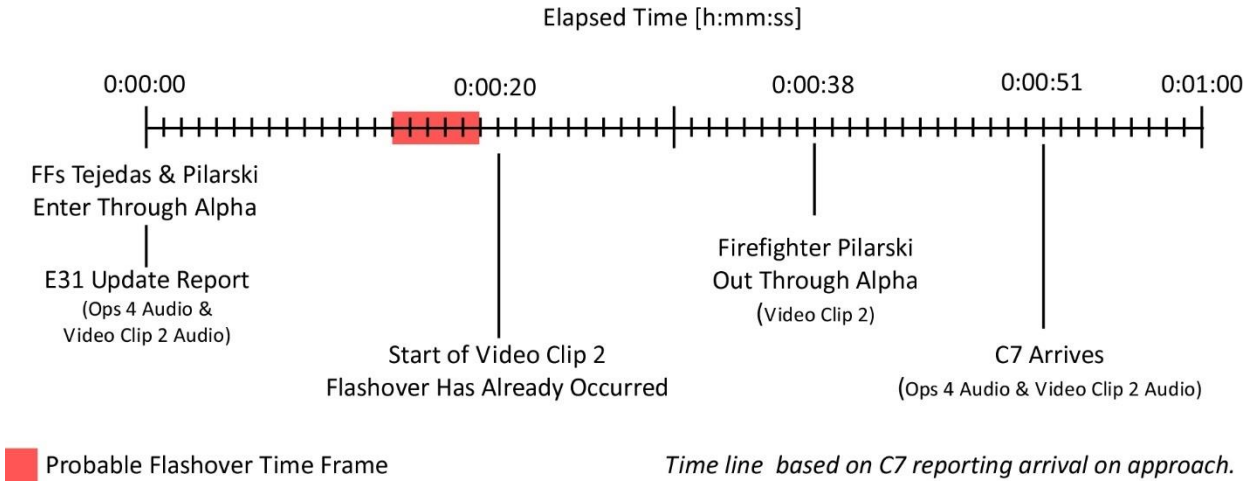
Note: Adapted from [Bystander Video Clip 1 at 0:00:30].

Prior to Firefighters Tejedas and Pilarski entry through the door on Side Alpha, there were multiple flow paths between the fire in the bathroom and hallway as illustrated in Figure 32. Air was entering from the bottom of the door on Side Alpha and from the door on Side Charlie (no report of the level of the neutral plane, but likely predominantly an inlet due to wind speed and direction and limited smoke above the roofline prior to flashover). Smoke was exiting from the upper area of the door on Side Alpha and bedroom windows on Sides Alpha and Charlie.

Figure 32. Dominant Flow Paths Prior to Flashover

Firefighters Tejedas and Pilarski had moderate visibility as they entered the house below the smoke layer which was approximately 3’ to 4’ above the floor at the point of entry. As they advanced along the living room wall to the hallway, fingers of flame from the hallway were visible in the smoke layer. As they turned right at the hallway, rollover was observed on the hallway ceiling. While Firefighter Pilarski searched the first bedroom on the right and Firefighter Tejedas proceeded down the hallway to search the second bedroom on the right, temperature and heat flux in the hallway increased rapidly due to flaming combustion in the upper layer along the hallway ceiling. As Firefighter Tejedas returned to the first bedroom and Firefighters Tejedas and Pilarski attempted to egress to their entry point on Side Alpha, the flashover resulted in rapid transition to a fully developed fire in the hallway, living room, and kitchen.

Figure 33. Entry to Flashover Timeline



Note: This timeline was developed using the audio recording from the Ops 4 talk group, bystander Video Clip 2, and narrative data from an interview with Battalion Chief Mick Wesener (C7). There is a margin for error based on C7 calling on-scene with the Ops 4 dispatcher as he arrived (exact location unknown), which may result in a time difference of several seconds.

As illustrated in Figure 34, the pressure generated by the fully developed fire overcame the pressure from the wind blowing from the northwest on Side Charlie (west aspect) resulting in discharge of a large volume of dark gray to black smoke through openings on Side Charlie (visible above the roofline post flashover). Flaming combustion in the kitchen was visible through the intact window on Side Bravo.

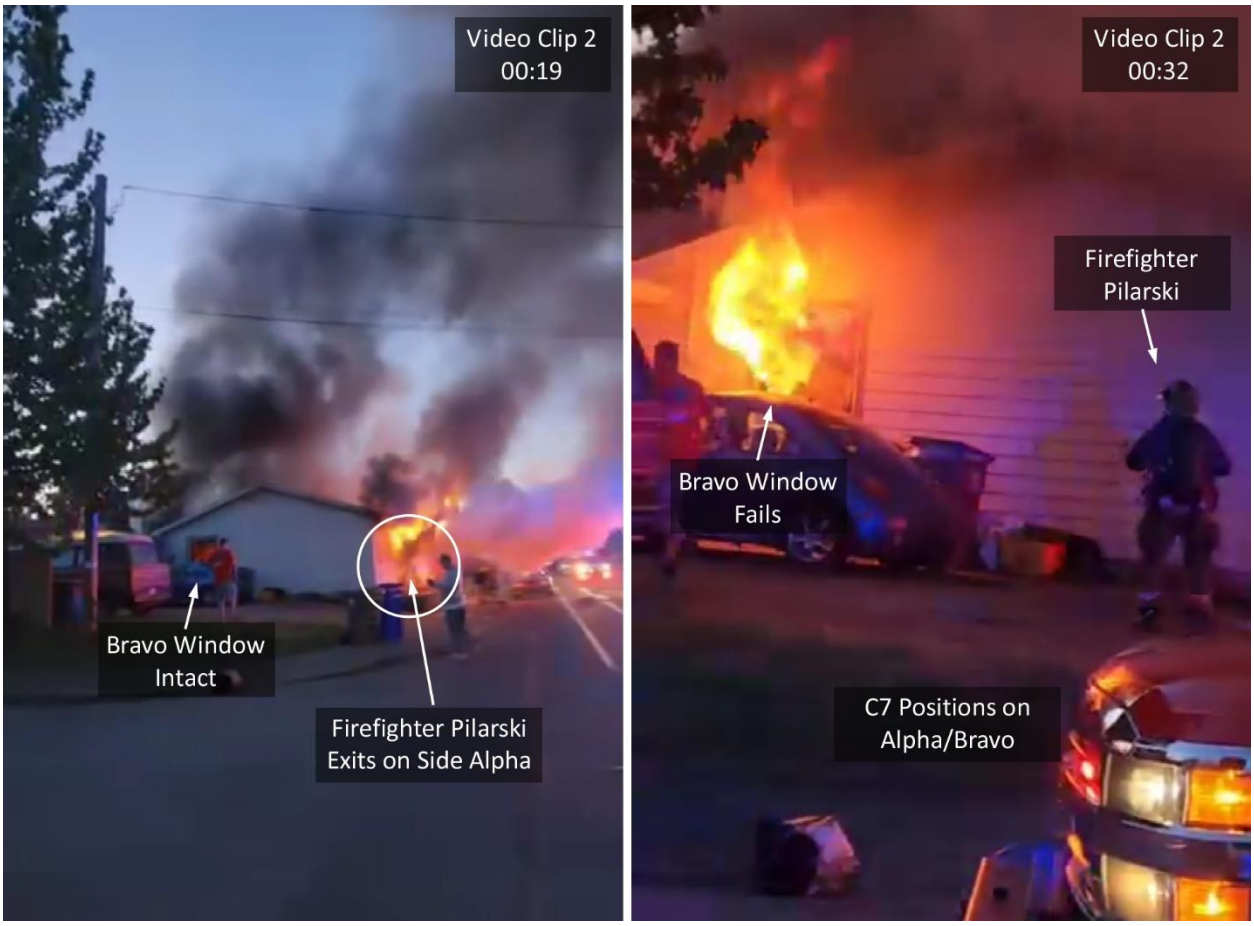
Figure 34. Conditions Post Flashover (Firefighters Tejedas and Pilarski Inside the Fire Occupancy)

Note: Adapted from [Bystander Video Clip 2 at 0:00:10].

At this stage in the incident, it is likely that the oxygen concentration in Bedrooms 1, 2, and 3 was too low to support flaming combustion immediately after flashover. This is supported by smoke discharge without flaming combustion from the partially open windows in these rooms.

Shortly after flashover, Firefighter Pilarski exited through the door on Side Alpha with flames pushing from the open door to within approximately 1’ of floor level. Immediately after Firefighter Pilarski exited, the window on Side Bravo failed with flames exiting with a unidirectional (out) flow.

Figure 35. Post Flashover Conditions (Firefighter Pilarski Exits)



(Firefighter Pilarski Exits) Note: Adapted from [Bystander Video Clip 2 at0:0019&0:00:32, & 0:00:40].

Firefighter Spencer Tejedas exited Bedroom 2 through the left side (looking from the interior) of the window on Side Alpha between the time that Firefighter Pilarski returned to Side Alpha and when Firefighters Lunger, Pilarski, and Markham advanced the attack line and backup line through the door on Side Alpha (see Figures36-41)

Figure 36. Smoke Conditions on Side Alpha

Note: Adapted from [Bystander Video Clip 4 at 0:00:12 and 0:00:21].

Figure 37. Firefighter Tejedas on Side Alpha in Front of Bedroom 2

Note: Adapted from [Bystander Video Clip 4 at 0:00:31].

As illustrated in Figure 38, Firefighter Tejedas had to navigate multiple obstructions to access the right side of the window (which had been opened by an occupant prior to Engine 31's arrival). It is important to note that while thermal conditions in Bedroom 2 were untenable, there was little to no flaming combustion in this room due to low oxygen concentration. This room transitioned through flashover to a fully developed stage after the fire in the living room, kitchen, and hallway had been knocked down and Truck 71 vented the intact side of the Bedroom 3 window.

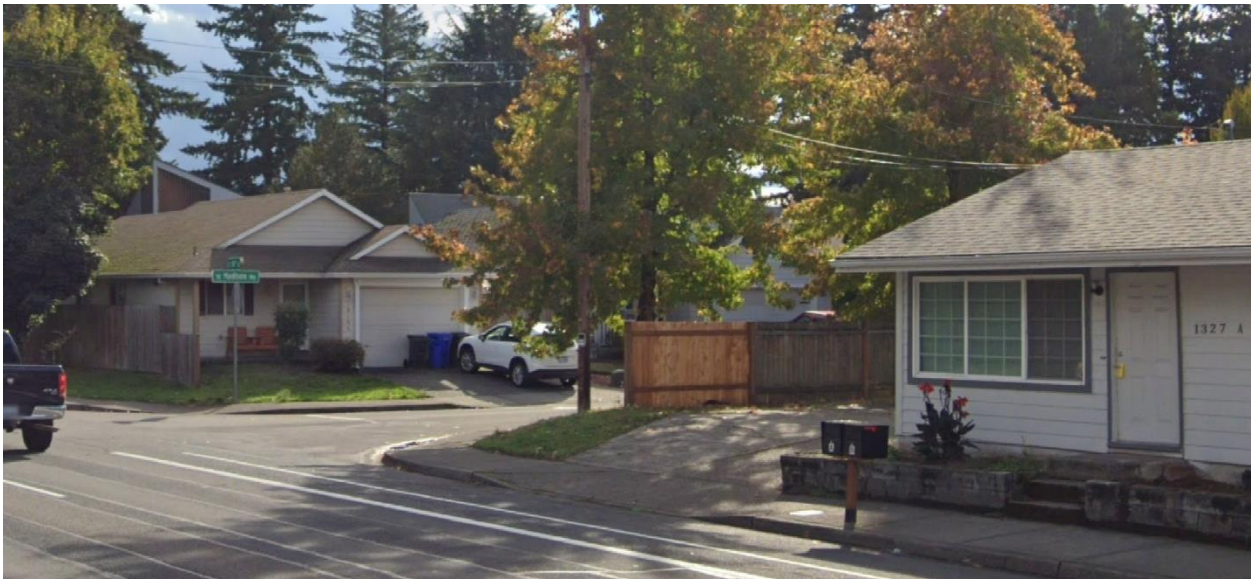
Figure 38. Bedroom 2 Exit Point

Note: Adapted from Gresham Fire Department Fire Photo P6060077.

Figure 39. Firefighter Tejedas on the Alpha/Bravo Corner Prior to Fire Control

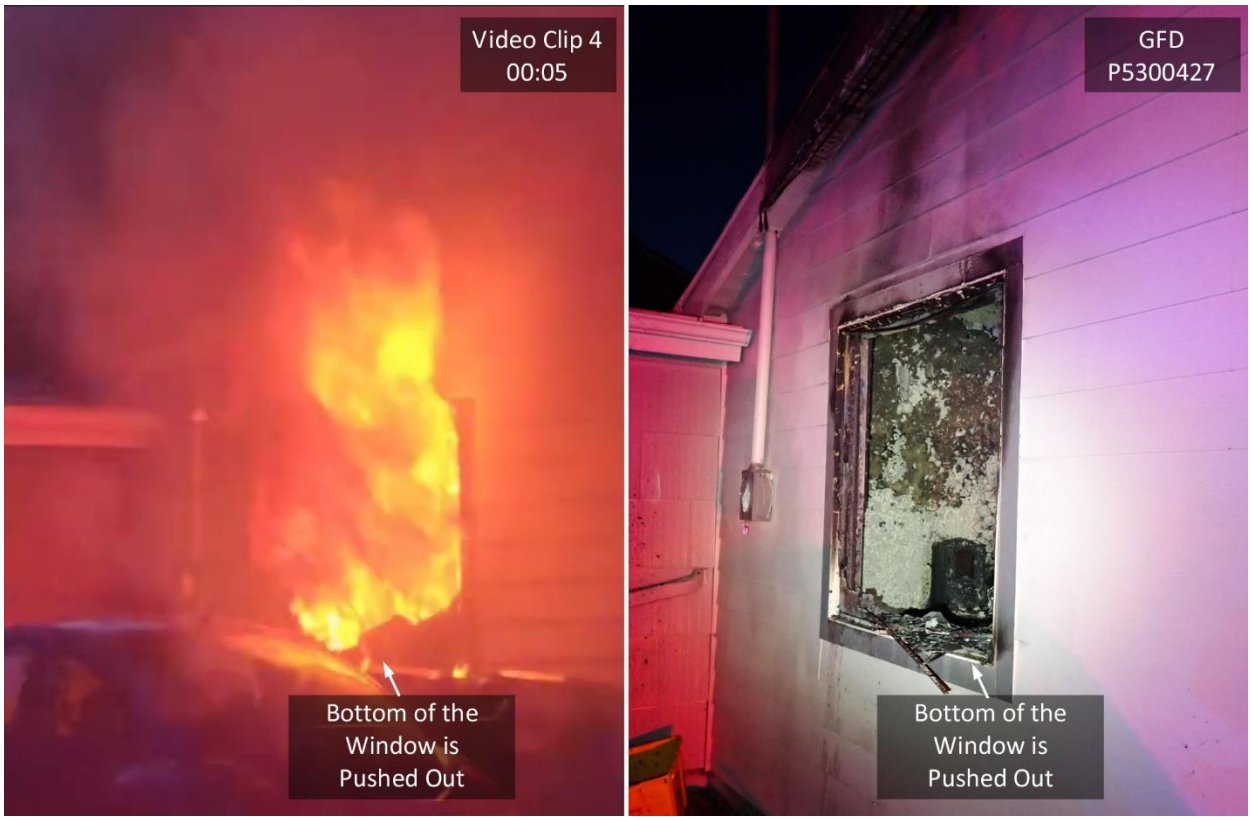
Note: Adapted from bystander photo IMG 6212, 5/30/2024 at 9:11 PM.

Figure 40. Street View of the Alpha/Bravo Corner



Note: Adapted from Google. (2023). [Street View 1327 SE 182nd Avenue, Gresham, OR]. Retrieved June 22, 2024, from https://bit.ly/3KTa8Yr.

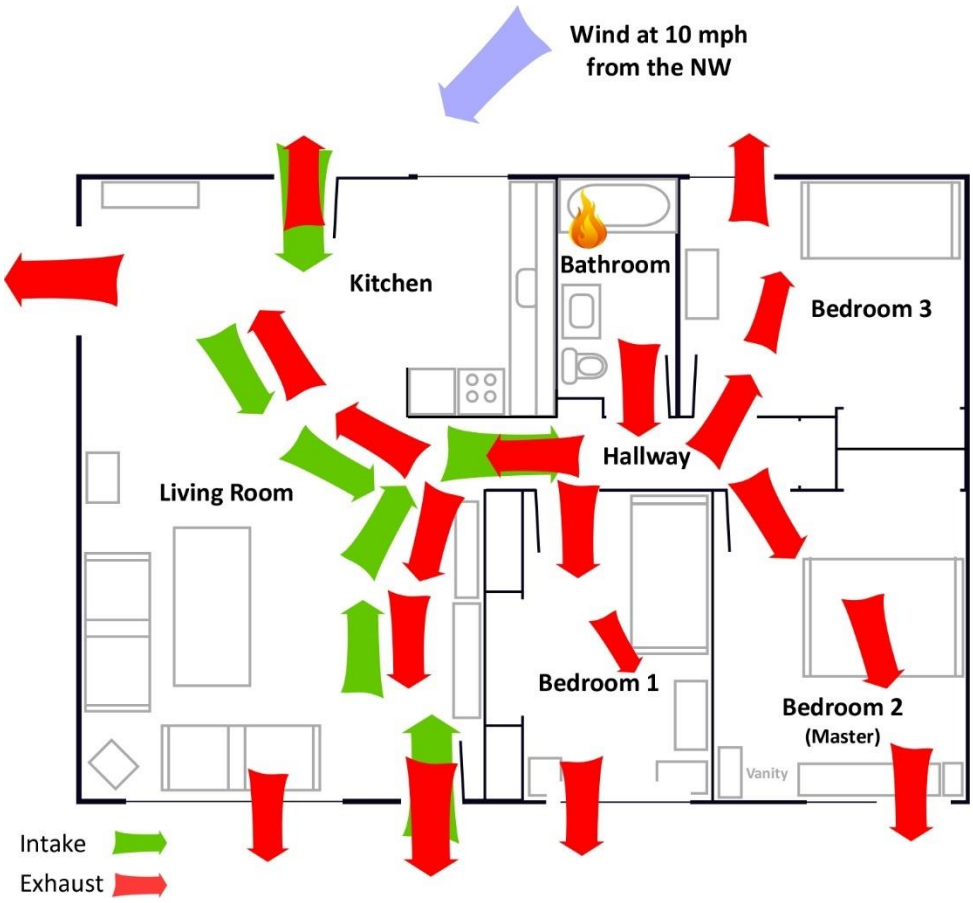
Figure 41. Side Bravo Window



Note: Adapted from [Bystander Video Clip 4 at 0:00:05 and Gresham Fire Department Photo P5300427].

Failure of the window on Side Bravo, large living room window on Side Alpha, and kitchen window resulted in additional ventilation openings each of which had a unidirectional (out) flow. Likely post-flashover flow paths are illustrated in Figure 42.

Figure 42. Post-Flashover Flow Paths



Initial water application occurred post flashover but was ineffective due to severe kinking in the attack line that resulted in low pressure and flow rate. The lack of flow and pressure negatively impacted water mapping within the living room. Fire in the hallway, kitchen, and bedrooms was shielded from exterior water application from the doorway on Side Alpha.

A second attack line was stretched, and pressure increased in the initial attack line. As illustrated in Figure 43, once adequate flow rate and pressure was developed, the fire was quickly knocked down. The attack line and backup line were stretched through the door on Side Alpha for fire control and the fire was extinguished. Fire was confined to the interior of the house with no extension into the attic or the attached Bravo 1 Exposure.

Figure 43. Exterior Attack and Attack Line Entry

Note: Adapted from [Bystander Video Clip 4 at 0:00:15].

Ventilation Openings

Figure 44 illustrates ventilation openings on Side Alpha and lack of ventilation openings on Side Delta.

- The living room door (2.92’ x 6.58’, 19.21 ft^2) was opened by an occupant and remained open throughout the incident.
- The living room window (three panels with a total opening 8.70’ x 4.29’, 37.32 ft^2) remained intact until post flashover at which point it substantially failed.
- The window in Bedroom 1 (two panels with a total opening 5.87’ x 2.96’, 17.37 ft^2) was slightly open prior to ignition (exact extent undetermined). This window remained intact prior to entry, but one side of the window was vented or failed due to thermal insult (see Figure 45).
- The window in Bedroom 2 (two panels with total opening 5.87’ x 2.96, 17.37 ft^2) was opened approximately halfway by an occupant after the door on Side Alpha was opened and an attempt was made to enter the house via the door).

Figure 44. Ventilation Openings on Sides Alpha and Delta

Note: Adapted from Gresham Fire Department Fire Photos P5300490, P5300510, P5300395, & P716005.

Figure 45. Changing Conditions in Bedrooms 1 and 2

Note: Adapted from [Bystander Video Clip 1 at 0:00:02] Bystander Video Clip 4 at 0:00:40 & Bystanders Photo IMG_6214].

Figure 46 illustrates the ventilation openings on Sides Charlie and Bravo.

- The door on Side Charlie (2.58' x 6.58', 16.98 ft^2) was kicked in by civilian bystanders (exact time is unknown, but likely after the front door and window of Bedroom 2 were opened by an occupant). This door remained open throughout the incident.
- The window in Bedroom 3 (two panels with total opening 3.37' x 4.58', 15.43 ft^2) was reported to have been partially broken (part of a single panel) by civilian bystanders. Truck 71 observed that one side of the window was at least substantially open when they arrived on Side Charlie and took the remainder of the glass and frame.
- The window in the Kitchen (two panels with a total opening 3.81' x 2.83', 10.78 ft^2) remained substantially intact until firefighting operations in the kitchen at which point it is likely that the glass was taken to provide additional ventilation.
- The window in the Living Room on Side Bravo (3.83' x 3.83', 14.67ft^2) failed post flashover.

Figure 46. Ventilation Openings on Sides Charlie and Bravo

Note: Adapted from Gresham Fire Department Fire Photos P5300402, P5300406, P5300407 & P5300427.

Rapid Fire Progression

The rapid progression of fire conditions in this incident was likely a ventilation induced flashover which was influenced to some extent by wind from the northwest impacting ventilation openings on Side Charlie. The sequence of events leading up to the flashover began with unplanned ventilation performed by building occupants and other bystanders trying to rescue reported occupants in the building.

Flashover in the Bathroom, Hallway, Living Room, and Kitchen

Opening the door on Side Alpha provided a flow path between the fire in the hallway and the door. Partially opening the windows increased the removal of smoke and concurrently the intake of air from the door on Side Alpha. As the windows were located higher than the bottom of the door (low intake-high exhaust), the differential in elevation between the intake and these exhaust openings increased the efficiency of the exchange of smoke and air between the interior and exterior of the building.

Increased air intake resulted in a rise in heat release rate, increasing temperature within the involved and adjacent compartment. High temperature gases and flaming combustion moving towards the flow path exhaust openings resulted in increased convective and radiant heat transfer.

Wind from the northwest at 10 mph impacted Side Charlie which had a west aspect, increasing pressure on this side of the building but likely was mitigated to some extent by the patio roof, fence, and tall vegetation to the northwest of the fire occupancy. Civilians opening the door and window on Side Charlie and the effects of wind increased air intake. The additional ventilation openings on Side Charlie made after initial ventilation on Side Alpha resulted in further increase in heat release rate and hastened transition to flashover.

Flashover in the Hallway and Bedroom 2

In addition to the flashover in the bathroom, hallway, living room, and kitchen, bedroom 2 transitioned through flashover to a fully developed fire after the fire in the living room was knocked down and Truck 71 ventilated the window in the bedroom. It is likely that atmospheric oxygen introduced through the lower area of the doors on Sides Alpha and Charlie was being consumed by the fire burning in the living room, kitchen and hallway, resulting in insufficient oxygen concentration in bedrooms 1, 2, and 3 to support flaming combustion. Once the fire in the living room was knocked down, the flow path between the exterior doors, windows, and the bedroom windows would have allowed increased oxygen concentrations in these compartments. When Truck 71 took the second half of the window in bedroom 2, the area of this exhaust opening was doubled, increasing the flow of hot gases out the opening, and inflow of atmospheric oxygen through the hallway and into the bedroom resulting in a ventilation induced flashover within this compartment.

Figure 47. Fully Developed Fire in Bedroom 2

Note: Adapted from [Bystanders Photo IMG_6214].

Post Fire Conditions

"Current residential structure fires are predominantly fueled by synthetic contents and commonly become ventilation limited. How and where the fire receives oxygen, especially with a ventilation-limited fire, impacts the fire growth and subsequent fire damage patterns" (Madrzykowski & Weinschenk, 2019, p. xviii). Examination of post-fire conditions in this incident can substantially assist in understanding the fire development and conditions encountered in this incident.

Figure 48. Living Room (looking directly in from the door on Side Alpha)

Note: Adapted from Gresham Fire Department Fire Photo P5300572.

Figure 48 illustrates post fire conditions immediately inside the door on Side Alpha. This door was the first ventilation opening created by an occupant and it remained open throughout the incident. As the bottom of the door opening was lower than all other ventilation openings created by the occupant and bystanders it served as one of two ventilation openings having a bi-directional flow with the bottom of the door serving as an inlet for fresh air. The limited low level burning and thermal damage to the wooden fuel packages inside the front door is potentially due to the cooling effect of air intake from this opening.

Figure 49. Living Room (looking towards the Bravo/Charlie Corner)

Note: Adapted from Gresham Fire Department Fire Photo P5300571.

Figure 50. Living Room (looking towards the Alpha/Bravo Corner)

Note: Adapted from Gresham Fire Department Fire Photo P5300568.

Figure 361. Living Room (looking toward Side Charlie)

Note: Adapted from Gresham Fire Department Fire Photo P5300581.

Figures 48 through 51 illustrated post fire conditions in the living room. This room has conditions consistent with post flashover combustion. Fuel packages and compartment linings show evidence of floor to ceiling combustion and significant thermal damage. Conditions in this room are likely a result of the number and type of fuel packages present (two couches, twin mattress, flat screen TV, etc.) as well as the location of this compartment between the doors on Sides Alpha and Charlie, each having a bi-directional flow with the bottoms of both doors serving as inlets for fresh air.

Figure 52. Kitchen (looking towards Side Delta)

Note: Adapted from Gresham Fire Department Fire Photo P5300585.

Figure 52 illustrates post fire conditions in the kitchen. As illustrated in this photo, the kitchen was immediately adjacent to the door on Side Charlie. The kitchen window on Side Charlie visible behind the open door remained substantially intact throughout the fire. This room shows evidence of burning and significant damage at the upper level with less damage to the lower kitchen cabinets, potentially because of the flow path between the major area of involvement in the living room and hallway and the door on Side Charlie.

Figure 53. Hallway (looking towards Side Delta from the Living Room)

Note: Adapted from Gresham Fire Department Fire Photo P5300599.

Figure 53 illustrates post fire conditions in the hallway. The hallway has conditions consistent with post flashover combustion. Compartment linings show evidence of floor to ceiling combustion and significant thermal damage. Conditions in the hallway are likely a result of the flow paths between the exterior doors on Sides Alpha and Charlie and the partially open window in bedroom 1 (Side Alpha) and open windows in bedroom 2 (Side Alpha) and bedroom 3 (Side Charlie). The flow of gases in the hallway between the bathroom (origin of the fire) and the living room was likely bi-directional with air flowing in at floor level and hot smoke and flames flowing outward at the upper level. The flow of gases in Bedroom 1 was likely unidirectional from the hallway through the bedroom due to the partially open window. The flow of gases in the hallway between the bathroom and bedrooms 2 and 3 was likely unidirectional due to the open windows in these rooms.

Figure 54. Bedroom 1 (looking towards Alpha from the Hallway)

Note: Adapted from Gresham Fire Department Fire Photo P5300612.

Figure 54 illustrates post-fire conditions in bedroom 1. Conditions indicate that bedroom 1 did not transition through flashover to a fully developed fire. Thermal damage in this compartment was moderate with no evidence of significant involvement of fuel packages within this room. Incident video and photos (Bystander Video Clip 1, 2, 3, & 4, 2024 and Bystander Photo IMG_6214, 2024) illustrate that the window in bedroom 1 (Side Alpha) showed unidirectional flow of smoke (out), with no flaming combustion throughout the incident. Damage to the bedroom door indicates that the door between bedroom 1 and the hallway had flaming combustion at the doorway to this compartment.

The lack of combustion in bedroom 1 is likely due to consumption of atmospheric oxygen by the post flashover fire in the living room and hallway and the exhaust opening provided by the slightly open window in this room during early stages of the fire and slightly larger opening provided by this window being pushed open or failing due to thermal effects post flashover in the hallway and living room.

Figure 55. Bathroom (looking towards Side Charlie from the Hallway).

Note: Adapted from Gresham Fire Department Fire Photo P5300689.

Figure 55 illustrates post fire conditions in the bathroom (room of origin) after removal of gypsum board and insulation from the ceiling opened when firefighters were checking for extension. The bathroom has conditions consistent with post flashover combustion. The acrylonitrile butadiene styrene (ABS) plastic shower enclosure was completely burned, and the bathtub comprised of the same material was melted and substantially burned. Compartment linings and the bathroom sink enclosure (veneer covered particleboard) show evidence of floor to ceiling combustion and significant thermal damage. The ceramic toilet cracked and failed into multiple pieces due to severe thermal exposure.

Figure 56. End of the Hallway (Looking towards Side Delta)

Note: Adapted from Gresham Fire Department Fire Photo P5300617.

Figure 56 illustrates post fire conditions at the end of the hallway (looking towards Side Delta). The hallway has conditions consistent with post flashover combustion. Compartment linings, the closet doors, and shelving show evidence of floor to ceiling combustion and significant thermal damage. There likely was a unidirectional flow from the hallway through Bedroom 2 due to a window in this compartment which was opened by an occupant and subsequently completely broken out by Truck 71 post knockdown of the fire in the living room (but prior to knockdown of fire in the hallway and bathroom). The window in Bedroom 3 was partially broken by a bystander which also would have resulted in a unidirectional flow (out) from the hallway through this room.

Figure 57. Bedroom 2 (looking towards Side Alpha)

Note: Adapted from Gresham Fire Department Fire Photo P6060077.

Figure 57 illustrates post-fire conditions in Bedroom 2. This room has conditions consistent with post flashover combustion. Fuel packages and compartment linings show evidence of floor to ceiling combustion and significant thermal damage. The window in this compartment was opened halfway by an occupant after they opened the door on Side Alpha. This resulted in a unidirectional flow from the hallway through bedroom 2. Incident video and photos (Bystander Video Clip 1, 2, 3, & 4, 2024 and Bystander Photo IMG_6214, 2024) illustrate that the window in bedroom 1 (Side Alpha) showed unidirectional flow of smoke (out) prior to Firefighter Tejedas's exit and until this window was

completely broken out by Truck 71 post knockdown of the fire in the living room (but prior to knockdown of fire in the hallway and bathroom).

When Truck 71 completely cleared the window in bedroom 2 to perform a window-initiated search, the room transitioned through flashover to a fully developed fire**.** This ventilation action by Truck 71 occurred after the start of fire suppression operations through the door on Side Alpha. It is likely that the fire in the living room and hallway was consuming the oxygen introduced through the doors on Side Alpha and Charlie and that the oxygen concentration in this compartment was insufficient to support flaming combustion prior to knockdown of the fire in the Living Room. Reduction of the oxygen consumption from the fire in the living room combined with increases unidirectional flow through bedroom 2 and out the window, likely resulted in the transition through flashover to a fully developed fire within this compartment. Post knockdown in the living room and kitchen, firefighters quickly pushed down the hallway, knocking down the fire in the hallway, bathroom, and bedroom 2.

Figure 58. Bedroom 3 (looking towards Side Charlie from the Hallway)

Note: Adapted from Gresham Fire Department Fire Photo P5300630.

Figure 58 illustrated post-fire conditions in Bedroom 3. Conditions indicate that Bedroom 1 did not transition through flashover to a fully developed fire. However, there is evidence of flaming combustion in the upper level of this compartment. Condition on the exterior of this window reflect high temperature flow of smoke, fire gases and likely flames out this window (Engine 74 reported observing flames from a window on Side Delta (there are none), but this may have been from the bedroom 3 window observed from Side Delta.

The bottom bunk bed had a twin mattress, but the top bunk bed did not appear to have been in use (no twin mattress). However, there was a crib sized mattress on the floor next to the bunk beds. Both mattresses showed thermal damage but were not significantly burned.

The varied conditions in bedrooms 1, 2, and 3 are like those observed in the Underwriters Laboratories Fire Safety Research Institute (UL FSRI) horizontal ventilation study (Kerber, 2010) and study of the impact of ventilation on fire patterns (Madrzykowski & Weinschenk, 2019).

> In most cases surrounding rooms such as the dining room and kitchen [adjacent to the living room or family room involved in fire] had no fire in them even when the fire room was fully involved in flames and was ventilating out of the structure. There was not enough oxygen in the structure to burn so there was some pyrolysis or melting because of high temperatures, but there was no burning in the adjacent rooms. The only time this did not hold was when remote windows were ventilated (Keber, 2010, p. 308).

Figure 59. UL FSRI Fire Patterns Experiment 5

Note: Adapted from Madrzykowski, D. & Weinschenk, C. (2019). *Impact of fixed ventilation on fire damage patterns in full-scale structures.*

Figure 59 illustrates bedroom conditions in Experiment 5 of the UL FSRI fire patterns study. This experiment involved a living room fire with bedroom doors open and one bedroom having a closed window and another bedroom having an open window.

The differences between the experimental results and this incident conclude there was some degree of ventilation in each of the rooms (but this varied considerably).

Fundamental Concepts

Understanding the fire behavior in this incident requires examination of several interrelated fire behavior concepts. This discussion is not intended to address these concepts comprehensively but serves as a framework for understanding the fire development and flashover that occurred in this incident.

Oxygen Consumption and Heat Release

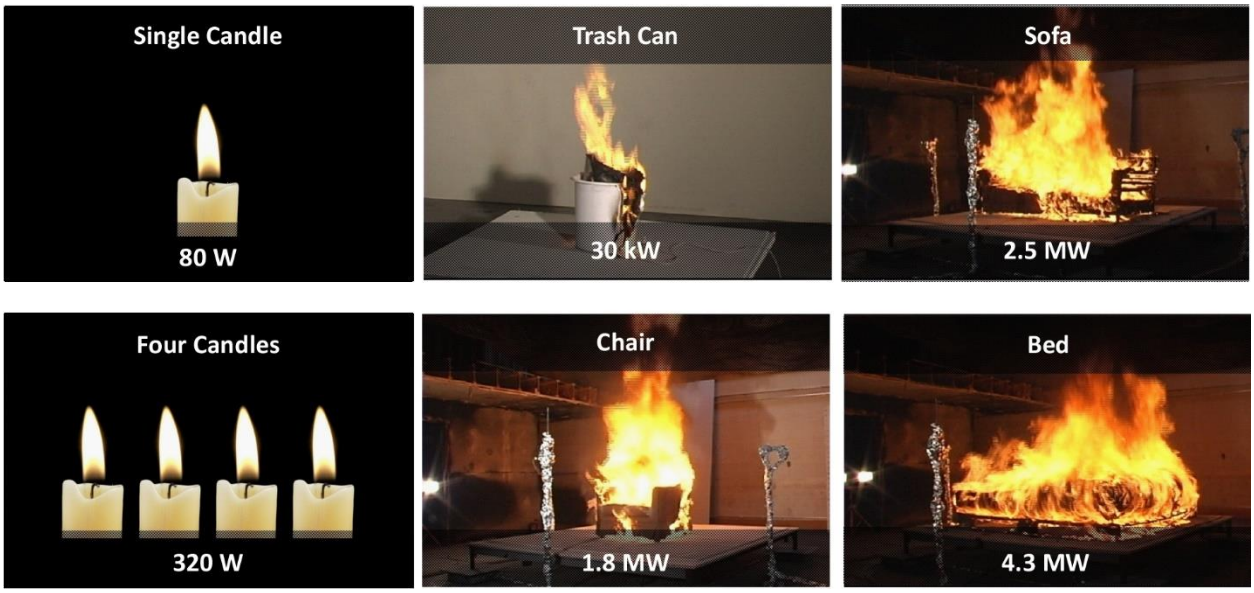
Combustion is an oxidation reaction. In most cases, when ignited, fuel reacts with oxygen in the atmosphere and releases energy. The international unit of measure for energy is the Joule (J). One way to understand this unit of measure is to consider that it takes 4.186 J to raise the temperature of 1 kilogram (1 liter) of water one degree Celsius (C).

The amount of energy released in a combustion reaction (regardless of the type of fuel) is dependent on the amount of oxygen consumed in the reaction. 13.1 megajoules (MJ) of thermal energy are released for each Kilogram (kg) of oxygen (O_2) consumed in the combustion reaction. However, air contains approximately 21% O_2. As such only 2.877 MJ of thermal energy are released when the O_2 in a kg of dry air is used in a combustion reaction. It is difficult to imagine what a kg of air looks like, so it is much more useful to think about oxygen consumption in terms of volume. One cubic meter (m^2) (approximately 40" x 40" x 40"in traditional units of measurement) contains sufficient O_2 to release 3.6 MJ of thermal energy.

A fire's size or power is described in terms of energy released per unit of time, generally in terms of Watts. A Watt is a Joule per second. As a Watt is a small unit of measure, typical measurements of fire size are expressed in terms of Kilowatts (thousand watts) (kW) or Megawatts (million watts) (MW). As a fire grows, the heat release rate increases, consuming oxygen at a faster and faster rate. For example, a 3.6 MW fire will consume all the O_2 contained in one m^2 of air in two seconds.

Figure 60 illustrates typical heat release rates from common fuel packages when burning in a fuel limited regime (actual heat release rates will depend on composition, geometry, and configuration of the fuel). As previously discussed, it is likely that the peak heat release rate from the tub and wall surrounds in the bathroom of the fire occupancy would have had a heat release rate between 4 and 8 MW.

Figure 60. Heat Release Rate Comparison

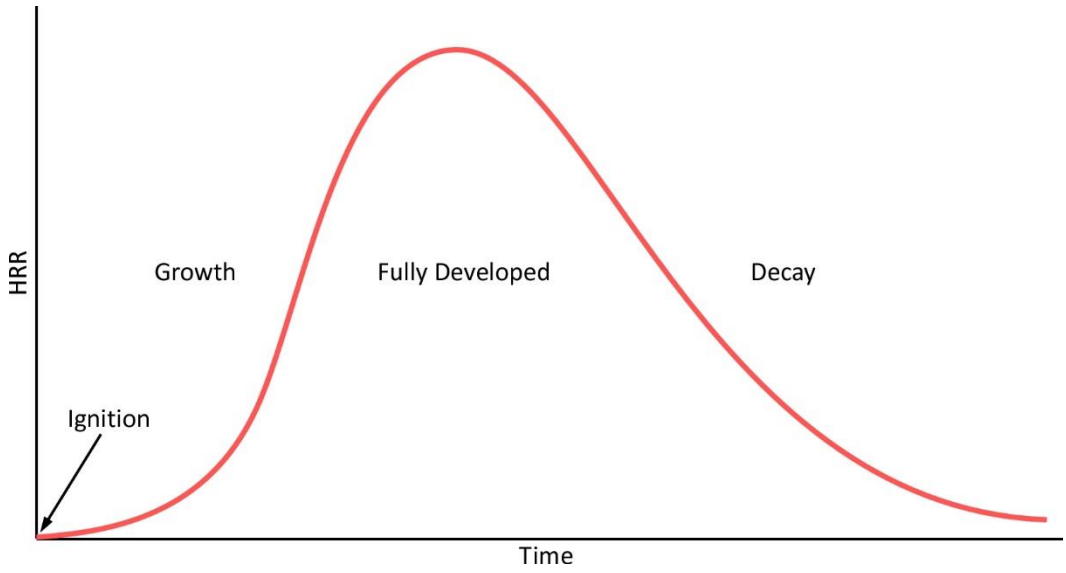


Note: Adapted from Hartin, E. (2013). *Fire Behavior Training for the 21st Century*. Washougal, WA: CFBT-US.

Fire Development

When a fire burns in an open environment, fire development is determined in large part by the type of fuel involved and its geometry (surface to mass ratio) and arrangement. As the fuel determines the rate and extent of fire development and subsequently the heat release rate (energy released per unit of time) the fire is described as fuel limited. Hot gases are unconfined and rise with convective heat transfer to the surrounding atmosphere. Thermal energy is also radiated in all directions, back into the fuel and to any adjacent fuel packages. As illustrated in Figure 61, the stages of fire development are described as ignition, growth (increasing heat release rate), fully developed (maximum heat release rate), and decay (decreasing heat release rate).

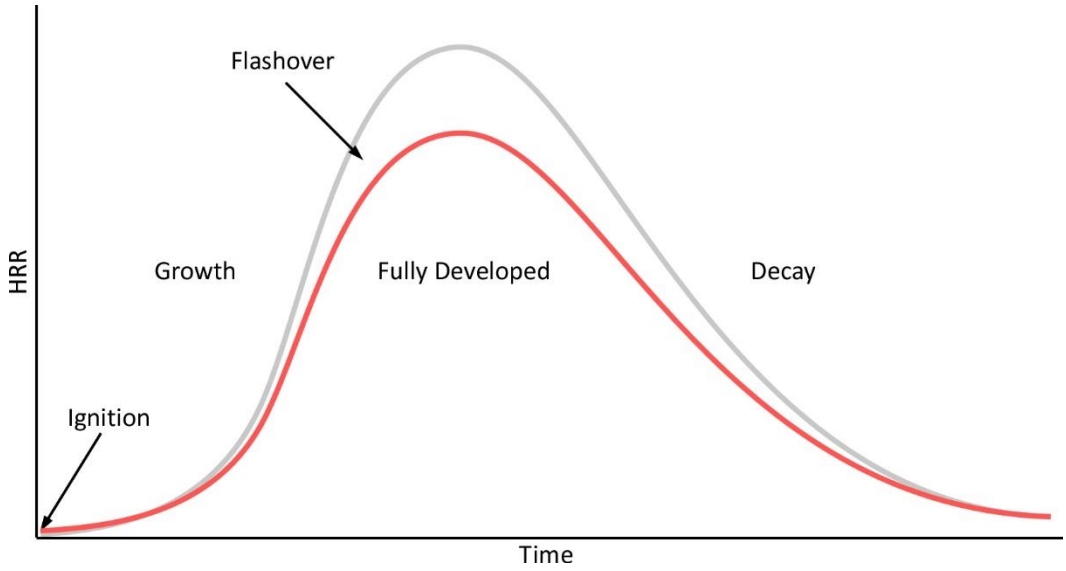
Figure 61. Fuel Limited Fire Development Curve



When a fire occurs in a compartment or enclosure[2] with walls, along with a ceiling and floor with any windows and doors closed, there are several important differences in fire development. When first ignited, the fire will be fuel limited. Atmospheric O_2 within the compartment will be sufficient for the fire to develop based on characteristics of the fuel, its geometry, and configuration. Thermal energy released by the fire will cause the temperature within the compartment to increase. As illustrated in Figure 62, the fire may rapidly transition through flashover to a fully developed, ventilation limited fire.

[2] The term compartment or enclosure is used to describe a room, rooms, or the interior of an entire building that is enclosed by walls, a ceiling and floor.

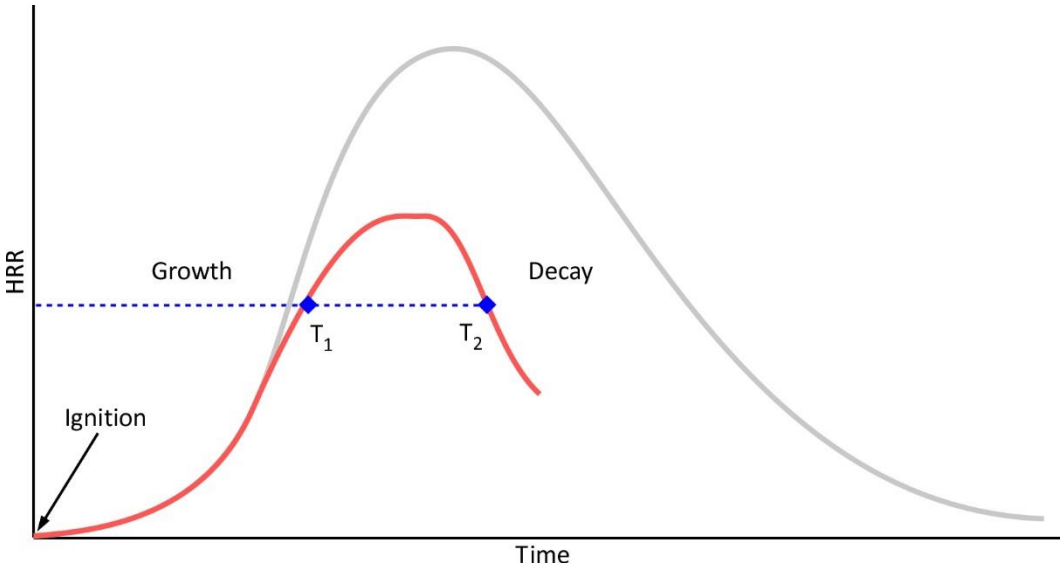
Figure 62. Flashover and Ventilation Limited Fully Developed Curve



However, as the heat release rate from the fire (and the rate of oxygen consumption) increases atmospheric oxygen is consumed and the concentration of O2 available to support combustion decreases. When this occurs, fire growth is limited by the availability of oxygen and the fire is described as ventilation limited. When the fire becomes ventilation limited, the increasing heat release rate slows, and the fire may begin to decay (become smaller). As the heat release rate slows, the contents of the compartment will remain hot, but the temperature will decrease over time.

Temperature within the compartment is driven by the heat release rate (HRR) of the fire. As HRR rises, so does temperature and as HRR decreases, temperature will decrease as well. Smoke conditions visible on the exterior of a structure fire are driven by the pressure resulting from expansion of gases heated by the fire. As illustrated in Figures 63 and 64, the temperature within the compartment may be the same during growth and decay ($T_1 = T_2$). When the temperature within the compartment is similar during growth or decay, the visual smoke and flow indicators visible on the exterior are likely to be similar as well. However, subtle indicators such as condensation of moisture on window glass during growth vs condensation of pyrolysis products on window glass during decay may provide cues to the stages of fire development. Other indicators would include changes in conditions after changes in ventilation such as occurred during this incident. Firefighters and fire officers may miss subtle indicators at night due to darkness or under time pressure and other stressful conditions.

Figure 63. Ventilation Limited Fire Development Curve

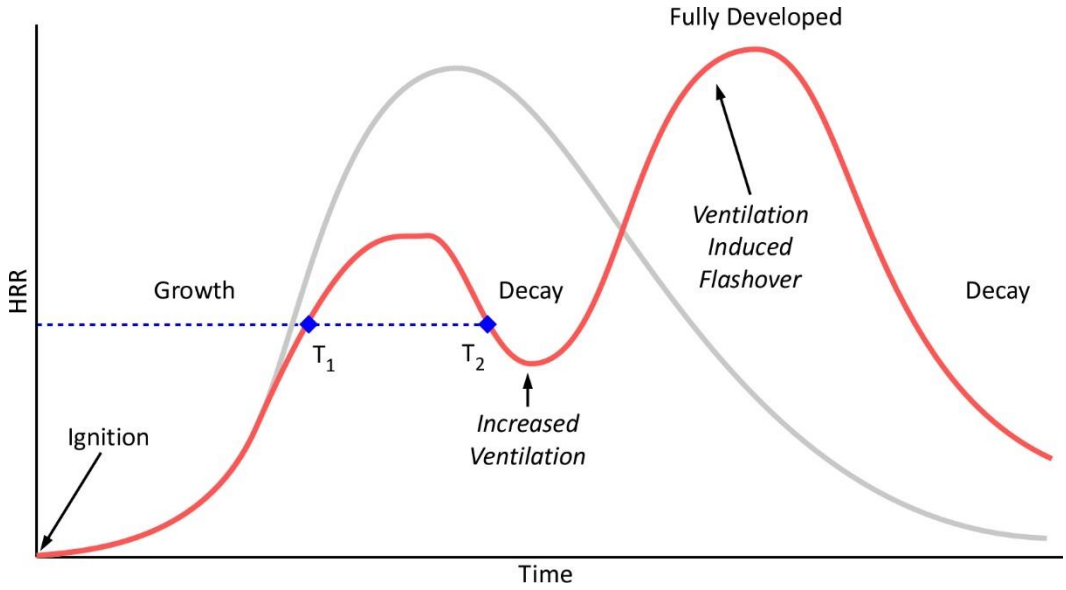


Influence of Ventilation

Ventilation is the exchange of atmosphere inside a compartment or enclosure with the atmosphere on the outside. When a fire occurs inside an enclosed compartment, ventilation may be limited to leaking from around any windows and doors and ventilation provided by designed heating, ventilation, and air conditioning systems.

As illustrated in Figure 64, when ventilation is increased to a ventilation limited fire, the heat release rate will increase as additional atmospheric oxygen becomes available. It is important to consider that most fires that progress beyond the incipient stage are ventilation limited when the fire department arrives. If ventilation increases sufficiently, the fire will reenter the growth stage (or speed of growth will increase) and rapidly transition through flashover to the fully developed stage. Increased ventilation may result from failure of window glass due to openings created by occupants as they exit the building, by bystanders attempting to assist or rescue trapped occupants, by failure of window glass due to flame impingement or high temperatures. These types of increase in ventilation may occur prior to the arrival of the fire department. It is important to recognize that any increase in ventilation to a ventilation limited fire without application of water for fire suppression will result in increased heat release rate and the fire may progress to flashover and the fully developed stage.

Figure 64. Ventilation Induced Flashover



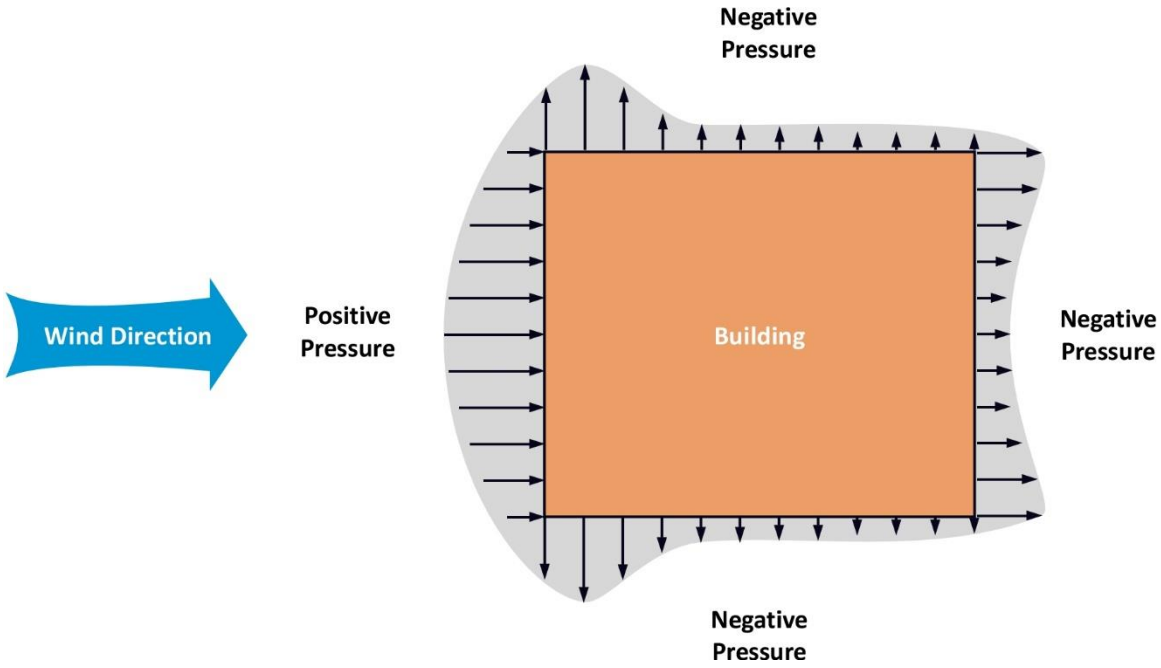
Increased heat release rate resulting from ventilation may or may not result in the occurrence of flashover or other rapid fire progression phenomena. Factors influencing the outcome of increased ventilation include temperature within the compartment, the location and extent of ventilation, and a variety of other factors.

It is important to note that the fire development curves in Figures 61 through 64 are generalized to illustrate fuel and ventilation limited fire development. For any given incident, changes in heat release rate over time will vary with the type, amount, configuration, and arrangement of the fuel and location and extent of ventilation openings.

Impact of Wind

Even when a building is relatively sealed, pressure differences from wind can have a substantial impact on how air flows into and smoke and fire gases flow out of a building. Pressure resulting from wind on the exterior of a building is proportional to the wind speed squared. As such, even a relatively slight wind can cause pressure differentials between different sides of the building (see Figure 65), affecting the inward flow of air and outward flow of smoke and fire gases (Svensson, 2020).

Figure 65. Wind Caused Pressure Effects on a Building



Note: Adapted from Svensson, S. (2020). *Fire ventilation*.

Wind velocity can be expressed using different units of measurement. In the United States, miles per hour (mph) are a common way to express wind speed. Another way to express wind speed is in meters/second (m/s). When the wind is blowing on the side of a building pressure increases and can be higher than the pressure on the inside. If there is a building opening, this can result in air flow into the building (even against the pressure generated by the fire as hot gases expand). The higher the wind speed the more air (think atmospheric oxygen) is driven into the building to support combustion and an increasing heat release rate.

Pressure differentials between the windward and leeward sides of the building and the increased atmospheric oxygen introduced to the fire can result in a wind influenced or wind driven fire.

- ***Wind Influenced Fire:*** Any fire in which fire dynamics are negatively influenced by the wind.
- ***Wind Driven Fire:*** Hot gases or flames flowing horizontally out of the room of fire origin (blow torch). Under these conditions fire gases are well mixed and of equally high temperature from the floor to the ceiling, at ≥400^{o} C.

Research conducted by the National Institute for Standards and Technology (NIST) has shown that the effect of wind needs to be considered as part of the initial and ongoing size up during structural firefighting and that wind speeds as low as 10 miles per hour (mph) can create wind driven fire conditions.

> In these simulations and in previous full-scale experiments, it has been demonstrated that wind can increase the thermal hazards of a structure fire. Therefore, wind needs to be considered as

> part of the initial "size-up" of the fire conditions and needs to be monitored and reported throughout the fire incident. It is critical for firefighters to not be in the exhaust portion of the fire flow path. The directional nature of the fire gas flow path results in higher temperatures than the area adjacent to the flow path or upwind of the fire. The flow path can be controlled by limiting ventilation…The unexpected ventilation from a broken window can suddenly change the interior thermal conditions. Interior operations need to be aware of potentially rapidly changing conditions (Barowy & Madrzykowski, 2014). Wind speeds on the order of 10 mph to 20 mph are high enough to create a wind driven fire condition in the structure with an uncontrolled flow path (Madrzykowski & Kerber, 2009a).

Friction against the ground surface and obstructions such as structures and vegetation can cause significant variations in wind speed and direction. These factors increase the complexity of estimating wind caused pressure differences (other than low or high) and specific direction (also impacting the force exerted on a surface) (Svensson, 2020).

The behavior of smoke exiting the fire occupancy in this incident provided an indicator of wind effects as significant horizontal smoke movement across 182nd Avenue was evident. While wind speeds of 10 mph were encountered in this incident and wind may have had some influence on changes in fire development after ventilation of the door and window on Side Charlie, the effects of wind are likely to have been mitigated to some extent by the patio roof, fence, and tall vegetation to the northwest of the fire occupancy.

Fire Behavior Indicators

Recognizing current and potential future fire behavior is a critical element in maintaining accurate situational awareness and effective decision-making at a structure fire incident. The building, smoke, flow (smoke and air movement), heat, and flame may be used to categorize fire behavior indicators.

This section of the fire behavior analysis is not intended to address fire behavior indicators or reading the fire on a comprehensive basis but will focus on indicators that are specifically relevant to the incident being investigated.

Building: The building provides context for other fire behavior indicators and potential changes in fire behavior. In this incident, the building was a small, legacy style house which was divided into small compartments with low ceiling height. This small volume structure allowed for rapid fire development and conditions that changed quickly.

Ventilation Limited Fire: In the modern fire environment, most fires that progress beyond the incipient stage are ventilation limited when the fire department arrives. Indicators of a fire in a compartment or enclosure that is ventilation limited include:

- Little to no smoke showing with condensed pyrolysis products on windows and possibly fingers of soot around doorways (vent limited decay stage fire).
- Flames and/or smoke showing from one or more openings (vent limited growth stage or fully developed fire).
- Bi-directional flow with a well-defined and lowering neutral plane at one or more openings (growth stage ventilation limited fire as illustrated in Figure 66).

Figure 66. Fire Development in a Single Compartment and Changes in the Neutral Plane

Note: Photos adapted from National Institute of Standards and Technology (NIST) *ISO-Room/Living Room Flashover*.

As illustrated by these examples, a ventilation limited fire can present itself in a variety of different ways. In this incident, conditions on Side Alpha when Engine 31 arrived appeared to be somewhat innocuous (as previously illustrated in Figure 28). Several firefighters and officers observed that this appeared to be a typical or routine incident. There was a bi-directional flow with a high neutral plane at the door on Side Alpha and a unidirectional flow (out) from the windows on Side Alpha. Velocity of smoke discharge from openings on Side Alpha was moderate. However, in the short time that it took the

crew from Engine 31 to mask up prior to entry through the door on Side Alpha, the neutral plane at the door had dropped significantly (as previously illustrated in Figures 28 and 29), indicating that this ventilation limited fire had returned to the growth stage and the speed of fire development would continue to increase with any additional ventilation in the absence of effective application of water for fire control.

Flow Path: The flow path is the volume of space between the inlet(s) providing air to a fire and outlet(s) allowing a flow of smoke and hot gases from the enclosure or compartment. The speed of air, smoke, and hot gas movement in the flow path can vary considerably. The velocity in the flow path is influenced by the elevation gradient between the inlet and outlet. Velocity will increase with a low inlet, high exhaust configuration. Velocity is also impacted by the pressure differential provided by the impact of wind. Fire will spread readily towards the outlets and firefighters operating in the downstream flow path will be subject to increased radiant and convective heat transfer due to movement of hot smoke and fire gases toward the outlet(s).

In this incident, the lower area of the doors on Side Alpha and Charlie served as low inlets, and the upper area of the doors and windows served as high exhaust openings. This flow path configuration resulted in efficient movement of air to the fire and smoke away from the fire towards the multiple ventilation openings on Sides Alpha and Charlie.

Flashover: Indicators of potential for flashover include:

- Increasing smoke discharge from compartments or enclosure openings such as doors and windows.
- Darkening smoke from gray or brown to black.
- Increased velocity of smoke discharge from openings or increased velocity of smoke movement inside a compartment or enclosure.
- Lowering neutral plane at opening with a bi-directional flow or lowering smoke layer in the compartment or enclosure.
- Rapidly increasing temperature within the compartment or enclosure (a late indicator which may not provide adequate warning).
- Isolated flames in the hot gas layer (ghosting) or more substantially moving through the gas layer or across the ceiling (rollover). If smoke is thick (optically dense) it may be difficult to see flame indicators on the interior.

In this incident, a well-defined neutral plane was present at the door on Side Alpha and dropped considerably between arrival and the time that the Engine 31 firefighters made entry. As the firefighters moved through the living room towards the hallway, they observed fingers of flame moving through the upper layer and upon reaching and operating in the hallway encountered rollover throughout the hallway. Rapidly increasing temperatures in the bedrooms on Side Alpha and in the hallway were a critical factor in the crew attempting to immediately exit through the door on Side Alpha.

Thermal Environment

Firefighters' personal protective equipment including turnout clothing (boots, pants, coat, gloves, hood, and helmet) along with self-contained breathing apparatus are designed to protect the wearer against thermal insult and exposure to toxic products of combustion.

Firefighters experience heat transfer through convection, conduction, and radiation. Heat transfer by convection is the result of hot air and fire gases around the firefighter. Convective heat transfer is influenced by temperature and the velocity of the gases (increases in temperature and increases in velocity correspondingly increase convective heat transfer). Heat transfer by conduction results from the firefighter contacting a hot surface such as the floor or a wall. Radiant heat transfer results from emission of energy in the form of electromagnetic waves from hot surfaces and flames. Heat transfer or thermal exposure to firefighters can be measured in terms of heat flux (rate of energy transfer per unit of area), expressed in kilowatts per square meter (kW/m^2) (Weinschenk, Knight, & Regan, 2024).

Table 2 illustrates the impact of elevated temperature that may be encountered in the fire environment and the associated human response. Similarly, Table 3 illustrates heat flux values that may be encountered in the fire environment and associated human response. It is important to consider both temperature and total heat flux when examining thermal insult in the firefighters operating environment. The temperature at the firefighter position may not be excessive, but radiant heat transfer from flames and hot smoke overhead may present a significant threat.

Table 2. Temperatures and Specific Human Response

Temperature °C (°F)	Response
37.0 (98.6)	Average normal human body temperature.
38 (101)	Typical body core temperature for a working firefighter.
43 (109)	Human body core temperature that may cause death.
44 (111)	Human skin temperature when pain is felt.
48 (118)	Human skin temperature causing a first-degree burn injury.
54 (130)	Hot water causes a scald burn injury with 30s exposure.
55 (131)	Human skin temperature with blistering and second-degree burn injury.
62 (140)	Temperature when burned human tissue becomes numb.
72 (162)	Human skin temperature at which tissue is instantly destroyed.
100 (212)	Temperature at which water boils and produces steam.
250 (482)	Temperature when charring of natural cotton begins.
>300 (>572)	Temperature at which modern synthetic protective clothing fabrics begin to char.
≥400 (≥754)	Temperature of gases at the beginning of room flashover.
≈ 1000 (≈ 1832)	Temperature inside a room undergoing flashover.

Note: Adapted from Madrzykowski, D. (2017). Fire fighter equipment operational environment: evaluation of thermal conditions.

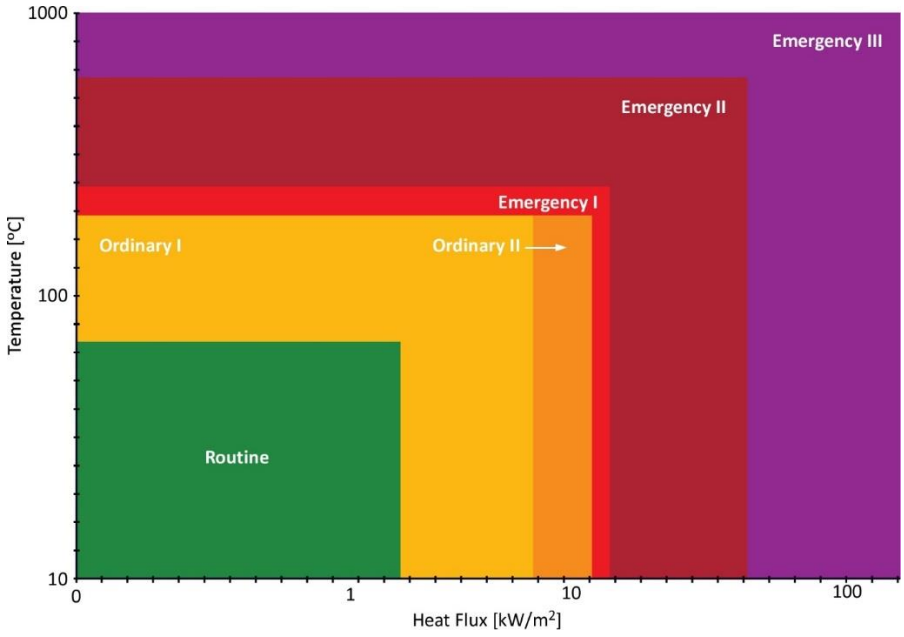
Table 3. Heat Flux Values and Specific Human Response

Heat Flux kW/m²	Response
≈ 1	A typical clear day solar radiant heat flux on the earth's surface.
2.5	Typical firefighter exposure and working environment.
4.5	Unprotected human skin will receive a second-degree burn in about 30s.
6.4	Unprotected human skin has pain in 8s and second-degree burn in about 18s.
10	Unprotected human skin will receive a second-degree burn in about 10s.
13	Wood volatiles (pyrolysis products) ignite with flame exposure.
18	Unprotected human skin experiences sudden pain and second-degree burn after 5s.
20	Unprotected human skin will receive a second-degree burn in about 4s, heat flux at floor level at the beginning of flashover.
80	Unprotected human skin will receive an instant second-degree burn, post flashover heat flux.

Note: Adapted from Madrzykowski, D. (2017). Fire fighter equipment operational environment: evaluation of thermal conditions.

Weinschenk, Knight, & Regan (2024) have extended research conducted by Utech (1973) to identify six thermal classes based on the protective characteristics and more importantly the limitations of current firefighters protective clothing and self-contained breathing apparatus (see Figure 67 and Table 4).

Figure 37. Thermal Classes



Note: Adapted from Weinschenk, C., Knight, H., & Regan, J. (2024). Toward improved thermal exposure classes for structural firefighters, *Journal of Fire Sciences*, 42(3). 217-235. doi:10.1177/07349041231222852.

Table 4. Thermal Classes, Temperature, and Heat Fluxes

Operating Class		Temperature Range [°C]	Heat Flux Range [kW/m^2]	Notes
Routine		20-72	1-2	Conditions observed outside a structure fire.
Ordinary I		72-200	2-7	Operational time of 10-20 minutes.
Ordinary II		72-200	7-12	SCBA lens is impacted around 7 kW/m^2.
Emergency I		200-260	12-15	SCBA lens degradation around 12 kW/m^2.
Emergency II		260-600	15-50	Above NFPA 1971 (1918) Test Requirement at 260° C.
Emergency III		>600	>50	Flashover conditions.

Note: Adapted from Weinschenk, C., Knight, H., & Regan, J. (2024). Toward improved thermal exposure classes for structural firefighters, *Journal of Fire Sciences*, 42(3). 217-235. doi:10.1177/07349041231222852.

The ordinary operating class encompasses both conditions which are unlikely to result in damage to Personal Protective Equipment (PPE) in the firefighter operational timeframe and conditions which have the potential to exceed conditions by which various components of the PPE ensemble are evaluated in standardized testing.

The emergency classes represent thermal exposures that can only be withstood for a short period of time. The upper limits of the Emergency I thermal class are based on the temperatures and heat flux that firefighter PPE is currently tested to as specified in NFPA 1971 (2018) and NFPA 1981 (2019).

> Emergency II is defined as the region where the thermal conditions are representative of localized burning/flaming combustion, and Emergency III would be equivalent to a post flashover exposure. The emergency classes represent exposures at which a firefighter may be able to safely operate on the order of tens of seconds (Emergency I), to beyond the limits of personal protective ensembles (Emergency II and Emergency III). This thermal class approach has a sharp change between an Emergency I and Emergency II class; however, thermal conditions may still be operable (on the order of seconds) at the transition between these two classes. In particular, recent work by Kessler and Madrzykowski showed that masks that meet the NFPA 1981 2013 standard showed significantly greater times to crazing, bubbling, and hole formation compared with older masks when exposed to 20 kW/m2, a heat flux above the current test standard (Weinschenk, Knight, & Regan, 2024, p. 223).

It is likely that Firefighters Spencer Tejedas and Jack Pilarski encountered thermal classes that transitioned quickly from Routine on the exterior of the building just prior to entry through Ordinary I and II as they made their way through the living room to the hallway. Conditions in the hallway likely transitioned to Emergency I when beginning their search down the hallway and into the bedrooms on Side Alpha. As Firefighters Tejedas and Pilarski began their egress through the hallway, conditions transitioned to the Emergency II thermal class and post flashover to the Emergency III thermal class.

Water Application

In the Underwriter Laboratories Fire Safety Research Institute (UL FSRI) technical report *Impact of Ventilation on Fire Behavior in Legacy and Contemporary Residential Construction* Kerber wrote "If you add air to the fire and don't apply water in the appropriate time frame the fire gets larger and safety decreases" (Kerber, 2010, p. 3).

The first 911 call reporting a fire at 1327A 182nd was received at 21:02:43 and Engine 31 arrived at the incident at 21:07:15, for a total response time of 4 minutes and 32 seconds. In this incident, the occupant and bystanders increased ventilation to a ventilation limited fire by opening doors and windows prior to Engine and Rescue 31's arrival. This early ventilation without application of water for fire control, developed imminent pre-flashover conditions prior to the arrival of Engine 31 and Rescue 31. Firefighters Spencer Tejedas and Jack Pilarski initiated primary search through the door on Side Alpha without a hoseline and in less than 30 seconds, the fire reached flashover and transitioned to the fully developed stage.

While an attack line was quickly stretched by Firefighter Christie Choma, Engine 31 Apparatus Operator (AO) and staffed by Firefighter Jaden Markham, Engine 71, initial fire control efforts were unsuccessful due to severe kinking at the pump discharge reducing the flow rate and reach of the stream.

Firefighters Noah Lunger, Rescue 31, Jaden Markham, Engine 71, and Jack Pilarski, Engine 31 began effective application of water from the exterior on Side Alpha at approximately 21:12, approximately five minutes after arrival. Once adequate flow rate was established through the attack and backup lines, the fire was quickly knocked down.

Operational Assessment

The operational assessment is critical to finding opportunities for improvement and prevention of serious injury events in the future. The operational assessment was conducted by a subcommittee including Portland Fire & Rescue and Gresham Fire Department. The findings are meant to find areas for improvement. It is important to note that all personnel on the scene acted with limited time and situational awareness. All members acted with what they believed to be the best decision they could make given the limited amount of time and resources available. The decisions made are a combination of their experience, training and background. The fire department needs to improve its training and Standard Operating Guidelines.

Contributing Factors

- *Insufficient risk assessment/size up difficulties*
- *Lack of effective Incident Command and control*
- *Primary search without a hoseline or Fire Attack established*
- *Lack of critical communications in requesting changes to tactics and tasks*
- *Loss of crew integrity and accountability*
- *Radio/communication difficulties*
- *Rapid fire growth*
- *Lack of effective Standard Operating Guidelines (SOGs), and failure to follow established SOGs*
- *Lack of training (fire behavior, officer development)*
- *Lack of City of Gresham support for fire department structure identified from decades of studies and recommendations*

Key Recommendations

Fire Operations

- *Develop Operational Policies for fire operations.*
- *Ensure the IC clearly identifies the strategy, Offensive or Defensive, on every fire incident.*
- *Outside agencies recommend implementing the Operations Chief Position.*
- *Remove "Rescue Mode" as a strategy available to Incident Commanders.*
- *Ensure all fire incidents prioritize an immediate 360 evaluation.*
- *Collaborate with Portland Fire & Rescue on Operational Policies.*
- *Develop an effective transfer of command SOG.*
- *Define the backup line and develop a policy.*
- *Define company tactics and tasks and how to request or advise a change in assignment to Command.*
- *Ensure all responding units stage, notify the IC, and standby until an assignment is given (consider level one staging).*
- *Ensure Ventilation is coordinated with Fire Attack.*
- *Evaluate command and control job aids for function and best practice.*

Communication

- *Develop Standard Operating Guidelines (SOGs) and training to ensure all teams and companies operating on an incident are aware of the overall strategy of the incident, their tactical assignment, and they confirm that information with the Incident Commander.*
- *Develop a communications SOG to correct tactical errors noted by the IC up to and including emergency traffic.*
- *Develop a policy and train companies to ensure radios will be carried to prevent remote mic cord thermal damage. Purchase individual holders and straps for all individuals. Standardize how radios are carried.*
- *Identify the radio call sign of each position on the apparatus. (example E31 nozzle, hydrant)*
- *Ensure the Battalion Chief IC removes as many distractions as possible so they may hear radio traffic. (consider wireless headsets)*
- *Work with BOEC dispatchers to develop a policy to convey critical victim updates in a timely manner.*
- *Work with BOEC to provide a procedure when radio transmissions are blocked by any source to restore communications on scene.*
- *Evaluate the actions of the Emergency Action Button (EAB) on the radio, implement changes and provide training.*
- *Define and train how and when to activate Emergency Tones on all radios.*

Accountability

- *Review and update the department's existing Accountability SOG to include strategic, tactical, and task level accountability. Ensure all GFD members follow the Accountability SOG and know how to conduct a Personnel Accountability Report (PAR).*
- *Ensure crew integrity is properly maintained by voice or personal contact when operating in an atmosphere that is immediately dangerous to life and health (IDLH).*
- *Ensure there is no freelancing on fire scenes by completing a Post Incident Assessment Checklist and following a robust accountability plan.*

Training

- *Develop and implement training in fire behavior, search, fire extinguishment, ventilation and building construction to include effective situation assessment (reading the fire), and the impact of tactical operations. This training will need to include classroom instruction, small-scale exercises, live fire training and simulation. Effective training in this content area needs to begin in the recruit academy and continue throughout careers.*
- *Invest in early leadership and officer development at the Firefighter, Lieutenant, Captain, and Battalion Chief levels.*
- *Train for operations with four-person companies.*

- *Ensure all personnel know when and how to issue a "Mayday," and/or "Emergency Traffic".*
- *Train to ensure communications are heard and understood (closed loop communications).*
- *Train for emotional and psychological stress and pressure on the fireground.*

Department Organization

- *Define roles and responsibilities of Firefighters, Lieutenants, Captains, Fire Investigators, and Battalion Chiefs.*
- *Correct weaknesses in department structure to provide for effective administration, operations, and training identified by past studies of fire department organizational structure.*
- *Evaluate how to adequately distribute experience throughout the Department. The committee recommendation is to place company officers on Rescues.*
- *Set clear expectations at rollcall, designate B-team leader, or Rescue lead (radio operator).*
- *Apply NFPA 1710 to staffing of Gresham Fire Apparatus which includes four-person staffing.*

Equipment and Personnel

Initial dispatch response included:

- Engine 31 (Company Officer, Engineer, Hydrant Firefighter, Nozzle Firefighter)
- Rescue 31 (Driver, Passenger Firefighter)
- C7 (Battalion Chief)
- Engine 71 (Company Officer, Engineer, Hydrant Firefighter)
- Engine 74 (Company Officer, Engineer, Hydrant Firefighter)
- Truck 71 (Company Officer, Aerial Operator, Jump Seat Firefighter, Tillerman Firefighter)
- Engine 73 (Company Officer, Engineer, Hydrant Firefighter)

Automatic-aid and second alarm companies:

- Engine 7 (Company Officer, Engineer, Hydrant Firefighter, Nozzle Firefighter)
- Engine 72 (Company Officer, Engineer, Hydrant Firefighter)
- Engine 29 (Company Officer, Engineer, Hydrant Firefighter, Nozzle Firefighter)
- C3 (Battalion Chief)
- Rescue 74 (Driver, Passenger Firefighter)
- Truck 7 (Company Officer, Aerial Operator, Jump Seat Firefighter, Tillerman Firefighter)
- C700 (Fire Chief)
- C720 (Chief Investigator)
- I722 (Investigator)
- I725 (Investigator)

Issues and Recommendations:

At 2103 hours, units were dispatched to a residential fire with a report of people inside the structure. The initial dispatch response was Engine 31, Engine 74, Engine 73, Engine 71, Truck 71, and C7. At 2106 hours, BOEC received a report that a caller thinks everyone is out.

ISSUE – This is critical information to factor into the calculated risk that a rescue is needed.

RECOMMENDATION – There may not have been adequate time for this to be relayed prior to the entry into the structure by E31B. However, every effort should be made by BOEC to provide victim updates as timely as possible.

At 21:07:08 hours Engine 31 arrived on scene, established Command (initial Incident Commander), and reported a "1-story, wood-frame house, smoke showing on the alpha side." Incident Command announced, "Engine 31 pulling an inch and three-quarter to the front door, Rescue 31 you're going to be Backup." Engine 31B (Hydrant Firefighter and Nozzle Firefighter) departed the apparatus, approached the doorway on the alpha side, and donned SCBA masks.

Figure 68. Firefighters Tejedas and Pilarski prepare to enter the building.

Note: Adapted from bystander video [Bystander Video Clip 1 at 0:00:00].

ISSUE – An offensive strategy is inferred based on the order to stretch a line to the front door. This is not a direct statement of the strategy. This inference is common on fire scenes and can lead to confusion.

RECOMMENDATION – Incident Commanders should declare their strategy directly, making their intent clear, reducing errors.

ISSUE – Based on witness statements, it is believed E31B removed their Firecom headsets upon arrival and discussed they were the rescue team.

RECOMMENDATION – Firefighters should not depart the apparatus until they understand the strategy, tactic, and/or task established by the Incident Commander or Company Officer to whom they are assigned. No team or company shall establish their own strategy or tactic without confirming with the Incident Commander.

ISSUE – E31B's actions infer they were in "Rescue Mode," even if it was not verbally expressed by either firefighter. Since 2009, there has been a promotion of "Rescue Culture." Though well-intentioned, this

belief has been promoted and interpreted as the primary tactical objective at most fire scenes and placed as a higher tactical objective than Fire Attack. Prior to 2009, Gresham had a robust fire behavior and live fire training program. It had extensive education in the science of reading smoke. In 2009, Gresham Fire closed its training division due to budget cuts. Furthermore, they sold or otherwise removed all other live fire and fire behavior props and supplies. Since 2009, fire behavior and live fire training have been sporadic and limited. Combining these issues with new, less experienced firefighters has created a concerning environment.

RECOMMENDATION – Eliminate "Rescue Mode" from the list of strategies available to Incident Commanders. Incident Commanders establish the strategy, then assign Rescue as a tactical assignment for a known victim in a known location. There may be situations when Rescue outweighs Fire Attack. In general, Fire Attack is the tactical priority for most incidents. Training is needed on strategies and tactical assignments.

ISSUE – The driver of R31 had not heard their tactical assignment.

RECOMMENDATION – Firefighters should not depart the apparatus until they understand the strategy, tactic, and/or task established by the Incident Commander or Company Officer for whom they are assigned.

ISSUE – The driver of R31 was in "Rescue Mode".

RECOMMENDATION – No team or company shall establish their own strategy or tactic without confirming with the Incident Commander.

ISSUE – The passenger of R31 understood the order and did not close the communication loop with Command.

RECOMMENDATION – Incident Commanders should make every effort to close the communication loop. All teams and companies should close the communication loop when they receive an order.

ISSUE – The driver of R31 conducted a search in an atmosphere that was Immediately Dangerous to Life and Health (IDLH) without a partner.

RECOMMENDATION – All tactics and tasks that occur in the IDLH atmosphere shall occur with a minimum team of two personnel and be assigned or approved by the Incident Commander.

At 2108 hours, Engine 31B made entry into the structure. The IC noted this and reported, "Correction Rescue 31, Engine 31(B) has gone in on search without a hoseline. Take a hose line to the front door and start knocking the fire down." C7 arrived, assumed command, assigned E31 to join his crew, and stated that E31 will be Fire Attack with Rescue 31 working for him.

ISSUE – Command misidentified the radio callsign of E31B by calling it E31.

RECOMMENDATION – Identify and standardize the radio callsigns of each position, team, and company. Individuals are not teams. Last names should not be used.

ISSUE – The initial Incident Commander (E31) adjusted his strategy to match the actions of E31B.

RECOMMENDATION – Incident Commanders are to ensure orders are received and followed, and only they can make strategic or tactical adjustments. Determine the best method for Incident Commanders to correct teams or companies that are not following strategic and/or tactical assignments. This may include the use of Emergency Tones or Emergency Traffic.

ISSUE – E31B initiated a search through an exterior door, without Fire Attack in progress. Rapid fire development occurred.

RECOMMENDATION – All searches initiated from an exterior door shall be coordinated with a hoseline dedicated to Fire Attack. Controlling the fire cools the atmosphere and provides additional time and safety to search and rescue victims.

ISSUE – The ventilation profile of the structure was not evaluated and controlled.

RECOMMENDATION – Provide all operations personnel with up-to-date training on reading smoke, fire behavior, and controlling the ventilation profile of structures involved in fire.

ISSUE – Command assigned E31 Officer to join his crew and stated they are Fire Attack. The crew was E31B engaged in Search, not Fire Attack. R31 will be with E31's crew. R31’s driver was not available as he was engaged in Search on the Charlie side.

RECOMMENDATION – Command needed to perform a reset on this fire. E31B should have been ordered to withdraw from the building. Once a Fire Attack team was properly mustered and an adequate hoseline established, a targeted search of the bedrooms could occur. When E31’s Officer looked up and saw fire everywhere, he attempted to make a transmission, but the open mic issue prevented this.

Figure 69. Strap that caused hose to have significant kink causing reduced water flow.

Note: Adapted from Gresham Fire Photo 103422, 104702

ISSUE – A containment strap on E31 was hung up on the retaining D ring causing a severe kink in the hoseline. The hose pressure was not adequate for firefighting operations.

RECOMMENDATION – Portland Fire & Rescue should remove the fold in the webbing strap to prevent any possibility of entrapment in the D ring. COMPLETED July 2024

At 2109 hours, BOEC received a report that the child believed to be inside, was outside with mom (not announced on the radio). Engine 71 arrived, and Command prompted Engine 31 to confirm their assignment and who will be working for them. Engine 31 acknowledged the order and repeated it back to Command. Engine 74 also arrived. Command assigned Engine 74 to perform a 360 and Truck 71 all in for Search. Engine 73 arrived.

Figure 70. BOEC police radio report to DP 8

DP17	21:05:58	RG11310:THIS IS GOING TO BE A DUPLEX,NOW SAYING PEOPLE I/S
DP17	21:06:51	RG11310:CALLER THINKS EVERYONE IS OUT
DP4	21:07:54	R31 BACKUP LINE
DP4	21:08:06	E31 IS WF,SMOKE SHOWING FROM A SIDE
DP8	21:09:32	(134) 134 - FOR FIRE - MOM WAS CONCERNED ABOUT CHILD BEING INSIDE BUT THE KID IS OUTSIDE W/MOM

Note: Adapted from BOEC report Computer aided dispatch report, incident RG24-11310 *Gresham Fire*

ISSUE – Figure 70 reported by the police officer on scene. The report that the child was outside with mom is critical information that should be considered when assessing the need for a rescue. This was not announced on the Ops channel.

RECOMMENDATION – BOEC should review their protocols for relaying victim information and consider establishing a framework for timely communication.

STANDARD OPERATING GUIDELINE 2.2.3 PERSONNEL ACCOUNTABILITY SYSTEM (EXCERPT):

3.2 Communications
Face-to-face and radio communications critical to maintaining accountability include the following: Organizational assignments, tactical assignments, and reports on conditions.

3.2.1 Individuals receiving an assignment must provide feedback confirming that communication (i.e. assignment, location, resources).

3.2.2 Resources who have completed their assignment or who are unable to complete their assignment (i.e. additional resources required, change in conditions) must provide a report on conditions.

3.2.3 Supervisors should request reports on conditions on a periodic basis to maintain an awareness of conditions.

ISSUE – Command missed the transmission from E71 upon their arrival. This can be a common issue when multiple companies arrive simultaneously. The incident appeared to be lacking resources, causing confusion about tactics and personnel location. At this point, E71 did not have an assignment upon arrival, a Backup line wasn't assigned, there was a kinked Fire Attack line and lack of Water Supply.

RECOMMENDATION – A training program should be developed for company and chief officers to enhance emergency scene management skills and ensure they are maintained. The program would help establish incident priorities and a common incident management system for all commanders.

ISSUE – Command assigned E74 to perform a 360 and T71 to Primary Search. With two people already in a burning house, no water on the fire, and without a Backup team or line in place, a 360 is likely a lower priority compared to other tasks. Assigning T71 to Primary Search results in six people in the building without water on the fire.

RECOMMENDATION – A training program should be developed for company and chief officers to enhance emergency scene management skills and ensure they are maintained. The program would help establish incident priorities and a common incident management system for all commanders.

ISSUE – E71 was acting without an assignment.

RECOMMENDATION – Effective communication at the fire scene is crucial for relaying orders and ongoing size-up. Actions should not be taken without orders, as it compromises accountability at the scene. Companies and teams should wait for assignments, unless immediate, imminent threats require action. Command should be prompted at the appropriate time to remind them of availability. This was a rapidly developing incident with time compression, worsened by E71 acting on their own, without an assignment from Command.

STANDARD OPERATING GUIDELINE 2.2.3 PERSONNEL ACCOUNTABILITY SYSTEM:

3.1 Incident Command System
Key elements of the ICS related to accountability include maintaining unity of command and an effective span-of-control.

3.1.1 The Incident Commander and other individuals in a supervisory role must ensure that reporting relationships are clearly defined and an effective span-of-control is maintained (based on incident complexity).

3.1.2 Each individual in a supervisory role is responsible for maintaining accountability for the individuals and resources reporting directly to them.

3.3 Company/Crew Integrity
Company and Crew (i.e. B Team) integrity is the basis for the accountability system.

3.3.1 All members operating inside the Hazard Zone must be part of a Company or Crew with a tactical assignment.

3.3.2 Company/Crew integrity is defined as each member of the Company or Crew being within sight or voice (not radio) contact and physically close enough to provide immediate assistance in the event of an emergency.

3.3.3 If it is necessary for a member of a Company or Crew to leave the Hazard Zone, all members of the Company or Crew must leave together.

3.3.4 Company Officer and Crew Leaders are responsible for maintaining Company/Crew integrity.

3.3.5 Loss of Company or Crew integrity is an emergency and should be reported as an Emergency Traffic radio message!

ISSUE – E71's jump seat firefighter announced he was going to get a Backup line as he recognized this was an immediate issue. Although he was correct in his assessment, all assignments come through Command, and crew integrity is critically important.

RECOMMENDATION – Assure all actions are vetted through the Incident Commander and be diligent with crew integrity.

ISSUE – Radio communications failed. E71 developed and employed their own incident action plans.

RECOMMENDATION – If radio communications are failing, the company officer should approach Command and articulate his arrival and offer to solve the Backup issue.

ISSUE – E71's apparatus operator assisted E31's apparatus operator by dressing the hydrant to facilitate a water supply.

RECOMMENDATION – Water Supply was a pressing issue, and it appears more resources were needed to accomplish the tactic, but this was not the assignment of that crew. Had Command recognized the availability of the company and assigned a different tactic, it would have been difficult to bring them together.

ISSUE – While all these actions were vital to the incident, none of them were assigned or articulated in any way.

RECOMMENDATION – Maintain crew integrity. All three members were working to accomplish three different tactical objectives. Had a PAR been called, E71 would not have been able to complete it without looking for each company member. More training is needed in personnel accountability.

ISSUE – A Backup Line was pulled by one member. Command had not assigned it, was not aware it had been pulled, who was pulling it, there wasn't a company officer assigned to that tactic, and crew integrity was compromised as E31 was not made aware of the Backup line firefighter.

RECOMMENDATION – No individual shall operate in the IDLH atmosphere alone. All company and team members will ensure they have orders.

ISSUE – E71's Officer joined T71 on the Charlie side of the structure and assisted with Search. He is the eighth person to be involved in Search. He is not with his company. He is not accounted for by Command.

RECOMMENDATION – Crew integrity must be maintained at all incidents. The urgency of the scene reduced the discipline to adhere to recommended and accepted department and industry standards. We must run the incident and not let the incident run us.

ISSUE – T71 received several citizen reports of a child in the building. Assigned Primary Search, they performed a window-oriented search (VEIS). T71 took out the window on the Alpha/Delta corner, and fire came out the window. This likely contributed to the change in fire behavior. There was no water on the fire, 2 people inside the building searching, no Backup line or team, and a changed ventilation profile. T71 also took out a window on the Charlie side. There appeared to be very little coordination of tactics on this incident.

RECOMMENDATION – T71 was mostly unaware of this information at the time of their search attempts. All personnel need to be aware of the general location of the fire and its status. As much as possible, all tactics need to be coordinated to provide safety and effectiveness.

At 2109 hours, BOEC notifies Command that Engine 31 has an open mic. BOEC then notifies Engine 31 they have an open mic. Engine 31 notifies Command they have a firefighter who needs medical attention in front of the car in front of the structure. Command asks Engine 31 to repeat their message.

Figure 71. Tejedas radio cord burned

Note: adapted from Gresham Fire Photo P61801778, P6180148

ISSUE – The open mic caused all radio communications to cease. E31 had a seriously injured firefighter on the alpha side. They communicated this information twice to Command. It is too common for Command to miss radio transmissions, even priority transmissions. This issue can be worsened when radio communications cease, as Command often must rely on face-to-face communication and hand gestures in the meantime. The radio lockup was likely caused by the injured firefighter's remote mic cord burning through.

RECOMMENDATION – Command distractions are a problem. An Incident Commander's ability to effectively carry out their responsibilities during critical incidents is often stretched to the limit. It is important to prioritize radio traffic over job aids, especially early in the incident. Consider memorizing primary tactics that are common to most fire incidents (Fire Attack, Backup, Primary Search, Water Supply, Ventilation). BOEC should assist by entering these assignments and the companies assigned to them allowing the Incident Commander a quick reference. The job aid can be updated when time allows. Keeping eyes on the scene will help the Incident Commander be more responsive to changes. Evaluate the operation of the Emergency Action Button (EAB) as a possible solution to radio lockup situations. Consider requiring all radios to be worn in a holster under the structural ensemble. This would prevent further occurrences of radio lockup.

ISSUE – A non-emergent declaration of an injured firefighter on the alpha side.

RECOMMENDATION – When a firefighter is injured to the extent they can no longer perform their duties and require medical attention, it should be treated as priority traffic. If Engine 31 had used the "Emergency Traffic" declaration, it is highly likely that Command would have heard the first transmission.

At 2111 hours, Engine 31 notifies Command they have an injured firefighter standing on the alpha side who needs immediate medical attention. Command acknowledges and asks if there is a company available for medical assistance. Engine 73 states they are available for Medical. Command assigns

them to Medical and informs BOEC to start a 2nd alarm. Command assigns Medic 340 (AMR) to assist Engine 73 with Medical.

ISSUE – When Engine 31 notifies Command of an injured firefighter, it should be classified as a critically injured firefighter.

RECOMMENDATION – "Emergency Traffic" should be used in this situation. The term "immediately" suggests Engine 31 suspected the firefighter was seriously injured.

ISSUE – Command asks if there is an available company for medical. It seems Command has not kept track of the resources on scene or is lacking in resources. As a result, Command immediately calls for a second alarm. Engine 73 is assigned to the Medical tactical assignment. There is no company available for RIT.

RECOMMENDATION – This situation should have prompted Command to use "Emergency Traffic" as it becomes evident that the incident has become more complex due to the firefighter's need for "immediate" medical attention. Even though Engine 71 was lost, it is likely that Engine 73 would have served as RIT and been reassigned as Medical. Adding an additional heavy asset to the assignment or increasing the minimum staffing for heavy assets to four people would provide the Incident Commander with resources to handle unexpected emergent issues. It would be more effective to increase unit staffing, as this would make resources immediately available. Additional apparatus would be delayed by the response distance. After assigning Engine 73 to medical, a Personnel Accountability Report (PAR) wasn't conducted. No one on scene knew who the injured firefighter was, which team/company they were assigned to, or the status of the rest of the team/company. At any given time, there were 8 firefighters from 4 different companies conducting a search. Elements of 3 of these companies formed a Fire Attack and Backup coalition. In hindsight, a PAR was clearly needed for this incident. Moving forward, sentinel events on the fire ground should prompt a PAR to ensure everyone is accounted for prior to proceeding with the strategy and tactics.

ISSUE – The only reason a medic unit was assigned to this incident was because of the report of possible victims. Fortunately, there were no victims, so the medic unit was available for the injured firefighter.

RECOMMENDATION – Gresham Fire should have a medic unit or a transport-capable rescue as part of the first alarm assignment, regardless of the presence of suspected victims.

At 2112 hours, E74 updates Command with her location and actions. Command asks E74 if she can have her crew establish a Water Supply. E31's Apparatus Operator informs Command the water supply is established. This is the first tactical objective that is accomplished and transmitted on the radio. E74 is now unassigned.

ISSUE – E74 is on the Charlie side of the incident and is out of position to accomplish this tactical objective and it is their second tactical assignment. This is a consequence of Command losing E71, E71 not receiving an order, E71 not persisting in making their availability known to Command, and an under-resourced incident.

RECOMMENDATION – Crew integrity must be maintained at all incidents. The urgency of the scene reduced the discipline to adhere to recommended and accepted department and industry standards.

At 2113 hours, E31 tries to transmit to Command the fire is out. This is the second tactical objective completed. Backup is likely the third tactical objective completed, though the timing is unknown. Command is unable to copy the traffic from E31.

ISSUE – E31 radio communications struggle to be effective.

RECOMMENDATION – Gresham Fire uses Portland Fire radios on E31. Gresham Fire radios should be placed on E31 while it is staffed by Gresham personnel. These radios can pair via Bluetooth to Gresham SCBAs, promoting better radio communications. Training on radio communications should be a company priority.

At 2114 hours, Command sends E74 to connect with E31 to establish communications with them and gather information. This is E74's third assignment. Command transmits that T71 reported Primary Search is complete. This is the fourth tactical objective accomplished.

ISSUE – E74 is assignment-saturated.

RECOMMENDATION- Command needs to re-evaluate availability and locate another company. A report on Conditions, Actions, Needs (CAN) helps track who is doing what, where, conditions encountered, and what needs companies/crews have to accomplish objectives. Increasing staffing would allow company officers to split their crews, allowing for concurrent assignments rather than consecutive.

At 2118 hours, Command asks E74 if they can conduct a Secondary Search. T7 reports that the attic is clear.

ISSUE – E74's fourth assignment, additional saturation.

RECOMMENDATION – Four person staffing to strengthen first alarm fighting force, as previously identified.

At 2120 hours, E72 arrives and is assigned RIT, 13 minutes after the first arriving company.

ISSUE – RIT is assigned 13 minutes after the first arriving company. It highlights the distance and time it takes to get additional resources on-scene. It also demonstrates the preference for four-person companies.

RECOMMENDATION – Gresham Fire should staff their heavy assets with four firefighters. Increasing staffing would allow company officers to split their crews, allowing for concurrent assignments rather than consecutive.

Personal Protective Equipment

Gresham Fire Department's current turnout specification is the Lion Rainier V-Force coat, Lion Rainier V-Force pant ensemble, Lion RedZone particulate blocking hood, Lion Commander Ace Glove and HAIX Fire Hunter Xtreme boots. This turnout ensemble utilizes the patented PBI max outer shell and K7 Glide thermal liner. These products meet or exceed all NFPA 1971 requirements in terms of flame resistance, heat/thermal resistance, tear resistance, shrinkage, and breaking strength both initially and after laundering. The HAIX Fire Hunter Xtreme boots are NFPA 1971 and 1990 certified.

In review and product demonstrations of other personal protective equipment (PPE), it is believed the best possible specification of turnout gear is donned by the department.

PBI Max:

PBI max is tested and performs up to 1175 degrees before there is thermal decomposition of the material. It also has a demonstrated trap tear test of 235 lbs. new, with 230 lbs. after 90 hours of UV exposure. In product testing, the demonstrated tear test decreases to 72 lbs. after 180 hours of UV exposure. Temperatures experienced within the structure exceeded 1175+ degrees, with numerous areas of the outer shell completely broken down. It is believed FF Tejedas's life was saved by the personal protective equipment worn.

Moving Forward:

Testing shows direct exposure to Ultraviolet (UV) light reduces the integrity and safety of the PPE. In just 180 hours, the Trap Tear test reduces from 235lbs to 72lbs. The turnout program manager recommends eliminating any storage of gear that allows exposure to UV light.

ISSUE - Turnout storage throughout the department may or may not have exposure to UV light.

RECOMMENDATION - Eliminate as much UV light exposure as possible in turnout storage areas.

Uniforms:

At the time of the incident the critically injured firefighter was wearing their station t-shirt, department issued nylon shorts, turnout coat, pants, gloves, hood, helmet, boots, and self-contained breathing apparatus with integrated PASS device. They carried a portable radio, thermal imaging camera, and flashlights assigned by the department. The investigators examined and photographed the personal protective clothing and equipment at the fire department's headquarters facility. The performance of each article was scrutinized by representatives of the distributors and manufacturers.

ISSUE - Nylon shorts and personal garments were adhered to the turnout liner due to heat.

RECOMMENDATION - Eliminate non-compliant NFPA articles of clothing from the uniform policy. COMPLETED- Logistics directed to discontinue the use and ordering of shorts that do not meet NFPA compliance.

ISSUE – HAIX recommends NFPA 1851 guidelines for routine and advanced inspection of their turnout boots.

RECOMMENDATION – Confirm NFPA 1851 guidelines are followed and provide standard care and maintenance instructions for the boots.

Outside Operational Review

Chief Lewis requested outside reviews of the incident to ensure a thorough and well-developed evaluation of action. This came in two parts, a review from a neighboring agency, and a document review by a situation matter expert. One of the team of investigators is a Chief Officer for Portland Fire & Rescue. Portland Fire & Rescue works closely with Gresham Fire department, with Gresham operating Station 31 on B shift and Portland operating A, and C shifts. Both departments use the same county-wide Bureau of Emergency Communications (BOEC) dispatch center. It was requested that he review with an outside lens, the incident and department operation. The following sections on Training, Incident Command, and Staffing contain his comments and recommendations.

Training

Gresham Fire Department's Training Center was closed from 2009-2013 due to budgetary restraints that affected the Fire Service nationwide. Prior to the closure, GFD had a robust fire behavior/dynamics program that included classroom learning alongside hands on training and simulations via training props. During the closure those props were sold, and the training section dismantled, except for EMS. When the Training Center reopened it was with a much leaner staff and less robust recruit training program.

Newly hired firefighters go through a 13-week academy at Gresham Fire Department's training center and follow the curriculum for NFPA 1001 Firefighter task book, which was adopted by Oregon Department of Public Safety as the minimum requirements for Structural Firefighters employed by a department that has over 50% paid staff. While this builds a strong foundation, it is inadequate to train firefighters that work for an all-hazards department like GFD. Upon completion, firefighters then spend the next 4 shifts at a fire station where they are paired with a senior firefighter. New firefighters are then deemed fit to be the lone firefighter in the back of an apparatus.

Training Recommendations:

- *Add additional training staff to train new firefighters.*
- *Increase academy time to a minimum of 16-weeks to allow basic training beyond the taskbook to include fire behavior and fire dynamics, ideally with equal portions of hands on and classroom instruction.*
- *Bolster recruit training with more staff and longer academy.*
- *Training on emotional and psychological stress and pressure on the fireground.*
- *Develop SOGs that prescribe specific operations to be followed routinely for designated operations such as residential fires, apartment fires, and commercial fires.*
- *Train firefighters on leadership as it pertains to assignment to a rescue or in an acting capacity.*
- *Create a B-team leader role and expectations.*
- *Implement 360 size-up by B-team with radio communication to Command.*
- *Consider pre-assignments on all responses into an IDLH.*
- *Mandatory annual review of pertinent SOGs i.e.: accountability, radio communications, occupancy based firefighting tactics.*
- *Create robust academy for company officers and chief officers and provide training prior to appointment.*
- *Provide Company Officer training for multiple alarm incidents beyond the initial assignments.*
- *Develop an official written policy/procedure to ensure adequate training and interoperability while working on Portland apparatus.*
- *Clearly written and expressed expectations delivered Department-wide.*
- *Develop an SOG to correct tactical errors noted by the IC up to and including emergency traffic.*
- *Invest in officer development at the lieutenant, captain, and battalion chief levels.*

- *Ensure all personnel know when and how to issue a "Mayday," and/or "Emergency Traffic" transmission. Define and train how and when to activate Emergency Tones.*
- *Develop and implement training in fire behavior and building construction to include effective situation assessment (reading the fire), and the impact of tactical operations.*
  This training will need to include classroom instruction, small-scale exercises, live fire training and simulation. Effective training in this content area needs to begin in the recruit academy and continue throughout firefighters and officers' careers.
- *Identify the frequency of Incumbent Training and key topics to review annually (operations based).*

Command/Size-up/Initial Assignments

The initial response from E31 and R31 was appropriate and given the nature of the dispatch information nothing seemed out of the ordinary. Reports of a possible victim are not unique and are reported on most fires in the Metro area. The E31 Officer gave a good descriptive size-up and painted a reasonable picture of the events that were unfolding based on the initial impression of fire conditions. The IC made appropriate assignments given an Offensive mode of operation. E31 was assigned Fire Attack and to pull a line to the front door and R31 was assigned back-up. An offensive strategy is inferred based on the order to stretch a line to the front door. It is unclear if the assignment from Command was not heard or disregarded based on the rescue profile. The proximity of this fire to the station is very close and the turnout time would have been minimal, not allowing B-team members to don the FireCom headset to hear their assignment. Based on witness statements, it is believed E31B removed their FireCom headsets upon arrival and did not acknowledge their assignment. As relayed from crew members enroute to the call, E31B had committed verbally to operate in "Rescue Mode" prior to arrival, based on the singular report of possible occupants.

Prior to 2021, "Rescue Mode" was not formally described in a policy or training. Newer members of GFD describe it being taught as part of their academy training provided by the department. It has been described as entering the IDLH without a hose line to perform search and rescue. Below is the excerpt from a PowerPoint presentation from 2021.

> **Rescue Mode**- *Command option where information has been provided to the IC about a known victim. -OR- For any firefighter transmitting a MAYDAY for themselves or on the behalf of another firefighter or civilian because of injury, entrapment, or becoming lost. PP January 2021.*

By all accounts, searching without a hose line as a first arriving engine company is not something that is common practice and is not supported in policy. Most members could not recall a time when they had ever heard it or participated in it. The Incident Commander recognized that it was not the assignment he had given as he watched it happen from his window. It was at this point he changed assignments and gave R31 Fire Attack because E31B is searching without a hose line. The IC should have redirected E31B to accomplish its original assignment instead of changing the assignments. Fire Attack is a tactical

priority on all offensive fires. Rescue implies a known victim in a known location. Fire service standards support searching ahead of a hose line or from a hose line, but not without a hose line when one is available.

Given that E31B did not pull a hose line, E31 AO was given the additional task of deploying the hose line to the front door. The AO pulled a 200' preconnect and laid it in an area of approximately 15' to 20' from the front door. In doing so, the entirety of the hose load was not cleared from the bed and resulted in a kink which impeded the flow of water to the hose line. Not pulling the attack line added another task to the AO's tasks which they were not prepared for. They were able to overcome the kink by upping the pressure in the hose line. Ultimately, the kink was created by a small flap of webbing caught in a loop which prevented the hose from clearing the bed completely.

R31 was assigned backup line and then reassigned Fire Attack. R31 is comprised of two firefighters without additional training in being a team leader or specifics on accountability or radio procedures. Common practice when responding in tandem with E31 is for the rescue to pull a backup line to support Fire Attack. R31's assignment was changed once on scene. R31 passenger side firefighter heard the transmission and the change in assignment. He was slow getting off the apparatus due to an equipment issue. R31 driver was out of the apparatus quickly and donned his PPE. He was approached by multiple bystanders stating victims inside. He then made the decision to jump the fence and go to the Charlie side and attempt rescue. He mistakenly thought his partner was pulling the backup line, but it was E31 AO. He then proceeded to perform a search to no avail. Neither member of R31 acknowledged their assignment by Command over the radio nor did R31's driver give any updates on conditions or search results from the Charlie side.

The actions and decisions of the first arriving companies directly factored into the events that caused injuries sustained by Firefighter Tejedas. Most notably, operating in "Rescue Mode", not carrying out assignments and Command not resetting the assignments to match strategy.

Initial Attack/Command Recommendations:

- *Always declare strategy; offensive or defensive and adherence to declared strategy through accountability.*
- *Discontinue "Rescue Mode" immediately as a strategy, define rescue as a tactical assignment.*
- *Firefighters should not depart the apparatus until they understand the strategy, tactic, and/or task established by the Incident Commander or Company Officer for whom they are assigned.*
- *Set clear expectations at rollcall, designate B-team leader and Rescue lead.*
- *Engine Company search should be done off the hose line or ahead of the hose line.*
- *Always have a tool appropriate for the construction type.*
- *Train all members in standardized communication procedures and the importance of acknowledging assignments.*
- *Standardize how radios are carried.*
- *Encourage and support Incident Commanders to correct unsafe acts or crews self-assigning.*
- *Stress accountability and the buddy system.*

- *Consider pre-assignments based on tactical objectives present at most fires.*
- *Embrace CAN reports and encourage crews to give updates via radio.*

Incident Command

C7 was the responding Chief to this incident and was responding from quarters. C7 was responding with T71 and E71. Enroute, he relays to BOEC to get a better address and start a medic unit. He states he hears Command reassign Fire Attack but does not consider searching without a hose line out of the ordinary. He did state that he felt the need to get E31 officer back with his crew as soon as possible to direct interior fire operations. During this transition period an open pacset caused some radio transmissions to be missed. The open pacset is believed to be FF Tejedas's when the mic cord burned through. Command was able to give T71 the assignment of ALL-IN for search but missed the arrival of E71. Command should have recognized that the tactical priorities were not being met and basic fireground functions were not assigned. Command assigned E74 four different tasks in the incident and had to ask over the air if he had any crew available for medical. This shows a lack of command presence and lack of control of the scene. C7 should have used "Emergency Traffic" and conducted a PAR of all resources on scene after the report of an injured Firefighter. C7 should have reset the incident enroute which may have changed the outcome. No other factors contributed to the injuries sustained by Firefighter Tejedas.

Incident Command Factors:

- *Took command too fast and reassigned E31 prior to clearly transferring information.*
- *Did not recognize the deviation from practice and correct enroute.*
- *Did not prioritize completion of tactical objectives such as Water Supply, Fire Attack, Search, Backup Line, or RIT.*
- *Assigned E74 (4) different assignments; 360, Water Supply, make contact with 31's, and Secondary Search.*
- *An injured firefighter should have triggered an emergency traffic, withdrawal and a PAR.*
- *Unaware of company functions and locations.*
- *Without command presence crews free-lanced and made their own assignments.*

Resources and Factors

Second Engine

E71 arrived as the second engine. Enroute to the fire E71 passed the hydrant that E74 staged on and went directly to the scene. E71 attempted to radio Command they had arrived but were not copied, as this happened around the time of the open mic. E71's backseat firefighter noticed there was no backup line pulled and told his officer he was going to go pull one to which the officer agreed. The AO exited the apparatus to help E31 dress the hydrant, and the Officer attached himself to T71 and their assignment for ALL-IN search. Self-assigning is not the policy of GFD. In this case crew integrity was not maintained and the Officer was not aware of his crew's actions or location. In lieu of communication problems, E71's Officer should have done a face-to-face with Command and assist in meeting tactical objectives. E71's Firefighter was in the IDLH engaged in Fire Attack.

The actions of E71 did not contribute to the events causing injuries to Firefighter Tejedas. Their actions merely highlight the need for more training and adherence to policy.

E71 Factors:

- *Passed a hydrant and went straight to the scene.*
- *Their arrival wasn't copied on air, so they self-assigned.*
- *Zero accountability by company officer, or crew members.*
- *Officer performed truck work.*
- *The Officer should have recognized the gravity of the scene and assisted Command in meeting tactical/incident objectives found at all fires.*
- *A crew member pulled a backup line and was in the IDLH performing Fire Attack.*

First Truck

T71 arrived on scene and was assigned ALL-IN for search. T71 proceeded past the front door to the alpha side and took the window in bedroom #2 which caused the room to flash. The window was taken apparently with the intent to perform VEIS in bedroom #2. This window was taken without any radio transmission to Fire Attack or Command. Potential flow path changes should be made with knowledge and approval of interior firefighting companies. T71 made their way to the Charlie side where all members and one member of E71 entered through a window to conduct a search in bedroom #3. T71 cleared this window of glass with no radio transmission. T71 did not radio Command they were entering on the Charlie side through a window. Command did mention that normally ALL-IN would mean entering the same opening as the hoseline to conduct a search, but Command leaves those decisions to the search team.

T71's actions did not contribute to Firefighter Tejedas's injuries but do not exemplify the policies or practices of GFD.

T71 Factors:

- *Assigned all-in for primary search but performed tasks more in line with VEIS.*
- *Took window glass without communication or acknowledgement of interior Fire Attack crews.*
- *Proper notification to Command regarding location.*
- *Based on size of structure it would have been appropriate to split crew.*

Third Engine

E74 was the third engine on scene. E74 was unable to maintain crew integrity. While some crew members were conducting 360, one found Firefighter Tejedas and assisted in his care. E74 was given four assignments on this fire and should have refused some assignments due to inability to complete them. While doing the 360 they were assigned water supply, then assigned get in touch with E31 and their fourth assignment was secondary search.

No actions by E74 contributed to the injuries of Firefighter Tejedas but do highlight that command did not have accountability for crews on scene.

E74 Factors:

- *Given 4 assignments as the go-to company for Command.*
- *Did not maintain crew integrity.*

Fourth Engine

E73 was the fourth engine on scene. E73 followed the policy and procedure of GFD and spotted on a hydrant and announced arrival. Not self-assigning made them available for the medical treatment of Firefighter Tejedas.

E73 Factors:

- *Arrived and waited for assignment.*
- *Available for the most crucial assignment, medical.*

Staffing

Gresham Fire Department is understaffed. On a typical box alarm assignment, the Incident Commander has the minimum number of firefighters to address the incident objectives and tactical assignments. Three-person staffing does not allow any deviation or flexibility on dynamic incidents. Deviation in the linear flow of assignments dictates the necessity for the Incident Commander to call for greater alarms and more resources. Given the unpredictable nature of incidents, the IC needs the flexibility of increased staffing to maintain safety and accountability. A single residential structure fire should not deplete the city of firefighting resources. The addition of a fourth member would allow Incident Commanders the ability to split crews, which would allow the completion of objectives that can be safely accomplished by two firefighters. Today, those tasks are assigned to an entire 3-person crew to maintain accountability. While this would be a force multiplier on the fire side of staffing, it would also enhance GFD's EMS response, enabling a single 4- person crew to run a cardiac arrest call. Currently, 3-person crews call for an additional engine company, reducing GFD's response reliability. The City of Gresham needs to prioritize adherence to NFPA 1710 by implementing four-person staffing.

Call volume has taken a toll on responders' county wide and GFD's has experienced the same issue as neighboring agencies. The call volume has forced more senior members to seek out and work at slower paced firehouses. This leaves busy firehouses with younger and more inexperienced members. GFD's should investigate ways to reduce the call volume in conjunction with other jurisdictions to relieve the physical and mental toll on responders. GFD would benefit from a staffing model that spreads experience and seniority around the organization, where lessons learned could be passed to the next generation.

GFD rescues should be staffed with an officer or at the very least a designated team lead. The rescues are often staffed by junior members without the experience to make the decisions required of them. Most rescue calls are lower on the acuity side to keep engines in service, had an engine been assigned to the call an officer would be making the decisions now being asked of a junior member. In the short term, rescue firefighters should receive cursory training on radios and accountability.

Recommendations:

- *Increased staffing in Operations and Training is warranted based on need.*
- *Discontinue staffing high-call volume stations with the least experienced members.*
- *Staff Rescues with Officers to take the lead on calls, operate the radio, and maintain accountability.*
- *GFD is too reliant on auto-aid and mutual aid partners to meet the growing demands of the City of Gresham.*
- *The City of Gresham should conduct a response study to plan a path forward for GFD amid the continued growth of Gresham.*

Contributing Factors

Noted public safety attorney and risk management subject matter expert Gordon Graham is often quoted as emphasizing "if it is predictable, it is preventable" referring to undesirable outcomes. Some root causes may be immediate in relation to the incident, while others may have occurred over an extended period. How does probationary training impact incidents that occur years later at the scene of a fire? How does the fire department culture and approach to risk impact the actions of firefighters and command officers at an incident? The following factors contributing to the significant injury incident have been examined to provide best practices for the future development of policy and practices at Gresham Fire Department. These factors were generated by Gemini, August 12, 2024, Open AI and edited by Battalion Chief Peter Graves.

Insufficient Size-Up and Risk Assessment: A Critical Fireground Issue

Insufficient size-up and risk assessment are significant contributors to firefighter injuries and fatalities. Size-up is the continuous and ongoing evaluation of problems encountered at an emergency scene. This fire changed rapidly, and signs of rapid fire growth were missed. These factors often stem from a combination of issues, including:

Common Causes of Insufficient Size-Up and Risk Assessment

- **Rushed or incomplete size-up:** Firefighters may be under pressure to quickly enter a structure, leading to a cursory assessment of conditions. This fire was fully ventilated and heated to a point where flashover was imminent as crews had arrived. Subtle signs were missed predicting the rapid fire development and flashover events that occurred as firefighters were in the building.
- **Lack of experience:** Newer firefighters may not have the experience to accurately assess fire behavior and building construction. Frequent practice at Gresham Fire has been to assign new firefighters to busy stations including station 31. Gresham should evaluate its staffing of fire stations to distribute experience throughout the department.
- **Communication breakdowns:** Ineffective communication among crews can hinder the sharing of critical information. Opportunities for reports on conditions, changes to tasks being performed, and equipment failures all contributed to the outcome of this incident.
- **Overconfidence:** Overestimating firefighting abilities or underestimating fireground hazards.
- **Distractions:** External factors, such as bystanders or media, can divert attention from the primary task. Extreme pressure was applied to firefighters on scene from multiple sources. BOEC updates reported possibility of persons trapped in the structure. Arriving companies were met with hysterical family members stating that their baby was inside the home.

Consequences of Insufficient Size-Up and Risk Assessment

- **Increased risk of injury or death:** Incorrectly assessing fire conditions can lead to firefighter entrapment, flashovers, or backdrafts. The fire was in a state of decay prior to arrival as

identified by the fire behavior analysis. Citizen actions prior to arrival changed the ventilation profile of the building leading to rapid fire development.

- **Property loss:** Delayed or ineffective firefighting operations due to poor planning can result in increased damage.
- **Public safety hazards:** Incorrectly assessing the situation can endanger civilians.

Improving Size-Up and Risk Assessment

- **Enhanced training:** Provide comprehensive training on size-up procedures, building construction, fire behavior, and risk assessment.
- **Realistic simulations:** Conduct regular training exercises that simulate real-world fireground conditions.
- **Emphasis on situational awareness:** Train firefighters to constantly assess the environment and identify potential hazards.
- **Effective communication:** Implement clear communication protocols to ensure information is shared accurately and promptly.
- **Post-incident analysis:** Review incidents to identify areas for improvement in size-up and risk assessment.

Key Components of a Thorough Size-Up

- **Building construction and occupancy:** Understanding the building's age, materials, and purpose.
- **Fire location and extent:** Identifying the fire's location, size, and rate of spread.
- **Smoke conditions:** Observing smoke color, density, velocity, and volume.
- **Water supply:** Assessing available water sources and hydrant locations.
- **Personnel and equipment:** Evaluating the number of firefighters and available resources.

By prioritizing size-up and risk assessment, Gresham Fire Department can significantly improve firefighter safety and operational effectiveness.

Lack of Incident Command and Control

A well-defined and executed Incident Command structure is paramount to effective fireground operations. Its absence can lead to chaos, confusion, and increased risk for firefighters. Loss of situational awareness in transfers of command can lead to higher risks to personnel operating on scene. In this incident the transfer of command never conveyed the critical information of E31B’s assignment as Rescue. E31 was re assigned to fire attack with E31B, and R31 however, E31B had already committed to their Rescue attempt.

Common Issues Leading to Lack of Incident Command and Control

- **Poor Command presence:** Command operates in a manner lacking confidence and positive directed action.
- **Unclear roles and responsibilities:** Confusion about who is in charge and who is responsible for specific tasks.
- **Poor communication:** Ineffective use of radio channels or unclear messaging can hinder coordination.
- **Lack of training:** Insufficient training in ICS principles and procedures can lead to breakdowns.
- **Resource management issues:** Inefficient allocation and utilization of personnel and equipment. Gresham Fire Department has been historically under resourced.

Consequences of Poor Incident Command and Control

- **Increased risk to firefighters and victims:** Uncoordinated actions can lead to injuries or fatalities.
- **Ineffective resource utilization:** Misallocation of resources can hinder firefighting efforts.
- **Delayed incident stabilization:** Lack of clear leadership can prolong the incident.
- **Negative public perception:** Poorly handled incidents can damage the department's reputation.

Enhancing Incident Command and Control

- **Robust ICS training:** Provide comprehensive training in ICS principles and roles.
- **Regular drills and exercises:** Simulate various incident scenarios to build proficiency.
- **Succession planning:** Train potential successors for the IC role.
- **Effective communication systems:** Utilize reliable and redundant communication channels.
- **Clear command structure:** Establish a clear chain of command and assign specific responsibilities.
- **Post-incident analysis:** Conduct thorough reviews to identify areas for improvement.

Specific Considerations

- **Span of control:** Adhere to the principle of span of control to ensure effective supervision.
- **Resource management:** Develop systems for tracking and allocating resources efficiently.

By implementing these strategies, Gresham Fire Departments can strengthen their Incident Command capabilities and improve overall operational effectiveness.

Primary Search Without a Hoseline or Fire Attack: A High-Risk Decision

Conducting a primary search without a hoseline or established Fire Attack is inherently dangerous and should be considered the last resort. This decision should only be made in extreme circumstances where the potential for life loss outweighs the risks to firefighters.

Factors to Consider

- **Time-critical situation:** Evidence suggests a known location of victims trapped inside that are visualized or heard.
- **Limited resources:** Insufficient personnel or equipment to support both Search and Fire Attack simultaneously. Searching with a hoseline is the recommended tactic.
- **Rapid fire growth:** A rapidly deteriorating fireground environment that necessitates immediate search.
- **Vent, Enter, Isolate, Search:** If victim is in a room that can isolate from the fire choose this tactic.

Safety Precautions

If this decision is made to VEIS or search without a hoseline, the following safety precautions are crucial:

- **Rapid search:** Conduct a focused, expedited search to locate victims quickly.
- **Limited exposure:** Minimize time spent in the fire environment.
- **Crew integrity:** Maintain strict accountability of search team members.
- **Communication:** Clear and constant communication with the Incident Commander and other crews. *"we are going in without water because"*
- **Protective equipment:** Ensure all firefighters wear appropriate PPE.
- **Backup crew:** Have a ready backup team prepared to provide support or relief.
- **Water Can:** Bring an emergency source of water.

Alternative Approaches

Prioritize establishing a hoseline and initiating fire attack before commencing a primary search. This provides a crucial safety margin for firefighters!

- **Search and rescue team:** Dedicate a specific team to search operations.
- **Rapid intervention team (RIT):** Ensure a RIT is immediately available.
- **Ventilation:** Coordinate with the fire attack crew to create ventilation openings.
- **Search methods:** Employ efficient search patterns, such as the small area search or large area search.

It is essential to emphasize that conducting a primary search without a hoseline or fire attack is a high-risk operation. Every effort should be made to mitigate these risks through proper planning, training, and equipment. If you have not trained to do it on the drill ground, do not do it.

Lack of Critical Communications in Requesting Changes to Tactics and Tasks

Effective communication is paramount on the fireground, and the ability to request changes to tactics and tasks is crucial for adapting to evolving conditions. When this communication breaks down, it can lead to inefficiencies, safety hazards, and compromised incident outcomes. This incident had a breakdown of communication both in practice and equipment malfunctions. Recommended changes to tactics must be communicated to Incident Commanders over the radio.

Common Issues Leading to Communication Breakdown

- **Overreliance on radio communication:** Radio channels can become saturated, leading to delays or missed messages.
- **Unclear message content:** Messages may not be specific enough or lack critical details.
- **Lack of standardized terminology:** Inconsistent use of terms can lead to misunderstandings.
- **Noise and interference:** Environmental factors can impede clear communication.
- **Hesitancy to challenge authority:** Firefighters may be reluctant to question tactics or request changes.

Consequences of Ineffective Communication

- **Delayed or incorrect actions:** Crews may not implement necessary changes in a timely manner.
- **Increased risk to firefighters:** Misunderstandings can lead to unsafe conditions.
- **Inefficient resource allocation:** Miscommunication can result in wasted resources.
- **Damage to property:** Delayed or incorrect actions can exacerbate fire conditions.

Improving Communication and Tactical Change

- **Clear and concise messages:** Train firefighters to deliver concise and informative messages.
- **Standard Operating Procedures (SOPs):** Develop clear protocols for requesting changes to tactics and tasks.
- **Designated communication channels:** Establish specific channels for different types of communication. Consider multiple talk groups for complex incidents.
- **Feedback mechanisms:** Encourage firefighters to provide feedback on communication challenges. Pertinent negatives encountered are critical pieces of information. Examples include fire blocking entry for search.

Example Communication Protocols

- **Request for change:** "Command, Engine 31B, has reports of a known victim in bedroom 1, requesting permission to perform “rescue alpha side bedroom 1."
- **Acknowledgment:** "Engine 31B, copy changing assignment to rescue alpha side bedroom 1."
- **Status updates:** "Command, Engine 31, performing rescue, encountering high heat, requesting a hose line to assist rescue."

By implementing these strategies, Gresham Fire Department can improve communication and decision-making on the fireground, leading to safer and more effective operations.

Loss of Crew Integrity and Accountability on the Fireground

Loss of crew integrity and accountability on the fireground is a critical safety issue. It can lead to tragic consequences if not addressed effectively. Crew integrity was a major issue on this fire with companies operating without voice or visual contact. Accountability must be maintained on incident and company levels.

Factors Contributing to Loss of Crew Integrity

- **Rapid fire growth:** Intense fire conditions can quickly overwhelm crews and disrupt crew accountability
- **Disorientation:** Smoke and low visibility can cause firefighters to become disoriented.
- **Mayday situations:** Emergency conditions can lead to rapid deployment of resources and loss of crew cohesion.
- **Lack of training:** Insufficient training in crew integrity and accountability procedures.
- **Equipment failures:** Malfunction of communication devices or personal protective equipment.

Consequences of Lost Crew Integrity

- **Increased risk of injury or death:** Isolated firefighters are more vulnerable to hazards.
- **Delayed rescues:** Locating and rescuing trapped firefighters can be challenging.
- **Ineffective firefighting operations:** Loss of crew members can hinder overall strategy.
- **Negative public perception:** High-profile incidents involving lost crew integrity can damage the department's reputation.

Enhancing Crew Integrity and Accountability

- **Rigorous training:** Emphasize crew integrity and accountability in all training programs.
- **Buddy system:** Require firefighters to work in pairs or small teams.
- **Personnel Accountability Systems (PAS):** Implement a robust PAS to track firefighter locations.

- **Effective communication:** Maintain clear and constant communication within crews and with command.
- **Mayday procedures:** Develop and practice emergency procedures for lost or trapped firefighters.
- **Post-incident analysis:** Review incidents to identify areas for improvement in crew integrity.

Specific Strategies

- **Crew integrity drills:** Conduct regular training exercises to reinforce crew cohesion.
- **PAS equipment:** Provide reliable and user-friendly accountability tags and systems.
- **Mayday response teams:** Establish dedicated teams for rapid response to Mayday situations.

By prioritizing crew integrity and accountability in training and practice, Gresham Fire Department can significantly reduce the risk of firefighter injuries and fatalities.

Radio/Communication Difficulties and Failures

Effective radio communication is critical for fireground safety and efficiency. Challenges can arise from various sources, including equipment malfunction, environmental factors, and human error. In this fire, the lack of radio communication from companies on scene, and equipment malfunction, was a major contributing factor to the significant injury incident. The loss of communications, and lack of ability to transfer to an operating channel could have been a contributing factor to further injuries, or fatalities. Gresham Fire should develop communications SOG and define best practices to protect the radio cords from thermal damage.

Common Causes of Radio/Communication Difficulties

- **Equipment malfunctions:** Radio failures, battery issues, antenna problems.
- **Environmental factors:** Interference from buildings, terrain, or other electronic devices.
- **Human error:** Incorrect channel selection, poor radio discipline, or unclear transmissions.
- **Overcrowded channels:** Multiple units attempting to transmit simultaneously.
- **Infrastructure issues:** Repeater failures or network congestion.

Consequences of Communication Failures

- **Delayed response:** Critical information may not reach crews in a timely manner.
- **Misunderstandings:** Incorrect or incomplete messages can lead to errors in judgment.
- **Increased risk to firefighters:** Lack of communication can compromise safety.
- **Inefficient operations:** Delayed or incorrect actions can impact incident progression.

Mitigation Strategies

- **Regular equipment maintenance:** Ensure radios are in good working condition.
- **Backup communication systems:** Implement alternative communication methods (e.g., hardwired phones, runners).
- **Clear radio procedures:** Establish standard operating procedures for radio use and protection of mic cord.
- **Crew integrity:** Maintain close proximity within crews to facilitate face-to-face communication.
- **Situational awareness:** Anticipate potential communication challenges and develop contingency plans.
- **Training:** Conduct regular training on radio procedures and emergency communication protocols.

Specific Considerations

- **Radio coverage mapping:** Identify areas with poor coverage and implement solutions.
- **Interoperability:** Ensure compatibility with other agencies' communication systems.
- **Emergency communication plans:** Develop protocols for handling radio failures.
- **After-action reviews:** Analyze communication issues during incident debriefings.

By addressing these factors and implementing appropriate strategies, Gresham Fire Department can improve the reliability of their communication systems and enhance overall fireground operations.

Rapid Fire Growth: Types and Dangers

Rapid fire growth is a significant threat to firefighters. Understanding the different types and their associated dangers is crucial for survival and effective firefighting operations. Gresham needs to develop a fire behavior training program that focuses on a career of learning.

- **Flashover:** The rapid transition of a compartment from growth stage to fully developed fire, involving all combustible surfaces.
    - **Dangers:** Intense heat, high levels of toxic gases, and rapid fire spread.
- **Backdraft:** The explosive burning of heated gases in a compartment deprived of oxygen, often caused by sudden ventilation.
    - **Dangers:** Explosive force, high temperatures, and rapid fire spread.
- **Smoke Explosion:** A sudden ignition of accumulated flammable gases within a compartment.
    - **Dangers:** Explosive force, potential for severe burns, and rapid fire spread.

Factors Contributing to Rapid Fire Growth

- **Fuel load:** The amount and type of combustible materials in a structure.
- **Ventilation:** The availability of oxygen to the fire.

- **Compartmentation:** The division of a building into separate spaces.
- **Building construction:** The materials used in building construction.
- **Fire suppression efforts:** Improper or delayed firefighting tactics.

Recognizing Signs of Rapid Fire Growth

- **Rapidly increasing temperature:** A noticeable increase in heat within a short period.
- **Building loading:** The structure begins to deform due to heat.
- **Smoke color and density:** Dark, thick smoke often indicates a well-developed fire.
- **Window failures:** Glass breakage or bulging can indicate high internal pressures.
- **Fire growth patterns:** Observing how the fire spreads can provide clues about potential rapid fire growth.

Mitigation Strategies

- **Aggressive interior attack:** Quickly cool the fire to prevent flashover.
- **Ventilation:** Control ventilation to prevent backdrafts and smoke explosions.
- **Crew integrity:** Maintain accountability and communication within firefighting crews.
- **Personal protective equipment:** Ensure firefighters wear appropriate PPE.
- **Training and education:** Provide comprehensive training on rapid fire growth and firefighting tactics.

By understanding the types of rapid fire growth and implementing effective mitigation strategies, Gresham Fire Department can significantly reduce the risks associated with these dangerous phenomena.

Lack of Effective SOGs and Failure to Follow Established SOGs on the Fireground

Standard Operating Guidelines (SOGs) are essential for maintaining consistency, safety, and efficiency on the fireground. Their absence or non-adherence can lead to significant operational challenges. Specifically Fire Operational SOG's, Communications SOG, and Accountability SOG's

Challenges Associated with Lack of Effective SOGs

- **Inconsistency:** Varying procedures among crews can lead to confusion and errors.
- **Safety risks:** Without clear guidelines, firefighters may be exposed to unnecessary hazards.
- **Inefficiency:** Time-consuming decision-making due to lack of established procedures.
- **Difficulty in training:** New firefighters may struggle to learn and adapt to department practices.

Challenges Associated with Failure to Follow Established SOGs

- **Discipline issues:** Non-compliance with SOGs can lead to disciplinary actions.

- **Safety risks:** Deviation from established procedures can increase the likelihood of accidents.
- **Operational inefficiencies:** Non-adherence can hinder the effectiveness of firefighting operations.
- **Legal implications:** Failure to follow SOGs may have legal consequences in case of incidents.

Improving SOG Development and Implementation

- **Involve frontline personnel:** Ensure SOGs reflect the needs of firefighters.
- **Clear and concise language:** Use plain language to avoid confusion.
- **Regular review and updates:** Keep SOGs current and relevant.
- **Effective training:** Provide comprehensive training on SOGs.
- **Enforcement:** Consistently enforce adherence to SOGs.
- **Performance evaluation:** Incorporate SOG compliance into performance evaluations.

Overcoming Challenges in Adhering to SOGs

- **Leadership emphasis:** Strong leadership support for SOG compliance.
- **Open communication:** Encourage feedback and suggestions for improving SOGs.
- **Realistic SOGs:** Ensure SOGs are practical and applicable to real-world situations.
- **Positive reinforcement:** Recognize and reward adherence to SOGs.
- **Consequences:** Clearly define consequences for non-compliance.

By developing and implementing effective SOGs, and ensuring consistent adherence, Gresham fire Department can significantly enhance safety, efficiency, and overall operational effectiveness.

Key Recommendations

Fire Operations Key recommendations

- *Develop Operational Policies for fire operations.*
- *Outside agencies recommend implementing the Operations Chief position.*
- *Ensure the IC clearly identifies the strategy, Offensive or Defensive, on every fire incident.*
- *Remove "Rescue Mode" as a strategy available to Incident Commanders.*
- *Ensure all fire incidents prioritize an early 360 evaluation.*
- *Collaborate with Portland Fire & Rescue on Operational Policies.*
- *Develop an effective transfer of command SOG.*
- *Define the backup line and develop a policy.*
- *Define company tactics, tasks and how to request or advise a change in assignment to Command.*
- *Ensure all responding units stage, notify the IC, and standby until an assignment is given (consider level one staging).*
- *Ensure Ventilation is coordinated with Fire Attack.*

- *Evaluate command and control job aids for function and best practice.*

Fire Operations Guidelines for Safe Operation

Safe fire operations are paramount to protect both firefighters and the public. Adhering to established guidelines ensures that incidents are handled effectively and efficiently while minimizing risks. Here are some key guidelines for safe fire operations:

Pre-Incident Planning

- **Risk Assessment:** Conduct thorough risk assessments for structures and areas, identifying potential target hazards.
- **Operational Policies and Incident Action Plans (IAPs):** Develop detailed IAPs outlining strategies, tactics, and resource allocation.

Scene Assessment and Size-Up

- **Initial Assessment:** Conduct a rapid initial assessment to identify the nature and extent of the incident.
- **Size-Up:** Conduct a thorough size-up to determine the situation, resources needed, and potential hazards.
- **Early 360: E**nsure a 360 evaluation of the structure is performed.

Personnel Safety

- **Personal Protective Equipment (PPE):** Ensure all firefighters wear appropriate PPE, including SCBA, turnout gear, and gloves.
- **Accountability:** Implement robust accountability systems to track firefighter locations and status.
- **Rehabilitation:** Provide regular rehabilitation breaks to prevent fatigue and heat-related illnesses.

Fire Suppression Operations

- **Offensive vs. Defensive Tactics:** Determine the appropriate tactics based on the nature of the fire and risk assessment. These are the two strategic modes available to the Incident Commander. Rescue is a tactic assigned by the Incident Commander.
- **Fire Attack:** Fire attack is the continuous operation of extinguishment by and continues until the fire is recalled.
- **Search:** Search is the planned and coordinated tactical assignment to locate potential victims in a space that is Immediately Dangerous to Life and Health. Search may include VIES operations.

VEIS must be coordinated with Command. Opening an exterior window is ventilation and invites the fire to your location. Search companies must notify command if unable to isolate the room targeted for search.

- **Rescue:** The assignment for Rescue is a known victim in a known location.
- **Water Supply:** Ensure adequate water supply is available for firefighting operations.
- **Ventilation:** Control smoke and heat by implementing proper ventilation techniques. Ventilation needs to be coordinated with Fire Attack.

Post-Incident Procedures

- **Debriefing:** Conduct post-incident debriefings to identify areas for improvement and learn from experiences.
- **Equipment Inspection:** Inspect and maintain equipment after each incident.

Communications Key Recommendations

- *Develop Standard Operating Guidelines (SOGs) and training to ensure all teams and companies operating on an incident are aware of the overall strategy of the incident, their tactical assignment, and they confirm that information with the Incident Commander.*
- *Develop a communications SOG to correct tactical errors noted by the IC up to and including emergency traffic.*
- *Develop a policy and train companies to ensure radios will be carried to prevent remote mic cord thermal damage. Purchase individual holders and straps for all individuals. Standardize how radios are carried.*
- *Identify the radio call sign of each position on the apparatus. (example E31 nozzle, hydrant)*
- *Ensure the Battalion Chief IC removes as many distractions as possible so they may hear radio traffic. (consider wireless headsets)*
- *Work with BOEC dispatchers to develop a policy to convey critical victim updates in a timely manner.*
- *Work with BOEC to provide a procedure when radio transmissions are blocked by any source to restore communications on scene.*
- *Evaluate the actions of the Emergency Action Button (EAB) on the radio, implement changes and provide training.*

Communication Recommendations for Firefighters

The National Institute for Occupational Safety and Health (NIOSH) has issued several key recommendations to improve communication among firefighters, enhancing safety and operational efficiency:

Radio Systems and Technology

- **Daily Testing and Maintenance:** Ensure radio systems are regularly tested and maintained to prevent failures.
- **Environmental Factors:** Consider the impact of environmental factors on radio performance, such as temperature, humidity, and interference.
- **Backup Systems:** Have backup communication systems in place to avoid total communication failure.

Communication Protocols

- **Clear and Concise Messages:** Use plain language and avoid jargon.
- **Standard Operating Procedures (SOPs):** Establish clear SOPs for radio communication, including call signs, codes, and procedures.
- **Emergency Procedures:** Develop specific procedures for emergency situations, such as Mayday calls emergency traffic, and evacuation orders.

Training and Education

- **Regular Training:** Provide ongoing training on radio communication procedures and best practices provided by the company officer and reinforced by the training division.
- **Scenario-Based Training:** Use realistic scenarios to simulate challenging communication situations.
- **Peer Evaluation:** Encourage peer evaluation and feedback to improve communication skills.

Equipment and Accessories

- **Radio Placement:** Consider the best placement of radios on firefighters' uniforms for optimal accessibility and performance. Best practice includes placement of the radio strap under the turnout jacket.
- **Radio Accessories:** Use appropriate accessories, such as microphones and headsets, to enhance communication.
- **Battery Life:** Ensure that radio batteries are adequately charged and replaced as needed.

Incident Management

- **Clear Chain of Command:** Establish a clear chain of command to ensure effective communication.
- **Coordination with Other Agencies:** Develop protocols for coordinating communication with other emergency response agencies.
- **Post-Incident Review:** Conduct regular reviews of communication systems to identify areas for improvement.

By following these recommendations, Gresham Fire Department can enhance communication effectiveness, improve safety, and improve overall operational efficiency.

Accountability Key Recommendations

- *Develop SOGs and training to ensure all teams and companies operating on an incident are aware of the overall strategy of the incident, their tactical assignment, and they confirm that information with the IC.*
- *Review and update the department's existing Accountability SOG to include strategic, tactical, and task level accountability.*
- *Ensure crew integrity is properly maintained by voice or personal contact when operating in an atmosphere that is Immediately Dangerous to Life and Health (IDLH).*
- *Develop an effective Transfer of Command SOG.*
- *Work with BOEC dispatchers to develop a policy to convey critical victim updates in a timely manner.*
- *Ensure that the IC clearly identifies the strategy, Offensive or Defensive, on every fire incident.*
- *Ensure all fire incidents get an early 360 evaluation.*
- *Ensure all GFD members follow the Accountability SOG and know how to conduct a PAR.*
- *Remove "Rescue Mode" as a strategy available to Incident Commanders.*
- *Identify the radio call sign of each position on the apparatus. (example E31 nozzle, hydrant)*
- *Ensure all responding units stage, notify the IC, and standby until an assignment is given.*
- *Ensure there is no freelancing on fire scenes by completing a Post Incident Assessment Checklist and following a robust accountability plan.*

Fire Accountability

To ensure effective fire accountability, it is essential to implement measures at the strategic, tactical, and task levels. This comprehensive approach will enhance safety, efficiency, and overall performance. It is essential that all members of the fire department operate under the Incident Commander as part of the incident action plan. Gresham Fire needs to review its accountability policy for updates and subsequent training.

Strategic Level Accountability

- **Incident Command:** Establish clear lines of authority and responsibility within the Incident Command structure. There are two strategies available to Incident Commanders: Offensive and Defensive fire attack. Rescue is recommended to be a tactic used on a known victim in a known location and is not recommended as a strategy.
- **Planning and Coordination:** Develop and implement comprehensive incident action plans that address accountability.

Tactical Level Accountability

- **Tactical Management:** Ensure that resources are allocated effectively and efficiently within the Incident Commanders span of control. Ensure all companies are working with a tactical assignment from the incident action plan of the Incident Commander.
- **Typical Tactical Assignments:** Fire Attack, Search, Ventilation, Evacuation, Rescue, Extension, Decon, and more.
- **Personnel Accountability Reports (PARs):** Implement a robust PAR system to track firefighter locations and status.
- **After Action Reviews (AARs):** Use AARs to monitor the status and effectiveness of assigned companies after every incident.

Task Level Accountability

- **Individual Responsibilities:** Clearly define the roles and responsibilities of individual firefighters.
- **Safety Practices:** Ensure that firefighters adhere to safety protocols and procedures.
- **Equipment Use:** Monitor the proper use and maintenance of equipment.
- **Safety Officer:** Safety is everyone's responsibility. Assign a safety officer to every building fire.

Best Practices for Fire Accountability

- **Clear Procedures:** Develop clear and concise procedures for accountability, including PARs, AARs.
- **Regular Training:** Provide ongoing training on accountability procedures and best practices.
- **Continuous Improvement:** Regularly review and update accountability systems to address evolving challenges.
- **Culture of Accountability:** Promote a culture where accountability is valued and expected at all levels.

By implementing these measures and following best practices, Gresham Fire department can establish a strong accountability framework that ensures safety, efficiency, and effective operations.

Department Organization Key Recommendations

- *Define roles and responsibilities of Firefighters, Lieutenants, Captains, Fire Investigators, and Battalion Chiefs.*
- *Correct weaknesses in department structure to provide for effective administration, operations, and training identified by past studies of fire department organizational structure.*
- *Evaluate how to adequately distribute experience throughout the Department. The committee recommendation is to place company officers on Rescues.*
- *Set clear expectations at rollcall, designate B-team leader, or Rescue lead (radio operator).*
- *Apply NFPA 1710 to staffing of Gresham Fire Apparatus which includes four-person staffing.*

Correcting Weaknesses in Fire Department Structure

Identifying and addressing weaknesses in a fire department's structure is essential for providing effective administration, operations, and training. A well-structured department can enhance efficiency, improve morale, and ultimately improve public safety. An organizational assessment was completed in March of 2004 outlining key recommendations based of findings of weakness. Many of these weaknesses are present today and recommendations remain unfulfilled. [Walker 2004]

Common Weaknesses in Fire Department Structure

- **Lack of clear roles and responsibilities:** Ambiguity in roles can lead to confusion, inefficiencies, and conflicts. In 2004 the City's organizational assessment recommended "conduct a new task analysis of all duties and responsibilities of administrative staff. Compare these needs with top priority needs of the department" [Walker 2004]
- **Inadequate communication channels:** Poor communication can hinder decision-making, coordination, and information sharing.
- **Insufficient training and development:** A lack of training can result in underqualified personnel and operational deficiencies. In 2009 the fire training division was eliminated due to budget cuts. The downstream effects are evident in today's Gresham Fire department. To bolster the effectiveness of the training division, Gresham should increase staffing in the training division and add an administrative assistant. In the absence of funding to provide the necessary staffing, outside instructors should be hired to provide expert instruction in the areas of fire behavior, tactics and strategies, and other defined training weaknesses identified by the training advisory group.
- **Outdated policies and procedures:** Outdated guidelines can impede progress and limit effectiveness.

- **Ineffective leadership:** Weak leadership can negatively impact morale, productivity, and overall performance. Leaders at all levels in the organization must own what is in their sphere of influence and seek out mentors to further their understanding and performance.

Strategies for Improvement

Conduct a thorough assessment:

- Identify current strengths and weaknesses. In 2004 Walker identified critically low administrative and support within the department has created additional "paper load" on all levels of the organization. In 2004 Walker identified the lowest support staff in the city of 1 to 35, today the fire department remains critically understaffed in support staff.
- Analyze organizational structure, communication channels, and training programs. In 2009 the Fire Chief faced budget cuts due to the 2008 recession. The training staff for Gresham Fire was eliminated and all fire behavior training props were removed from the training grounds.
- Gather feedback from personnel at all levels.

Clarify roles and responsibilities:

- Develop clear job descriptions for all positions.
- Establish lines of authority and reporting relationships.
- Ensure that roles and responsibilities are well-defined and understood.

Improve communication:

- Implement effective communication channels, such as regular meetings, written reports, and technology-based tools. In 2004, the City of Gresham Organizational Assessment recommended communication improvements in 5 specific areas including meetings with all fire companies and distributing communications bulletins. [Walker, K 2004] These measures were never implemented.
- Encourage open communication and feedback.
- Promote a culture of transparency and accountability.

Enhance training and development:

- Develop a comprehensive training program that addresses both technical skills and leadership development.
- Provide opportunities for continuous learning and professional growth.
- Evaluate training effectiveness and make necessary adjustments.

Update policies and procedures:

- Review existing policies and procedures to ensure they are relevant and up-to-date.
- Develop new policies as needed to address emerging challenges.

- Involve stakeholders in the policy development process. Consider the Lexipol system. (Gordon Graham)

Strengthen leadership:

- Develop leadership skills through training and development programs.
- Encourage a culture of mentorship and support.
- Hold leaders accountable for their performance.

Foster a positive work environment:

- Promote a culture of respect, teamwork, and collaboration.
- Address issues promptly and fairly.
- Recognize and reward employee achievements.

By addressing these common weaknesses and implementing effective strategies, Gresham Fire Department can create a more efficient, effective, and resilient organization.

Summary

Gresham Fire Department should evaluate the contributing factors, and implement the recommendations defined in the report. Recommendations on operational standards, rescue mode, communication, staffing practices, and accountability should be of a high priority for implementation immediately. Gresham Fire should implement policies, request needed funding for improvements and review the recommendations of this report annually to ensure Gresham Fire reduces the risk of operational injuries or fatalities on the fire ground.

I want to thank the members of the investigation team for their time and effort in bringing this report to completion.

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