Report of Investigation Committee into Firefighter Injuries Sustained at 41 Eaton Street

31 March 2016

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Executive Summary

On 31 March 2016, the Providence Fire Department experienced two multiple alarm wind driven fires that tested the Department’s command and control, communications, strategy and tactics, training, operations for large scale events, and mutual aid response and capabilities. These fire events highlighted the effects that wind driven fire conditions can have on department operations at structure fires, the demand for adequate and rapid deployment of firefighting resources, and the great physiological demands placed upon firefighters working at these types of long duration events. A total of twenty six Providence Fire Department members were injured. Fourteen members were injured at the Eaton Street fire. A senior fire captain and senior firefighter experienced critical injuries at the Eaton Street. Of the twenty six injured, ten Providence members were treated for presumed cyanide poisoning. The fire event highlighted the complexity of cyanide issue, the dangers of hydrogen cyanide in smoke, the danger to firefighters from smoke exposure, and need for continued education of Providence Fire Department members and the Rhode Island medical community about the dangers of hydrogen cyanide poisoning from smoke exposure. This fire event provides learning opportunities regarding the need for firefighters to maintain a level of fitness throughout the course of their careers to meet these physiological demands, during structural firefighting; the need to ensure adequate tracking, rotation, rehabilitation, and rest of fatigued fire fighters; learning opportunities regarding the Providence Fire Department Incident Command System (ICS), and the command and control of a large scale emergency incident. This fire event highlighted the Providence Fire Department’s inability to fulfill ICS Command Staff and General Staff positions with chief officers with Fire Ground Command experience. This fire event also highlighted the demands placed upon the Providence Fire Department Bureau of Operational Control (BOC) during emergency operations of this size, and demonstrated the challenges for the present on duty staffing levels of the BOC. The universal consensus of this committee was that Eaton Street
fire presented learning opportunities for the entire Department and as such, the focus of this report is to provide learning objectives for all departmental ranks.

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Introduction

On 31 March 2016, the Providence Fire Department simultaneously experienced two multiple alarm wind driven fires that tested the department’s command and control, communications, strategy and tactics, training, operations for large scale events, and mutual aid response and capabilities. These events began with a general alarm fire during which a second three alarm fire occurred.

The Providence Fire Department Bureau of Operational Control (BOC) began receiving phone calls for a report of a house fire in the vicinity of 41 Eaton Street at 14:04 hours. This fire quickly grew to a general alarm fire. Approximately two and a half hours into the Eaton Street
fire, the BOC asked the Incident Commander if he had any units available to clear the first fire, because the BOC was receiving multiple phone calls for the second fire.

At 16:39 hours, the BOC dispatched mutual companies, along with Providence Fire Department companies that were able to clear the Eaton Street fire, to the area of Laurel Hill Ave. and Laban Street for reports of multiple houses on fire. This fire quickly grew to three alarms.

These wind driven fire events tested the entire 94 member platoon of the Providence Fire Department, off duty members who returned to work on their own initiative, as well as firefighters of several surrounding communities that provided mutual aid to the city of Providence. It was the training, dedication, and professionalism displayed that day, along with the time tested aggressive interior structural firefighting strategies and tactics employed by the Providence Fire Department members (for which the Department has traditionally been recognized for) that kept both fire incidents from becoming major conflagrations.

The Providence Fire Department companies on the scene at 41 Eaton Street and later at Laurel Hill Ave. faced rapidly escalating, extremely fast moving fires that were enhanced by the effects of the wind. Meteorologist Steve Cascione, from local news station ABC6News, was contacted for the recorded wind speeds for the time of the fires. He provided the investigation committee recorded weather statistics, from the website www.wunderground.com, that showed sustained winds of 20.7 to 34.5 mph, with the highest gust of wind recorded at 46 mph for the five hour period of time during the fire events. The winds were blowing from Side 1 to the Side 3-4 corner of the original fire building for the fire event on Eaton Street.

These fire events highlight the danger of wind driven fires, the effects that wind can have on department operations at structure fires, the demand for adequate and rapid deployment of firefighting resources, and the great physiological demands placed upon firefighters working at these types of long duration events. Of the 94 members working that day, Fifty nine of those members operated at both fire events.

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As a result of these two fire events twenty six Providence Fire Department members were injured. Fourteen members were injured at the Eaton Street fire. A senior fire captain and senior firefighter experienced critical injuries at the Eaton Street fire requiring extended stays in area hospitals. Of the twenty six injured, ten Providence members were treated for presumed cyanide poisoning.

Because of the number of injuries at these fires, Assistant Chief of the Department Operations Scott Mello ordered an investigation into the circumstances surrounding the two incidents. Two committees were formed to investigate the incidents and related injuries, and prepare reports on each incident.

Battalion Chief Kenneth Rainone, Acting Battalion Chief Stephen Capracotta, and Acting Battalion Chief Kevin Jutras were assigned the duties of investigating the injuries that occurred at 41 Eaton Street.

All officers who responded to 41 Eaton Street were instructed by Acting Battalion Chief Kevin Jutras to submit a Providence Fire Department Form 17 regarding company actions, at this incident, along with the names of individuals who were injured, and circumstances related to those injuries. Key individual members involved with the events of this fire were interviewed by committee members.

The intent of the committee was to objectively collect and review the facts of the Eaton Street fire, analyze departmental procedures, and to make recommendations for improvement in departmental policy and procedures.

The universal consensus of this committee was that Eaton Street fire presented learning opportunities for the entire Department and as such, the focus of this report is to provide learning objectives for all departmental ranks.

The fire event at 41 Eaton Street once again highlighted the dangers of hydrogen cyanide as a product of combustion, and the potential danger to firefighters related to hydrogen cyanide poisoning from accidental smoke exposure. The Providence Fire Department had been involved
in bringing this danger light to the nation’s fire service exactly 10 years ago (to the month) back in March of 2006.\(^2\) The Eaton Street fire event reiterates the need for continued education of department members and the medical community about the dangers of hydrogen cyanide poisoning from smoke exposure.

The fire provides learning opportunities regarding the physiological demands placed on the firefighters. The fire demonstrates the need of firefighters to maintain a level of fitness throughout the course of their careers to meet these physiological demands, during structural firefighting and long duration events. In addition, this fire event provides lessons on the need to ensure adequate tracking, rotation, rest, and rehabilitation of fatigued fire fighters.

The large scale fire event at Eaton Street also provided learning opportunities regarding the Providence Fire Department Incident Command System (ICS) and the command and control of large scale emergency incidents.

Within the realm of ICS this fire event highlighted the Providence Fire Department’s inability to fulfill ICS Command Staff and General Staff positions with chief officers with Fire Ground Command experience.

This fire event also highlighted the demands placed upon the Providence Fire Department Bureau of Operational Control (BOC) during emergency operations of this size. This event further demonstrated the challenges for the present on duty staffing levels of the BOC.

The Department can be very thankful that no civilian death or firefighter line of duty death occurred at 41 Eaton Street. This fact is a testament to the training and professionalism exhibited by department members operating at this challenging fire scene. The challenge for the Providence Fire Department is to learn from this incident, identify actions that may have contributed to the event, and learn any lessons from the injuries that occurred at this fire. The ultimate goal is to share these lessons with future generations of Providence Firefighters and prevent future injuries or deaths.

Background and Significance

The devastating effect of wind on structural firefighting strategies and tactics has been recognized for many years. Through the investigative work of the National Institute for Occupational Safety and Health (NIOSH) and the scientific research performed by the National Institute of Standards and Technologies (NIST) the fire service has become better educated about the devastating effects of wind driven fires. NIOSH has repeatedly identified the effects of wind driven fires as a contributing factor in many Line of Duty Deaths (LODD) that this agency has investigated.

Most recently, the NIOSH LODD report F2014-09 on the deaths of two Boston Fire Department members released in March of 2016 reiterate the dangers associated with wind driven structure fires. This report stated when responding to a reported structure fire, an overriding consideration concerning size-up must be wind conditions and its potential effect on the fire. The key to successfully operating at wind-impacted fires in a structure depends on recognizing the wind-impacted fire conditions that may change a seemingly routine fire into a “blowtorching” fire. “Blowtorching” is the appropriate description of what will occur when fire conditions are impacted by wind conditions.

The Providence Fire Department also has experienced the effects of wind driven fires in the past, most notably on 14 April 2014. On that day the Providence Fire Department experienced a firefighter “near miss” event and multiple maydays were transmitted when department members were over run by a wind driven fire event.

As a result of the “near miss” and maydays on 14 April 2014, a department investigation was conducted. That report stated:

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5 Bates, M., Crowley, D., Doughty, P., Jutras, K., Toro, A. *Report of Investigation Committee into Firefighter Mayday and Injuries Sustained at 55 Plymouth Street.* April 2014
In 2008, The National Institute of Standards and Technologies (NIST) in conjunction with Fire Department of New York (FDNY), Polytechnic Institute of New York University, and support from the Department of Homeland Security, conducted research on the effects of wind driven fires. The objective of this study was to improve the safety of fire fighters and building occupants by developing a better understanding of wind driven fires and wind driven firefighting tactics, including structural ventilation and suppression (NIST 2008, p. viiii). The research was also intended to study the “effects of positive pressure ventilation fans, wind control devices, and external water application with floor below nozzles to mitigate the hazards of the wind in structure fires” (NIST 2008, p. i).

As a result of these wind driven experiments: A baseline was developed for the hazards associated with a wind driven fire and the impact of pressure, ventilation, and flow paths within a structure. Wind created conditions that rapidly caused the environment in the structure to deteriorate by forcing fire gases through the apartment of origin and into the public corridor and stairwell. These conditions would be untenable for advancing fire fighters. Multiple tactics used in conjunction with each other were very effective at improving conditions for fire fighter operations and occupant egress (NIST 2008, p. i).

From the NIST study, information has been gained about the understanding of flow paths within structure fires and the effects that wind, pressure, and ventilation will have on these flow paths. The flow path of the energy of the fire is influenced by areas of high and low pressure. Simply put, wind creates areas of high pressure and will push heat, smoke (unburned fuels), and toxic products of combustion towards areas of low pressure. The wind will push the fire from the room of origin out into areas of low pressure such as adjacent rooms, hallways, and stairwells.

Depending on the wind velocity this movement may be very explosive, and fire fighters operating in these areas may be over-run by intense radiant heat. It is imperative
that fire fighters be able to recognize these dangers within the structure and operate in areas outside of these flow paths when wind is influencing the progression of the fire.

Appropriately applied ventilation tactics are a way for fire fighters to control these flow paths and ensure their safety. This requires strong knowledge of fire behavior and ventilation tactics. By understanding the effects of wind and by applying the appropriate ventilation tactics, fire fighters can control the fire and these dangerous flow paths.

Simply closing doors is another tactic is to control the flow path of the fire. This can be accomplished by controlling the door of the room of origin. If this is not possible control of other interior doors may assist in controlling the flow path. In high-rise fires the control of stairwell doors becomes very important when the apartment door is left open during these types of fire events.

In some cases, depending on the wind velocity and pressure, head long direct attack with a hose line, from the low pressure area to the high pressure area (from the unburned to burned) directly against the flow path of the fire may not be prudent. Fire officers and Incident Commanders need to recognize this danger. Standard aggressive tactics may have to be altered to ensure the safety of members.

Research into wind driven fires provided the line of duty death reports listed above. These reports are just a small sample of line of duty deaths that indicated wind was found to be a contributing factor. The investigations into these events demonstrated the effect that wind had on the progression of the fires. The extensive documentation of these events are indicators for the fire service of the need to incorporate the knowledge gained from these investigations, and the research from the NIST study, into daily structural firefighting training.

NIST research has determined that wind speeds as low as 10 mph (16 km/hr.) are sufficient to create wind-driven fire conditions if the flow path is uncontrolled. NIST, in a recent study on wind-driven fires in structures, has shown that wind speeds as low as 10
mph can turn a routine “room and contents fire” into a floor to ceiling fire storm or “blowtorch effect,” generating untenable conditions for fire fighters, even outside of the room of origin. Temperatures in excess of 600 °C (1100 °F) and total heat fluxes in excess of 70 kW/m² were measured at 4 ft. above the floor along the flow path between the fire room and the downwind exit vent. These conditions were attained within 30 seconds of the flow path being formed by an open vent on the upwind side of the structure and an open vent on the downwind side of the structure.

The work by NIOSH and NIST indicate that the fire service as a whole still has work to do understanding the dangers of wind driven fires, educating members on identifying wind driven fire potential, incorporating recognition of wind speeds in initial size-up, identifying potential explosive flow paths, and choosing the appropriate tactics when combating these types of fires.6

The Providence Fire Department has in place 50 pre-established standard operating procedures (SOP’s). The standard operating procedures are intended to act as decision making guides for company officers and members. These standard operating procedures are based upon nationally recognized consensus standards that are intended to make fire ground activities as safe as inherently possible. There are a number of Providence Fire Department SOP’s related to structure fires, most notably Operations at Structure Fires, Accountability, Mayday, Fast Company, and Safety Company Operations. The department also follows the principles of Incident Command, outlined in a document titled “Providence Fire Department Incident Command” (1993). Decisions officers make and actions that they take should be guided, and be influenced by the department’s SOP’s, Incident Command document, Department Rules and Regulations, standing General Orders, and the officer’s training and experience.

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The Providence Fire Department Bureau of Operational Control (BOC) is responsible for the dispatch of fire companies to emergencies. The BOC, or Fire Alarm (FA), receives telephone calls for emergencies and via the state operated 911 Enhanced System. The department also has telegraph fire alarm street boxes as well as municipal alarm boxes in buildings throughout the city referred to as master boxes.

The standard assignment for a master box is three engines, two ladders and a chief. When both chiefs are unavailable, a command company will be dispatched. A command company can be an engine or ladder company with a captain in command of the company.

The standard first alarm assignment for a building fire is three engines, two ladders, the Special Hazards, a rescue and a chief. Immediately following the dispatch of the first alarm companies the BOC dispatches a Fast Assist Search Team (FAST) company. The FAST Company is comprised of a Ladder and Engine Company. When a working fire is confirmed, the BOC will dispatch Engine 5 with the Air Supply Unit. The officer of Engine 5 will be assigned the Incident Safety Officer duties at the incident.

Fires beyond the capabilities of the first alarm assignment are known as multiple alarm fires. An additional alarm has two engines and one ladder assigned to it. The Providence Fire Department has the ability to assign six alarms, after which the fire would be referred to as a General Alarm fire.7

Upon the announcement of a Mayday on a fire ground the department has procedures to make the fire and automatic multiple alarms with what is known as a “Mayday response.” Mayday response is comprised of two engines, two ladders, and two rescues.

The Providence Fire Department changed over to a hybrid 800 MHz system in 2009. This seven channel system is a combination of digital and analog radio channels. Channels 1, 5, 6 and 7 are digital. Portable radios on 1, 5, 6 and 7 transmit to a series of repeater towers throughout the City. Fire ground channels 2, 3 and 4 are analog. Portable radios on 2, 3 and 4 transmit directly to one another, walkie talkie style. However, apparatus or mobile radios

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7 Providence Fire Department Rules and Regulations 1996
transmit directly to the towers on all channels. Apparatus radios will not receive the portables on channels 2, 3 or 4 the walkie talkie style, unless a vehicle repeater system (VRS) is manually turned on. The VRS repeats the analog message over the digital frequency. Engines, ladders and the line chief vehicles are equipped with VRS. This is a very general explanation of the fairly intricate communication system. Pertinent to this investigation, portable radios on channels 2, 3 or 4 only transmit to other portables or need to be repeated through a VRS on the same channel. If no apparatus radio is on the same channel with a VRS, the transmission will not reach fire alarm or apparatus.

This intricate radio system requires strict adherence to SOP 17 and SOP 35 which dictate the procedures for using multiple radio channels for one incident. These procedures require one VRS be switched to the second radio channel assigned for the Rescue Sector during Mayday events at fires.8

Procedures

The Investigative Committee was selected by Assistant Chief of Department Scott Mello. An organizational meeting was held. From this meeting three objectives were set. The first objective was to gather as much data as possible. Second, to evaluate the information collected. Lastly, report any lessons that can be learned to prevent injury or death.

The data collection began with the retrieval of the radio transmissions for the Eaton Street Fire Captain Julia O’Rouke provided the committee a CD audio recording for each radio channel (Primary Dispatch Channel 1 and Fire ground Channel 2). Acting Battalion Chief Kevin Jutras instructed all company officers to submit a Providence Fire Department Form 17 regarding company actions at this incident along with the names of individuals who were injured and circumstances related to those injuries. Photos that had been taken at the fire scene by witnesses and provided to Car 79 were also given to the committee. Members of the committee collected data regarding the type of injury and functions being performed that contributed to the injury.

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8 Providence Fire Department Maydays  Standard Operating Procedure 35. 2012
Incident at 41 Eaton Street

On 31 March 2016 at 14:07 hours, the Providence Fire Department Bureau of Operational Control (BOC) dispatched Engines 12, 7, 15, Ladder 4 and 6, Special Hazards 1 Rescue 4 and Battalion 3 to 41 Eaton Street for a report of a building fire. The BOC also reported that Providence Police were on the scene and that there was a brush fire on Leigh Street extending to a house on Eaton Street.

While responding along Douglas Avenue to Eaton Street, Engine 12 and Ladder 3 were directed to Leigh Street by civilians. Engine 12 reported to the BOC that he was being directed to Leigh Street, and that there was a possible brush fire on Leigh Street. The BOC radioed Engine 12 and reiterated that Providence Police stated a there was a possible brush fire behind 41 Eaton. This radio transmission was immediately followed by a transmission from Engine 12 stating that there was a house fire on Eaton and that Engine 12 would be backing down Leigh Street to respond to the original address of 41 Eaton Street.

At approximately 14:10 hours, Rescue 4 was the first fire apparatus to arrive on the scene at 41 Eaton Street. Rescue 4 transmitted a “Code Red” and gave a size up that stated there was a fully involve house fire with heavy fire showing second, third and fourth floor of a three family residential wood frame.” This transmission was immediately followed by Engine 7 and Rescue 4 both requesting a second alarm. Battalion 3 arrived on the scene and informed the BOC to prepare for a third alarm.

The officer of Rescue 4 established the EMS sector became the EMS Sector officer. He began assessing the need to expand the EMS sector based upon the potential for injured members and rehab of members as the incident progressed. The EMS Sector Officer began to request additional rescues to ensure that EMS services were provided on the west and east sides of the rapidly expanding incident.

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9 Recorded Audio Files Providence Fire Department April 2016
At 14:11 hours, Battalion 3 requested a third alarm. At 14:12 hours Ladder 6 radioed the BOC and reported that there was fire in Exposure 4. This transmission was followed with a transmission from Battalion 3 establishing Eaton Command. Eaton Command provided the BOC with the first status report which stated “one three and one half story wood frame building fully involved in fire, Exposure 4 was on fire with fire showing on the second and third floors, Exposure 2 was on fire with fire in the loft, and that the fire was doubtful at this time.”

First alarm companies self-deployed following Providence Fire Department Standard Operating Procedures and the department’s Incident Command sequence of pre-established incident priorities, size-up, strategic objectives, and tactical operations outlined in the department’s Incident Command System Manual. The first alarm company officers all recognized the escalating fire event unfolding before them, and understood the Incident Action Plan of writing off what was already lost (the original fire building) and focusing actions on exposure protection and fire control.

Engine 7 arrived first to the Eaton Street side of the event. Engine 12 established a water supply to Engine 7. Engine 7 stretched a two and a half inch hand line to begin exposure protection of Side 2 of Exposure 4. The chauffer of Engine 7 used his deck gun to begin exposure protection on Side 4 of Exposure 2.
Ladder 3 remained on Leigh Street where they were originally directed by bystanders. The fire fighters assigned to Ladder 3 positioned their apparatus and attempted to provide vertical ventilation on Exposure 4, while the officer of Ladder 3 controlled the growing brush fire that threatened buildings on Leigh Street. Engine 4 supplied Ladder 3 with water from a hydrant on Douglas Ave.

Ladder 4 and Ladder 6 arrived and positioned and prepared their apparatus for defensive operations on the original fire building and exposure protection of Side 2 of Exposure 4.

Engine 14 followed Ladder 6 in on the original dispatch. Engine 14 positioned their apparatus to use the deck gun on the third floor of Exposure 4 and Protect Exposure 4A. The members of Engine 14 began to prepare feeders to supply Ladder 4, Ladder 6 and later Ladder 1. Engine 3 supplied Engine 14 with a five inch feeder from Oakland Ave.

Engine 15 stretched a three inch attack line fitted with a “Blitzfire” nozzle to begin exposure protection in the rear of Exposure 2. The chauffer of Engine 15 later returned to his apparatus to begin water supply operations to Ladder 7 which was dispatched on the second alarm, and was now positioned in front of Exposure 2.

Members of Special Hazards made entry into Exposure 4 which was now on fire. They performed primary searches on the first floor and some areas on the second floor that did not contain fire. The officer of Special Hazards notified the Incident Commander (IC) of the search.
results and informed the IC his members were stretching hand line into Exposure 4 and were operating on the second floor.

Engine 2 arrived on the second alarm. They stretched a hand line into Exposure 2 and performed a search on floors one and two. Engine 2 then informed the IC that they were operating on the third floor, Side 4, of Exposure 2. After securing a water source for Engine 7, Engine 12 deployed hand line into Exposure 2 and made their way up to the loft of Exposure 2.

With defensive operations underway on the original fire building and companies moving offensively into the Exposure 2 and Exposure 4, the IC began to sectorize the incident. The IC designated the officer of Special Hazards as the Exposure 4 Sector Officer, and the IC designated the officer of Engine 12 as the Exposure 2 Sector Officer. The IC established a third sector on the exterior of Side 3 of all buildings involved. Engine 15 was assigned as the Side 3 Sector Officer.

The IC then began to assign companies to the three sectors now established. Engine 14 backup the members of Special Hazards in Exposure 4, and stretched up the front stairs of Exposure 4. The officers of Ladder 1 and Ladder 6 moved into the Exposure 4 to assist with offensive operations now taking place in that building.

Engine 8 and the officer of Ladder 7 moved into the Exposure 2 to assist offensive operations now taking place in that building.

Car 2 arrived on the scene, and at 14:26 hours he requested a fourth alarm just 19 minutes after the dispatch of the first alarm. Ten minutes later Car 2 requested a general alarm be struck at 14:36 hours.

With the remainder of available Providence Fire Companies arriving on scene, the IC assigned companies into the exposure buildings to gain control of the fires in these buildings and keep the incident from growing any further.

Engine 13 and Ladder 2 were assigned to the Exposure 2 Sector and the IC made the officer of Engine 13 the Exposure 2 Sector Officer. This allowed for Engine 12 to maintain their position in the loft and provided greater supervision of companies operating in Exposure 2.
Engine 10, Engine 6 (after providing Engine 14 a second five inch feeder), and Ladder 5 were assigned to Exposure 4 Sector and the officer of Ladder 1 was assigned as the Exposure 4 Sector Officer. The change in the assignment of the Sector Officer role was made again to gain better supervision of companies operating in Exposure 4.

Engine 11 and Ladder 8 were assigned the duties of the FAST Company. Engine 4 and Ladder 1 were originally assigned the FAST Company duties, but the rapidly escalating fire event required use of these companies by the IC for tactical operations.

At 14:51 hours, the IC provided the BOC with another incident status update. The IC reported that he had “one building fully involved, heavy fire in Exposure 2, and heavy fire in Exposure 4 fire still doubtful.” As the incident duration progressed the IC requested an additional ladder and engine to have in staging. A North Providence engine and ladder were dispatched to the scene. The North Providence Ladder was used to relieve some of the Providence crews in Exposure 2 while the North Providence Engine was used in Exposure 4.

The members operating at 41 Eaton Street faced fierce fire conditions as a result of the effect that wind played upon the incident. The effects of the wind made the tasks of controlling fire spread, overhauling extinguished areas of fire, and completely extinguish pockets of fire that would flare up when influenced by the wind, an extremely arduous time consuming task.

Exposure 2 was the first building where head way was gained, and control of the fire in that building was completed. Crews operating on floor two and three performed extensive overhaul to completely extinguish the fire on those floors. Crews operating in the loft of Exposure 2 faced an unfinished loft which allowed them to cover the entire floor with their hose line from the relative safety of the rear stairwell. The officer of Engine 12 reported that his crew was able to make it up onto the floor and slowly move toward Side 1 to complete the extinguishment of the fire in the loft.

The control of the fire in Exposure 4 was more difficult. The loft of that building had been finished into an occupied living space. The unit was divided front to back with a stair to the fourth floor on Side 1 and Side 3. Because it was a finished space, additional hose was required
to cover the hallways and rooms off of the hallway to reach all areas of the floor, unlike the open floor area in the loft of Exposure 2.

The first hose line advanced up the rear stairs stretched short. Original headway into the loft was lost when the hose line had to be backed down to piece in additional hose to make the stretch. At one point during the battle to gain the fourth floor, companies attempting to move up to the fourth were ordered down to the third floor by the IC. The IC was concerned about the conditions he was witnessing from the exterior that interior crews were not aware of. When it was confirmed that all members were in a safe location on the third floor, the IC directed Ladder 3 and Ladder 1 to place their master streams into the loft of Exposure 4, to knock down the growing bulk of the fire on the fourth floor.

Prior to the use of the master streams on the fourth floor, members could darken down the flames on Side 3 and move up the stairs only to be driven down the stairs when gusts of wind would drive hidden fire and heat out of the concealed spaces down onto the hose line crew. After the master streams knocked down the bulk of the flames on the fourth floor, the master streams were redirected back on the original fire building. Crews in Exposure 4 could now move back up to complete the extinguishment or the fourth floor, by opening up the finished ceilings and walls to complete the extinguishment of hidden pockets of fire.

The fire was placed under control at 15:41 hours. Some companies remained on the scene for approximately two more hours, with Providence Fire Department Arson Investigators remaining on the scene until 19:45 hours.

Discussion

The dangers of acute hydrogen cyanide poisoning from smoke inhalation are not new to the Providence Fire Department. On March 23 and 24 of 2006, the Providence Fire Department learned of the true magnitude of the dangers of cyanide in smoke as the result of three fires over the course of two days. In the aftermath of the three fires, a total of 28 members sought medical
follow up, 27 of who were tested for cyanide poisoning.\textsuperscript{10} Eight of those members were found to have elevated levels of cyanide.\textsuperscript{11}

One member, who had elevated cyanide levels from an exposure to smoke at the second fire, suffered a heart attack at the third fire. While the investigation committee was not able to conclude that cyanide related arrhythmia led to the member’s heart attack, it was determined with certainty that the member had elevated levels of cyanide in his blood at the time of he suffered the heart attack.\textsuperscript{12} The investigation did determine that cyanide poisoning can lead to death by affecting the body’s ability to carry oxygenated to the vital organs, as well as having the ability to causes heart arrhythmias, and that the arrhythmias can occur up to two weeks after the exposure.\textsuperscript{13}

The investigative report from the events in 2006 brought the dangers of acute cyanide poisoning from smoke inhalation to the national level. The investigative report from 2006 discovered that hydrogen cyanide is produced in significant quantities at fires involving materials that are commonly present in modern buildings, such as plastics, synthetics and nitriles.\textsuperscript{14} At that time, the investigation committee found research that supported the most common cause of cyanide poisoning was from smoke inhalation.\textsuperscript{15}

Prior to 2006, the Cyanide Poisoning Treatment Coalition (CPTC) had been slowly raising the awareness of the dangers of cyanide in smoke, but as a result of the events in Providence in 2006, the nation’s fire service is now greatly aware of the dangers. Cyanide is now


known as one of the deadly “toxic twins,” along with Carbon Monoxide, that can have acute affects to firefighters from smoke inhalation.

The investigative report in 2006 found that the exposures to cyanide were a result of trained, seasoned firefighters misperceiving the risk, and making a calculated risk versus benefit analysis on the fire ground without all of the pertinent information. The 2006 report found that firefighters are expected to make the decision to wear or not wear their SCBA at a variety of incidents, from building fires to investigations of false or accidental alarms, to investigating strange odors or the smell of smoke, to operating at brush fires, rubbish fires and car fires. The 2006 report also stated that the decisions firefighters are required to make related to air use is often made relying on their skill, judgement and experience in determining when to mask up. This decision to mask up is influenced by the potential for the atmosphere to be hazardous, the limited air supply duration, the ability of the crew to accomplish tactical assignments, and the desire of members not wanting to consume air in non-contaminated areas, so that they have air when needed to ensure the unit’s tactical effectiveness.

The Investigative Committee conducted a lengthy interview with the Fire Captain who was hospitalized for cyanide poisoning from the Eaton Street fire. During the interview the Fire Captain explained his air use was influenced exactly as was explained in the previous paragraph. While operating on the third floor of Exposure 4, the Captain removed his face piece once the fire on the third floor was completely knocked down, walls were opened up and checked for hidden fire, and windows were taken out to ventilate the third floor. The Captain did acknowledge that members did operate in and out of smoke, for small periods of time, due to the swirling wind conditions. At times it was acceptable to remove face pieces only to have the wind change direction and push smoke down from the fourth floor, onto their position. The Captain

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and other company officers operating in that sector knew that they would have to push up the rear stairs to the fourth floor to control and extinguish the fire on the fourth floor in Exposure 4.

The first hose line brought up the rear stairs to the third and fourth floor stretched short when members attempted to push up to the fourth floor. The members of Ladder 3 had attempted to ventilate the roof on Exposure 4, but were pushed off of the roof because of the radiant heat from the original fire building and the swirling fire coming up Side 2 of Exposure 4. As the members were leaving the roof they were only able to ventilate an existing sky light opening on the roof of Exposure 4. The lack of enough hose to reach the fourth floor, the wind driven fire conditions that day, and the inability of the members of Ladder 3 to adequately ventilate Exposure 4 made the push up to the fourth floor a difficult, physically demanding, and time and air consuming task.

Those members not on the rear stairs and working on the third floor, waiting to move up to the fourth floor, removed face pieces believing the atmosphere was safe on the ventilated third floor. The Fire Captain stated during his interview that he “had operated that day (March 31, 2016) just as he had done for every other fire he had operated at, during his thirty one year career.” He perceived the atmosphere on the third floor to be safe because of the strong winds blowing in from Side 1 towards Side 3, of Exposure 4. He also wanted to conserve his air for when his crew moved up the rear stairs to the fourth floor. The Fire Captain also stated that his crew was masked up when they were on the rear stairs to the fourth floor and while on the fourth floor before being relieved.

Following the events in 2006 the Providence Fire Department implemented several changes to attempt to address the cyanide issue. The first change was to assess the presence of cyanide at fire scenes and assist department officers in identifying unsafe Immediately Dangerous to Life and Health (IDLH) atmospheres, and make correct risk versus benefit analysis. The second change was to move to a longer duration air supply.

In 2006, the Providence Fire Department worked with one manufacturer of gas monitoring devices. This company partnered with the PFD and provided 23 single gas meters.
The cyanide gas meters were placed on all company officer’s air packs. The idea was to turn on the devices when entering structure fires, to allow the devices to alert company officers of the presence of cyanide.

After the implementation and use of the detectors, it became apparent that the gas meters were not built to meet the rigors of structural firefighting. The filters on the gas meters, as well as other components, are only rated for temperature environments of one hundred and twenty degrees Fahrenheit or lower. Soon meters were being damaged, because the meters were being used in elevated temperature environments. After being damaged the meters were returned to manufacturer for repairs. The manufacturer wanted to be paid to repair or replace the meters. The Providence Fire Department made a fiscal decision to move away from air monitoring for cyanide. Company officers no longer carry the cyanide single gas meters.

What did become readily apparent was the prevalence of cyanide at fire scenes. When the meters were in service they could be heard alarming at many types of fire events that PFD members responded to. Prior to the presence of the meters, members performing a risk versus benefit analysis at similar types of fire events assumed the atmospheres were safe.

Air monitoring of fire environments, after the fire has been knocked down, has now become a standard operating procedure for some fire departments around the country. The Providence Fire Department no longer employs air monitoring procedures for fire scenes.

The idea behind air monitoring is to provide officers with additional information about the atmosphere, as to whether it is safe to remove face pieces or not. Air monitoring is a procedure that the Providence Fire Department should consider to incorporate back in to department procedures. A company at each fire could be assigned the responsibility of providing air monitoring once the fire is under control.

With respect to air monitoring, not all the dangers associated with the toxic products of combustion, can be monitored for. The gas detection equipment can only provide information with respect to the type of gas being monitored. Carbon monoxide and cyanide levels could be monitored for, but other known dangerous carcinogens present in smoke cannot be monitored
for. Firefighters need to be educated and understand that other dangers are present in smoke, and it is not acceptable to breathe smoke, even when the gas meters are not alarming for carbon monoxide or cyanide.

A recommendation, from the 2006 investigation, was for the Providence Fire Department to investigate the idea of comprehensive air management. At that time four members of the Seattle Washington Fire Department had been moving to educate the American fire service of the need for firefighters to better manage air use. The motivation, for better air management by the Seattle members, was the result of firefighter “near misses” and several Line of Duty Death (LODD) incidents experienced by the Seattle Fire Department. The LODD’s were the result of firefighters running out of air in IDHL atmospheres.

In 2008, the Providence Fire Department moved to a longer duration air supply cylinder. The Seattle Fire Department and other departments around the country had moved to the longer duration cylinders to combat the issue of firefighters running out of air in an IDLH atmosphere, and being exposed to smoke. The move to the longer duration cylinders was done to allow fire fighters to mask up earlier, enter, work and exit the Immediately Dangerous to Life and Health (IDLH) atmosphere while still being on air.

This method of knowing how much air you have upon entering, monitoring that air while in the IDLH atmosphere, and exiting the IDLH atmosphere before the low air alarm indicator begins to sound has become known to the fire service as the “Rule of Air Management.”

Since 2013, the principle of the Rule of Air Management, along with the requirement of training members on individual consumption rates and the requirement to manage air consumption as part of a crew has been incorporated into the National Fire Protection Association (NFPA) Standard 1404 Standard for Fire Service Respiratory Protection Training.

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When the Providence Fire Department moved to the longer duration air supply, the intent of getting members to go on air sooner and stay on air longer was not conveyed to all members of the department. The training on the intent and purpose of the longer duration air supply was presented as a point school presentation. Chiefs, officers, and firefighters not needing or not interested in receiving a half a point toward promotion, did not attended.

The department did not revise its Standard Operating Procedure (SOP) 2 to reflect the intent of the change to the longer duration air supply. In 2010, a draft revision of the Department’s SOP 2, was submitted to the administration upon their request. The draft SOP incorporated the Rule of Air Management and outlined the necessary resources needed to meet the tenants of the Rule of Air Management. This draft was not adopted nor has the SOP been revised since being established in 1999.

The administration at that time was mainly concerned with the aspects of the draft SOP that outlined what is known as “three deep deployment” resource allocation model. The three deep deployment model is described in the book Air Management for the Fire Service. This deployment model had been used primarily in the past for high rise type fires, as well as long duration events where members were required to remain on air while in the IDLH atmosphere. The Providence Fire Department SOP 29 High Rise Fires recommends incident commanders use this method of resource allocation for relief, tracking, and rehabbing of crews. Progressive departments around the country have been moving to this type deployment model for every day fire events of shorter durations. The intent of the use of this deployment model was to combat the dangers of members being exposed to smoke.

The practice of adhering to three deep deployment models is resource dependent. A lot of resources (i.e. engine and ladder companies) are required to meet this deployment mode. Essentially for every hose line deployed there is one engine company on the line, one engine company on deck, and one engine company in staging, to relieve the members on the line when their air supply begins to become low. The on deck crew can move up and relief the initial hose

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24 Providence Fire Department Standard Operating Procedure 29 High Rise Fire 1995
line crew before their low air alarms activate, if their tactical assignment and position requires
them to be continually on air. Then the crew in staging would move up. This same process for
ladder companies would need to be used for those ladder company tactical assignments and
positions that require the crew to be on air continually.

An alternative to the three deep deployment resource allocation model, for shorter
duration events, is the staffing of engine and ladder companies with one officer and three
firefighters. Four person crews, when operating in the IDLH atmospheres requiring air use, have
the ability to split the crew and operate in the IDLH in teams of two or more.\(^{25}\) When the need
for replacing air supplies becomes apparent, the officer can split his crew and send two members
out to replace their air cylinders while two remain in the IDLH. When the first two members,
sent to replenish their air supply return, the next two members can rotate out for new air
cylinders. This procedure, of air management and splitting the crew, allows the company to
maintain their tactical assignment within the IDLH atmosphere without the need for additional
crews.

Three person engine and ladder companies cannot follow the same procedure for
replenishing their air supply as four person companies. Three person companies do not have the
ability to split the crew and maintain tenants of the “two in two” out rule found in the
Department’s standard operating procedures.\(^{26}\)

Since 2006, there have been five less high profile fire events, where an individual
member of the department was treated for cyanide poisoning as a result of exposure to smoke
from structural firefighting. The events of March 31, 20016 and the previous exposures to
cyanide indicate that more education and training of department members is required.

Clearly the continued exposure of members to cyanide, indicate the problem for the
Providence Fire Department is what has become known as an “adaptive challenge” and not a

\(^{25}\) Providence Fire Department Standard Operating Procedure 32 *Operations at Structure Fires* 1999

\(^{26}\) Providence Fire Department Standard Operating Procedure 32 *Operations at Structure Fires* 1999
technical challenge for the department.\textsuperscript{27} The department has continued to address the cyanide issue, and air use with technical solutions, but the problem of members being exposed to cyanide continues to occur.

As was found in 2006, this Investigation Committee finds that characterizing the problem strictly as a “disciplinary issue ignores the complexity of the problem.” \textsuperscript{28} Also, simply changing tactical operations of the Providence Fire Department would not address the issue of continued exposures to smoke. This type of change will require the type of “transformational leader” that Heifetz and Linsky write about in the book Leadership on the Line.\textsuperscript{29}

The issue is extremely complex requiring strong transformational leadership, support throughout the department (both politically and administratively), continued education and training of all members and ranks of the department.

There has been much research of the physiological demands placed upon firefighters during structural firefighting. The personal protective firefighting gear required for thermal protection, the self-contained breathing apparatus carried on the backs of firefighters, necessary equipment needed to perform inside the fire environment, and the physiological and emotional stress all have a synergistic effect, placing extreme physiological demands on the firefighter’s body. According to information provided by the United States Fire Administration (USFA), the leading cause of fatalities to firefighters is heart related medical emergencies and USFA data also indicates that after age 35 the proportion of deaths due to traumatic injuries decrease, and the proportion of deaths due to medical causes steadily increase.\textsuperscript{30}

A study found that the provision of fire suppression and emergency medical services entails sporadic high levels of physical exertion, uncontrolled environmental exposures, and


\textsuperscript{28} Dorsey, J et al. \textit{Report of Investigative Committee into Cyanide Poisoning of Providence Firefighters}. May 2006


psychological stress from observing intense human suffering. Firefighters experience inordinate numbers of line-of-duty deaths, deaths due to occupational diseases, forced retirements, and line-of-duty injuries. Firefighter fatalities and injuries occur at a rate one and one half times those of police officers.

Often firefighter heart rates will go from normal resting rates to well above age related maximum heart rates. This physiological demand can occur with little or no warning, as well as with little or no warm up due to the nature of emergency response. Research has found that the pattern of sedentary periods interrupted by catecholamine surges and heavy physical exertion has been suspected to put firefighters at an increased risk for acute heart attacks. A danger of exceeding the maximum heart rate is the body’s inability to carry oxygenated blood to vital organs of the body.

From the investigation of the events at the Eaton Street fire, it is known that the firefighter who was critically injured suffered a heart related medical emergency that was diagnosed as demand ischemia. Demand ischemia is a type of heart related event for which blockages in the arteries may not be present. It occurs when a patient’s heart needs more oxygen than is available in the body’s supply, and may occur in patients with tachyarrhythmias (abnormally fast heart rates). Blood tests will show the presence of enzymes that indicate damage to the heart muscle.

The activities at the emergency scene, of the critically injured firefighter, and subsequent injury highlight the extreme physiological demands placed upon firefighters during the

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34 Hales, T. Heart Disease in the Fire Service: Cause for Concern 2011

performance of their duties. The critically injured firefighter was assigned to an engine company for the fire on Eaton Street. His engine company, staffed with an officer and two firefighters, was dispatched upon the general alarm. The initial assignment for the engine company was to secure an additional water source. The engine company laid a one thousand foot five inch feeder from the hydrant located at the corner of Chad Brown Street and Oakland Avenue.

The critically injured firefighter was responsible for turning in this hydrant, and then ran up to the fire scene. Once at the scene he retrieved his air pack and tools, and was instructed by his officer to assist the other firefighter in deploying an attack hose line into Exposure 4. The crew’s assignment from the Incident Commander was to take the line to the fourth floor and relief crews already operating on the fourth floor. When interviewed, the critically injured firefighter reported that he had moved up and down, the four flights of the rear stairs, several times to ensure adequate hose was stretched up to the fourth floor. These actions were necessary to allow for the hose line to cover the entire foot print of the fourth floor.

What needs to be remembered is that this firefighter was carrying sixty pounds of personal protective equipment and tools necessary to perform safely and effectively while performing these assigned tasks. Additionally, this was a three person engine company. The officer was needed on the fourth floor to supervise and direct the activities of the nozzle man in the zero visibility, IDLH atmosphere. Leaving, all of the work of stretching the hose line into position, on the shoulders of the critically injured firefighter.

After completing duties as the backup firefighter, the critically injured firefighter joined his crew on the fourth floor. Shortly after reaching the fourth floor, and with improvements of conditions on the fourth, the injured firefighter informed his officer of the need to take a quick break. The firefighter went outside to an area of Sector 3 where could remove his SCBA and personal protective equipment. He was given a bottle of water by members operating in that Sector. After drinking the water and catching his breath he then donned his personal protective equipment and SCBA and joined his crew on the fourth floor. The crew remained on the fourth floor until the floor was completely overhauled and the fire completely extinguished.
Upon exiting the building the entire crew reported to the EMS Sector for rehabilitation. It was there that the critically injured firefighter’s vital signs were discovered not to be within acceptable levels. His pulse rate was initially recorded at 154 beats per minute. After approximately fifteen minutes of continued rest and observation, his pulse rate remained at 135 beats per minute. At this point, the EMS Sector Officer made the decision to have the firefighter transported to the hospital. The other firefighter assigned to this engine company was also transported to the hospital for overexertion and exhaustion related symptoms.

The National Fire Protection Association’s 2014 Firefighter Injury Report listed that there were 63,350 firefighter injuries for 2014. Strain, sprain and muscular pain resulted in more than half the major types of injuries received during fireground operations. Overexertion ranked second at 25% for the leading cause of injuries.

An investigation into the injuries at Eaton Street found that the majority of the injuries were overexertion. There were fourteen original injuries from the Eaton Street fire. When classifying the type of injuries sustained, aside from two hand injuries (one crushing, one burn) and one eye injury, the remaining eleven injuries can be classified as overexertion, fatigue type injuries. These injuries comprised strains and sprains of various body parts (The Fire Captain treated for cyanide poisoning was originally transported for a knee injury).

One day following the Eaton Street fire, six additional firefighters sought medical follow up. Four of the six members had operated at both the Eaton Street fire and the Laurel Hill Avenue fire on March 31, 2016. All of these members were symptomatic with overexertion and fatigue type injuries.

When examined, the injuries at the Eaton Street fire correlate with research that has been done that identifies the major contributing factors for firefighter injuries. The contributing factors


are crew size, standard operating guidelines, and health, wellness, fitness, and medical status of firefighters.\textsuperscript{39}

Crew size has been researched by National Institute of Standards and Technologies (NIST).\textsuperscript{40} The NIST research addressed the effects that crew size has on firefighter safety and effectiveness. The research quantified the effectiveness of crew size, first-due engine arrival time, and apparatus arrival stagger on the duration and time to completion, of twenty two key fireground tasks and the effect on occupant and firefighter safety.\textsuperscript{41} The research from NIST experiments substantiated the requirements in the NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.

In 2007, NIOSH published a NIOSH Alert for the service related to cardiovascular disease and other sudden cardiac events. The NIOSH Alert provided recommendations to minimize the risk of injury and death to fire fighters from cardiovascular events. One of the recommendations calls for fire departments to ensure adequate staffing levels for emergency operations to prevent over-exertion injuries\textsuperscript{42}.

What is interesting about the number and types of injuries recorded, of the fourteen injuries, nine of those members were from three person crews while the remaining five injuries were from four person crews. Research has demonstrated that crew size of four persons versus three persons reduced the risk of injuries and improved overall firefighter safety.

As mentioned above, standard operating guidelines have been identified as a contributing factor for firefighter injuries. The research cited above particularly reflects the lack of standard

\textsuperscript{39} Moore-Merrell, L. et al. \textit{Reducing Firefighter Deaths and Injuries: Changes in Concept, Policy, and Practice Contributing Factors to Firefighter Line-of-Duty Death in the United States.}

\textsuperscript{40} Averill, D., Moore-Merrell, L., Barowy, A., Santos, R., Peacock, R., Notarianni, K., Wissoker, D. \textit{Report on Residential Fireground Field Experiments.} NIST Technical Note 1661. 2010


\textsuperscript{42} NIOSH. \textit{Preventing Fire Fighter Fatalities Due to Heart Attacks and Other Sudden Cardiovascular Event.} Publication No. 2007–133. 2007
operating guidelines or failure to follow established standard operating guidelines as a contributing factor for injuries.

The Providence Fire Department ICS provides for ensuring that mechanisms for tracking and rehabilitating personnel are in place and being used.\textsuperscript{43} The Providence Fire Department ICS also states that personnel must be also monitored for signs of physical or emotional exhaustion, indications of exposure to smoke, hazardous materials, or weather extremes.\textsuperscript{44} The command matrix for tracking the location and status was in place and being used on March 31, 2016. The EMS sector was established and in place to provide EMS and rehab to firefighters working at the scene.

Following a discussion and review of the number of overexertion and fatigue type injuries at the Eaton Street fire, the IC acknowledged that the activation of additional intermediate command level positions of the Providence Fire Department ICS would have improved direct supervision of members working at the scene. The IC further acknowledged that the additional intermediate command level positions could have assisted the IC in maintaining a proper span of control as outlined in the Department’s ICS document.\textsuperscript{45} By building a proper command structure the IC could have improved the span of control which would have improved the monitoring of crews working in the two exposure buildings, as well as monitoring the amount of time these crews worked in those IDLH atmospheres. The intermediate command level positions could have worked more closely with the company officers identifying those members needing reliefs. Then reliefs could have been provided in a more timely fashion to prevent members from overexerting themselves.

The injuries from the Eaton Street fire reflect the dangers associated aggressive interior structural firefighting. The injuries further highlight the physiological demands placed upon firefighters. The nature of the work performed and injuries sustained at the Eaton Street fire

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{43} Providence Fire Department \textit{Incident Command System 1993}
\item \textsuperscript{44} Providence Fire Department \textit{Incident Command System 1993}
\item \textsuperscript{45} Providence Fire Department \textit{Incident Command System 1993}
\end{itemize}
\end{footnotesize}
reflect the need of firefighters to maintain levels of fitness that involve the components of cardiovascular, strength and conditioning, and flexibility training throughout the course of their careers.

It is important to note that rest is an important component of the aspects of fitness, health, and wellness for combating the physiological and psychological stressors of firefighting. When performing an objective review of the injuries that occurred at the Eaton Street fire, the recent reorganization of the platoon structure of the Providence Fire Department cannot be overlooked when examining the overexertion and fatigue related injuries sustained by department members.

The reorganization to the Fire Department involved no input from fire department officials. Had the political administration consulted the fire department members, the administration would have been informed of the impact that this type of change would have on the overall safety of the firefighters.

NIOSH through the Center for Disease Control (CDC) has performed research that identifies the impact of increased hours worked with a decrease in the amount of time off for recuperation.46 A National Response Team technical report found that fatigue will be a greater impact on overall safety when responders are working long shifts and the tasks are very demanding such as highly cognitive or emotionally intense work, physical exertion, extreme environments, or exposure to other health or safety hazards.47 These findings suggest that firefighters, who frequently work longer shifts combined with longer work weeks and night shifts, may be at a higher risk of injury and reduced performance.48 Another report found longer and more stressful the work shift/week, the greater the need for recuperative time off.49

46http://www.cdc.gov/niosh/emres/
47 Nation Response Team Guidance for Managing Worker Fatigue during Disaster Response 2009
48 Nation Response Team Guidance for Managing Worker Fatigue during Disaster Response 2009
The present work schedule does not provide adequate rest or recuperation for maintaining proper fitness, health, and wellness levels to meet the physiological and psychological demands of the job.

The Eaton Street fire provides learning opportunities with respect to the Providence Fire Department ICS and command and control of large scale emergency incidents. The Providence Fire Department ICS provides a professional approach to emergency management. ICS can enhance the ability of fire officers to organize and control resources and activities at the incident scene to handle the situation in the most effective manner possible. ICS can increase the overall effectiveness of command officers while at the same time making their job easier and less stressful.

Because of the everyday use of the ICS, the first arriving company officers along with the first arriving Battalion Chief were able to coordinate the activities of the units dispatched on the first alarm. Command was established, the command sequence begun, incident priorities identified, size up performed, strategic objectives established, and tactical operations assigned.

In an effort to maintain proper span of control the IC quickly recognized the need to divide the scene into manageable units. The IC established Exposure 4 as one sector, and Exposure 2 as a second sector, and assigned the first company officers into these buildings as the sector officers. Once these sectors were established and resources assigned to each sector, the IC established the Side 3 Sector to manage the companies operating on exterior of Side 3 of the incident.

The IC’s span of control was exceeded even with establishment of the sectors and the EMS sector being established by the officer of the first arriving rescue. During the course of the fire, the IC was responsible for the accountability of, tracking of, and assigning timely reliefs of members assigned to twenty two PFD fire units, six PFD ALS rescue units, two North Providence Fire units, and four out of town ALS rescue units.

50 Providence Fire Department Incident Command System 1993
51 Providence Fire Department Incident Command System 1993
The lesson to share, from an objective review of the command structure for this fire event, is the need to establish additional intermediate command level positions to improve the overall safety and accountability of members operating at the scene. The IC should have considered assigning an Operations Chief. As well, the geographical area of the incident justified the establishment of two Division Chief positions, one Division Chief for control of activities in each of the two exposure buildings. The Division Chiefs could then assign sector officers for each floor of the exposure buildings improving direct supervision, accountability, and overall safety of members working in those buildings.

The review of the events of the Eaton Street fire, highlight the Providence Fire Department’s inability to fill ICS Command Staff, General Staff and intermediate command level positions with chief officers who have Fire Ground Command experience.

Historically chief officers of the department would promote up through the ranks. These chief officers would have had experience as Fire Lieutenants and Fire Captains. The Fire Captains would promote to Fire Battalion Chiefs (BC). The BC’s could promote to Deputy Assistant Chief (DAC) positions, and the DAC’s would move on to the Assistant Chief of the Department (ACOD) Staff positions, or Chief of the Department (COD).

Since 2008, the Providence Fire Department has moved to eliminate several Chief Officer Staff positions. The Fire Marshall and Director of the Division of Training were once Chief Officer positions. The duties of these positions have since been assigned to the Captains of those respective divisions. In 2010, a reorganization of the number of Chief Officer Line positions, eliminated a battalion chief position from each of the four platoons. Also since 2010, the Department Safety Officer position has been vacant. This position traditionally had been a Battalion Chief rank. In 2016, the Department was once again reorganized. The restructuring of the number of platoons eliminated two more Chief Officer Line positions (one DAC one BC).

More recently the unfilled COD, ACOD Operations, and the unfilled DAC Line positions have reduced the number of Providence Fire Department Chief Officers with fire ground command experience.
Historically, when the Department has had fires of the size and complexity of the Eaton Street fire, whether during the day or night, upon the occurrence of a multiple alarms the COD, ACOD, Fire Marshall, Director of Division of Training, Department Safety Officer, EMS BC, and Superintendent of Automotive Repair would respond to the scene of the alarm and carry out their assigned duties. The return of these chief officers to the multiple alarm fires provided the IC with chief officers, so that if the ICS command structure required, these chiefs could be assigned ICS Command Staff, ICS General Staff positions, or intermediate command level positions.

When objectively reviewing the events surrounding the injuries at the Eaton Street fire, discussion of the unfilled Department Safety Officer position cannot be overlooked. As mentioned above, this position has been left unfilled since 2010. Since 2012, four Department investigations and reports have been done because of fire events involving maydays, firefighter near miss events, and fires resulting in serious injuries to firefighters. Each of these previous reports has recommended the re-activation of the Department Safety Officer and Battalion 2 Chief Officer positions.

The intent of these recommendations was to improve overall firefighter safety. The Department Safety Officer position had been responsible for the management of Department Occupational Safety and Health program. The Department Safety officer maintained a thorough knowledge of current and changing Federal, State, and local laws regulating safety in the working environment, applicable to the fire department. The Safety Officer was responsible identifying, and causing the correction of, safety and health hazards. It was the Safety Officer’s responsibility to investigate all occupational injuries, illnesses, exposures and fatalities involving fire department personnel, and all accidents involving fire department vehicles, apparatus, equipment, and facilities. The Safety Officer managed the collection and analysis of the records and data pertaining to apparatus accidents, deaths, injuries, illnesses and exposures of fire department personnel. The Safety Officer responded to emergency incidents that involved a high

52 Providence Fire Department Rules and Regulations 1996
degree of risk to personnel, and integrated into the Providence Fire Department ICS to serve as the incident safety officer.

The repeated recommendation, for the re-establishment of the Battalion 2 Chief Officer Line position, to each working platoon was also intended to improve firefighter safety. The present structure of two Chief Officers per platoon makes each chief responsible the direct personal command, control and supervision over the personnel of fifteen companies assigned to each of the two battalions. Each chief is required to make monthly inspection of the quarters, and a daily inspection of personnel assigned to the battalion.\textsuperscript{53}

With the present organizational structure of two Chief Officers per platoon, one Chief Officer is responsible for nine companies during the initial stages of a fire incident. The first alarm for a structure fire is three engines, two ladders, one heavy rescue, one ALS rescue. Immediately following the dispatch of the first alarm companies, an engine and ladder is dispatched as the Fast Assist Search Team (FAST) companies. This brings the first alarm compliment to nine companies. The International Fire Service Training Association’s Chief Officer book states that the standard span of control for an incident commander is three to seven, with five being the optimal number for appropriate span of control.\textsuperscript{54} The Providence Fire Department ICS also states that this is the standard for span of control. Currently the second chief, if available, is being dispatched to fire incidents to assist with managing a fire incident leaving no supervisor for the remaining nineteen companies in the city.

The decimation of the Chief Officer positions, by past and present administrations, along with the unfilled existing chief officer positions has created a situation that prevents the Providence Fire Department from following command control procedures outlined in the Department’s Rules and Regulations, Incident Command System, and various Standard Operating Procedures. As stated previously lack of following standard operating guidelines was identified by research as a contributing factor to firefighter injuries.

\textsuperscript{53} Providence Fire Department \textit{Rules and Regulations} 1996

This fire event also highlighted the demands placed upon the Providence Fire Department Bureau of Operational Control (BOC) during emergency operations of this size. This event further demonstrated the challenges for the present on duty staffing levels of the BOC.

During the Eaton Street fire which required all available Providence Fire Department units, The BOC was coordinating the required mutual aid coverage throughout the remainder of the city, monitoring the primary dispatch radio channel, and continued to answer routine and emergency telephone call volume.

It was fortunate that the Eaton Street fire occurred during day time operations for the BOC. The Captain of the BOC, who normally works day time hours, stepped in to assist the normal on duty staff of one Fire Lieutenant and two civilian dispatchers to meet the demands of challenges faced by the BOC. In addition to personally assisting the on duty staff, the Captain of the BOC immediately recognized the need of additional staff. The Captain of the BOC ordered two civilian dispatchers to remain on duty, when their reliefs arrived for the change of shift.

Approximately two hours and thirty five minutes into the Eaton Street fire, the BOC began receiving phone calls for a second wind driven fire on Laurel Hill Avenue. The BOC was now monitoring two fire events, and simultaneously monitoring the radio channels assigned for each fire, and continuing to dispatch other calls out on the primary dispatch channel.

Conclusions

On March 31, 2016, the members of the Providence Fire Department were faced with a rapidly escalating wind driven fire scene, in a densely populated area of the city. The original wood framed fire building, which was surrounded by wood frame structures, was fully involved with fire and threatening adjacent buildings, requiring an adequate, rapid deployment of firefighting resources.

It was the training, dedication, and professionalism displayed that day, along with the rapid application of time tested aggressive interior structural firefighting strategies and tactics, that kept this fire from becoming major conflagration. The fire scene expanded to require all of
the 94 on duty members, fourteen engines, eight ladders, and seven rescues of the working shift to keep the fire from expanding beyond the three buildings that were on fire, when the Providence Fire Department arrived on scene. The fact that no additional buildings burned, is a testament to valiant work those members displayed.

The complexity of the cyanide issue continues to plague the Providence Fire Department. The continued exposure of department members reiterates the need to train and educate all ranks, all divisions, and all members of the dangers of cyanide in smoke. The message of the dangers of breathing smoke needs to be continual and repeated frequently. Firefighters, company officers, chief officers when performing risk versus benefit analysis need to understand that the risks of breathing smoke far outweigh any benefit of allowing members to do so.

It is incumbent upon each member, each company officer, and each chief officer not to breathe smoke or allow those they supervise to breathe smoke. When members allow themselves to breathe smoke they are performing a disservice to their family. When company officers allow the members of their company to breathe smoke, they also are performing a disservice to those member’s families. When chief officers allow their firefighters to breathe smoke, they too are performing a disservice to those member’s families.

The department should purchase cyanide detection equipment and develop and establish procedures for air monitoring of fire scenes following the immediate knock and control of fires.

The injuries sustained highlight the extreme physiological and psychological demands of firefighting. The injuries were the result of firefighters pushing their personal limitations, at the same time demonstrating their commitment to duty.

The extreme physiological and psychological demands of firefighting require personal commitment to, and adherence of, safe operating practices, and maintenance of personal levels of health, wellness, and fitness to combat the demands of firefighting.
The injuries sustained highlight the importance of strong leadership by company officers to ensure for the wellbeing of company members, and monitor those members for signs physical or emotional stress while in the performance of their duties.

The injuries sustained highlight the importance of chief officers ensuring standard operating procedures and safe operating practices are followed. These same chief officers need to ensure that during emergency operations that the mechanisms for accountability, tracking, and the rehabbing of members, are in place and being adhered to.

The injuries sustained highlight the necessity of the present administration to fill the now vacant chief officer staff positions, and chief officer line positions with fireground command experienced chiefs.

Lastly the elimination of the Battalion 2 Chief Officer positions in 2010, and the most recent reorganization of the platoon structure, of the Providence Fire Department, by the present administration, cannot be overlooked when examining the overexertion and fatigue related injuries sustained by department members at this event. The present work schedule does not provide adequate rest or recuperation for maintaining proper fitness, health, and wellness levels to meet the physiological and psychological demands of the job, and the present administration should reorganize the Department back to a four platoon structure.
Recommendations

Based upon the information gathered during the course of the investigation, the Investigation Committee recommends the following:

• Fill the vacant Chief of the Department position.

• Fill the presently vacant Chief Officer Administrative Staff positions with fire ground command experienced Chief Officers.

• Fill the vacant Deputy Assistant Chief Positions.

• Re-activate Battalion 2.

• Re-activate the Department Safety Officer Position.

• The Providence Fire Department should reorganize back to a four platoon system.
• The Providence Fire Department should increase staffing on all engines and ladder companies to four firefighters to meet the minimum requirements of the National Fire Protection Association (NFPA) 1710.

• Update and revise annually Department Standard Operating Procedures.

• Establish procedures for air monitoring practices for fire scenes.

Appendix A
## Firefighter Injuries that occurred at 41 Eaton Street

<table>
<thead>
<tr>
<th>Rank</th>
<th>Type Injury Transported for</th>
<th>Treated for Cyanide Poisoning</th>
<th>Location Company Worked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firefighter</td>
<td>Fatigue, Dizziness, Back</td>
<td></td>
<td>Exposure 2,4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Back, Overexertion</td>
<td></td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Eye Injury</td>
<td>X</td>
<td>Sector 3 Exterior, Exposure 4</td>
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<tr>
<td>Firefighter</td>
<td>Back</td>
<td></td>
<td>Exposure 2</td>
</tr>
<tr>
<td>Captain</td>
<td>Knee</td>
<td>X</td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Captain</td>
<td>Back</td>
<td></td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Arm, Shoulder</td>
<td></td>
<td>Exposure 2</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Arm</td>
<td></td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Captain</td>
<td>Hand, Fracture</td>
<td></td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Exhaustion</td>
<td></td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Hand, Burn</td>
<td></td>
<td>Exposure 2</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Fatigue, Exhaustion</td>
<td>X</td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Abdominal Pain</td>
<td>X</td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Unstable Vital Signs</td>
<td></td>
<td>Exposure 4</td>
</tr>
</tbody>
</table>

## Firefighters injuries that occurred at Laurel Hill Ave.

- Firefighter: Back
- Lieutenant: Back
- Firefighter: Back

## Firefighters treated one day later after 41 Eaton Street

<table>
<thead>
<tr>
<th>Rank</th>
<th>Type Injury Transported for</th>
<th>Treated for Cyanide Poisoning</th>
<th>Location Company Worked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firefighter</td>
<td>Fatigue, Exhaustion</td>
<td>X</td>
<td>Exposure 4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Fatigue, Exhaustion</td>
<td>X</td>
<td>Side 1 Exterior Exposure 4</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Fatigue, Exhaustion</td>
<td>X</td>
<td>Exposure 2</td>
</tr>
<tr>
<td>Lieutenant</td>
<td>Fatigue, Dehydration</td>
<td>X</td>
<td>Exposure 2</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Fatigue, Exhaustion</td>
<td>X</td>
<td>Exposure 2</td>
</tr>
<tr>
<td>Firefighter</td>
<td>Fatigue, Exhaustion</td>
<td>X</td>
<td>Exposure 4</td>
</tr>
</tbody>
</table>

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