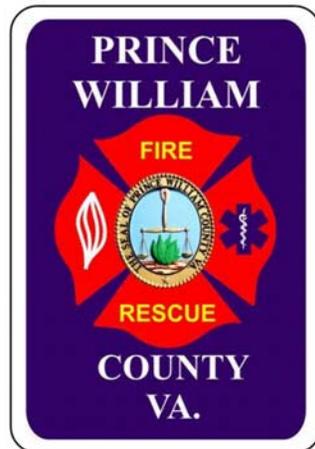


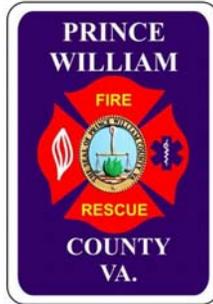
**Prince William County  
Department of Fire and Rescue**

**Line of Duty Death  
Investigative Report**

**Technician I Kyle Wilson**



**15474 Marsh Overlook Structure Fire  
April 16, 2007**



# Prince William County Department of Fire and Rescue

## Line of Duty Death Investigative Report

Technician I Kyle Wilson



**15474 Marsh Overlook Structure Fire  
April 16, 2007**

**Technician I  
Kyle Robert Wilson**



Kyle Robert Wilson became a firefighter to save the lives of others. He died in the line of duty on Monday, April 16, 2007, while performing a primary search at a house fire in Woodbridge, Virginia. He was 24 years old.

Kyle was born in Olney, Maryland on May 25, 1982 and grew up in Prince William County, Virginia. He graduated from C.D. Hylton High School in 2000 and then went on to graduate from George Mason University in 2005 with a degree in athletic training. Kyle was an avid baseball player and during his high school years was awarded the Most Valuable Defensive Player Award. He continued to play ball even after high school and was a member of two adult softball leagues in Prince William County.

Kyle joined the Prince William County Department of Fire and Rescue on January 23, 2006 and graduated from the County's Training Academy on June 23, 2006. After graduation, he was assigned to Station 12 on Engine 512. He quickly became a great contributor to Station 12's team. Kyle rapidly progressed through his probationary manual and upon successful completion, began to further his training and was gaining experience on the various other units within Station 12.

Kyle was an ultimate performer. He did everything with drive and determination. Whether he was on the baseball field or on fire apparatus, he was totally committed to the team and the goal. Kyle deeply loved his family and fiancée, and was dedicated to both his family and friends. Everyone who knew Kyle will remember his warm smile, kind heart and sensitive yet fun-loving personality. He will always remain a hero to all he touched, and his sacrifice will never be forgotten.





Kevin J. McGee  
Chief

## COUNTY OF PRINCE WILLIAM

1 County Complex Court (MC470), Prince William, Virginia 22192-9201  
(703) 792-6800 Metro 631-1703, Ext. 6800, FAX 792-7691

## DEPARTMENT OF FIRE & RESCUE

April 16, 2007 was a tragic day in Prince William County. Technician I Kyle R. Wilson died in the line of duty and was the first line of duty death in the 41 year history of the Prince William County Department of Fire and Rescue. The loss of Technician I Wilson has dramatically affected all of the fire and rescue providers in Prince William County.

For eight months a dedicated team of Department personnel consisting of Battalion Chief Jennie Collins, Battalion Chief Jerry Shepherd, Captain Rob Clemons, Captain Brian Cooke and Lieutenant Ramon Perez; Division Chief Richie Bowers from Montgomery County, MD Fire and Rescue Service and Battalion Chief Danny Gray from Fairfax County, VA Department of Fire and Rescue, meticulously reviewed every aspect of this incident so that we can apply what was learned to create recommendations that will improve service and lower the risk to firefighters in an inherently dangerous job.

This is the most comprehensive after action analysis performed in the history of the Department of Fire and Rescue. Many positive efforts were performed by response personnel during that fateful incident and those efforts are recognized by the leadership of our Department. The goal of this report is to ensure the loss of Technician I Wilson was not in vain, and we are committed to sharing our findings in the hope of preventing the loss of another firefighter.

There are two key issues to emphasize for the consideration of all firefighters. First, the impact the wind had on this event was significant. While weather conditions, and specifically wind, are often discussed in the firefighting environment of wild land fires, it does not receive the same attention and consideration in structure fires. This incident showed the dramatic and devastating effect the wind can have on the spread of fire in a building. The wind forced the fire into the building and caused the sudden change in fire conditions inside, including the "blowtorch" effect witnessed by the crews on the scene. The Line of Duty Death Investigation Team identified other structure fires, with firefighter fatalities, where the wind impacted events. We need to ensure size up and situational awareness accounts for the effects wind will have on a fire, even a fire inside of a building.

The second key issue was how lightweight building construction and materials impacted the fire spread. When fires start on the inside of a structure, interior walls constructed with gypsum board drywall aid in the protection of the structural support components and delay the devastating impact that fire can have on the structural components. The life safety protection of occupants and the protection of structural integrity can be vastly improved and fire spread can be further delayed with the use of fire suppression

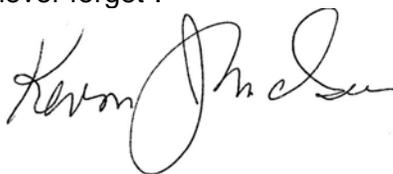


systems, such as residential sprinkler systems. There is a disturbing trend emerging which is the increase of fires that are originating on a structure's exterior. Exterior fires spread rapidly on commonly used building construction materials. The exterior fires attack the structural support components, as there are no protective coverings to delay the fire spread. At the Marsh Overlook incident, there were no protective elements in place to stop the exterior fire from directly impinging and weakening the structural components. Lightweight building construction fires are dangerous to firefighters and in this case, deadly. The fire and rescue profession must continue to re-evaluate the operational approach to fires involving lightweight building construction.

As a result of this tragic incident, there have been initiatives implemented which may not be fully reflected in this report's discussions and recommendations. The Line of Duty Death Investigation Team has focused on determining and validating the facts of the incident and was not expected to document changes that were simultaneously occurring within the Department and system. So while reading this report, please keep in mind that the recommendations were based on the operating environment that existed on April 16, 2007, and further, that our Department and the Fire and Rescue Association continue to advance our service in areas that we believe should be improved without waiting on this report for findings and recommendations. In partnership with the Fire and Rescue Association, I will consider all recommendations included in this report and will establish priorities and focus areas for further improvements.

I recognize the many heroic efforts of the firefighters that placed themselves directly in harms way under intense and extremely dangerous conditions in their repeated attempts to rescue Technician I Wilson. These firefighters were willing to sacrifice their own lives to save Technician I Wilson, and I will always be grateful to them. We were fortunate that additional firefighters did not suffer injuries during the extreme fire conditions experienced in this incident. As Chief, I could not have asked for, nor expected, our personnel to have tried any harder or done more in their personal and physical expenditure of effort, energy, and attempts to rescue Technician I Wilson.

Technician I Kyle Robert Wilson will always be recognized as a hero. I have dedicated all initiatives and accomplishments within the Department during my first year as Chief to the memory and honor of Kyle. As the bottom of each page in this report states, "we will never forget".



Kevin J. McGee  
Chief



## Executive Summary

This Line of Duty Death (LODD) Investigative Report is dedicated to Technician I Kyle Wilson, his parents Bob and Sue Wilson, his sister Kelli, his brother Chris, his fiancée Kristi, and his extended family and many friends. Kyle will never be forgotten and to honor his supreme sacrifice, the Prince William County Department of Fire and Rescue commits to sharing our lessons learned in all aspects of this report within our department, system, region, and industry so that no other family or department suffer a similar tragic loss.

This report was developed with a multi-dimensional team approach. The objectives of the LODD Investigation Team were to examine the events that occurred at the Marsh Overlook fire incident and identify the factors involved with the line of duty death of Technician I Kyle Wilson. The Investigation Team has reviewed all available information at the time of publication and documented the factual findings, discussions, and recommendations in an effort to prevent another tragic outcome from occurring again.

Virginia Occupational Safety and Health (VOSH) and the National Institute for Occupational Safety and Health (NIOSH) performed independent investigations of the Marsh Overlook fire incident. The Prince William County Department of Fire and Rescue's LODD Investigation Team's report took a dissecting approach from every aspect which reaches beyond the scope of the VOSH or NIOSH reports. To prevent another tragic event, a critical self assessment of the organization was necessary. This report represents thousands of hours of effort to analyze fire and rescue operations and recommend needed improvements. These organizational improvements range in complexity and many will have budgetary impacts that will be impossible to achieve in a single fiscal year. However, the report provides a framework for improvements that when enacted will improve responder safety and elevate service delivery to the citizens and visitors of Prince William County.

The LODD Investigation Team had the advantage of examining this incident over a period of months. The team would spend days dissecting a single snapshot of time and considering what actions were taken and what the resulting impacts were. However, this is starkly contrasted by the actual incident the responding personnel faced on that fateful day. The Marsh Overlook incident was an immense fire fueled by extremely flammable building material products and a vicious wind. It was an environment where information gathering and decision making had to be performed in a time measurement of seconds. During the chain of events that occurred and under severe circumstances, fire and rescue personnel performed at exceptional levels. In an attempt to rescue Technician I Kyle Wilson, personnel displayed heroic efforts and jeopardized their own safety to try and reach their missing comrade.



The major factors in Technician Wilson's line of duty death were determined to be:

- Initial arriving fire suppression force
- Size up of fire development and spread
- High wind impact on fire development and spread
- Structure size, lightweight building construction and materials
- Rapid intervention and firefighter rescue efforts
- Incident control and management

The fire conditions that were present in the structure, the large size and lightweight building construction of the structure, the behavior of the fire impacted by the high wind environment, and the organizational preparation for and response to the incident were contributing factors in this tragic event. The weather conditions and construction features resulted in the rapid and catastrophic progression of fire conditions and the loss of integrity to the building. The conditions of the fire cannot be changed but this incident investigation shows organizational response to similar incidents can and should be improved. Resulting from this tragic incident and the dissecting analysis that followed, the Department will be improving numerous aspects of their operations centered on staffing, training, procedures, and communications.

We will never forget Kyle and by sharing our loss and knowledge unfortunately gained from our pain, we will ensure that he is not forgotten nor will his sacrifice have been in vain.

To Technician I Kyle Wilson, may you rest in peace. May your family, both immediate and fire and rescue, also find peace.



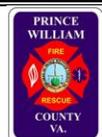
## Report Format

This document is a comprehensive technical report regarding the fire and rescue services within Prince William County and focuses on a single tragic incident. The Line of Duty Death Investigative Report is organized into sections which begin with an incident summary, followed by detailed incident information, and include comprehensive findings, discussions and recommendations for major issues. There are several appendices which include a glossary, reconstructed time line, as well as other supporting documentation.



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# Acknowledgements

## **Acknowledgements**

The Prince William County Department of Fire and Rescue wishes to thank the following individuals for all their effort and dedication through the difficult process of examining the circumstances involved in Technician I Kyle Wilson's line of duty death. Technician I Wilson was the first line of duty death in the 41 year history of the Prince William County Department of Fire and Rescue. By sharing this report it is the Department's goal to educate all first responders.

### **Investigation Team Members:**

Battalion Chief Jennie L. Collins, Team Leader  
Prince William County Department of Fire and Rescue  
EMS Operations/Health and Safety

Battalion Chief Jerry A. Shepherd  
Prince William County Department of Fire and Rescue  
Training Division

Captain Rob Clemons  
Prince William County Department of Fire and Rescue  
Health and Safety

Captain Brian Cooke  
Prince William County Department of Fire and Rescue  
Prince William Professional Firefighters  
Local 2598 Representative

Technician II Ramon Perez, Jr.  
(promoted to Lieutenant June 16, 2007)  
Prince William County Department of Fire and Rescue  
Operations Section Field Representative

Division Chief Richard Bowers  
Montgomery County Fire and Rescue Service  
Division of Wellness, Safety and Training  
Rockville, Maryland

Battalion Chief Daniel Gray  
Fairfax County Fire and Rescue Department  
Safety and Personnel Services  
Fairfax, Virginia

### *Recorder:*

Administrative Support Assistant III Darlene Hodge  
Prince William County Department of Fire and Rescue  
Management Services Section



**Assisted by:**

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Captain Tim Taylor  
Lieutenant Mark Dinsmore  
Lieutenant David Doehler  
Lieutenant Tim Hattwick

Prince William County Office of Public Safety Communications  
Captain Ted McInteer  
Operations Manager Sheila Ragan

Prince William County Attorney's Office  
Deputy County Attorney Angela Horan

Prince William County Risk Management Office  
Risk Management Division Chief Lori Gray

***The team would like to recognize the following individuals for their support, efforts and contributions to the team members:***

Prince William County Government – County Executive Craig Gerhart and his staff

Prince William County Department of Fire and Rescue – Chief Mary Beth Michos (retired October 1, 2007), Assistant Chief Brett Bowman, Assistant Chief Hadden Culp, Assistant Chief Kevin McGee (promoted to Chief October 1, 2007) and staff

Montgomery County Fire and Rescue Service – Fire Chief Thomas W. Carr, Jr.

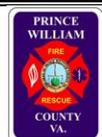
Fairfax County Fire and Rescue Department – Interim Fire Chief David Rohr and Fire Chief Ronald Mastin

Prince William County Police Department – Chief Charlie Deane and staff

**Special Acknowledgement:**

Prince William County Department of Fire and Rescue

- To all the Department personnel from all the divisions who took on additional duties so the Department's Investigation Team members could focus on this investigative report, and to all the station personnel who provided the team with valuable information during their interviews and requests.
- Lieutenant Erik McCoy
- Technician I David Weese
- Battalion Chief Steve Kersse
- David Simms



- Katherine Good
- Battalion Chief Dale McCleese
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- Chris Bizjak and the entire Breathing Apparatus Services Shop staff
- Susan Sablinski
- Lori Counts and the entire Management Services staff

Prince William County Police Department – Identification Bureau, Crime Scene Unit

- 1<sup>st</sup> Sergeant Ross Randlett
- Crime Scene Analyst Erich Junger
- Crime Scene Specialist Emily Rancourt
- Crime Scene Analyst Kenneth Werner
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Prince William County Risk Management Office

- David Wenzel

Prince William County Service Authority

- Tom Robinson
- Gerry Turner
- Scott Hartman

Montgomery County Fire and Rescue Service

- Public Information Officer Pete Piringer
- Assistant Chief Michael Donahue
- Senior Fire Protection Engineer Rick E. Merck
- Lieutenant Inspector Matthew Carrigan
- Master Firefighter/Inspector Joe Simpson
- Fire Protection Engineer Tyler Mosman
- Fire Protection Engineer S. Marie LaBaw
- Fire Protection Engineer Patsy Warnick
- Fire Protection Engineer Intern Adam St. John

NIOSH Personal Protective Technology Laboratory

- Vance Kochenderfer

International Personal Protection, Incorporated

- Jeff Stull

Mine Safety Appliance (MSA) Company

- Jeff Gutshall
- Julian Möller
- Mike Rupert



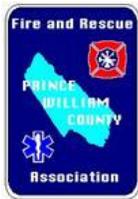
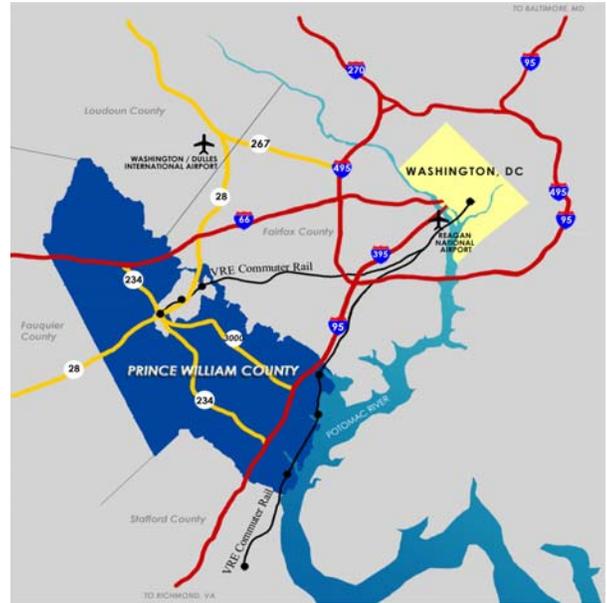
# **Overview of Fire and Rescue Services**

## Fire and Rescue Service Overview

### Prince William County, Virginia

Prince William County is a rapidly developing urban, suburban and rural community located 35 miles southwest of Washington, D.C. The County encompasses 348 square miles with two independent cities, a Marine Corps base, and two National Parks. The current population is estimated at 381,221.

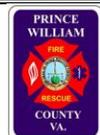
Prince William County's fire and rescue services are provided by a combination career and volunteer system. The career Department of Fire and Rescue and twelve independent volunteer fire and rescue organizations make up the fire and rescue service where collectively they work together to staff 19 fire stations 24 hours a day, seven days a week. In Fiscal Year 2007, Fire and Rescue responded to 38,638 incidents which encompassed an estimated 84,000 unit responses.



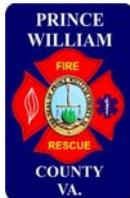
### Fire and Rescue Association

The Fire and Rescue Association consists of the Department of Fire and Rescue and each volunteer fire, rescue, or fire and rescue company lawfully established and organized in the County. The Chief of the Department of Fire and Rescue serves as chairman of the Fire and Rescue Association. The Fire and Rescue Association's Board of Directors consists of the Department's next senior ranking uniformed officer and one uniformed employee below the rank of lieutenant, along with the chiefs of each volunteer company. Including the chairman, there are 15 members on the Board of Directors.

The Fire and Rescue Association is the governing body of all fire and rescue services in the County. It provides for the administration and coordination of all these services. It makes recommendations as to the boundaries of any fire and rescue service areas and evaluates the overall facility, equipment, and budgetary needs of the total fire and rescue system. The Fire and Rescue Association formulates policies, standards and guidelines for the location, design, and construction of new stations, and the acquisition and disposition of apparatus. The County's Capital Improvement Program identifies investments to construct



new fire stations and renovate existing fire stations to improve fire and rescue response times. Historically, once a station is completed, the individual volunteer company manages it. While the Fire and Rescue Association is responsible for the overall facility and equipment needs, the volunteer departments maintain autonomy and routinely exceed the base standards established by the Fire and Rescue Association thereby customizing their stations, apparatus, and equipment.



## Department of Fire and Rescue

At the time of the Marsh Overlook incident, the Department of Fire and Rescue was led by Chief Mary Beth Michos. Chief Michos retired October 1, 2007, and the Department is currently led by Chief Kevin McGee. The Prince William County Department of Fire & Rescue is a dynamic organization that is rapidly expanding to meet the needs of the citizens and visitors of Prince William County. The 450 plus men and women of the Department of Fire and Rescue, in partnership with the Fire and Rescue Association, staff 19 fire and rescue stations. The Department has a relatively small fleet of apparatus consisting mainly of advanced life support units, training apparatus, and staff vehicles. The majority of the stations have volunteer owned apparatus that are staffed and operated by career personnel. The Department provides staffing for administrative sections, a training center, logistics/supply warehouse, Candidate Physical Ability Test (CPAT) center, and a Self Contained Breathing Apparatus (SCBA) repair and maintenance facility. The highly-trained staff is assigned to one of four divisions to support the Department's goals which support the County's Strategic Plan.

### Office of the Chief

Staff in this section coordinates the long range fire and rescue service strategic plan, Department performance measures, data development and reporting for local, regional, state and national projects and programs.

### Operations

The Operations Section is responsible for the provision of emergency and non-emergency services to protect lives, property, and the environment, as well as offering humanitarian assistance. Staff responds to calls for assistance during all emergency situations: accidental, natural, or manmade. The Operations Section provides the full realm of service for calls ranging from basic and advanced pre-hospital emergency medical life support, fire suppression, hazardous materials incidents, and technical rescues (i.e. vehicle extrications, rope rescue, etc.). The minimal staffing responsibility at any of the stations is a Monday through Friday,



12-hour shift (0600 – 1800). Some stations have 24-hour career personnel assigned to them.

The Operations Section is divided into five areas. Four of the areas are organized into geographic sectors called battalions which encompass the supervision of station level personnel across the nineteen station locations and provides for incident command. The fifth area is a specialty branch responsible for the coordination and management of system wide emergency medical services (EMS) components and health and safety initiatives. This area provides for the appropriate training, supervision, procedures, policies, program support and review to achieve specific EMS and health and safety objectives in all functions and activities.

Operations Section personnel also assist the Community Relations staff in the delivery of prevention and life safety education programs/activities to Prince William County residents, businesses, and visitors. In addition, they assist the Fire Marshal's Office with inspections of the commercial properties within the County.

### **System Support**

System Support is made up of numerous sections that include Human Resources, Logistics/Communications, Management Services, and Planning and Information Group. Human Resources includes training and personnel services. The Training Section is responsible for the planning, coordinating, and delivery of all emergency service training for both career and volunteer members in compliance with state and national standards. The Personnel Section is responsible for planning and coordinating the recruitment and selection of uniform and non-uniform positions with the Department of Fire and Rescue. They assist with the management of promotional processes and provide liaison with the County Attorney and County Human Resources concerning personnel issues.

Logistics/Communications delivers a comprehensive support system to the Department of Fire and Rescue and the Fire and Rescue Association. Logistics support functions include operating the centralized supply warehouse, providing short and long-term emergency incident support with facilities, equipment, supplies and provisions, and overseeing the respiratory protection maintenance and testing program. The Communications functional responsibility is to provide a fire and rescue technical advisor capacity in the Public Safety Communications Center.

Management Services provides administrative, accounting, and budget support to the Department of Fire and Rescue as well as to the Fire and Rescue Association.



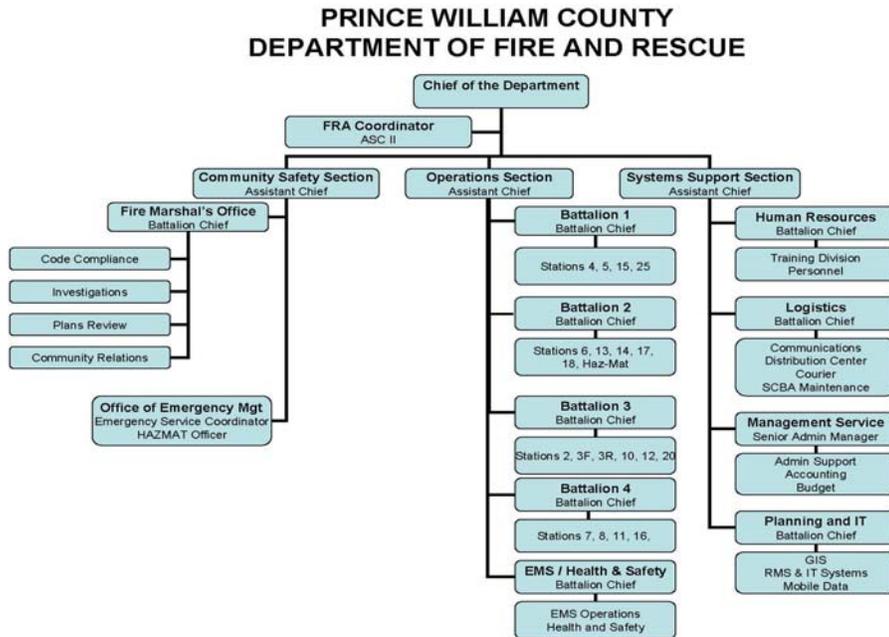
The Planning and Information Group is responsible for research, project management, data collection and analysis in support of the Department of Fire and Rescue and the Fire and Rescue Association. The group's work encompasses projects that include strategic planning, station and unit deployment, capital improvement projects, geographic information system, records management systems, mobile data computers, EMS field reporting, and information technology systems support.

### Community Safety

Community Safety is made up of numerous sections that include the Fire Marshal's Office, Office of Emergency Management and Community Relations. The Fire Marshal's Office staff investigates the origin and cause of fires and explosions and conducts criminal investigations of arsons. Staff also inspects commercial properties and new construction sites to ensure compliance with fire codes. They also review building, fire suppression, and alarm system plans.

The Office of Emergency Management manages and maintains the Hazardous Materials Program, coordinates Local Emergency Planning Commission (LEPC) efforts and provides technical support to emergency response operations. The Office of Emergency Management develops, maintains, and exercises disaster plans in accordance with federal laws and regulations.

Community Relations staff coordinate public education activities related to fire and rescue injury prevention in the community. The Public Information Officer handles press releases and coordinates media interaction with the Department.





## Office of Public Safety Communications

The Office of Public Safety Communications is a separate entity and provides for the command, control, and information support services that are needed by fire and rescue services and the police department. OPSC telecommunicators answer 911 and non-emergency public safety calls and dispatch fire, rescue, emergency medical services (EMS), police, and animal control services for Prince William County, the towns of Dumfries, Haymarket, Occoquan, and Quantico. The main objective of the Office of Public Safety Communications is to facilitate the flow of information in a seamless and rapid manner and to provide aid, comfort, and instructions to the public prior to the arrival of police or fire and rescue field resources. The Office of Public Safety Communications personnel track each incident and process updated information as a situation progresses.

The Chief of the Department of Fire & Rescue and the Chief of Police make up the Joint Policy Authority. Each chief has equal authority in the administrative and managerial oversight of the Office of Public Safety Communications. Each chief has areas of responsibility reserved solely for that chief as required by State law and County ordinances. The Fire and Rescue Chief retains sole authority for the Office of Emergency Services, Emergency Medical Dispatch (EMD), and the Fire and Rescue Dispatch policy. The Department of Fire and Rescue provides a technical advisor (uniformed officer) in the Office of Public Safety Communications Center on a 24-hour, 7-day a week basis to ensure oversight and coordination of fire and rescue resources.



# **I n c i d e n t**

# **S u m m a r y**

## Incident Summary

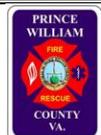
On April 16, 2007, the Prince William County region experienced a severe north eastern storm which was moving off the Atlantic coast. Rain had stopped falling the previous day, but Prince William County was experiencing significant sustained winds of 20 – 30 miles per hour with gusts up to 45 plus miles per hour.

At 0601 hours, the Prince William Office of Public Safety Communications (OPSC) began receiving 911 calls for a house fire in Company 512's first due response area. The first caller reported the structure fire but the exact location of the street address was unknown. A second 911 call was received at 0602 hours with a specific address location reported as next to 15492 Marsh Overlook Drive. The incident was dispatched at 0603 and the initial alarm assignment included Wagon 512, Engine 510, Engine 520, Tower 512, Ambulance 510-A, Medic 512-C, and Battalion 503. Rescue 510 and Safety 502 added themselves to the incident dispatch. The exact location of the fire incident was 15474 Marsh Overlook Drive.

Wagon 512 was the first unit to arrive on the scene at 0608 hours and reported heavy fire showing on Sides B and C of a two story single family home. Tower 512 arrived right behind Wagon 512. Both Wagon and Tower 512 officers independently performed a size up of the structure and met on Side A of the structure to establish an initial incident action plan. During their size up, a minivan was observed in the driveway as well as cars on the street in front of the house. There were no interior lights on in the house and given the early morning time period, an occupant rescue situation was suspected. Due to the potential rescue situation, a second alarm assignment was quickly requested by Wagon 512's officer.

The initial incident action plan included Wagon 512's crew advancing a 2 ½ inch hose line for interior fire attack and Tower 512's crew performing a primary search. Both crews planned to proceed to the second floor to accomplish a search of the bedroom areas first. Interior conditions on the first floor were reported as light smoke with no heat. Tower 512's officer reported seeing fire on the house's exterior at the B/C corner. The interior windows were still intact and viewed by the Tower officer from the foyer area on the first floor.

Upon ascending the foyer stairs to the second floor, Tower 512's inside crew encountered smoke banked down approximately three to four feet from the ceiling. Technician I Kyle Wilson and the Tower officer were in the process of performing a right hand primary search of the master bedroom when conditions on the second floor rapidly deteriorated and changed to thick black smoke, zero visibility, and high heat conditions. Reacting to the change in conditions, the Tower crew began to evacuate the bedroom area to exit the structure. Intense



fire and extreme heat rapidly moved down the hallway from Side B toward the master bedroom.

Tower 512's officer stated that while in the master bedroom verbal communications with Technician Wilson were maintained during the rapid fire and heat development. The officer reported that Technician Wilson indicated he was behind his officer as the officer attempted to locate the bedroom door. The officer crawled into the hallway and became entangled with a table. The entanglement caused the officer to fall down approximately five to six stairs to the curve of the interior staircase. The Tower officer immediately called back for Technician Wilson who indicated he was having difficulty locating the stairs.

Simultaneously, Wagon 512's crew experienced the rapidly changing conditions at the front door area and encountered thick black smoke and a ball of fire that was reported to have pushed out the front door. Wagon 512's officer called to the Tower crew to leave the structure. The Wagon officer heard noises that the officer believed were the interior stairs collapsing. Wagon 512's officer reacted to the noise and informed Command that the stairs had burned out, with a crew upstairs, and ordered an evacuation of the structure.

Wagon 512's crew and Rescue 510's interior crew were at the front door when they observed a white helmet appear in a ball of fire in the staircase and foyer area. The crews reached in to that area and located Tower 512's officer and quickly removed the officer to the front yard. Tower 512's officer reported that Technician Wilson was still on the second floor and believed to be in or near the staircase.

Rescue 510's officer transmitted a mayday radio report about the missing firefighter:

*“Rescue 510 officer to, mayday, mayday, mayday, Tower 512 is missing one firefighter; we have a firefighter missing, in the stairwell.”*

This was immediately followed by a mayday transmission from Technician Wilson stating:

*“Mayday, mayday, mayday, Tower 512 bucket, I'm trapped inside, I don't know where I am, I'm somewhere in the stairwell, I need someone to come get me out.”*

In a rescue attempt, crews reentered the structure. The first floor area around the staircase, the staircase, and the second floor hallway area were heavily involved in fire. Crews attempted to protect the staircase with hose lines operating from the foyer area. Despite the intense heat and fire conditions, crews made multiple attempts to ascend the staircase to the second floor to



locate Technician Wilson while the hose lines operated from the foyer area. During the multiple attempts in these extreme conditions, crews reached the second floor landing area twice where Technician Wilson was reported to have been but were not able to locate him. A partial collapse of the ceiling and roof structure in Quadrants Charlie/Delta occurred and extremely intense fire conditions forced crews back down the stairs. Safety 502 observed the deteriorating conditions from the exterior and issued an emergency evacuation and all crews were ordered out of the structure by Command.

Crews worked to bring the fire under control, reentered the structure, and an extensive search was initiated for the missing firefighter. Several areas of the first and second floors had been burned through and the entire stability of the structure was of concern.

Tower 512's officer received partial thickness burns to both ears and the tip of an index finger. The officer was treated and released from the emergency department without hospitalization.

Crews located Technician Wilson in the master bedroom. Technician Wilson's body was transported to the Virginia Department of Health's Medical Examiner's office. The cause of the line of duty death to Technician Wilson was determined to be thermal and inhalation injuries.



# Incident Information

## Incident Information

### Dispatch Information

Date: April 16, 2007  
 Dispatch Time: 0603 hours  
 Incident Number: 07010980  
 Incident Address: 15474 Marsh Overlook Drive, Woodbridge, VA 22191  
 Box Number: 1209

#### First Alarm Units 0603 hrs:

Unit
Wagon 512
Engine 510
Engine 520
Tower 512
Medic 512-C
Ambulance 510-A
Battalion 503

#### Second Alarm Units 0611 hrs:

Unit
Wagon 502
Engine 513
Engine 517
Tower 513
Rescue 504
Medic 552
Battalion 502
AIR 512 <sup>1</sup>
Rehab 520 <sup>2</sup>
Ambulance 515 <sup>3</sup>

#### Third Alarm Units 0634 hrs:

Unit
Engine 518
Wagon 520
Engine 531
Truck 511
Medic 553
Battalion 502-1
Ambulance 515 <sup>3</sup>

#### Self Dispatched:

Unit
Rescue 510
Safety 502

#### Self Dispatched:

Unit
Safety 503

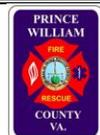
<sup>1</sup> AIR 512 was not staffed. The unit responded with volunteer staffing.

<sup>2</sup> Rehab 520 was not staffed. The unit responded with volunteer staffing.

<sup>3</sup> Ambulance 515 was dispatched but was placed in service due to the extended distance it would respond from (stationed at the opposite end of the County).

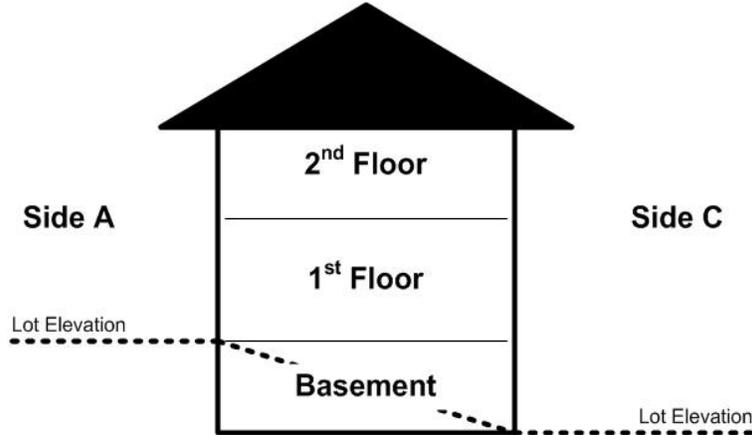
#### Additional units on the Incident:

Unit	Unit	Unit
Planning 501	FM 500	FM 522
Operations 500	FM 501	Command 503
Chief 500	FM 503	Brush 512
Asst Chief 514	FM 512	Chaplain 504
Captain 512	FM 516	Chaplain 505
EMS Operations 501	Wagon 510	Training 504
Safety 501	FM 520	PW1 (County Executive)
Safety 504	FM 521	





The following diagram is a side view of the structure to clearly define the terms to describe the floor levels:



The structure involved in this incident was a single family residence located in the Dawson Landing Subdivision situated in the eastern portion of Prince William County. The structure was a two-story colonial that was built in 2002 and was equipped with smoke detectors but did not have a residential sprinkler system. In 2005, the unfinished basement of the structure was fully finished to include a bedroom, full bathroom, living space, and office. The ground level walk out basement had a sliding glass door located in the middle of Side C. This structure had two floors in the front (Side A) and three floors in the rear (Side C). There was an attached two car front loading garage located at the A/D corner.

The colonial style home had a two story center foyer. Access to the first floor areas could be gained by going in either direction of the foyer entry. The home consisted of three staircases, two of which were accessible from the foyer, one leading to the basement and the other to the second floor. The third staircase was located in the two story family room (Quadrant Charlie) that ascended to the second floor near the master bedroom. The structure contained eleven rooms on the first and second floors.

The structure had an approximate 700 square foot deck on Side C with accessibility from the single kitchen door, double doors off the sun room, or by the deck's staircase located near the B/C corner. Positioned under the deck was a brick paver patio. Built on top of the pavers and under a portion of the deck was a shed constructed with plywood walls and a corrugated roof material. Items reported to have been in the shed at the time of the fire included lawn and garden equipment, bags of fertilizer, and a relatively small amount of flammable liquids (gasoline). The shed was equipped with a fluorescent light that was powered by an outdoor extension cord that was spliced together to extend the reach of the cord to an exterior outlet located beside the kitchen door (second floor).

The overall building dimensions were 48.5 feet wide by 68.6 feet long. The first two floors contained approximately three thousand nine hundred eighty two square feet (3,982) of space. The basement square footage was two thousand one hundred thirty-eight (2,138) square feet and the garage was four hundred eighty eight (488) square feet, bringing the structure's approximate total square footage to six thousand one hundred twenty (6,120) square feet.

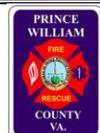
The building was constructed of Type V light weight residential structural members with a brick veneer front with vinyl siding on the remaining three sides.

The exterior load bearing wall profile from exterior to interior is described below:

<p style="text-align: center;">Vinyl siding</p> <p>0.106 inch Energy Brace Insulative Sheathing</p> <p style="text-align: center;">Fiberglass insulation</p> <p style="text-align: center;">5 mil vapor barrier (plastic sheathing)</p> <p style="text-align: center;"><u>Wall framing:</u></p> <p>First floor exterior load bearing wall studs were 2x6 Second floor exterior load bearing wall studs were 2x4</p> <p style="text-align: center;">½ inch gypsum wall board (dry wall)</p>	
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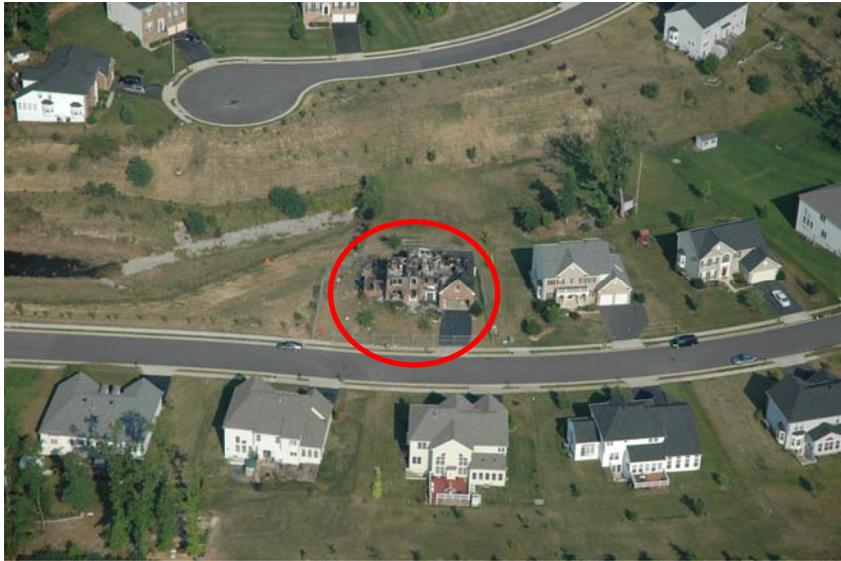
The roof profile from exterior to interior is described below:

<p>Fiberglass shingles</p> <p>Underlayment</p> <p>7/16 inch Weyerhaeuser Structurwood® Sheathing</p> <p>Fiberglass insulation</p> <p style="text-align: center;"><u>Roof framing:</u></p> <p>2-story Family Room Area – Engineered I-beams; Eat-in Kitchen Area – Solid Wood 2x12; Remaining Areas – 2x4 Trusses</p> <p style="text-align: center;">½ inch gypsum wall board (dry wall)</p>	
	
2x4 Trusses	Engineered I-beams



The positioning of the structure on the street placed it with a similar style house located to the right (Exposure David). A storm water retention pond was located to the left of the structure. The back yard was not fenced and the topography included a downhill grade away from the house with the slope ending in a storm water management easement. There were no other immediate exposures to the structure.

The picture below is an aerial view of the Marsh Overlook house and adjacent areas:



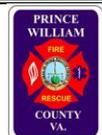
**15474 Marsh Overlook Drive**

**Weather**

The summary of the weather conditions were reported from a weather station located at Quantico, Virginia which is approximately seven miles from the incident location.

At the time of the incident (0601 hours), the weather conditions were overcast and cool with no precipitation. The temperature was approximately 45° Fahrenheit. Sustained winds during this time were from the northwest and averaged 23.5 mph. The wind gusts averaged 42 mph with a peak gust of 48 mph.

<b>Time</b>	<b>Temperature</b>	<b>Wind Direction</b>	<b>Wind Speed</b>	<b>Wind Gust/Time</b>
6:00am	45° Fahrenheit	NW	25 mph	38 mph at 6:09am
6:19am	45° Fahrenheit	NW	25 mph	48 mph at 6:19am
7:00am	45° Fahrenheit	NW	25 mph	39 mph at 7:19am



There was a wind advisory issued for Sunday, April 15<sup>th</sup> starting at 2000 hours until 0200 hours Tuesday, April 17<sup>th</sup>. On April 16<sup>th</sup> at 0327 hours, the high wind advisory was upgraded to a high wind warning for the time period of 1100 hours until 1800 hours. The difference in a high wind advisory and a high wind warning is that the advisory indicates a possibility of wind gusts up to 60 mph whereas the warning indicates wind gusts in excess of 60 mph.

Strong northwest winds developed across the region as a strong low pressure system deepened off the Mid-Atlantic coast. The National Weather Service predicted morning winds of 30 mph with gusts to 50 mph and increasing during the morning hours bringing gusts to 60 mph late in the morning and afternoon.

### **Origin and Cause**

Investigators from Prince William County Department of Fire and Rescue's Fire Marshal's Office were assisted by the Bureau of Alcohol, Tobacco, Firearms, and Explosives Task Force which included investigators from Fairfax County Fire and Rescue Department, Loudoun County Fire and Rescue, and Arlington County Fire Department. All agencies supported Prince William County's Fire Marshal's Office in the origin and cause examination and investigation.

At this time, the origin of the fire is believed to have occurred on the structure's exterior on Side C, near the B/C corner. The Fire Marshal's Office continues to investigate the case and the cause of the fire is currently classified as undetermined.

### **Fire Modeling**

The Investigation Team worked closely with fire protection engineers from the Montgomery County Fire and Rescue Service, Office of the Fire Marshal. Montgomery County Fire and Rescue Service have the ability and certification to perform fire modeling and their staff works cooperatively with the National Institute of Standards and Technology (NIST) and Bureau of Alcohol, Tobacco and Firearms (ATF).

Fire modeling is a process that is used to calculate various aspects of fire conditions within a compartment or structure by using data inputs collected from the fire scene. There are two computer software programs that Montgomery County Fire and Rescue Service utilizes when developing a fire model. One of the programs is the Fire Dynamics Simulator (FDS) which utilizes mathematical equations to predict smoke and heat flows from fires. The other software program is Smokeview which is a visualization tool. Both were developed by NIST. Smokeview takes the mathematical output from FDS and creates a visualization of the FDS parameters in a given container.



Fire modeling has limitations that will not exactly replicate any particular fire. It is a prediction tool to help understand the heat, fire and smoke travel, as well the impact of external forces on a fire in a given container or compartment.

Montgomery County's fire protection engineers worked cooperatively with the Investigation Team to ensure the data from the Marsh Overlook incident information was as accurate within acceptable program limitations. The resulting data was developed into a fire model for the Marsh Overlook Fire Incident and was reviewed by the Investigative Team.



# **Fire Ground Operation Sequence**

## Fire Ground Operation Sequence



### **0600 hours**

The temperature in the Marsh Overlook area was 45°F and the area was being impacted by sustained winds of 25 mph.

Shift start time for 12-hour shift personnel (weekday staffing) and shift change time for 24-hour shift personnel.



### **0601 hours**

On April 16, 2007 at 0601 hours, the Prince William County Office of Public Safety Communications (OPSC) began to receive numerous 911 calls for a house fire at 15492 Marsh Overlook Drive in Company 512's first due response area. A neighbor observed the house on fire and immediately went to the residence and knocked on the door to alert the occupants of the fire and assist in their exit from the house. Several of the occupants exited the house from Side A and others from Side C. The occupants dressed in night time clothing sought shelter and gathered in an adjacent house and in a vehicle that was parked between the involved and adjacent house on Marsh Overlook Drive.



### **0603 hours**

OPSC dispatched a structure fire call for Box 1209 at 15492 Marsh Overlook Drive. Units dispatched for the initial alarm were Wagon 512, Engine 510, Engine 520, Tower 512, Ambulance 510-A, Medic 512-C, Battalion 503 and were assigned radio channel 5-C.



**Side C view from neighbor's house Eiderdown Ct.  
prior to arrival of fire and rescue units**



### 0608 hours

Wagon and Tower 512 marked on the scene with a two story single family home with heavy fire showing Sides B and C. Wagon 512's officer gave instructions for the next arriving pumper (anticipated to be Engine 510) to pick up their water supply at 15169 Marsh Overlook. See Appendix A for street and unit placement diagrams.



**Side B view as Tower 512 approaches  
(Headlights can be seen on roadway)**



**Tower 512 arrives on scene – Side B**

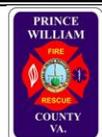
Wagon 512's officer requested the third arriving pumper to approach the scene from the opposite side in order to establish a secondary water source. Engine 520 acknowledged the secondary water source instructions and requested a fourth engine be dispatched to function as the supply pumper for this task. The address that Wagon 512's officer gave for the primary water source did not exist, therefore contributing to Engine 510 approaching the scene from the wrong direction. When Engine 510's officer recognized the incorrect location was given and their approach to the scene was from the opposite direction, the officer immediately advised Engine 520 to switch assignments and become the water supply pumper for Wagon 512.

Tower 512's officer walked to the B/C corner to assess fire conditions. Wagon 512's officer walked to the C/D corner to assess conditions. The officers observed vehicles in the driveway with no visible occupants. The officers met on Side A and developed their initial action plan. The decision was for Tower 512's crew to conduct a primary search of the second floor. Wagon 512's crew was to advance a hose line to assist the search operation and attack the fire suspected to be in the attic.



### 0609 hours

Wind gust of 38 mph is recorded.





### **0610 hours**

Rescue 510 with a crew of five personnel marked on the scene closely followed by the arrival of Engine 510.



### **0611 hours**

Due to poor visibility on Side A and the inability to see the wagon's driver due to the blowing smoke conditions, Wagon 512's officer and driver met and performed a face to face communication to charge the 2 ½ inch hose line. Wagon 512's bucket firefighter then checked the nozzle pattern.

Tower 512's crew waited for Wagon 512 to indicate they were ready to enter the structure together to coordinate the search and fire attack. When Wagon 512's officer indicated their readiness to enter, Tower 512's two member crew entered the structure (Side A) and reported that the front door closed behind them. Tower 512's officer stopped and directed Technician Wilson to reopen the front door for the incoming engine company crew. The door was reopened and the Tower crew ascended the stairs to the second floor to initiate a primary search beginning with a right hand search pattern which led the crew into the master bedroom. Tower 512's officer stated the interior conditions of the structure had light smoke on the first floor and approximately three to four feet of smoke from the ceiling level on the second floor.

Wagon 512's officer was at the front door steps and recalled the front door again gently closing and not latching. Just as the door was closing, the officer visualized the Tower crew ascend the foyer stairs to the second floor.

Battalion 503 marked on the scene and requested a situational report from Wagon 512. Wagon 512 reported back to Battalion 503 that they had an outside fire, that there was fire in the attic, the Tower crew was on the second floor and the Wagon crew was taking a 2 ½ inch hose line to the second floor to search for victims.

As Engine 510 pulled to a stop, a citizen reported to Engine 510's driver that he thought everyone was out of the house but the citizen was not sure. Engine 510's driver passed this information to his officer and backed his apparatus to a hydrant located at 15455 Marsh Overlook Drive and established a secondary water supply.

Rescue 510's inside crew of two reported to the front of the structure and did a face to face with Wagon 512's officer. Wagon 512's officer reported Tower 512 was on the second floor and Rescue 510 was assigned the primary search on the first floor. Engine 510's crew reported to the front of the structure and was



directed by Wagon 512's officer to pull a 1 ¾ inch hose line to the rear of the structure.

Wagon 512's officer reopened the front door and was immediately confronted with thick black smoke and a ball of fire. Simultaneously, a member from Rescue 510's X-ray crew retrieved a twenty-four foot ladder off Wagon 512 and positioned it to Side A, Quadrant Alpha, at a second floor bedroom window. A member of Tower 512's X-ray crew also retrieved a fourteen foot ladder off Wagon 512 and positioned it to Side C, between Quadrants Bravo and Charlie, and at the deck area off the kitchen.



### **0612 hours**

Battalion 503 established Marsh Overlook Command and positioned the command post across the street in a private home driveway just north of the incident scene.

Wagon 512's driver communicated their readiness to receive their water supply on channel 5-A. Wagon 512's driver was directed by OPSC to change their radio channel to 5-C for incident operations.

Engine 510's crew was unfamiliar with Wagon 512's hose load configurations and needed to confirm with Wagon 512's driver the correct hose line to deploy.



### **0613 hours**

Engine 520 marked on the scene and established the water supply to Wagon 512. Command directed Engine 520's crew to advance a hose line to protect Exposure D. Engine 520's crew located a two hundred foot 1 ¾ inch hose line on Wagon 512 and deployed the hose line to the exposure.

Safety 502 arrived on the scene and readied the unit's video camera. Safety 502 donned personal protective equipment and self contained breathing apparatus.

Tower 512's interior crew was searching the second floor, beginning with the master bedroom, when the smoke and fire conditions rapidly deteriorated to heavy black smoke and high heat conditions. Tower 512's officer tells Technician Wilson to immediately exit the bedroom. Tower 512's officer directed Technician Wilson to move towards the doorway and the Tower crew maintained verbal communications as they attempted to exit the master bedroom. Tower 512's officer reported Technician Wilson replied he was on his way to the doorway and he was located behind the officer. The officer located the master bedroom door and began to crawl into the second floor staircase landing area and became entangled in a hallway table causing the officer to fall head first



down five to six stairs. The officer's right elbow penetrated the wall board at the curve of the staircase which stopped the officer's descent down the stairs. The officer immediately yelled back to Technician Wilson who was still on the second floor. The officer stated that Technician Wilson verbally communicated back that he could not find the stairs. The officer replied back for Technician Wilson to come toward the officer's voice and shined a flashlight toward the top of the landing area of the staircase.

Simultaneously, Wagon 512's officer responding to the changes in fire conditions and loud noises reported to Command that there was a crew upstairs, the stairs were burned out, and called for an emergency evacuation. Command acknowledged the emergency evacuation request and directed OPSC to sound the evacuation tones. OPSC complied with the order. Concurrently, Wagon 512's officer observed a white helmet in the staircase area which was engulfed in orange flames. Wagon 512's officer and Rescue 510's inside crew reached into the fire and located Tower 512's officer at the base of the stairs and immediately removed the officer to the outside. Tower 512's officer immediately reported to the crews that Technician Wilson was still inside on the second floor in the staircase area. Tower 512's officer attempted to reenter the structure but was stopped by the personnel from Wagon 512 and Rescue 510.



**Foyer stairs to the second floor**

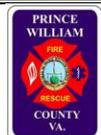


**0614 – 0615 hours**

(06:14:53 hours) Rescue 510's officer transmitted a mayday radio report about the missing firefighter:

*“Rescue 510 officer to, mayday, mayday, mayday, Tower 512 is missing one firefighter; we have a firefighter missing, in the stairwell.”*

(06:15:06 hours) This was immediately followed by a mayday transmission from Technician Wilson stating:



*“Mayday, Mayday, Mayday, Tower 512 bucket, I’m trapped inside, I don’t know where I am, I’m somewhere in the stairwell, I need someone to come get me out.”*

Command requested the last message be repeated. There was no response. Command then asked Rescue 510 to repeat their last message.

Reacting to the immediate firefighter rescue situation, crews advanced the 2 ½ inch hose line into the foyer but were forced out because of extreme heat and fire conditions. As they exited the structure the 2 ½ inch hose line was flowed into the foyer area. The crew realized the water stream was being deflected off the front door as the door had shut again. Wagon 520’s crew began to flow their 1 ¾ inch hose line on Side D. Engine 510’s crew reacted to the mayday and positioned their 1 ¾ inch hose line to Side A (Quadrant A), but experienced low flow pressure on the hose line. Rescue 510’s crew were able to reopen the front door but stated there was significant resistance while attempting to open the door. Rescue 510’s crew along with Wagon 512’s crew attempted to reenter with the 2 ½ inch hose line. They were joined by Engine 510’s crew with their 1 ¾ inch hose line. The entire first floor area around the staircase, the staircase, and the second floor hallway area were heavily involved in fire. Members of the three crews operated the two hose lines in the foyer area to protect the staircase and combat the fire that was progressing toward them on the first floor. Despite the intense heat and fire conditions, other crew members made multiple attempts to ascend the foyer stairs to the second floor. On one of the multiple attempts in these extreme conditions, crews reached the second floor landing area where Technician Wilson was reported to have been but were not able to locate him. The crews were forced back by intense fire and heat conditions.

The crews regrouped and made another attempt to reach the second floor. As crew members of Rescue 510 and Wagon 512 reached the second floor landing, large pieces of debris began to fall on them, forcing them to retreat to the foyer area. The other crew members in the foyer continued to flow the hose lines in an attempt to protect the staircase and second floor landing areas. Additional ground ladders were placed on Side D at the second floor window of the master bedroom by a member of Rescue 510’s X-ray crew. A member of Tower 512’s X-ray crew secured the gas at the meter on Side B.

Safety 502’s stationary video camera comes into focus and begins recording.

Rescue 510’s officer responded to Command’s request to repeat the last radio message and the officer transmitted the following:

*“Tower 512 bucket portable is in the stairwell, he is lost, we have a RIT operation.”*





**Side B**  
**Side A/D**  
**Intense fire and heat conditions are throughout the structure**



**0616 hours**

Command questioned if Rescue 510 needed another crew to assist and Rescue 510's officer replied:

*"Not at this time."*



**0617 hours**

Command requested a situation report from Rescue 510. Wagon 512's officer requested that the pressure on the hose lines be increased. As Wagon 512's driver returned from hand laying a supply line to Tower 512, the driver observed two other fire and rescue personnel at the pump panel attempting to determine the cause of the reported low pressure on the hose lines. Wagon 512's operator evaluated the pump panel controls and determined all controls were appropriately set but increased pressure on all hose lines in an effort to improve the pressure at the nozzle.



**0618 hours**

Command continued to call for Rescue 510. Upon hearing the repeated calls from Command to Rescue 510, Safety 502 began to search the fire ground for Rescue 510. The medic unit dispatched on the second alarm arrived and reported to the command post and began to set up the command boards for incident tracking and coordination. Several engine companies transmitted water supply instructions and master stream utilization questions to Command. Command requested all tactical radio traffic to stand by because of the crews that were still inside and repeated the calls to Rescue 510 for a situational report.



### **0619 hours**

Peak wind gust of 48 mph is recorded.

A transmission determined to be Technician Wilson was made on the tactical fire ground channel (5-C) and stated:

*"I need water (inaudible) 512 bucket. I need water, I'm burning up in here, I need water fast!"*

Following the transmission, Command called Wagon 512 and asked "are you direct?" Command transmitted:

*"We got a firefighter in the stairwell, need water."*

Battalion 502 marked on the scene and was assigned to Division A by Command.

Safety 502's video footage documents the collapse of the sunroom's Side B wall at this time.

Engine 513 reported to the command post and was verbally assigned to find the missing firefighter by the incident commander.



### **0620 hours**

Wagon 512's officer reported to Command that the roof was coming in on the interior crews. Command acknowledged the transmission and asked if a firefighter was still in the stairwell.

Safety 502 transmitted an order to Command to "pull everyone out of the house" but transmitted the message on the dispatch radio channel (channel 5-A).



### **0621 hours**

Realizing the initial transmissions were on the wrong radio channel, Safety 502 repeated the evacuation order on the fire ground tactical radio channel (channel 5-C) for Command to pull everyone out of the house. Command immediately ordered an evacuation of the structure and apparatus air horns were sounded.

Command repeated attempts to get a situation status report from Rescue 510.



Wagon 502 reported to the command post and was assigned as the rapid intervention team (RIT). Wagon 502 performed a walk around of the structure and determined that Side C was deemed best for entry to initiate a firefighter search and rescue mission. Wagon 502 gained access to first floor via ladder to the deck on Side C and Engine 520 passed them their 1 ¾ inch hose line. Wagon 502's crew entered the first floor and initiated a search for the missing firefighter while attacking the fire.



**Wagon 502 entry point on Side C;  
Red circle notes the entry point**



**0622 hours**

Division A reported to Command that the Division supervisor was in position and Command communicated that resources were ready to initiate master stream operations but a situation status report from Rescue 510 was required.



**0623 – 0624 hours**

Several units attempted to communicate various messages on their portable radios but many received the radio prohibit signal. Additionally, other portable radio performance difficulties were experienced. As units continued to attempt communication of activities on the tactical radio channel, Command requested a second time for units to hold their radio traffic.

Division A transmitted the following to Command:

*“Division A; situation is confirmed we still have one firefighter inside unaccounted for, last seen second floor, Division Charlie.”*

Command replied and identified Engine 513 and Engine 502 to Division A as RIT resources.





#### **0625 hours**

Division A replied back to Command that personnel were not going to reenter the structure because of the collapse danger and directed units operating near the fire ground to immediately back up out of the collapse zone. Division A and the incident commander conferred on the initiation of a deck gun.



#### **0626 hours**

Hose lines and a deck gun mounted on Engine 510 began to flow on Side A and Division A requested the need for additional crews due to low air pressure alarms activating on several of the operating crews. The water flow from the multiple hose lines began to suppress the fire.



#### **0628 hours**

Division A requested Command to confirm there are two RITs standing by in the front yard. Command interpreted the transmission as a confirmation and replied acknowledging there were two RIT teams in the front yard. Division A believed Command confirmed the request and utilized Tower 513 and Engine 517 for rescue operations.

Command also stated a personnel accountability report (PAR) check was going to be performed. The PAR check was initiated but never completed.



#### **0630 hours**

Wagon 502 transmitted that their unit was getting a knock down on the fire on Side C and the crew was initiating a search for the firefighter on the first floor, quadrant Charlie.



#### **0631 hours**

Engine 517 retrieved a 14 foot ladder from Engine 510 and brought it to the front door. Tower 513's crew placed a ladder on the foyer stairs for weight distribution due to earlier reports of the interior stair collapse.

Division A reported to Command that Tower 513's crew, along with Engine 517's crew, were entering Side A and initiated search and rescue operations for the missing firefighter. Tower 513's crew attempted to ascend the foyer stairs but

were forced back due to intense heat and fire conditions that were present on the second floor.



### **0632 hours**

Command was advised by OPSC that the incident was at the twenty minute mark and Command acknowledged the message.

Division A requested confirmation from Command that Side C was clear of any personnel operating as opposing hose lines were of concern. Division A also requested Command to provide two units in the front yard in case of a secondary collapse. Division A's intent was to establish a RIT for the firefighter rescue crew (Tower 513 and Engine 517) that was actively engaged in search and rescue operations.



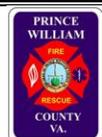
### **0633 hours**

Division A requested two relief crews to replace the initial crews and requested a level two RIT established in the front yard, once again to provide RIT resources for the operating rescue crews. Command confirmed Division A was requesting two relief crews to the front yard. Command did not request a level two RIT to be dispatched from OPSC.

Tower 513 performed a rapid search of the first floor Quadrants Delta and Charlie and met with Wagon 502's officer who reported the search of Quadrant Charlie was accomplished. Tower 513 continued the search of the first floor, Quadrants Alpha and Bravo and discovered a burn through and hole in the floor in Quadrant Bravo. Tower 513's officer crawled to the edge of the burn through with the crew holding the officer's feet; the hole was examined with the thermal imaging camera (TIC). There was no evidence found of the missing firefighter and the officer reported these findings to Division A.



**First floor burn through in Quadrant Bravo  
(Dining room)**





### **0634 hours**

Command requested a third alarm for the incident as all available resources had been given tactical assignments.

Engine 513's crew advanced a 1 ¾ inch hose line from a leader line into the basement area from Side C. The crew initiated fire suppression efforts and assisted with the immediate search of the basement areas. At this time, Division A asked to retain the operating channel for RIT operations. Command complied and switched fire ground tactical operations to channel 5-D.



### **0635 – 0636 hours**

Division A changed its radio designation to RIT Command.

Tower 513's officer ascended the foyer stairs to the second floor landing (firefighter was directed to stay at the staircase's curve) and scanned the area with a thermal imaging camera. However, the camera's screen displayed "white out" due to the high heat in the area. The intense heat and fire conditions pushed Tower 513's officer and firefighter back down the stairs.



### **0637 hours**

RIT Command reported to Command that Tower 513 and Engine 517 were out of the structure and that there was a hole from a burn through on the first floor into the basement and the crews were going to relocate to Side C to make entry. Command acknowledged the report.



### **0638 – 0639 hours**

Several units attempted to communicate various messages but received the radio prohibit signal and other portable radio performance difficulties continued to occur.



### **0640 hours**

There were several transmissions between RIT Command and Command in an attempt to clarify what units were operating in the basement. Crews in the basement performed a search for the missing firefighter and initiated fire suppression efforts. The crews that operated in the basement around this time frame included Tower 513, Engine 513, Engine 517, Engine 520, and Wagon



502. RIT Command reported to Command that the crews had entered the basement area of the structure on Side C and were attempting to make the basement stairwell. Command acknowledged the message.



#### **0643 hours**

After completing a search of the basement area, crews exited and attempted to reenter the first floor. Tower 513's crew entered the first floor from Side A and again ascended the foyer stairs. Engine 513's crew entered the first floor from Side D via a ground ladder through a window.



#### **0644 hours**

Command reestablished Division A and appointed volunteer Assistant Chief 514 to that assignment. Station 512's career captain was previously on a training detail assignment that day, but reported to the scene and was assigned to Division A.



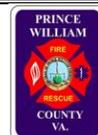
#### **0646 hours**



**Rear staircase from family room**

Engine 513 entered on Side D and was able to ascend a second staircase located in the family room between Quadrants Charlie and Delta. The officer was able to breach the family room dry wall into the master suite area and performed a visual check through the hole made into the master bathroom. Not locating the missing firefighter, the crew moved further up the rear staircase and breached a second location. The second hole was breached into the master bedroom from the staircase drywall but a visual check was limited because of the intense fire and smoke conditions present in the master bedroom area. The area was swept with a thermal imaging camera but no shapes were identified on the screen because the room contained extremely high heat conditions.

Engine 513 and Tower 513's officers met at the second floor landing areas of the foyer and family room staircases. The master bedroom areas were scanned with the thermal imaging cameras but high heat conditions caused a white out on the



cameras' screens. Unable to visualize the room due to high heat and fire conditions, the officers backed down their respective staircases.



**0647 hours**

Safety 502 informed Command that crews were not to operate in the area of Quadrant Alpha and Bravo as there were signs of collapse.



**0649 hours**

RIT Command transmitted that crews were searching the second floor in the area of the collapse. RIT Command reported to Command that the collapse was in the upper bedroom in Quadrant Bravo and the crews had attempted to search the area, but the structure collapse was significant and the search could not be continued.



**Collapse and hole burn through of second floor bedroom in Quadrant Bravo**



**0650 hours**

RIT Command reported that Rescue Squad 504 was on Side D with extrication equipment, and the crew was trying to breach into some of the collapsed areas.



**0652 – 0653 hours**

Division A attempted to contact Command to request the identity of the unit working with them.



**0657 hours**

Division A reported to Command the following transmission:

*“We have found the missing firefighter; second floor Quadrant, between Quadrant Alpha and David.”*

The actual location of the missing firefighter was in the second floor master bedroom, Quadrant Delta. The missing firefighter was deceased, the area was secured for the Fire Marshal’s Office and the firefighter was protected in place. Fire Investigators assisted by the Prince William County Police Department began the task of documenting the incident. Proper respect of the firefighter was the primary mission.



# Findings, Discussions and Recommendations

# Building Construction

## **Section 1** **Building Construction**

### **Overview:**

Firefighting operations occur in various types of structures (i.e. single and multi-family residential, commercial, etc.). As the building industry modifies construction methods and materials, the trend has been to use lighter materials. In what is typically referred to as “lightweight” construction, the entire structure may be built using lightweight components and engineered lumber. Brick veneer may also be applied but the structural elements are wood without any fire rating. Since each structure is built differently using varied materials, structural member failure due to fire may be caused by a number of factors. It is extremely important that command officers, company officers, and firefighters educate themselves about construction methods and the various types of building materials found in their response areas and maintain an awareness of the structure during fire ground conditions to ensure safe operations.

Having a thorough knowledge and understanding of the significant differences in building construction is vital for firefighters as the hazards associated with different construction types present varying operational challenges and hazards. Firefighters must understand how buildings are constructed and the associated design features, to further understand and anticipate the rate of burn, fire spread, and in applying the appropriate strategy and tactics, as well as the structure’s integrity under stress conditions.

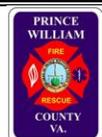
### **Findings:**

#### **1. The Marsh Overlook structure was Type V-B construction.**

**Discussion:** Type V construction is typically wood frame construction. Type V-A construction is required to have fire rated assemblies for all building elements (structural frame, bearing walls, floors and roof). Type V-B construction does not require any fire rating of the building elements.

#### **2. The fire growth, spread, and intensity into and through the structure, as well as the rapid change of conditions, was intensified by the building construction features:**

- a. Lightweight building construction materials significantly affect rapid fire spread and British thermal unit (BTU) production which impact firefighting operations.**
- b. There was rapid fire spread vertically and horizontally on the exterior that extended into the structure’s interior on multiple levels.**



**Discussion:** Initial strategic and tactical priorities focus on life safety (rescues), exposure protection, confining and extinguishing the fire, overhaul, ventilation, and salvage. The development of the incident’s strategies and tactics are performed following a structured risk management plan of:

- *We may risk a lot, in a highly calculated manner, to protect savable lives;*
- *We may risk a little, in a highly calculated manner, to protect savable property;*
- *We will not risk our lives to save what is already lost, be it life or property.*

The threat of firefighters becoming trapped in a structure is influenced by the structure’s construction features. NIOSH reports state that the greatest danger to firefighters operating above a fire is posed by wood-frame construction. Vertical fire spread is more rapid in this type of structure and can occur in four ways: up the interior stairs; through windows; up the combustible exterior siding; or within concealed void spaces.

The structure involved in the Marsh Overlook incident had vinyl siding on Sides B, C, and D. Vinyl siding is manufactured from polyvinyl chloride resin. The National Institute of Standards and Testing (NIST) have conducted testing on siding materials. Listed below are the flame extension times for untreated siding materials:

<b>Siding Material</b>	<b>Time to Initial flame Extension</b>	<b>Time of Flame Extension to Eave</b>
Aluminum	No extension	No extension
T1-11 Plywood	203 seconds	288 seconds
Vinyl	82 seconds	130 seconds

Note: taken from NISTIR 6030, June 1997, page 349, “Durable Agents for Exposure Protection in Wild land/Urban Interface Conflagrations”; Table 1.

Behind the vinyl siding was 0.106 inch EnergyBrace Insulative Sheathing. EnergyBrace Sheathing provides support for interior and exterior wall surfaces and is constructed with water-resistant kraft fiberboard piles, pressure laminated with water-resistant adhesive to polyethylene on the face and back. Both vinyl siding and the insulative sheathing materials will burn if exposed to an ignition source and have a high surface to mass ratio. When combating fires burning on the exterior of a structure, firefighters must anticipate rapid fire spread and extension into the attic areas, fire attacking structural members, and fire penetrating other interior spaces at more than one point.



On the Marsh Overlook incident, the fire penetrated into the basement prior to the arrival of fire and rescue units based upon witness interviews. Upon arrival, Wagon 512's officer suspected the fire had spread into the attic. When the initial attack crew entered the structure, they entered the foyer area of the house with fire above them in the attic and below them in the basement. The entry of Tower 512's crew into the structure placed them ahead of, and in the path of a rapidly developing interior fire, without the protection of a hose line. At the time of the mayday event, a sudden and unexpected heavy volume of smoke and fire rushed through the first and second floors of the house.

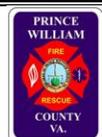
**3. At 0615 hours, seven minutes after the arrival of the first units, structural compromise of the roof and wall assemblies was advanced.**

**Discussion:** There is a small period of time to conduct interior fire suppression and search activities once the structural members of the building are attacked by fire. NIOSH states that a lightweight truss may be expected to collapse in less than ten minutes when exposed to a fully developed fire. The Marsh Overlook structure had roof framing that included engineered I-beams, solid wood trusses, and lightweight trusses. NIOSH recommends that a time limit for operations in, under, or above lightweight trusses should not be established. It is recommended that once a building's trusses are determined to have been exposed to fire, all firefighters operating under or above them should be immediately evacuated.

Through witness accounts, the fire extended into the basement prior to the arrival of the first units at 0608 hours. The fire rapidly consumed the vinyl siding up to the eaves and soffit areas, followed by the deterioration of the underlying 0.106 inch EnergyBrace Insulative Sheathing on Sides B and C. This fire spread resulted in the fire attacking the exterior building materials and wall studs from the outside and penetrated the structure on the first and second floors. Photo and video documentation indicate first and second floor wall penetration, as well as fire extending into the attic with sections of the roof compromised at 0615 hours. Once the fire involves interior components, there is an increased BTU production due to interior materials and finishes (i.e. plastics and petroleum based products). In Type V-B construction the structure, building materials, and building contents are on fire.

**Recommendations:**

- 1.1. Revise Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines to:**



- 1.1.1. Consolidate Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires and Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines into a single procedure.
- 1.1.2. Address strategy and tactics for rapidly progressing fires on the exterior of a structure.
- 1.1.3. Address the application of the strategy and tactics for modern construction methods and designs.
- 1.2. **Company officers need to visit new construction sites and observe the type of building components and construction methods being used.**
- 1.3. **Develop a process of identifying and maintaining institutional knowledge and training regarding the residential construction methods and designs as it relates to the time period in which they were built.**
  - 1.3.1. Develop a building construction training package focused on structures in Prince William County that were built in the last five decades.

***Related recommendations in other sections:***

- **Establish an internal task force and implement a system wide review of all procedure memorandums. This review must begin immediately and all efforts are to be taken to achieve it within a 90 day time period. See expanded discussion in General Section.**



# Environmental Conditions

## **Section 2**

### **Environmental Conditions**

#### **Overview:**

Firefighting operations occur during diverse environmental conditions. Environmental impacts include temperature extremes, wind, barometric pressure, humidity, and precipitation. All of these factors can impact fire development, spread, and travel. Weather extremes increase the complexity of fire ground operations and present unique challenges that can threaten firefighter safety. All aspects of fire ground operations must account for the environmental conditions at the time of the incident. This begins with the incident size up, continues through the implementation of the appropriate strategy and tactics, and does not conclude until the incident is mitigated.

#### **Findings:**

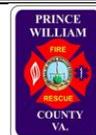
- 1. At the time of the Marsh Overlook fire, a high wind advisory had been issued for Prince William County. This was issued from Sunday, April 15, starting at 2000 hours until 0200 hours, Tuesday, April 17, 2007.**

**Discussion:** The difference in a high wind advisory and a high wind warning is that the advisory indicates a possibility of wind gusts up to 60 mph, whereas, the warning indicates wind gusts in excess of 60 mph.

- 2. There were Roam Secure Alert Network (RSAN) pages sent by the OPSC personnel to various fire and rescue pager groups regarding the National Weather Service storm advisories, watches, and warnings.**

**Discussion:** The Roam Secure Alert Network (RSAN) is a third party emergency notification system that sends text messages to e-mail accounts and wireless devices. This program is web based and the receiver may select which wireless device they receive these messages on. Prince William County also establishes group distribution lists for messages, but the programming of wireless devices to receive these is controlled by the end user. There is no policy, standard or common practice on how pagers and cell phones are to be configured to receive these messages.

The following RSAN pages were transmitted by OPSC on the dates and times indicated.



<b>Date</b>	<b>Time</b>	<b>Message</b> <i>(as typed by OPSC personnel)</i>	<b>Pager Notification</b>
04/14/07 Saturday	0900 hours	"FYI – There is a flood watch in effect for our area from midnight tonight thru mid day tomorrow. We are expecting 1-3" of rain for our area."	Fire Significant Event; Emergency Manager
04/15/07 Sunday	0805 hours	"FYI – The entire NOVA area is under a flood warning w/the exception of PWC. They expect to include PWC in the warning in the next hour or so. 1-2 additional inches of rain are expected through the day."	Fire Significant Event
04/15/07 Sunday	1054 hours	"National Weather has issued a flood warning for Prince William until 14:30 hours. We should expect to see an additional 1-2" of rain prior to the ending of the warning."	Fire Significant Event
04/15/07 Sunday	1256 hours	"The National Weather Service has extended the flood warning again. The warning is now thru 9pm this PM. We have received 1-2" of rain and they are expecting another 1-2" before 9pm."	Fire Significant Event
04/15/07 Sunday	1652 hours	"National Weather has advised we are under a high wind advisory from 8pm tonight thru 2am Tues. Sustained winds of 25-35 mph with gust up to 50 mph expected."	Fire Significant Event
04/16/07	1131 hours	"The NWS has issued a high wind warning for the Prince William for the Prince William county area from 1100 to 1800 this date. Winds of 30 mph with gust up to 60 mph can be expected."	Fire Career Staff; Volunteer Staff



- 3. At the time of dispatch, the officers from Wagon 512 and Tower 512 were unaware of any weather related advisories, watches, or warnings.**

**Discussion:** Currently, there is no consistent or effective means of communicating important weather related information to fire and rescue worksites and on duty personnel. There is also no process of confirming work site or personnel receipt of the information. Wagon and Tower 512 officers have assigned pagers but it cannot be confirmed if the devices were programmed to receive Roam Secure Alert Network (RSAN) or group distribution pages.

- 4. Initial arriving company officers did not anticipate the impact of high wind conditions prior to initiating their incident action plan.**

**Discussion:** During their initial response and scene arrival, Wagon and Tower 512's officers environmental and wind speed assessment was reported as variable. They stated that upon their size up assessment, the wind seemed calm and was not considered as a factor in their initial tactical decisions. The officers stated as the incident progressed, the wind conditions did become a complicating factor for fire ground tactical operations.

- 5. The fire growth, spread, and intensity into and through the structure and the rapid change of conditions was intensified by high winds.**

**Discussion:** Environmental factors such as wind increase fire development, fire spread and travel, and shorten the time frame that fire penetrates into a structure's interior. These environmental factors increase the complexity of fire ground operations as they become progressively more challenging, difficult to manage, and pose significant threats to firefighter safety and survival.

While not initially known at the Marsh Overlook incident, the basement sliding door and the kitchen door to the deck (on Side C) were left open by the escaping occupants. The open sliding glass door permitted air movement through the area which contributed to intensifying fire conditions in the basement. The fire in the basement traveled up the basement stairs to the first floor, as well as burning through the basement ceiling and the flooring materials of the first floor in Quadrant Bravo. Failure of the window glass in the basement and first floor on Side C (Quadrant Bravo) occurred. Fire penetrated the first and second floor wall assemblies on Side B. The fire in the attic vented through the roof. When the areas were penetrated by fire, the open doors, high winds, and structural component failures caused uncontrolled ventilation of the structure accelerating the fire growth and spread throughout the structure. Firefighters described the initial fire movement as a "blow torch" coming from the second floor down the foyer



staircase. As the fire progressed in the basement and first floor areas, it combined with the wind to create a chimney effect funneling the fire towards Side A and up through the structure.

The results of the fire modeling support the finding that high winds were a critical factor in the fire growth, spread, and intensity into and throughout the structure and were a major contributor to the rapid change of conditions.

- 6. Interior and exterior fire ground operations on Side A were hindered by high winds causing heavy smoke and fire movement from Side C toward Side A. Large embers were also fiercely blown horizontally from the structure, into the front yard and across the street.**

**Discussion:** As the roof became heavily involved in fire, smoke and embers were blown fiercely into the front yard and across the street hindering fire ground and command post operations. This caused some personnel to seek shelter behind vehicles and become concerned for further fire exposure of the houses across the street.

- 7. A procedure regarding the OPSC radio announcement of weather watches, warnings, and emergencies was located but it is questionable if the procedure remains in force.**

**Discussion:** Fire and Rescue Service Procedure Memorandum C-85-72 (effective July 15, 1986) titled Weather Watch, Warning and Emergencies was established to provide a notification procedure for the announcement of weather related conditions. This procedure directs the general radio announcement of weather watches and warnings. However, it is questionable if the dated procedure memorandum remains enforceable.

**Recommendations:**

- 2.1. Review and revise all existing Fire and Rescue and OPSC procedures related to operations in environmental extremes, to include high wind environments.**
- 2.2. Evaluate adjustment of dispatch complements when experiencing extreme environmental conditions.**
- 2.3. Develop a method of communicating important and timely weather related information to all fire and rescue worksites and on duty personnel. There needs to be a process of confirming receipt of the information.**



- 2.4. Develop a policy regarding the expectations of wireless device use and programming. This includes receipt of RSAN messages and group distribution lists.**



# Accountability

### **Section 3** **Accountability**

**Overview:**

The Personnel Accountability Reporting System (PARS) is an integral part of the Incident Command System (ICS). It establishes a process to identify and track the location of crews as they carry out their assignments on the emergency scene. The accountability system is initiated when the first unit arrives on the scene and continues until the Incident Commander determines it is no longer necessary.

**Findings:**

- 1. Some units properly assembled their unit accountability passports at the beginning of the shift. However, this was not consistently done by all response units.**

**Discussion:** A component of the unit accountability system is the passport which contains the unit identification tag and the names of all members assigned to that particular unit. At the beginning of each shift, the unit officer is responsible to ensure that the unit passport is prepared and accurate. In addition to the passport, every crew member's helmet has a unit accountability identification designator to visibly identify which unit they are assigned to.

Several units ensured accuracy of their passports and are to be commended for those actions. However, not having accurate unit passports for all of the response personnel caused the Incident Commander and command post support personnel to have to correct the passports. This is a difficult and lengthy process when there are crews already engaged in operations prior to the arrival of the Battalion Chief. Medic 552, arrived as part of the second alarm, assisted at the command post and used the PARS accountability kit on the Battalion Chief's vehicle to correct the passport information resulting in delayed accountability of all fire ground personnel.

- 2. All incoming units did not drop off passports at appropriate locations, either at Wagon 512 prior to the command post establishment or at the command post once established.**

**Discussion:** Fire and Rescue Association Procedure 5.1.1 titled Personnel Accountability Reporting System (PARS) directs each suppression unit to have an area on the apparatus driver's door with Velcro to serve as a passport drop-off point. Incoming units affix their passports to the drop-off area of the first arriving suppression unit prior to the command post being established. When the command post has been established, the passport is dropped at that location.



All of the first alarm units complied with this procedure, with the one exception of Medic 512. There was inconsistency with the additional alarms in this practice. This caused the initial actions of the command post support personnel to leave the command post in order to collect the missing passports. This delayed the accountability of all personnel on the scene and reduced the number of available support personnel to the Incident Commander for critical command post support operations.

**3. During this incident, personnel accountability report (PAR) checks were not performed or completed as identified in Fire and Rescue Association Procedure 5.1.1 titled Personnel Accountability Reporting System (PARS):**

**a. Following the initial emergency evacuation.**

**Discussion:** The Incident Commander attempted to determine if Wagon 512 was out of the building and PAR, but Command never achieved a confirmation of the information request. Wagon 512 never acknowledged Command's situational status request. However, it is acknowledged that the Incident Commander's focus of the incident quickly changed when the mayday traffic was initiated immediately after the PAR request of Wagon 512.

**b. Following the mayday transmissions.**

**Discussion:** The Incident Commander needed to perform a PARS check following the mayday transmissions to confirm the identity of the missing firefighter and determine if any other personnel were missing. An unaccounted member or crew shall not stop a PAR check from other elements of the command structure. The Incident Commander can assign a resource to check on the unaccounted crew but the PAR check must continue to determine if more than one person or crew is unaccounted for.

**c. Following repeated attempts to contact Rescue 510 with no reply.**

**Discussion:** When a unit or crew cannot be contacted in the hazard zone after three consecutive attempts at radio contact, a PAR check is to be performed. At the time of the unanswered calls to Rescue 510, the Incident Commander was dealing with a known mayday involving a missing firefighter, an unaccounted unit/crew, a rapidly progressing fire, and a depletion of resources. This occurs while the Incident Commander is operating alone without any incident command support in place.



- d. **A PAR check was initiated seventeen minutes into the incident, consistent with procedure time parameters. However, the PAR check was never fully completed. Subsequent PAR checks were not performed at designated time checks, following the receipt of the maydays, or at significant incident changes.**

**Discussion:** Per procedure, the Incident Commander is to perform a PAR check every 20 minutes or any time that it is deemed necessary due to a sudden change in conditions, reports of missing personnel, or a change in operational modes. If divisions or groups are established, then the area supervisor is responsible to account for their crews operating under their span of control and report back to Command when directed.

If units do not answer the PAR check, the Incident Commander shall recall the unaccounted unit(s). This recall is to be done on the assigned tactical channel as well as the Safety Channel (channel 5-O). If the unit is not successfully contacted the crews operating in the area of a missing crew are to be contacted or the Rapid Intervention Team is to be deployed. The Incident Commander attempted to call two units for a PAR check but never received a reply back from those units. Division/Group supervisors are to attempt to locate any unaccounted for crews within their own areas.

There were no further actions taken by the Incident Commander to recall the units, continue the PAR check, or perform a subsequent PAR check which was not in compliance with the procedure.

4. **Division A was established without effective accountability or communications between Command, Division A or the crews operating in that area. The designation of Division A was later changed to RIT Command, once again without effective communication of the crews assigned.**

**Discussion:** Once a division/group is established, the supervisor is to maintain accountability of the units assigned to their geographic area of responsibility. The division/group supervisor is responsible for the units assigned to that area and must advise Command when units are moving between divisions/groups. Unit officers assigned to a specific division or group are to communicate with that area's supervisor and discontinue direct communications with Command. When accomplished, this aids in the accountability of personnel and helps to maintain desired span of control.

5. **There is a conflict between Fire and Rescue Association and Office of Public Safety Communications (OPSC) procedure memorandums regarding the announcement of event timers. Neither procedure was complied with.**

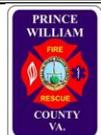


**Discussion:** One of the purposes of announcing event markers is to trigger command to perform a PAR check of all members operating on an incident. According to Fire and Rescue Association procedure, the OPSC Center is to announce the duration of the incident every ten minutes. However, the OPSC Center has a Standard Operating Procedure titled Incident Time Stamps and Progress Reports that directs center staff to announce twenty minute event markers. The only event time marker was transmitted at 0632 hours, twenty-nine minutes after the incident dispatch.

**Recommendations:**

**3.1. Ensure compliance with Fire and Rescue Association Procedure 5.1.1 titled Personnel Accountability Reporting System (PARS).**

- 3.1.1. All apparatus drivers' doors are to have appropriate Velcro mounted for passport drop off.
- 3.1.2. All passports are to be in compliance with procedures.
- 3.1.3. Stress the organizational importance to produce the passports at the designated location at the incident scene.
- 3.1.4. Ensure that all passports are updated at each shift change.
- 3.1.5. Ensure that all personnel reporting to the incident scene comply with the procedure.
- 3.1.6. During PAR checks, ensure the unit officer provides the Incident Commander with the number of personnel assigned to the unit, the area they are operating in, and the number of personnel operating outside the hazard zone.
- 3.1.7. The Incident Commander is to provide any division or group supervisor with units assigned to their location.
- 3.1.8. Division or group supervisors must maintain accountability of the units assigned to their area of responsibility.
- 3.1.9. Any change of operational mode and formation of divisions or groups is to be communicated to units operating on the fire ground with a confirmation of receiving the message.
- 3.1.10. An unaccounted member or crew shall not stop a PAR check from other elements of the command structure. The Incident



Commander can assign a resource to check on the unaccounted crew in their last known location, while the PAR check continues to determine if more than one person or crew is unaccounted for.

- 3.2. If the Incident Commander is attempting to address another situation on the incident scene, the PAR check is to be assigned to another resource to be completed.**
- 3.3. Fire and Rescue Association Procedure 5.1.1 titled Personnel Accountability Reporting System (PARS) must be reviewed to ensure all expected actions for unaccounted and missing crews are clear.**
- 3.4. Research should continue to refine the Personnel Accountability Reporting System (PARS) for increased efficiency and improve ease of use.**

***Related recommendations in other sections:***

- There needs to be an immediate resource assigned to arrive with the Battalion Commander to initiate command post support activities. See expanded discussion in Incident Command Section.**



**Crew**

**Integrity**

## **Section 4**

### **Crew Integrity**

#### **Overview:**

Crews involved in incident operations within a hazardous environment must operate as a member of a team of at least two or more qualified personnel. Team members are to maintain contact with each other at all times by sight, voice, or physical contact depending on the conditions in which they are operating. Fire and Rescue Association Procedure 5.1.1 titled Personnel Accountability Reporting System states a minimum crew shall be considered two people and a portable radio. It is preferred that every member operating in the hazardous environment have a portable radio to facilitate contact with their supervisor or other team members.

#### **Findings:**

- 1. Tower 512's interior crew maintained crew integrity until unintentionally separated by the fall of Tower 512's officer.**
  
- 2. Tower 512's X-ray (outside) crew did not maintain crew integrity at all times.**

**Discussion:** Tower 512 X-ray crew separated on two occasions when one member operated independently in the hot zone to place ladders and then again to control utilities (gas meter shut off). During this time, Tower 512's driver was setting up the tower for aerial ladder operations. The apparatus driver did have a portable radio along with access to the apparatus' mobile radio. The portable radio in the driver's bucket was switched to the officer's bucket when the incident was dispatched. Tower 512's driver's bucket firefighter, without portable radio communication, operated alone in an area that experienced a structural member collapse two minutes after the firefighter was in that same area. Had the firefighter been caught in the collapse, the occurrence would not have been immediately known as the firefighter operated alone and lacked the ability to communicate the situation.

- 3. Rescue 510's crew did not maintain crew integrity at all times during the incident.**

**Discussion:** Rescue 510's interior crew separated and did not enter the hot zone together. The firefighters preceded the unit officer but did reestablish themselves as a crew upon entry into the structure.

Rescue 510's X-ray crew never established crew integrity after they dismounted the apparatus. One member proceeded ahead of the other crew member and operated in the hot zone alone to throw a ladder and eventually joined the interior crew. The other X-ray crew member could not locate their



partner and finally discovered the member was with the interior crew. The lone outside member reported to the command post and requested their PARS unit passport to be updated to show the staffing change of the interior crew. The sole member of the X-ray crew then proceeded back into the hot zone to perform multiple activities alone without supervision or coordination.

**4. Engine 510's crew did not maintain crew integrity at all times.**

**Discussion:** Engine 510's crew lost crew integrity during the time they were assigned to deploy a hose line to Side C. While that task was being initiated, the officer noticed occupants in the house windows of Exposure David and went to evacuate the exposure. During this time, the firefighter advanced the hose line to Side A and became involved with interior fire attack. When the officer returned, a search of the area was initiated which necessitated the officer following the hose line to locate the assigned firefighter who was found positioned inside the structure on the first floor in the foyer area.

**5. After the mayday transmissions, Wagon 512, Engine 510, and Rescue 510's crews became mixed and lost crew integrity.**

**Discussion:** Following the mayday transmissions, crews attempted to protect the staircase and foyer areas with two hose lines. Wagon 512's 2 ½ inch hose line was operated to the left of the foyer staircase in an alternating fashion toward the second floor landing, staircase, and Quadrants Alpha and Bravo of the first floor. Engine 510's 1 ¾ inch hose line was operated to the right of the foyer staircase in an alternating fashion from the second floor landing, staircase, and Quadrant Charlie of the first floor. These actions were taken as there was significant fire on both the first and second floors, as well as in the basement. Operating between the hose lines were personnel attempting to ascend the stairs to reach the second floor landing to search the area reported to be the last known location of the missing firefighter. At times, these crews were mixed without a complete accounting or knowledge of where their team member was located.

**6. After the second emergency evacuation, Wagon 512, Rescue 510, and Engine 510 crews operating on Side A became disjointed with some members self initiating tasks while others joined in tasks assigned to other crews.**

**Discussion:** When Wagon 512, Rescue 510, and Engine 510's crews evacuated the structure, members independently initiated various tasks that were not directed to be performed and were dispersed at varying locations. Examples of the independent, undirected tasks were:



- One member pulled the 200 foot, 1 ¾ inch hose line from Wagon 512 and deployed it to the A/B corner and later repositioned to the B/C corner.
- Two crew members elected to join another crew involved in forcing entry into the garage by cutting a hole in the garage door with a saw.
- Three crew members repositioned a ladder from Side D to Side A above the garage and vented a window. The ladder was repositioned back to Side D.
- Other crew members operated hose lines on Side A.

**7. Medic 512 lost crew integrity when the crew separated in the hot zone.**

**Discussion:** Medic 512's officer and driver initially entered the hot zone together, but while performing a 360° walk around of the structure, they separated.

**8. Three crews had one member each that operated without a portable radio.**

**Discussion:** Tower 512, Rescue 510, and Ambulance 510 did not have a portable radio for every person riding the unit during this incident.

**9. There was an insufficient effective firefighting force to perform all the necessary, concurrent critical tasks associated with firefighting activities. See expanded discussion in Effective Firefighting Force findings.**

**Discussion:** This finding involves multiple issues which will be discussed in detail later in the report.

**10. The practice of splitting specialty service crews (trucks/towers/rescue) contributes to loss of crew integrity. See expanded discussion in Effective Firefighting Force findings.**

**Discussion:** This finding involves multiple issues which will be discussed in detail later in the report.

**Recommendations:**

**4.1. Unit officers must ensure that crew integrity is maintained during operations within a hazardous environment.**

4.1.1. Crew members shall not operate alone in the hazard zone.

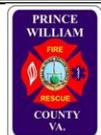
4.1.2. Crews shall not operate without a portable radio.



- 4.1.3. Crews shall always enter and exit the hazard zone together.
- 4.1.4. Each crew member operating in a team shall maintain contact with the team leader by sight, voice, or physical contact.
- 4.1.5. Each crew member must be able to provide direct help, call for help, or go get help for an injured member if needed.
- 4.1.6. Ensure operational discipline is maintained.
- 4.2. Ensure that all personnel operating in and around the hazard zone carry an operating portable radio.**
- 4.3. Ensure all fire ground activities are coordinated to prevent freelancing and improve the safety, efficiency, and effectiveness of operations. Operational discipline must be maintained, especially during responder emergencies.**

***Related recommendations in other sections:***

- **Increase the minimum qualified staffing of all fire suppression units to improve firefighter safety and operational effectiveness. See expanded discussion in Effective Firefighting Force Section.**
- **Evaluate and consider discontinuing the practice of splitting a single specialty service crew into an inside and outside crew (X-ray). See expanded discussion in Effective Firefighting Force Section.**
- **Perform a specialty service (trucks/towers/rescue) resource allocation study. See expanded discussion in Effective Firefighting Force Section.**
- **The dispatch complement must be increased to send an effective firefighting force capable of providing the amount of crews required to mitigate fires and other emergency incident types and increase firefighter and citizen safety. See expanded discussion in Effective Firefighting Force Section.**



**Emergency**

**Evacuation**

## **Section 5**

### **Emergency Evacuation**

#### **Overview:**

There are two types of firefighter evacuations that can occur on a fire ground. One is an organized retreat of personnel from the building to change operational mode from offensive to defensive. The other is an emergency evacuation that rapidly removes firefighters from a structure due to an impending threat of or an occurrence of a disastrous event.

When an emergency evacuation is ordered the OPSC will sound an Alert II Signal which is a distinctive sound for this type of situation. This Alert II Signal is to be sounded three times. When driver/operators hear command call for the emergency evacuation, they are to sound their air horn for ten seconds.

When an emergency evacuation order is given, all crews shall immediately cease activities and exit the structure to an area of safety. After evacuating the structure, each company officer is to account for their personnel. Reports of any unaccounted personnel are to be transmitted to the division/group supervisor or the Incident Commander as appropriate. After crews have exited the structure, the Incident Commander is to initiate a PAR check.

#### **Findings:**

##### **1. First Emergency Evacuation.**

- a. **Wagon 512's officer called for an emergency evacuation when positioned at the front doorway steps. The officer should have communicated a mayday transmission since there was a crew (Tower 512) operating on the second floor and they had lost their primary escape route.**

**Discussion:** Wagon 512's officer believed the interior stairs were burned out and Command was advised of that report. Wagon 512's officer stated the transmission was based on sounds in the staircase area. Wagon 512's officer also reported that a crew was on the second floor and to sound the emergency evacuation tones. A mayday transmission by Wagon 512's officer would have been appropriate because of Tower 512's crew operating on the second floor and the foyer staircase being reported as collapsed.

- b. **Command immediately reacted to the emergency evacuation request, announced the emergency evacuation order and notified OPSC to hit the evacuation tones.**



- c. **Driver operators reacted to the evacuation order and sounded the apparatus' air horns according to procedure.**
- d. **OPSC reacted to the first evacuation order and sounded the Alert II signal tone.**
- e. **Command initiated but did not complete a PAR check following the evacuation order.**

**Discussion:** Command was in the process of determining if Wagon 512 was out of the building and PAR when the maydays were transmitted. The transmission of the maydays shifted the focus of Command to the mayday events.

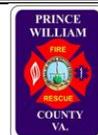
- 2. **Crews operated in the front door and foyer area to facilitate the emergency evacuation of Tower 512 inside crew following the first evacuation:**
  - a. **Crews saw and rapidly located Tower 512's officer as the officer tumbled down the staircase.**
  - b. **Crews attempted to protect the stairwell area in an effort to give Tower 512's inside crew an opportunity to exit the building.**
  - c. **When the emergency evacuation was unsuccessful, Rescue 510, Wagon 512, and Engine 510 attempted to reenter the structure in an effort to rescue the firefighter. They advised the Incident Commander of their actions.**

3. **Second Emergency Evacuation.**

- a. **Safety 502 transmitted an order to Command for the second emergency evacuation after performing a size up of the structure, fire conditions, as well as structural condition and integrity.**

**Discussion:** Safety 502 determined the fire conditions were excessive and the structure's integrity showed signs of collapse. Safety 502 transmitted the evacuation order twice on channel 5-A (dispatch channel) and used another nearby portable radio to transmit the order on channel 5-C (incident channel).

- b. **Driver operators who heard Safety 502's emergency evacuation transmissions to Command on channel 5-A, reacted by sounding their apparatus' air horns.**



- c. **Command immediately reacted to the emergency evacuation order and announced the order on the fire ground.**
- d. **Command did not request OPSC to sound emergency evacuation tones.**

**Discussion:** OPSC questioned Command if the emergency evacuation tones should be sounded again. Command never replied to the question and no further action was taken by OPSC.

- e. **Command did not perform a PAR check following the evacuation order.**

**4. Following the second emergency evacuation, crews did not adhere to the order.**

**Discussion:** Safety 502 observed crews on Side A were not adhering to the evacuation order. Safety 502 approached the front door to perform face to face communications and ordered personnel to adhere to the evacuation order. Post incident statements indicated that some members did not feel the evacuation order was for them, but that it was for Technician Wilson.

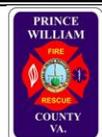
**5. Current operational procedures lack direction on requirements to enter structures following an emergency evacuation(s).**

**Discussion:** Command gave face to face instructions to Engine 513 and 502 to enter the structure in an effort to locate Technician Wilson. Tower 513 conferred with Division A on their entry to the structure which was initially on Side A. There were additional crews that entered the structure following the emergency evacuation. There was a lack of coordination between Command and Division A on the reentry of the building following the emergency evacuation.

Current operational procedures do not address the resumption of interior operations following an emergency evacuation order. Once an emergency evacuation has occurred, size up of the structure and conditions must be reassessed to determine the mode of operation. The Incident Commander must maintain personnel accountability and operational control.

**6. All evacuation orders of the structure were emergency evacuations.**

**Discussion:** On-going incident assessment and size up must be a priority of firefighters, officers, and the Incident Commander. When conditions begin to deteriorate and a change in operational mode is indicated, the decision must be communicated and performed rapidly. During transitional periods, those



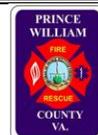
units engaged in offensive operations must be orderly removed while other units prepare for defensive operations. Ideally, this should be done prior to the need of performing an emergency evacuation.

***Recommendations:***

- 5.1. Ensure that the Incident Commander performs a Personnel Accountability Report (PAR) check when incident conditions change.**
- 5.2. Revise procedures and training curriculums to address the monitoring of incident conditions and need for operational mode changes prior to the occurrence of an emergency evacuation.**
- 5.3. Ensure all crew supervisors and crew members adhere to any and all orders to evacuate a hazard zone.**
- 5.4. Command shall order OPSC to sound the Alert II tone signal for every emergency evacuation order encountered on an incident. If Command does not transmit the order, then OPSC personnel must query the Incident Commander regarding the sounding of the Alert II tone signal until a decision is obtained.**
- 5.5. When an emergency evacuation order is given, all crews are to immediately evacuate without delay. Personnel are not to retrieve or remove equipment or hose lines, unless needed for protection while exiting.**

***Discussion:*** Retrieving equipment during an emergency evacuation delays the exit of crews. Hose lines should be left in place if not needed for exit protection. If the hose line can be left in place there is an additional critical benefit when situations of separated or disoriented crew members have occurred. Firefighters receive training to identify by touch the male and female ends of hose line couplings. Firefighters who locate a hose line in zero visibility environments can determine their exit path by identifying the couplings, as the male coupling end points toward the nozzle and female coupling end points to the water source.

- 5.6. When an emergency evacuation order is given, all crews are to comply unless a specific division or separate location is identified for a particular evacuation.**
- 5.7. Revise appropriate operational procedures to address crew re-entry into a structure following an emergency evacuation. Revisions shall address:**
  - Personnel accountability.



- Size up and reassessment of the structure and conditions.
- Declaration of mode of operation from the Incident Commander and include any safety considerations or instructions.

**5.8. Appropriate procedural memorandums, policies, and training regarding all evacuations shall be updated to reflect these recommendations.**

5.8.1. Coordinate all appropriate procedures among fire and rescue and OPSC.

5.8.2. Perform cross agency training exercises on new procedures and policies.

**5.9. Pursue regional and industry standardization of audio warnings (i.e. radio alert tones, apparatus air horn sounding, mechanical signaling, etc.) to alert firefighters to an emergency evacuation regardless of the authority having jurisdiction.**



Mayday

## Section 6 Mayday

### **Overview:**

Mayday is a term used to indicate a firefighter is lost, trapped, or is in an imminent life threatening situation. When a firefighter determines they are at risk, lost, or trapped they are to transmit a mayday call which communicates their unit designation, riding position, location in the building, nature of their emergency, and what action is needed for assistance.

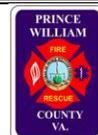
Prince William County's portable radio equipment has an emergency activation (EA) button which is depressed prior to transmitting the mayday call. The EA button activates an alarm in the radio system and alerts personnel and OPSC to an emergency transmission. The portable is programmed to hold the mic open for ten seconds to facilitate the verbal report transmission without any further action of the firefighter other than to speak into the radio the required information. After the radio transmission is made, the firefighter is to activate their PASS device.

Upon the receipt of a mayday call, the Incident Commander is to have OPSC initiate an emergency fire ground announcement and a PAR check is to be performed. Concurrently, the Incident Commander is to assign a RIT or other unit operating in the area to check on the missing personnel in their last known location. The Incident Commander is to revise the incident action plan to a high priority search and rescue operation and request the needed resources as appropriate.

### **Findings:**

1. **Wagon 512's officer, based on fire conditions and interior sounds, believed the foyer stairs to the second floor had burned out.**
  - a. **The officer made a radio transmission to Command regarding this event and indicated a crew was still upstairs.**
  - b. **The officer requested Command activate the emergency evacuation tones.**
  - c. **The officer did not transmit a mayday call on behalf of Tower 512's crew.**

**Discussion:** A life threatening change of fire conditions had occurred and was identified by Wagon 512's officer and the actions to call for an emergency evacuation were warranted. Transmitting a mayday call on behalf of the crew now believed to be trapped would have been appropriate for this event.



Command immediately reacted to the call for an emergency evacuation and was in the process of determining Wagon 512's status when the subsequent mayday calls were transmitted.

**2. Rescue 510's officer transmitted the first mayday for a missing firefighter from Tower 512's crew.**

**Discussion:** Upon being told by Tower 512's officer that Technician Wilson was still in the house at the top of the stairs, Rescue 510's officer transmitted a mayday call identifying the missing firefighter and his last known location. This action is consistent with Fire and Rescue Association Procedure 5.5.3 titled Personnel Deployment during the Initial Stages of Interior Structural Firefighting and IDLH Incidents. Rescue 510's officer recognized this event as a mayday situation and made the appropriate mayday transmission over the radio.

**3. Technician I Wilson recognized he was in a mayday situation and initiated appropriate actions.**

**Discussion:** Technician Wilson activated the EA button on his portable and broadcasted a clear, concise UCAN (Unit-Conditions-Actions-Needs) report. He identified his unit and riding position, advised he was trapped somewhere in the stairwell, and that he needed assistance. His actions initiating a mayday were consistent with procedures and firefighter survival training.

**4. An emergency fire ground announcement that a mayday event had occurred was not broadcast over the radio.**

**Discussion:** Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team requires Command to have the OPSC center initiate an emergency announcement that a mayday event has occurred so that all units operating on the fire ground are aware of the situation.

**5. The Incident Commander reported not hearing the mayday transmission from Technician Wilson.**

**Discussion:** The following radio traffic regarding the mayday transmissions occurred (transcribed from radio transmissions):

Rescue 510's officer transmitted a mayday on behalf of Tower 512's missing firefighter:

*“Rescue 510 Officer to, mayday, mayday, mayday, Tower 512 is missing one firefighter; we have a firefighter missing, in the stairwell.”*



Immediately following the end of Rescue 510's officer's transmission, Technician Wilson transmits his mayday call:

*"Mayday, mayday, mayday, Tower 512 bucket, I'm trapped inside, I don't know where I am, I'm somewhere in the stairwell, I need someone to come get me out."*

Command replied:

*"Repeat last message."*

Not hearing a reply, the Incident Command recalled Rescue 510:

*"Command to Rescue Squad 510, repeat last message?"*

Rescue 510 confirmed the situation:

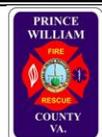
*"Tower 512 bucket portable is in the stairwell, he is lost, we have a RIT operation."*

**6. There was no attempt by Command, OPSC, or any other fire ground personnel to establish direct radio communication with Technician Wilson to acknowledge his mayday transmission.**

**Discussion:** While radio traffic did indicate fire ground activities were focused on locating and rescuing the missing firefighter, there was not direct communication established with Technician Wilson. Although not specifically required by any Fire and Rescue Association or Department procedure, the Department's Rapid Intervention Teams and Firefighter Survival training information does indicate a radio operator should be appointed to communicate with the firefighter, freeing the Incident Commander to develop a rescue plan.

**7. Technician Wilson was unable to self rescue.**

**Discussion:** The location of Technician Wilson's helmet and tools indicated his position in the master bedroom at some point was different than where he was finally located. Technician Wilson's movements, activities, and self rescue efforts on the second floor during his mayday event are impossible to factually recreate. The reason(s) Technician Wilson did not, or was not able to self rescue will never be known. Technician Wilson was not physically entangled in wire or debris within the master bedroom where he was found. The master bath may have provided an area of refuge as there was minimal heat damage in that area. There were three windows in the bedroom large enough for a fully equipped firefighter to exit. It is known that Technician



Wilson was exposed to temperatures that far exceeded the protection of his personal protective equipment. The combination of exposure to these extreme temperatures and products of combustion are known to have a detrimental impact on an individual's physiological and cognitive abilities.

While the portable radio was discovered a short distance from Technician Wilson, physical evidence on the portable radio indicated it was initially located with him. The discrepancy is attributed to an inadvertent move of the portable radio during recovery efforts.

***Recommendations:***

**6.1. Revise Fire and Rescue Association procedure memorandums and associated training curriculums to reflect expected reactions when a unit recognizes another crew is in trouble.**

6.1.1. Specific language should be added directing units to initiate a mayday call on behalf of crews that are threatened by a fire's spread, rapid growth, or changing conditions that may not be evident to crews on other locations.

**6.2. Consolidate the mayday actions that appear in various procedure memorandums into a single procedure. The following Fire and Rescue Procedures all contain guidance for personal emergencies and mayday situations:**

- Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (Section 3.4).
- Fire and Rescue Association Procedure 5.5.3 titled Personnel Deployment during the Initial Stages of Interior Structural Firefighting and IDLH Incidents (Section 5.2.4).
- Fire and Rescue Association Procedure 10.1.7 titled Radio Operation (Section 4.4).

**6.3. Revise Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team to require the Incident Commander, or another person assigned by Command, to acknowledge any mayday transmissions and maintain communications with a lost or trapped firefighter(s).**

**6.4. Laminate the Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team, Addendum 1 (Lost or Trapped FF Command Check List) for use at the command post for this low frequency/high risk activity as a ready reference guide card.**



**6.5. Radio discipline and radio silence must be exercised by all personnel on the fire ground radio channel when a firefighter mayday transmission has occurred.**

6.5.1. It is the Incident Commander's responsibility to decide which fire ground activity will move to the alternate radio channel. The Incident Commander may elect to maintain all units on the same tactical channel due to unavailability of command post support personnel.

**6.6. Perform continuous training of command level officers to reinforce required actions to mayday events, especially when personnel calling the mayday are not located in their reported position and alternative rescue plans must be developed.**

6.6.1. Perform cross agency training exercises on new procedures and policies.

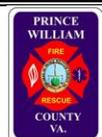
**6.7. Review and evaluate current mayday, Firefighter Survival, and RIT training to ensure adequate discussion, lecture, and practical time is focused on:**

6.7.1. Building construction methods, designs, and materials of single family dwellings and commercial buildings and the strategies and tactics associated with each.

6.7.2. Self rescue strategies and techniques in various types of structures.

**Discussion:** Department members that graduated recruit school before, with, and after Technician Wilson were able to recall specifics of their mayday and firefighter survival training regarding self rescue strategies and techniques. They spoke of transmitting a UCAN (unit-conditions-actions-needs) report, locating windows and areas of refuge, making noise with tools, and activation of their PASS devices. However, there were inconsistencies in their understanding of when they should move to attempt a self rescue versus when to stay in their location and await a rescue crew. These inconsistencies were also noted when they attempted to apply those techniques in a residential versus a commercial type of structure.

There is an extremely narrow window of opportunity to initiate and successfully rescue a firefighter. This factor alone requires firefighters to attempt any and all techniques for self escape from rapidly changing conditions in a structure. Today's construction methods, building materials, and designs are major contributing factors to a structure's rapid



fire spread and increased British thermal unit (BTU) production. Prince William County, as well as other fire departments, must reevaluate traditional suppression tactics and strategies to address modern construction methods, building materials, and designs and their inherent threats to firefighter safety.

**6.8. Review and revise as necessary Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team which states that OPSC should dispatch an additional engine company on any “working incident” where an IDLH atmosphere is present to reflect current dispatch complements and procedures (Section 6.4).**

**6.9. Evaluate OPSC staffing to:**

6.9.1. Determine appropriate depth and breadth of uniform fire and rescue presence in OPSC to provide needed technical expertise and support activities to ensure the appropriate resource utilization, reaction to emergencies, and procedure compliance.

6.9.2. Provide for a dispatcher to monitor, record, and react to each active fire and rescue radio channel.

**6.10. Develop an OPSC reference guide card for dispatcher use for this low frequency/high risk situation.**

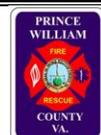
**6.11. Ensure that the appropriate OPSC actions are clearly outlined and taken when mayday transmissions have occurred.**

6.11.1. This includes the identification of the firefighter position transmitting the mayday call, what information was reported, and the requested needs.

6.11.2. An announcement must be made over the tactical radio channel indicating a mayday situation has occurred.

***Related recommendations in other sections:***

- **See other report sections for mayday related recommendations.**



**Rapid  
Intervention  
Teams and  
Rescue Operations**

## **Section 7**

### **Rapid Intervention Team and Rescue Operations**

#### **Overview:**

The Virginia Occupational Safety and Health Commission (VOSH) establish parameters for minimum staffing levels during initial firefighting operations. The term “two-in, two-out” refers to incident scene operations where the minimum number of firefighters (two) may enter an immediately dangerous to the life and health (IDLH) environment, while a minimum number of firefighters (two) remain outside the IDLH area as a standby rescue crew to monitor the activity of the interior crew and affect a rescue if necessary.

The minimum number of firefighters applies during the initial stages of operations and may be increased, but never decreased, unless justified by the unit officer based on a known or perceived life hazard. It is imperative that all firefighters operating within any hazardous area always operate in crews of two or more. They must maintain the ability for constant communication with each team member through visual, audible, physical, or safety device(s) in case of an emergency or life threatening situations.

Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (RIT) specifies when multiple crews are assigned or operating at a structure fire or hazardous area, at least one RIT shall be required. RIT must be a crew consisting of at least three qualified firefighters, one of which is capable of operating as an officer. The RIT is outfitted with specific equipment to affect a rescue of firefighting personnel. The primary function is to take proactive measures to improve firefighter safety. These proactive measures include:

- Report to and confer with the Incident Commander.
- Perform a reconnaissance of the structure.
- Assess emergency conditions and forecast potential rescue problems.
- Confirm the location of all units working in the hazard zones.
- Retrieve and review building preplan, if available.
- Assess building construction features.
- Determine all access points into the building including the strategic ground and/or aerial ladder placement to support firefighter egress from the building.
- Determine most rapid access to units operating in hazard zone to include forced entry and wall breaching requirements.
- Placement of lighting at strategic building entry and egress points.
- Force open exterior doors in the area of operations to improve egress opportunities and remove any window obstructions in the area of operations (i.e. security bars, security screens, casement window frames, etc.).



- Confirm utilities have been controlled and secured.
- Establish tool staging area for RIT tools.
- Assess ability to quickly render advanced life support care to injured firefighters after removal from hazard zone.
- After completion of the safety functions, the RIT is to locate at or near the command post, or at another strategic position as assigned by the Incident Commander.
- Monitor tactical radio traffic.
- Perform periodic secondary reconnaissance.
- Develop plan to acquire and deploy protective hose line if needed for rescue.

If a firefighter rescue situation is encountered prior to the establishment of RIT, the “two out” firefighters are to react and respond to the situation. Upon activation of the “two out” or RIT for a known mayday situation, the crew is to locate, remove, and/or protect the firefighter in place. The crew is to also provide an air supply to the firefighter and communicate with the Incident Commander on resource requirements for firefighter rescue.

The activation of the RIT transitions an event to a rescue situation. The Incident Commander needs to assign a rescue group supervisor to ensure coordination of rescue operations, especially when multiple crews are required to accomplish a firefighter rescue. Department RIT training has demonstrated that more than one RIT crew is required to rescue a trapped or disabled firefighter.

Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (RIT) also identifies when a RIT Level 2 or Level 3 Task Force should be dispatched. A RIT Level 2 or Level 3 Task Force is used to increase the firefighter rescue resource capability available to the Incident Commander during significant and/or difficult fire ground incidents.

***Findings:***

1. **Wagon 512’s officer declared a potential imminent life-threatening situation as there was an absence of a report that occupants were out of the residence in compliance with procedures.**

***Discussion:*** The declaration of a potential occupant rescue situation permits the entry of a team of at least two personnel into the IDLH atmosphere without adhering to the two-in, two-out requirements. On the Marsh Overlook incident, Wagon 512 complied with Fire and Rescue Association Procedure 5.5.3 titled Personnel Deployment During the Initial Stages of Interior Structural Firefighting and IDLH Incident and also had enough resources on the scene to adhere to two-in, two-out requirements.



**2. There is no standard practice that announces the designation of the two-out crew.**

**Discussion:** Personnel operating on the exterior were Medic 512, Wagon 512's apparatus driver, and Tower 512 X-ray crew. There were enough personnel resources available to be designated for the two out assignment, but this expectation is not presently communicated on the incident scene. The lack of clear communication causes crews to assume the responsibility will be carried out by other resources. The crews available to fill the "two-out" responsibility were not involved with the rescue attempt.

**3. Wagon and Tower 512 initiated operations with a total of nine personnel (Wagon 512 – 3 personnel, Tower 512 – 4 personnel, and Medic 512 – 2 personnel) on the scene. There were four personnel entering the structure and five operating on the exterior.**

**Discussion:** The personnel on the outside of the structure were equipped with the required minimum portable radios and were performing outside support functions as permitted in Fire and Rescue Association procedure.

**4. When Tower 512 entered the structure, there were two crews operating in the hazard zone. Current procedure requires a RIT to be assigned.**

**Discussion:** Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires identify RIT to be assigned to the third arriving engine company for single family detached dwellings. Current practice in the Department, system, and region often place multiple crews operating in the hazard zone before enough resources arrive to initiate a formal RIT.

**5. At the time of the mayday transmissions, there was no RIT established.**

**Discussion:** Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires identify RIT to be assigned to the third arriving engine company for single family detached dwellings. The third due engine (Engine 520) was reassigned to Exposure David protection by the Incident Commander.

The third arriving engine received two modifications to their expected standard operating guideline assignment. The first modification occurred when Wagon 512 directed the establishment of a secondary water source thereby creating the need for the third arriving engine to accomplish that task. To fully carry out this direction, a fourth engine company is required and was requested. This modification could potentially keep the remaining personnel from being able to fulfill the RIT assignment if they are at minimum staffing



levels. To be established as a RIT, there must be a minimum of three qualified personnel. If a unit must leave their driver to operate the apparatus for the secondary water supply function, the remaining crew is insufficient to fill the RIT function.

The second assignment modification for the third arriving engine occurred when Command assigned them to initiate exposure protection. Fire and Rescue procedure gives the Incident Commander the latitude to modify the assignments to meet the needs of the incident.

The Incident Commander assigned the fourth (Wagon 502) and fifth (Engine 513) arriving engines to rescue the firefighter and designated them as RIT. Both engine companies immediately initiated firefighter rescue activities. When the RIT is deployed to firefighter rescue activities, their RIT assignment must be back filled. A RIT must always be on standby and available for unexpected responder emergencies, even when a firefighter rescue is underway.

**6. The terms of RIT and rescue and the application of both are being used interchangeably where their functions are not.**

**Discussion:** RIT is a crew that is immediately available to respond to requests for help from lost, trapped, or incapacitated firefighters. The RIT is to be located at or near the command post or other strategic position as assigned by Command. A call for assistance deploys the RIT for a firefighter rescue function. Their deployment creates a lack of capacity for additional firefighter rescues and is a void in the incident command structure that must be backfilled. While a rescue operation is being performed, a RIT capability must be maintained.

The window of opportunity to successfully rescue a firefighter is narrow. The establishment of RIT resources prior to the development of a firefighter rescue situation is critical. If the RIT is established at the time of, or following a firefighter mayday call, the unit's reflex time in preparation to assume the RIT assignment will reduce the window of opportunity for successful firefighter rescue.

During the Marsh Overlook incident, the Incident Commander designated Wagon 502 and Engine 513 as RIT after the mayday. The Incident Commander then immediately assigned those crews to rescue the firefighter. This placed those crews in a rescue function. However, additional resources for the RIT assignment must be identified and maintained.



**7. A RIT was not maintained throughout the incident.**

**Discussion:** Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (RIT) identify the Northern Virginia Fire and Rescue Firefighting and Emergency Operations Manual, Volume 1 (General Firefighting Procedures Rapid Intervention Team Command and Operational Procedures) as the document to be utilized at all emergency and training events. When the formally established RIT is activated, the Incident Commander must designate another RIT to remain in standby mode for firefighter safety throughout the duration of IDLH operations.

The RIT should have been deployed to locate crews that were not responding to the Incident Commander's repeated radio calls during the Marsh Overlook incident.

**8. The size of structure, initial fire conditions, and firefighter mayday were all indicators for the request of a RIT Level 2 Task Force.**

**Discussion:** Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (RIT) identifies indicators for a RIT Level 2 Task Force. A RIT Level 2 Task Force response consists of one Engine Company, one Truck Company and one Rescue Company or a unit with heavy rescue capabilities, one Battalion Chief or Command Officer of appropriate level, and one advanced life support transport unit. The purpose of the RIT Level 2 Task Force is to have appropriate firefighter rescue capability available to the Incident Commander during significant and/or difficult fire ground incidents. Deteriorating conditions, large commercial building fires, complex fire grounds, or other incident conditions judged appropriate by the Incident Commander are situations for RIT Level 2 requests.

At 0633 hours, Division A requested a Level 2 RIT be established on Side A in the front yard. The Incident Commander in turn requested the dispatch of a third alarm with the thought process that the Level 2 RIT resources would be assembled from the third alarm complement.

**9. There is a contradiction regarding RIT Level 2 in Fire and Rescue Association Policy 5.5.2 titled Rapid Intervention Team (RIT).**

**Discussion:** The Fire and Rescue Association Policy 5.5.2 titled Rapid Intervention Team (RIT) defines a RIT Level 2 Task Force as including one engine company, one truck company or rescue unit, one battalion chief or command officer, and one transport unit. The same procedure recognizes the adoption of the NOVA manual for RIT operations. The NOVA manual defines resources for a RIT Level 2 Task Force differently as it includes one



rescue unit in addition to one truck and specifically identifies an ALS unit versus a transport unit which could be BLS or ALS.

**10. The rescue effort was attempted by various crews and individual crew members, but the activities were not coordinated under a rescue group supervisor.**

**Discussion:** Immediately after the mayday event occurred, the crews from Wagon 512, Rescue 510, and Engine 510 abandoned their respective tasks of fire attack and search and initiated firefighter rescue efforts. The crews aggressively attempted to protect the stairwell area to give Tower 512's inside crew an opportunity to exit the building. They also attempted to reach the area of Technician Wilson's last reported location on the second floor.

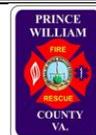
The mayday transmissions placed Technician Wilson's location on the second floor somewhere in the staircase. This information along with the radio transmission that the staircase had burned out, led all crews to focus rescue efforts on the stairs and the landing areas. As crews ascended the foyer interior stairs and determined the stair integrity was intact, this information was not relayed to Command or other units operating within the structure.

The additional crews assigned by Command to rescue the firefighter independently developed their own action plan which resulted in different entry points, uncoordinated tactics, and firefighter rescue efforts. Crews were entering Side C when suppression and rescue operations were underway on Side A. The entire structure was independently searched by multiple units in the event Technician Wilson had fallen through a hole in the floor due to hearing the radio transmission that the stairs had burned out. Establishing a Rescue Group, coordinated by a single supervisor, maximizes resource allocation, identifies areas of priority, tracks search outcomes, and ensures suppression operations support.

**11. There was miscommunication between Division A and Command regarding the resource availability of RIT teams, relief crews, and the establishment of a RIT Level 2 Task Force in the front yard.**

**Discussion:** At 0628 hours, Division A requested Command to confirm there were two RITs standing by in the front yard. Division A's radio transmission was (transcribed from radio transmissions):

*"I want to confirm I got two RIT teams in the front yard ready to go. I'm getting ready to send (garbled)."*



Command interpreted the transmission as a confirmation that Division A had two RITs in place in the front yard and replied acknowledging that:

*“Copy two RIT teams in front yard ready to send in. I’m gonna do a PAR check.”*

Division A believed Command confirmed the request to send two RITs to the front yard and utilized Tower 513 and Engine 517 for rescue operations:

*“OK, I’ve got Tower 513 making entry on Side A with Engine 517 to attempt a search. We need (garbled) lights in front of the building.”*

At 0632 hours, Division A repeated the request for two more units in the front yard:

*“I need to confirm, Side Charlie is clear, no one else operating; don’t want to get opposing hose lines. To continue with operations, I need two units in front yard, uh, in case we have secondary collapse.”*

Command acknowledged the request for two more units:

*“Alright, I’ll get you two more units to the front yard.”*

Division A then made a request for two additional units for relief crews:

*“Division A to Command, I need two additional relief units to front yard to relieve Rescue 510, in case we have a second, correction (garbled).”*

Command requested Division A to repeat the request and Division A transmitted:

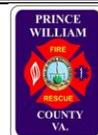
*“Yes I need two relief crews in the front yard to relieve Rescue 510, give me a level two RIT established in the front yard.”*

Command replied:

*“Copy two relief crews to the front yard.”*

At 0634 hours, Command requested a third alarm due to resource depletion and with the thought process that the Level 2 RIT resources would be assembled from the third alarm complement.

The requests for RIT teams, relief crews, and a RIT Level 2 Task Force were never fully filled and achieved.



**12. OPSC lacks a procedure and dispatch complement for RIT Level 2 or Level 3 Task Force requests.**

**Discussion:** Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (RIT) identifies a dispatch complement for additional resources, but the procedure has not been coordinated or implemented with OPSC.

**13. Current unit minimum qualified staffing levels provide an insufficient amount of personnel to perform all the necessary, concurrent critical tasks associated with firefighting activities. See expanded discussion in Effective Firefighting Force Section findings.**

**14. There was an insufficient effective firefighting force to perform all the necessary, concurrent critical tasks associated with firefighting activities. See expanded discussion in Effective Firefighting Force Section findings.**

**Recommendations:**

**7.1. Revise Fire and Rescue Association Procedure 5.5.3 titled Personnel Deployment during the Initial Stages of Interior Structural Firefighting and IDLH Incidents to the first arriving company actions. Examples of clarification needed include:**

7.1.1. The procedure addresses when three or four personnel are on the scene. Clarification is needed for circumstances when there are more personnel operating on a fire ground prior to the arrival of the RIT pumper. There needs to be alignment between OSHA, NFPA, local procedures, and operational practices.

7.1.2. The procedure needs to identify what is the acceptable practice when more than one team is operating in an IDLH atmosphere when no RIT has been established. There needs to be alignment between OSHA, NFPA, local procedures, and operational practices.

7.1.3. The two-out crew must be announced on the tactical radio channel.

**7.2. Standardize procedures designating the RIT crew.**

7.2.1. It is recommended that the third due engine be designated as RIT due to the critical need to have it in place when multiple crews are operating on the fire ground.



7.2.2. The unit assigned as RIT shall be announced on the tactical radio channel by the Incident Commander.

**Discussion:** Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires identifies the third arriving engine as RIT. Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (RIT) adopts the NOVA manual for RIT operations which identifies the fourth arriving engine as RIT for single family dwelling fires. The resource allocation in Prince William County will place multiple crews operating on the fire ground well before the arrival of a fourth or fifth due engine. While the Fire and Rescue Association is in the process of adopting the various NOVA manuals and may adjust dispatch complements, the current dispatch complement for single family dwelling fires only provide for the dispatch of three engine companies.

There must be standardization within the system identifying the third arriving engine as the RIT resource for all types of structure fires, regardless of the occupancy type. This practice needs to be adopted for inclusion in Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines. As the fire and rescue infrastructure expands with added resources, this practice is to be reevaluated.

**7.3. Develop a standardized field operations quick reference guide for low frequency/high risk events (i.e. mayday, RIT activation, unaccounted crews, active shooter, etc.) to be carried in all command vehicles.**

**Discussion:** Incident commanders need a ready quick reference guide that can be used when managing any low frequency/high risk event. This includes firefighter mayday check lists, RIT activation check lists, notification requirements, and employee accident, injuries, and investigation requirements.

**7.4. Evaluate the concept of staffing and deploying pre-established RIT resources that have specialized training in firefighter rescue operations.**

7.4.1. All crews shall be trained and maintain the ability to function as a RIT.

7.4.2. A minimum of one staffed specialized unit should be placed mid-County, with the ultimate goal of staffing one per battalion.



- 7.5. A RIT Level 2 should automatically be dispatched on all second or greater alarm fires and whenever firefighter mayday calls are encountered.**
- 7.6. A RIT Level 2 should be requested by the Incident Commander on incidents which have deteriorating conditions, large structures, or other complex incidents.**
- 7.7. RIT needs to be identified, announced, and re-established when deployed.**
- 7.8. When a firefighter rescue operation is identified and implemented, the following Incident Commander actions shall take place:**
  - 7.8.1. A division within the incident command structure for rescue must be established.
  - 7.8.2. Resources must be identified.
  - 7.8.3. Firefighter rescue operations must be fully coordinated and communicated.
  - 7.8.4. Alternative firefighter rescue plans must be developed for rapid implementation if situation changes or alternative solutions are required.
  - 7.8.5. A RIT Level 2 Task Force is to be requested if not dispatched by OPSC.
- 7.9. Ensure universal understanding of terminology and application of RIT versus rescue. Training needs to be focused and delivered in this area system wide.**
- 7.10. Ensure confirmations of radio and face to face communications have occurred by echoing the message.**
- 7.11. Establish an OPSC procedure for dispatch complement of RIT Level 2 and Level 3 Task Forces.**
- 7.12. Revise the Fire and Rescue Association procedure 5.5.2 titled Rapid Intervention Team (RIT) to address active fire ground listening for PASS devices and noises, as well as the expected actions to be taken upon hearing the activation of a PASS device.**



**Discussion:** Personnel should be keenly aware of the activation of the PASS alarm device during fire ground operations and take immediate action. The procedure should identify the following actions:

- Announcement of fire ground silence to listen for activated PASS alarm devices or other sounds being generated by lost, trapped, or disoriented firefighters.
- Identify another audible and visual device to identify access and egress points for use during an active rescue operation.
- Require search and rescue crews to deploy a hose line, when available, to facilitate tactical operations and provide firefighter and/or victim protection. The hose line would also provide a point of orientation for firefighters egress in zero visibility environments as firefighters are trained to “read” the couplings male and female ends (male coupling ends point toward the nozzle and female coupling ends point to the water source). In the absence of a hose line, then a rescue rope line should be deployed for the purpose of providing a point of orientation for firefighter egress.

***Related recommendations in other sections:***

- **Establish an internal task force and implement a system wide review of all procedure memorandums. This review must begin immediately and all efforts are to be taken to achieve it within a 90 day time period. See expanded discussion in General Section.**
- **Increase the minimum qualified staffing of all fire suppression units to improve firefighter safety and operational effectiveness. See expanded discussion in Effective Firefighting Force Section.**
- **The dispatch complement must be increased to send an effective firefighting force capable of providing the amount of crews required to mitigate fires and other emergency incident types and increase firefighter and citizen safety. See expanded discussion in Effective Firefighting Force Section.**



# Strategy and Tactics

## **Section 8**

### **Strategy and Tactics**

#### **Overview:**

To address how a particular emergency incident will be mitigated, an incident action plan is developed and includes the strategy and tactics expected to be implemented. Strategies are the objectives desired to be achieved where the tactics are the tasks needed to achieve the strategy. For example, a strategy may be fire confinement. The tactic used to achieve that strategy could be the deployment of a 1 ¾ inch hose line to confine the fire.

The development of a particular incident's strategy and tactics include consideration of numerous items. These items include the mode of operation, building construction, the current and expected fire travel, the length of time the fire has been present, and the resources available to support the plan.

A standard strategic/tactical approach and expectation of tactical unit assignments for initiating actions at a structure fire in a single-family dwelling are established in Department of Fire and Rescue procedure 5.5.1 Standardized Strategic/Tactical Activity Guides for Structure Fires in conjunction with the Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines.

Issues associated with accountability, crew integrity, RIT, and rescue operations are discussed in separate sections of this report.

#### **Findings:**

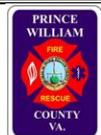
##### **1. First Arriving Engine (Wagon 512).**

- a. Upon arrival of Wagon 512 at the hydrant, the unit initiated water supply activities and a tactical decision was made by the unit officer to deploy a 2 ½ inch hose line for fire attack.**

**Discussion:** Wagon 512 initially stopped at the hydrant south of the incident location and dropped their 4 inch supply line. From this location, the officer was able to see Side B of the structure and observed the fire at the structure's B/C corner. At this location, the officer made the hose line selection decision without the benefit of performing a complete size up of the structure.

- b. The selection of a 2 ½ inch hose line in a residential structure with a crew of two personnel delayed the advancement of the hose line into the structure.**

**Discussion:** A 2 ½ inch hose line provides for a high volume of water flow but when the line is charged, it is extremely heavy which hinders its



deployment and maneuverability, especially in the interior of a structure. A charged 50 foot section of a 2 ½ inch hose line weighs approximately 133 pounds; therefore, Wagon 512's charged 200 foot, 2 ½ inch hose line weighed an estimated total of 532 pounds.

Wagon 512 was staffed with three personnel (one officer, one driver and one bucket person). It could realistically be expected that a crew of only two firefighters would advance this hose line only a minimal distance. While a 2 ½ inch hose line may be selected for an interior attack, there must be sufficient staffing to advance and negotiate the hose line. The deployment of this charged 2 ½ inch hose line was overwhelming for two firefighters due to the hose line size and weight which created delays in its deployment and operation. It may take four to six firefighters to effectively and efficiently move the heavy and difficult to maneuver hose line.

The maneuverability of a charged 1 ¾ inch hose line is vastly greater and the hose line weighs much less when compared to a 2 ½ inch hose line. A charged 50 foot section of a 1 ¾ inch hose line weighs 71 pounds; therefore, a 200 foot line would weigh an estimated total of 284 pounds, which is 53% the weight of the 2 ½ inch hose line. The 1 ¾ inch hose line can be maneuvered and advanced by two firefighters.

**c. Deployment of multiple hose lines were required to meet the estimated fire flow calculation.**

**Discussion:** Determining fire flow or the amount of water needed to combat a fire is estimated based on the amount of heat release by the burning materials and the amount of heat absorbed by applying water. All fire flow calculations are estimates and will be impacted by other incident variables such as environmental conditions.

Fire and Rescue Association Procedure 5.1.18 titled Building Preplan identifies the Iowa Formula to be used to estimate the amount of fire flow required during a knockdown or blitz attack, which is typically a 30-60 second attack. The Iowa Formula for the approximately 6,000 square foot Marsh Overlook structure is listed below:

<b>% Fire Involvement</b>	<b>Water Flow Requirement</b>
100%	1,229 gpm
75%	922 gpm
50%	615 gpm
25%	307 gpm



The estimated amount of water required for complete extinguishment is 26,340 gallons.

The NOVA Manual for Engine Company Operations indicates the required, sustained fire flow for the Marsh Overlook structure would be an estimated 600 gpm.

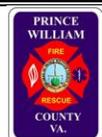
A 2 ½ inch hose line can be expected to flow 250 – 300 gpm and a 1 ¾ inch hose line can be expected to flow 150 – 200 gpm. The type of nozzles used affect the expected hose line flow rates. The total flow expected from the initial hose lines on Marsh Overlook was 400 – 500 gpm. With an estimated 50% involvement of the Marsh Overlook structure upon the units' arrival, there was inadequate fire flow initially available and inadequate resources to increase the number of hose lines deployed.

**d. The first arriving officer made the decision to initiate offensive interior fire attack and search for victims. The officer also requested additional resources.**

**Discussion:** Wagon 512's officer's size-up of the situation found a large two story single family home with heavy fire on the outside of the structure on Side B and C and extending into the attic. Wagon 512's officer viewed Sides A and B upon scene approach and walked Side D to the C/D corner where a portion of Side C was viewed. Tower 512's officer viewed Side B upon approach and walked Side B to the B/C corner where a portion of Side C was viewed. The tower officer returned to Side A observing conditions along the way and met with Wagon 512's officer where they established and coordinated their initial action plan. Due to the construction and lot features on Side C, neither officer was fully aware of the fire conditions present on Side C, the basement, or the roof.

The size up factors considered by Wagon 512's officer were:

- 0600 hours incident time.
- Single family, two story structure.
- No interior lights visible.
- Vehicles were present in the driveway and parked in the street.
- Large volume of fire on the structure's exterior with possible extension into the attic.
- Light amount of smoke on the structure's interior.
- No evidence of the occupants outside the structure.
- Potential for occupants sleeping.
- Second floor areas were priority for search of possible victims in bedroom areas.
- Recognized additional resources were required and requested second alarm.



- Identified primary and secondary water sources.

Wagon 512's officer's initial mode of operation was offensive, with the strategy to coordinate efforts with Tower 512's crew to conduct a search of the structure for any occupants, perform any rescues, and attack the fire believed to be in the attic. Further strategies included having the second engine company attack the fire on the outside of the structure and call for additional resources by requesting a second alarm. The rapid decision to request an additional alarm assignment was appropriate and critically important in the chain of events.

**e. The initial size up of the structure failed to adequately identify all the critical situational factors.**

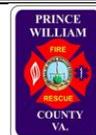
**Discussion:** According to Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines, a size up is the responsibility of the officer and can best be accomplished by surveying the entire exterior of the structure. The officer will assign the crew to deploy the hose line and forcible entry tools to a specified location while the size up is being conducted. Neither Wagon 512 nor Tower 512's officer performed a complete 360° survey around the structure. If a complete 360° survey had been done of the structure, this would have identified that the rear basement door was open and that the fire had penetrated into the structure on multiple levels to include the basement and attic.

Additional size up considerations include, but are not limited to, the environmental conditions (weather), the building construction and size, extent of the fire on the exterior and interior of the structure, smoke characteristics, time of day, and potential rescue scenarios. While some of these factors were identified, not all were considered.

**f. After completing the size up, Wagon 512's officer and Tower 512's officer identified an incident action plan.**

**Discussion:** Wagon 512's officer identified clues that the house may be occupied and given the time of day, search and rescue was expected to be an incident priority. Based on this situation, Wagon 512's officer requested an additional alarm assignment.

Wagon 512's officer planned to advance a 2 ½ inch hose line to the second floor of the structure for fire attack while Tower 512's interior crew searched the second floor for victims. This plan was augmented by the arrival of Engine 510 and Rescue 510. Engine 510's crew was instructed to pull a 300 foot 1 ¾ inch hose line and deploy it to the rear, and Rescue



510's interior crew was to assist with the structure search by beginning their effort on the first floor.

## 2. First Arriving Truck (Tower 512).

- a. **Tower 512 positioned short of the front of the structure which placed the aerial ladder out of position to support rescue operations or be used as an effective elevated master stream.**

**Discussion:** Tower 512 pulled short of the structure due to poor visibility and to avoid apparatus being placed in an exposure situation as the wind was blowing smoke and embers at street level from the rear to the front of the house.

The positioning of the aerial device could not support any rescue operations as it would not reach the structure. The positioning also was an ineffective location for the elevated master stream due to the distance to the structure and the environmental conditions.

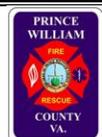
The positioning in the street permitted optimal outrigger placement and proper safety actions of placing wheel chocks down were taken.

- b. **Tower 512's officer split the crew into inside and outside (X-ray) teams and followed the operational guidelines.**

**Discussion:** The X-ray crew was initially focused on setting up for aerial ladder operations at the direction of the unit officer, while offensive operations were underway and needed to be rapidly supported. The crew then further split, with the driver staying at the ladder truck while the other firefighter placed ground ladders and secured the gas meter. Use of the aerial device will be discussed in a later finding.

- c. **While initiating a primary search on the second floor, Tower 512's inside crew did not have hose line protection.**

**Discussion:** Tower 512's inside crew entered the house through the front door, ascended the stairs to the second floor, and began a primary search of the bedroom in Quadrant Delta without the protection of a hose line. According to Fire and Rescue Association Procedure 5.1.6 Operational Guidelines, the Truck Company Officer needs to coordinate with the Engine Company for hose line protection. It further states that the hose line should be positioned to protect the inside crew performing the search. The hose line was not advanced into the structure until after the mayday event had occurred. Search crews must ensure they have adequate protection in place while conducting their tasks during fire conditions.



### 3. Second Arriving Engine (Engine 510).

- a. **Engine 510 was not able to perform their assigned task to establish a water supply for the initial attack engine company.**

**Discussion:** Engine 510's officer took the first Marsh Overlook entrance because of the inaccuracy of the hydrant address location and close proximity of the street. Engine 510 arrived on the scene and immediately recognized that their approach put them out of position to supply water to Wagon 512. Engine 510's officer immediately transmitted a water supply assignment adjustment to the next arriving engine company.

- b. **Engine 510 assumed Engine 520's initial assignment to establish a secondary water supply, but retained the second arriving engine's tactical responsibilities.**

**Discussion:** Engine 510 arrived on the scene and was out of position to complete the water supply for Wagon 512. Engine 510's officer directed his driver to back down to the closest hydrant and lay a supply line back toward the incident scene thereby establishing a secondary water supply. After giving this verbal direction, Engine 510's officer and firefighter proceeded to the scene and were given the task of deploying a second 1 ¾ inch hose line for fire attack to Side C.

- c. **Engine 510 positioning obstructed the command post view and was not optimal for master stream device use.**

**Discussion:** The final placement of Engine 510 unintentionally obstructed the command post view but was selected to facilitate any additional master stream operations if required. However, there were two other options readily available for this that included utilizing Wagon 512's master stream device or making Engine 510's master stream device portable.

### 4. Third Arriving Engine (Engine 520).

- a. **Engine 520's initial assignment was changed when Engine 510 arrived on the scene and was out of position.**

**Discussion:** Engine 520 was initially directed to establish a secondary water source off the first Marsh Overlook. However, when Engine 510's officer realized they were out of position he instructed Engine 520's officer to take the second Marsh Overlook and pick up Wagon 512's water supply. Engine 520 arrived four minutes after Wagon 512. The change of water supply assignment delayed the initiation of the primary water supply



for Wagon 512 by a minimum of two minutes. Wagon 512 has a 600 gallon tank to initiate immediate fire attack prior to an establishment of a water supply source and their supply line configuration does not include a four way hydrant valve (i.e. Humat). A four way hydrant valve permits the rapid initiation of water flow from the hydrant to the apparatus. Subsequent arriving apparatus can attach an additional line to the valve to boost the pressure initially being supplied (hydrant pressure) without the interruption of water flow.

A 2 ½ inch hose line is capable of flowing 250 – 300 gpm which would deplete a 600 gallon tank in approximately 2 minutes. If the tank supply is depleted prior to the initiation of a water supply source, it would result in an interruption of the hose line water flow. Wagon 512's officer did not report experiencing an interruption in the water flow, but numerous accounts of poor hose line pressure were reported.

When Engine 520 connected to the hydrant, they (apparatus driver and driver shadow which was in place due to an in-service training opportunity) encountered gushing water upon initiation of pump operations. It was determined that a previous crew had incorrectly left an open gate to the deck gun which caused it to unexpectedly discharge, but the correction was rapidly made.

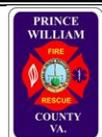
**b. Engine 520's crew was assigned to protect Exposure Delta.**

**Discussion:** Per Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires, the third arriving engine company is designated as the RIT. However, the Incident Commander modified their expected assignment from RIT to exposure protection. The crew complied with this assignment and maintained operational discipline when the mayday calls were transmitted.

**5. First Arriving Rescue (Rescue 510).**

**a. Rescue 510's initial actions complied with the operational guideline and informal expectations.**

**Discussion:** Rescue 510 self dispatched and added their unit to the incident in accordance with informal battalion policy expectations. The Department procedure lacks direction for a rescue unit on single family structure fire dispatches, but the Fire and Rescue Association procedure does contain expectations of the unit's actions. The officer split the crew into inside and outside (X-ray) teams and followed the operational guidelines.



## 6. First Arriving Medic (Medic 512).

- a. **Medic 512 staged the unit upon arrival and assisted Engine 520's driver with initial water supply.**

**Discussion:** Medic 512 arrived on the incident and positioned their unit out of the way of incoming suppression apparatus and to facilitate their egress if required. Later in the incident, their unit was repositioned closer to the incident scene to receive a potential patient. The crew assisted Engine 520 with the establishment of a continuous water supply. After hearing the mayday transmission the crew donned their personal protective equipment and went to the front of the house to find out who was missing. Upon learning Technician Wilson was the missing firefighter, the crew went back to the unit and prepared for possible transport.

- b. **Medic 512's crew entered the hot zone without any direction or accountability.**

**Discussion:** According to Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires, the crew of the medic unit should position for rapid egress from the scene, prepare for suppression operations, and deliver accountability passport to the collection point. If not needed for suppression activities, the crew is to establish a rehab/aide station. With no direction from Wagon 512's officer or the Incident Commander to engage in fire suppression activities, establishing a rehab area and remaining in position for rapid transport would have been an appropriate task rather than entering the hot zone with no assignment. Furthermore, it would have been appropriate for the crew to stage their equipment near the command post and provide some initial command post support activities early in the incident.

## 7. First Arriving Ambulance (Ambulance 510).

- a. **Ambulance 510 arrived on the scene and supported fire ground operations.**

**Discussion:** According to Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires, the ambulance crew should position for rapid egress from the scene, prepare for suppression operations, and deliver accountability passport to the collection point. If not needed for suppression activities, the crew is to establish a rehab/aide station.



Ambulance 510's officer directed crew members to gather the appropriate equipment and establish a rehab area. This activity was appropriate but should be coordinated with other EMS units on the scene. Ambulance 510's officer gathered passports from on-scene units and delivered them to the command post at which point the officer assisted with the management of the command boards. Ambulance 510's driver escorted a civilian from a parked car that was later identified as an occupant of the Marsh Overlook house.

## **8. First Arriving Battalion Chief (Battalion 503).**

### **a. Battalion 503 arrived and positioned his unit with a view of the house.**

**Discussion:** Battalion 503 established the command post in the driveway of 15469 Marsh Overlook (which was located diagonally northeast of the fire structure). Battalion 503 contacted Wagon 512's officer and requested a situation report. Command was formally established and announced to OPSC. When resources were available, runners were sent to collect passports that were not delivered to the command post directly.

### **b. Battalion 503 assigned the third arriving engine, Engine 520, to protect Exposure David.**

**Discussion:** Command assigned Engine 520's crew the task of protecting Exposure David upon their arrival to the scene. The third engine company is normally assigned RIT when it is confirmed that crews are operating in an IDLH environment. However, if the Incident Commander modifies the expectation, they must assign another crew as the RIT.

The Incident Commander modified the assignments based on the amount of embers flying from the involved structure and concern of fire spread to adjacent homes. Command stated during interviews that the intent was to have Engine 520 perform the RIT assignment and protect Exposure David. However, that intent was not verbalized and is not in compliance with procedure. Command also intended to have the fourth arriving engine (Wagon 502) assume RIT responsibilities upon their arrival.

## **9. The ladder trucks were positioned with aerial devices elevated for anticipated master stream operations in high wind conditions.**

**Discussion:** Fire and Rescue Association procedure 5.1.6 titled Operational Guidelines states an aerial ladder should be raised and extended to operating position complying with manufacturer's specifications for ladder pipe



operations. Aerial devices are rated by the manufacturers to withstand wind forces from 35 mph up to 50 mph. Two of the aerial devices were rated for 50 mph (Tower 513 and Truck 511) and one was rated for 35 mph (Tower 512). Unit officers and driver operators along with Command need to consider environmental factors when making the decision to operate aerial devices. There was a high wind advisory with recorded wind gusts of 48 mph the morning of the incident.

#### **10. The fire burned and progressed for more than twelve minutes prior to water application.**

**Discussion:** The first 911 call to report the fire was received at 0601 hours but it is undetermined how long the fire had burned prior to that call. Wagon 512 was the first unit to arrive on the scene at 0608 hours. Water application began at approximately 0613 hours, an elapsed time in excess of twelve minutes from alarm notification, but a greater elapsed time from the start of the fire. No water was applied on the fire prior to the events that led to Tower 512's crew becoming trapped by the rapidly progressing fire.

An estimation of burn time is a critical fire ground factor that must be addressed by the officer and crew during the initial incident size-up when developing the incident action plan and implementing the appropriate strategy and tactics for the incident. When developing the initial strategy and mode of operation, company and command officers must take into account the set up time to operationalize the tactics indicated for the incident. Firefighters may lose a perception of time when engaged in fire ground activities and may not recognize the elapsed time since their arrival or initiation of a strategy or tactic. The initial arriving company officers at the Marsh Overlook incident underestimated the rapidly progressing fire, the fire impingement upon the structural members, and the reflex time of fire ground operations.

The strategies and tactics, policies, procedures, and guidelines developed for the structures of yesterday are not appropriate for the structures of today and tomorrow. The changes in the building industry require the firefighting industry to adjust their structure fire strategy and tactical operations at lightweight, and emerging "ultra-light and featherweight" construction.

#### **11. Fire stream application using a straight stream nozzle pattern resulted in hose stream travel through the structure and out the exterior walls.**

**Discussion:** Straight stream nozzle patterns are effective when fire penetration and fire stream reach is required. With the rapid degradation of the wall, ceiling and roof components, the straight stream nozzle pattern was ineffective as there were no materials to deflect the stream. There were a tremendous amount of BTUs being produced which were not being absorbed



by the ineffective stream application and subsequently not able to suppress the fire.

The initial hose lines taken into the structure were advanced in a direction opposing the wind's direction on the structure. As the structural integrity failed resulting in the uncontrolled ventilation of the structure, the chance of successful hose line advancement against the additional force of the high winds was lost.

**12. Initially there were inadequate resource capabilities to confine and suppress the amount of fire on multiple levels of the structure.**

**Discussion:** The fire, intensified by the environmental conditions, had progressed to multiple floors and the attic. To effectively combat, confine and suppress the fire, multiple hose lines deployed on multiple floors were needed.

The fire had penetrated into the basement prior to the arrival of fire and rescue units based upon witness interviews. At the time Wagon and Tower 512 arrived, approximately 50% of the structure was involved as there was fire on both Sides B and C, and was suspected to have spread into the attic. An estimated 615 gpm fire stream application was needed with lines deployed to all three floors and to the attic space.

**13. There was ineffective deployment of 2 ½ inch hose lines and master stream devices for heavy water application.**

**Discussion:** Total involvement of the structure required the use of multiple 2 ½ inch hose lines and master stream devices. To accomplish this, there was one 2 ½ inch hose line and the deck gun from Engine 510 utilized. None of the elevated master streams were in position to be effectively used. The deck gun on Engine 510 was used, but the position was not optimal. The deck gun on Wagon 512 was in better position compared to Engine 510 but was not deployed. While Division A called for a deck gun to be placed on Side A, none of the devices were made portable and brought to that location.

**14. Four engines dropped supply lines at four different hydrants and laid lines toward the incident location.**

**Discussion:** Wagon 512 announced the establishment of the primary water source and directed Engine 520 to establish a secondary water source. However, two additional units elected to drop additional supply lines but their activities were not effectively communicated or coordinated. This additional action caused incoming engines to stop and perform supply operations, including leaving their driver at the remote hydrant locations to ensure



necessary actions if requested. This reduced the available resources reporting to the scene.

**15. Initially there were inadequate resource capabilities to rapidly place the number of ground ladders needed for tactical operations and size of the structure.**

**Discussion:** Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines states a minimum of two sides of the structure are to be laddered with one ladder placed to the fire floor and one placed to the floor above. If at all possible, all four sides of the building are to be laddered.

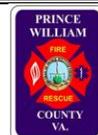
On the Marsh Overlook incident, the initial ground ladders were placed on Side A (Quadrant Alpha) and Side C (to the deck). The ladder on Side A was taken down due to fire impingement but the ladder was not repositioned to another location on Side A. There was a third ladder placed on Side D (Quadrant Delta) and later in the incident, a fourth ladder to Side D (Quadrant Charlie) was placed. The ladder on Side D (Quadrant Delta) fell down due to high wind conditions and was replaced more than one time. The Side D ladder was repositioned during the incident to Side A above the garage, but later replaced back to Side D. Side B was unable to be laddered due to the fire conditions.

When the firefighter rescue situation occurred, additional ground ladder placements were indicated but not achieved. While the structure did have ladders placed on three sides, the large size of the structure dictated the need for additional ladder placement.

**16. Some unit officers arriving on the scene initially thought, based on observed conditions, that the mode of operation would be defensive.**

**Discussion:** During interviews with the Marsh Overlook Investigation Team, some of the unit officers stated that while approaching the scene, and observing smoke and fire conditions, they thought that the mode of operation was going to be defensive.

Fire and Rescue Association Procedure 5.1.16 titled PWC Specific Additions to COG's Fire & Rescue Services Mutual Aid Operational Plan (ICS), requires that the first arriving officer establish strategy and objectives, then determine the mode of operation as either "Nothing Showing, Offensive Mode, Defensive Mode, or Marginal Mode." The procedure does not specifically require the first arriving officer to declare the mode of operation over the radio.



17. Current unit minimum qualified staffing levels provide insufficient amount of personnel to perform all the necessary, concurrent critical tasks associated with firefighting activities. See expanded discussion in Effective Firefighting Force Section findings.

18. There was an insufficient effective firefighting force to perform all the necessary, concurrent critical tasks associated with firefighting activities. See expanded discussion in Effective Firefighting Force Section findings.

**Recommendations:**

8.1. Reinforce the need to perform and complete an accurate incident size up.

8.1.1. Implement a procedural change to require the transmission of an on scene report followed by a size up report.

**Discussion:** The initial arriving unit officer is required to transmit an on-scene report. This is done prior to a size up being fully completed and may not include information about all fire conditions and locations. Transmitting a size up report will enable responding units and the incident commander to better understand the situation and anticipate needs. An example of the differences between the reports is as follows:

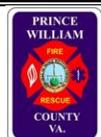
On scene report: “Engine 511 on the scene, two story wood frame single family detached house, smoke showing Side A, second floor.”

*Unit officer dismounts apparatus and performs size up.*

Size up report: “Engine 511 completed size up of all four sides. Structure is two stories on Side A and three stories Side C. Fire is on second floor, quadrant delta, heavy smoke throughout the structure, and reported victim trapped. Mode of operation will be offensive attack.”

8.1.2. Implement a procedural change to require a size up report to be transmitted from the unit assigned to Side C operations.

**Discussion:** While the initial size up is to include Side C conditions, there is reflex time associated from the point of the initial size up to when crews may be placed in operation on Side C. There may also be instances where the initial Side C size up may



not include a complete 360° survey as with large commercial structures, long row of townhouses, large apartment buildings, strip malls, etc. Requiring the unit assigned to Side C to provide a size up report, will give the incident commander updated situational information.

**8.2. Ensure the mode of operation and incident action plan are communicated over the radio on every incident.**

8.2.1. Any changes to the mode of operation must be announced on the radio tactical channel.

**8.3. Reinforce the need to communicate delays in implementing coordinated incident operations. Significant delays in implementing tactical operations may require the size up to be reevaluated.**

**8.4. Reinforce all search and rescue tactical operations are fully coordinated with and have adequate hose line protection.**

**8.5. Reinforce the need to secure raised ground ladders during fire ground operations in high wind environments.**

**8.6. Revise Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines to:**

8.6.1. Address the establishment of secondary water sources.

8.6.2. Fully coordinate the dispatch complement resources needed to achieve the operational guidelines.

8.6.3. Ensure resource assignment to Side C.

8.6.4. Consolidate Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires and Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines into a single procedure.

8.6.5. Evaluate NOVA operational guidelines for adoption and consolidation.

8.6.6. Address the strategy and tactics for a rapidly progressing fire on the exterior of a structure.

8.6.7. Address the strategy and tactics for lightweight construction structures.



- 8.6.8. Address the strategy and tactics for extreme environment conditions.
- 8.6.9. Clarify expectations of EMS transport units, especially regarding the need to prepare for victim and/or firefighter medical care and coordination of activities when multiple EMS units are present.

**8.7. Conduct a fire flow needs and capabilities assessment to identify the required apparatus and equipment to achieve the needed fire flow, application, and delivery method for structures within Prince William County. This assessment will serve as the cornerstone of establishing criteria for apparatus and equipment selection and standardization. Items for inclusion in the study are:**

- 8.7.1. Establish hose line flow and pressures to be used and standardize nozzles.
- 8.7.2. Standardize hose line sizes.
- 8.7.3. Standardize hose load configurations.
- 8.7.4. Standardize appliances to be used (i.e. four way hydrant valves, blitz nozzles).
- 8.7.5. Standardize apparatus and location of all equipment.
- 8.7.6. Evaluate the validity of Iowa Fire Flow Formula based on current building construction methods, designs, materials and fuel loads.
- 8.7.7. Identification of training curriculum revisions and/or requirements.

**Discussion:** A comprehensive fire flow needs and capabilities assessment must identify a logical and desirable approach to determine the optimal method to achieve the needed fire flow for structures found in Prince William County. The associated training curriculums will require revisions to reflect this information and current field practices.

***Related recommendations in other sections:***

- **Increase the minimum qualified staffing of all fire suppression units to improve firefighter safety and operational effectiveness. See expanded discussion in Effective Firefighting Force Section.**



- **The dispatch complement must be increased to send an effective firefighting force capable of providing the amount of crews required to mitigate fires and other emergency incident types and increase firefighter and citizen safety. See expanded discussion in Effective Firefighting Force Section.**
- **Perform a specialty service (trucks/towers/rescue) resource allocation study. See expanded discussion in Effective Firefighting Force Section.**
- **Refer to Training Section for additional related recommendations.**



**I n c i d e n t**

**C o m m a n d**

## **Section 9**

### **Incident Command**

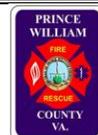
#### **Overview:**

To effectively and safely manage daily emergencies and other major incidents, the Prince William County Fire Rescue Association adopted the Incident Command System (ICS) as defined in the Council of Governments (COG) Field Operations Guide. The Fire and Rescue Association procedure 5.1.16 titled Prince William County Specific Additions to COG's Fire and Rescue Services Mutual Aid Operational Plan (ICS) outlines specific additions and identifies how the Incident Command System is to be used in Prince William County. The command structure is consistent with the National Incident Management System but varies in some terminology identifiers.

For command coverage, the County is divided into four career battalions during daytime hours (0600 – 1800 hours) Monday through Friday. These boundaries are geographic sectors and are staffed with a Battalion Commander. During the week nights (1800 – 0600 hours), as well as weekends and holidays, the County is divided into five volunteer battalions. Three of the five battalion boundaries are drawn along Dale City, Dumfries, and OWL volunteer station groupings, and the other two battalions contain the remaining volunteer stations in the middle and western sections of the County. Each are to have a Battalion Commander assigned when staffed.

This report focuses on career weekday hours for response and staffing logic, as this is the time parameter the incident occurred. Operations outside of the weekday coverage hours do not receive the same level of Department support as career staffing logic is modified and other staffing resources are not available (i.e. health and safety staffing providing incident safety officers, EMS operations officers, logistical or other support staff). During career weekday hours, each battalion has a battalion chief assigned who work four 12-hour shifts a week. Typically on the days that the battalion chief is off, one of the engine captains moves into the Battalion Commander position. Attempts to backfill with other battalion chiefs are made, but due to competing priorities in their primary job and responsibilities, they are often unavailable for backfill.

The Battalion Commander is dispatched according to the dispatch complements but may elect to respond to any emergency incidents that occur in their response area. At the time of the Marsh Overlook incident, the Operations Section had an informal expectation that the closest neighboring battalion chief would automatically respond (non-emergency or emergency mode depending on the incident information) toward a structure fire or other major incident to provide additional support and become part of the incident management team as needed. This was dependent on the availability of the closest neighboring



battalion chief as other emergency incidents dictated and has a reflex time associated with their arrival to assist.

**Findings:**

- 1. Wagon 512's officer was in charge of the incident initially and acted accordingly.**

**Discussion:** The Fire and Rescue Association has adopted standard operational guidelines for a variety of incident types. As outlined in the Fire and Rescue Association Procedure 5.1.16 titled PWC Specific Additions to COG's Fire and Rescue Services Mutual Aid Operational Plan (ICS), the first engine company officer on the scene is assumed to be in charge of the incident, unless they pass command to another unit or another unit formally establishes command. If the first arriving unit does not establish command, the next arriving engine company or command officer shall establish command. After the initial size-up of the incident, the first arriving engine officer must determine an initial strategy and mode of tactical operations.

- 2. Battalion 503 formally established command three and one half minutes after Wagon 512's officer marked on the scene, relieving Wagon 512's officer of command responsibility.**

**Discussion:** The transfer of command included a clear situational and status report from Wagon 512 to Battalion 503. The actions of Wagon 512 and Battalion 503 in establishing and transferring command were consistent with established procedures.

- 3. There were eight crews operating on the fire ground when Battalion 503 established command. Prior to the arrival of the next chief officer, Command had a span of control that contained 15 crews.**

**Discussion:** Fire and Rescue Association Procedure 5.1.16 titled PWC Specific Additions to COG's Fire and Rescue Services Mutual Aid Operational Plan (ICS) identify the optimum span of control being five subordinates with seven identified as the maximum. When the span of control exceeds the optimal or maximum levels, the incident command system is to be expanded.

Crews that were operating on scene when command was established:

- Wagon 512
- Tower 512
- Tower 512 X-ray
- Rescue 510
- Rescue 510 X-ray
- Engine 510



- Engine 520
- Medic 512
- Ambulance 510

Additionally, these crews arrived and were operating on scene prior to the arrival of the second battalion chief:

- Safety 502 (not a crew but a single member)
- Wagon 502
- Tower 513
- Tower 513 X-ray
- Engine 513
- Engine 517
- Medic 552

It was in excess of seven minutes (four minutes following the mayday transmissions) before the Incident Commander received any command post support in setting up the command boards to track the accountability and assignments of the fire ground units or to manage radio traffic. The arrival, assignment, and subsequent functional positioning of the second command level officer was in excess of thirteen minutes (ten minutes following the mayday transmissions) where a more manageable span of control could have been obtained. However, the incident command structure needed to be expanded further to more effectively control and coordinate activities as well as improve span of control.

**4. The Incident Commander did not announce the specific location of the command post upon arrival at the incident scene.**

**Discussion:** The Incident Commander positioned the command vehicle across the street from the incident (A/D corner side) in a driveway. An announcement of the establishment of command was made on the tactical radio channel upon arrival, but the command post location was not specifically announced. Announcing the command post location will alert on scene and responding crews to where the Incident Commander can be found and where the accountability passports are to be taken.

**5. The Incident Commander initially had good positioning with visibility of Sides A and D of the structure but visibility of the scene became obstructed when Engine 510 positioned on the street in front of the Incident Commander (Battalion 503).**

**Discussion:** Engine 510's officer selected their apparatus positioning for an anticipated need of deck gun operations. This positioning obstructed the Incident Commander's view of the scene at the moment when the mayday occurred. An Incident Commander's continued situational assessment and



incident size up requires the ability to view the structure and size up the changing fire and smoke conditions.

**6. The Incident Commander was operating alone without any immediate incident command support when several critical events occurred.**

**Discussion:** The Incident Commander was operating alone without any immediate command post support assistance in the initial stages of the incident when the following concurrent events occurred:

Events occurring within the first minute after establishing Command:

- Emergency evacuation with a report of a crew trapped on the second floor.
- A rapidly progressing fire.
- There was depletion of on scene resources.
- Operating in a hostile environmental condition that included high winds and flying embers spreading into the command post location.

Events occurring within two minutes after establishing Command:

- Mayday from a unit reporting a missing firefighter.
- Mayday from a firefighter reporting he is lost and needs assistance.
- Unanswered radio communications from units in the IDLH atmosphere.
- Confirmed lost firefighter situation.

**7. Personnel from EMS units reported to the command post to initiate command post support activities by setting up command boards and establishing the accountability tracking system.**

**Discussion:** The command post support activities have the responsibility to maintain a minimum of four functional areas to include situation status, accountability, communications, and resource status. A single individual cannot effectively manage all of these responsibilities, especially when encountering large, complex, or extremely hazardous situations. Examples of tasks that may be required to fulfill these functions include:

- Critical, strategical, and tactical decision making for an initial action plan and development of alternative operational planning.
- Accountability of units and personnel.
- Monitoring and managing radio communications (all tactical radio channels, command channel, talk around channel).
- Determining and tracking the status of resources.
- Directing and managing resources.
- Anticipating, requesting, and deploying additional resources.
- Receiving and providing progress reports.



- Anticipating and recommending logistical needs to support the operation.
- Briefing of incoming resources.

Ambulance 510's officer reported to the command post following their arrival on the scene at 0613 hours. The officer's initial actions were to begin retrieval of passports from the other on scene units. Medic 552 was the medic unit dispatched on the second alarm and reported to the command post following their arrival at 0618 hours. Their personnel began to set up command boards and establish the tracking of personnel and tasks.

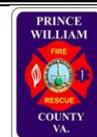
The appropriate resources needed to provide assistance to the command post incident support team were not immediately available and were provided by EMS units. These tasks took them away from their primary duties of patient care or in establishing personnel rehabilitation roles. If patient care needs had been immediately required, the Incident Commander would have lost all command post support at a critical and high risk time period.

Command level officers from staff assignments that normally respond when available to augment the incident command team are not readily available prior to or after their normal work hour assignment of 0700 – 1700 hours. While several of these command level officers responded from their home, their arrival was delayed due to not being rapidly alerted to the incident.

All these factors contribute to inconsistent command post support operations as resource availability is highly variable due to the type and complexity of the incident.

**8. Effective command post communications between the Incident Commander and the personnel assisting the Incident Commander were hampered when the Incident Commander remained in the front seat of the vehicle while the personnel functioned at the back of the vehicle utilizing the command boards.**

**Discussion:** After conferencing with the Incident Commander, the command post support personnel's primary effort should be to set up the command post, while the Incident Commander maintains focus on incident tactical operations. The Incident Commander determines whether to operate from the front of the vehicle or to move to the rear. However, once the command post is set up and ready to support communications, resources, and situation tracking, all personnel operating at the command post should relocate and operate from the rear of the vehicle using the command board(s) for incident management as a team, unless hampered by environmental conditions that negatively impact the exterior command post operations.



**9. There was no written tactical documentation captured from the command post during the incident because of the command board field tracking program currently used.**

**Discussion:** The Incident Commander and command post incident support team documented the tactical operations on the command board (dry erase board system) per procedure. However, when operations are revised or assignments changed, the command board is updated, and the historical event information to that point of the incident is lost.

While major event updates are communicated to OPSC for entering and recording in the incident history, the corresponding information and time stamp may not be fully accurate as it is dependent on human interpretation and reaction time. This may be further impacted when the OPSC personnel are attempting to manage multiple tasks and radio channels.

Command post support personnel attempted to preserve the initial command board information and obtain another command board for use when there was a change in the Incident Commander later in the incident. However, the incoming Incident Commander negated the efforts and utilized the original board revising the incident information.

**10. The incident command structure was expanded when the second arriving chief officer, Battalion 502, was assigned Division A but the change was not effectively communicated to all units on the fire ground.**

**Discussion:** Division A was established when a second command level officer arrived and assigned to control units operating on Side A, as they were involved in a complex operation. This benchmark took a total time of fourteen minutes to improve the incident command span of control. Neither Division A nor the units operating on the fire ground were briefed on what crews would be assigned to the Division. The Incident Commander maintained control and coordination responsibilities for all fire ground tactical operations as well as the rescue operations. The lack of communication among the Incident Commander, Division A supervisor, and the units operating on the fire ground caused a lack of accountability, operational coordination and control, and did not effectively reduce the amount of units reporting to Command. Expanding the incident command structure by assigning a rescue group supervisor would have relieved Command of that portion of operational coordination responsibility.

When determining the need for expanding the incident command structure into divisions or groups, several factors should be considered. A division is an organizational level that has responsibility for operations within a defined geographic area of the incident. A group is an organizational level in the



incident command system for a specified functional assignment at an incident. Examples include the potential for the incident to grow beyond the ability of Command to directly control incident resources, if companies are involved in complex operations, or when the situation is hazardous and close control of operating resources is needed. If the Marsh Overlook incident command structure had been modified to assign the second arriving chief officer as the rescue group supervisor, the span of control and the directing of tactical and rescue operations would have been improved.

**11. The rescue effort was attempted by various crews and individual crew members, but the activities were not coordinated under a rescue group supervisor.**

**Discussion:** Immediately after the mayday event occurred, the crews from Wagon 512 and Rescue 510 abandoned their respective tasks of fire attack and search and initiated firefighter rescue efforts. They aggressively attempted to search the area of Technician Wilson's last reported location.

As additional resources were assigned to the rescue effort, all the crews were not effectively coordinated with a single supervisor. Having a single supervisor responsible for this functional assignment maximizes the resource allocation and identifies areas of priority and tracks the search outcomes of each area.

The mayday transmissions placed Technician Wilson's location on the second floor somewhere in the staircase. This information along with the radio transmission that the foyer stairs had burned out, led all crews to focus rescue efforts on the stairs and the landing areas. As crews ascended the foyer interior stairs and determined the stair integrity was intact, this information was not relayed to Command or other units operating within the structure. With the belief a collapse had occurred, the entire structure was searched to ensure Technician Wilson had not fallen through a hole in the floor. A coordinated search and rescue ensures that a structure is thoroughly and systematically searched in areas of priority and is supported by suppression operations. The coordination would have reduced the amount of duplicated search efforts of the same areas and focused the rescue operation.

**12. The incident command structure was modified to adjust to rescue operations but the change was not effectively communicated to all units on the fire ground.**

**Discussion:** At 0634 hours, the Division A Commander requested to operate on a single radio channel with the RIT crews. This action terminated Division A and established RIT Command. The intent of RIT Command was to



coordinate crews entering the structure and search for the missing firefighter. The supervisor incorrectly used the terminology of RIT Command. The group should have been called a Rescue Group as firefighter rescue was the functional responsibility being performed.

A fire ground announcement was not made indicating discontinuation of Division A or the establishment of a RIT Command. The RIT Command supervisor had identified units operating in that group as Tower 513 and Engine 517. Command had also assigned Engine 513 and Engine 502 to rescue activities. The lack of assigning all the resources performing rescue to RIT Command did not effectively reduce the amount of units reporting information to Command. All the rescue activities that were underway were not fully coordinated by a single supervisor which led to duplicated efforts from multiple units. The lack of clear and concise communication from the Incident Commander to those units assigned to find the missing firefighter caused those units to interpret a broad assignment and develop their own independent action plans. Examples of these occurrences are:

- At 0619 hours, Command assigned Engine 513 to find the missing firefighter. Engine 513's crew surveyed Side A and D and attempted to enter the basement level on Side C. Due to the amount of fire in the basement, the crew elected to deploy a leader line from Engine 510 and enter the basement on Side C for fire attack and search of the missing firefighter. The entry location and plan were not initially communicated back to Command.
- At 0621 hours, Command assigned Wagon 502 to find the missing firefighter. Wagon 502's crew performed a 360° survey of the structure and elected to enter the first floor on Side C for fire attack and search of the missing firefighter. The entry location and plan were not initially communicated back to Command.

Uncontrolled units and unaccounted task assignments have severe consequences and can have disastrous outcomes as fire ground accountability is lost.

### **13. An additional radio channel was requested at 0635 hours.**

**Discussion:** When an incident increases in complexity, the incident command structure should be expanded and additional radio channels may be required to segregate the functional groups and their associated radio traffic. The Incident Commander must decide when an alternate channel is to be utilized and which fire ground activity should move to the alternate radio channel. The Incident Commander may elect to maintain all units on the



same tactical channel due to unavailability of command post support personnel to monitor and operate multiple radio channels.

Mayday training has identified the need for an additional radio channel but has varied as to the direction of either moving units assigned to fire ground tactical operations or moving the individual involved in a mayday situation.

On the Marsh Overlook incident a second radio channel was requested at 0635 hours and identified as the 'command channel'. A command channel is used for ancillary radio communications from the command post to the dispatch center or other location as necessary and is not used for tactical operations. However, the Incident Commander intended to utilize this second channel for incident operations radio traffic, and have RIT Command maintain communications on the initial radio channel.

Command did not make an announcement to all units operating on the fire ground to switch radio channels upon establishment of the second radio channel. Furthermore, the majority of units on the fire ground had been assigned to rescue the missing firefighter and it was unclear which units were to stay on radio channel 5-C and which units should move to radio channel 5-D.

**14. The incident command structure was expanded when a volunteer assistant chief arrived and was assigned to reestablish Division A. This change in assignment was not effectively communicated to all units on the fire ground.**

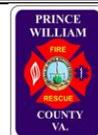
**Discussion:** At 0644, Command assigned Division A to volunteer Assistant Chief 514 but did not announce the reestablishment of the Division or what units would be reporting to the Division.

**15. The incident command support team expanded when the third arriving chief officer was assigned to handle communications with RIT Command.**

**Discussion:** Planning 501 arrived at 0646 hours and reported to the command post to assist in the command post support activities. Planning 501 was assigned to handle all communications with the RIT Command.

**16. EMS resources were not coordinated.**

**Discussion:** EMS units for patient treatment and crew rehabilitation needs were not specifically assigned by the Incident Commander. Without this coordination and direction, several EMS crews readied their units to receive the missing and presumed injured firefighter. This caused duplication of



efforts as units independently assumed their role would be that of patient care.

The initial arriving medic unit officer should assume the responsibility to confer with command and communicate the coordination of EMS resources until an EMS Group is established. When the appropriate coordination activities are not initiated and coordinated, then Command must identify the resources required for treatment, transport, and rehabilitation.

EMS Operations officers from staff assignments that normally respond when available to augment the incident command team are not readily available prior to or after their normal work hour assignment of 0700 – 1700 hours and were not rapidly alerted to the incident.

**17. The functional structural components of the incident command system were not fully achieved or integrated.**

**Discussion:** In review of the Marsh Overlook incident command structure, the functional groups that were practically in place were fire attack, rescue and EMS. These functional groups were not formally identified, organized or controlled. A geographic division was established but it also lacked formal organization and resources were not clearly assigned to it.

**18. The transition from offensive interior operations, to use of defensive exterior operation, and back to offensive interior operations was not clearly communicated.**

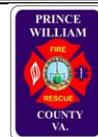
**Discussion:** Initiating defensive operations with large caliber lines and master streams with firefighters on the interior of a structure poses extreme risks to firefighter safety. To avoid firefighter injuries, all interior crews are to be withdrawn from the structure or relocated to a safe position.

**19. Master stream use was initiated with crews operating on the interior of the structure.**

**Discussion:** When the master stream device use was initiated, there was one crew (Engine 513) operating in the basement and one crew (Wagon 502) operating on the first floor.

**20. A higher ranking chief officer responded and elected to act as a senior advisor to the Incident Commander.**

**Discussion:** As an incident escalates or its complexity increases, higher ranking command officers typically respond. A higher ranking chief officer may assume command from the initial Incident Commander or elect to act as



a senior advisor to the Commander. The Operations Section Assistant Chief responded to the incident and upon arrival acted as a senior advisor to the current Incident Commander and did not assume command. In this role the Operations Assistant Chief ensured appropriate notifications were being made to other County officials, obtained an accurate count of the displaced tenants, and assisted with forecasting the reactions necessary to support the demobilization of the initial alarm crews.

Given the high degree of stress the Incident Commander experienced with the loss of a firefighter and the incident complexity, it would have been more appropriate in this incident for a higher ranking chief officer to assume command and relieve Battalion 503. Battalion 503 may have remained at the command post to provide the historical information, document information contained on the command boards, and begin to develop a demobilization and debriefing plan. Battalion 503 was eventually relieved by another Battalion Chief, but not until the incident was in the recovery mode.

- 21. Current unit minimum qualified staffing levels provide an insufficient amount of personnel to perform all the necessary, concurrent critical tasks associated with firefighting activities. See expanded discussion in Effective Firefighting Force Section findings.**
- 22. There was an insufficient effective firefighting force to perform all the necessary, concurrent critical tasks associated with firefighting activities. See expanded discussion in Effective Firefighting Force Section findings.**

***Recommendations:***

- 9.1. Evaluate the options to augment the existing regional command board system with a tactical worksheet or other mechanism to capture historical incident information.**
- 9.2. Evaluate the Department's current vehicle and outfitting for command post operation.**

***Discussion:*** The Department's current practice of the battalion commander level operating from the rear of a large utility vehicle (i.e. Suburban) needs to be evaluated for operations during severe weather conditions such as high wind, heavy rain, and extreme temperatures. The immediate needs of the initial Incident Commander, as well as the needs for protracted incident scenes, must be evaluated.



**9.3. There needs to be an immediate resource assigned to arrive with the Battalion Commander to initiate command post support activities.**

**Discussion:** An Incident Commander's responsibility of information gathering and management begins at incident dispatch. The task associated with incident commander response requires the individual to determine a response route, perform emergency response driving, access and read CAD terminal information, obtain and evaluate building preplans, begin to perform size up and formulate strategies for initial incident operations. Without assistance, the only tasks that can be performed are determining a response route and performing emergency response driving.

A single individual cannot effectively manage all the command post responsibilities. These responsibilities include the requirement to obtain and maintain situation status awareness, implementing and tracking the personnel accountability system, fire ground and command post communications, strategize, develop and implement incident action plans, and track resource status. Command post operations require the simultaneous monitoring and use of multiple radio channels, telephones, interaction with information management systems (i.e. personnel accountability system, CAD computer, building preplans, etc.), constant personnel interaction at the command post (i.e. unit officers, outside agencies, media, citizen, etc.), and utilization of all human senses.

The lack of immediate assistance places the Incident Commander operationally in a compromised position and the time lost cannot be effectively overcome during incident operations. If the Incident Commander does not have an immediate resource to assist in the management of command post operations, critical information, observations, and actions will be missed and firefighter safety is severely compromised. On the Marsh Overlook incident, the Incident Commander missed the mayday transmission from Technician Wilson.

As technology continues to increase and improve, it places additional demands on the Incident Commander and command post operations to monitor this information. Examples of this emerging technology is the transmission of thermal imaging cameras to an outside receiver, and personnel location tracking systems being integrated into SCBAs and other devices. All of this technology will require monitoring at the command post.



#### 9.4. **Develop and implement an incident command support team.**

**Discussion:** Assembling an incident command support team from responding resources leads to inconsistent command post functioning and operation and reduces the amount of resources available for firefighting tasks. On the Marsh Overlook incident, EMS personnel were utilized to perform command post support operations. This caused a portion of the EMS resources to be taken away from their primary duties of patient care or in establishing personnel rehabilitation. If an EMS need had occurred, the Incident Commander would have lost the command post support resource.

The minimum components to be considered in the evaluation and development of an incident command support team include:

- Incident Commander.
- Incident Commander assistant.
- Incident safety officer.
- EMS officer.
- Planning officer.
- How the team is assembled (transportation).
- What support equipment is needed to function from the command vehicles.
- What are the escalating needs as an incident grows in complexity and greater alarm assignments are required.

#### 9.5. **Reinforce importance for the Incident Commander and responding units to have shared responsibility when considering and selecting the most advantageous command post location and apparatus positioning.**

**Discussion:** For the incident command post to be fully functional and operational it must have the proper positioning on the fire ground. Selecting a site that allows the Incident Commander to view at least two sides of the building is preferred. Apparatus positioning is equally important in its ability to be fully functional and operational. All units on the fire ground must coordinate their positioning in relation to other units' needs to ensure their optimal functionality.

#### 9.6. **Ensure an appropriate span of control (5-7) is maintained throughout the incident.**

9.6.1. Change the dispatch complement for structure fire responses to include an additional battalion chief or command level officer.



9.6.2. Expand and reduce the command structure as needed to accommodate effective communications, operations, and maintain the appropriate span of control.

**9.7. The Department must establish a senior shift operational command officer level.**

**Discussion:** In order to provide the necessary supervision, resource management, coordination and operational oversight, a senior operational command officer is needed. This position would be responsible for the day to day administrative and operational requirements in each of the battalions, on each shift, and on a 24-hour basis. The position would also have the responsibility to provide supervision and enforcement of Prince William County Personnel Policy. The filling of this position would facilitate the current assistant chief level in focusing on the required organizational strategic planning.

On the Marsh Overlook incident, a battalion chief was functioning as the Incident Commander of an escalating and complex incident. There was not a senior level command officer immediately available to the battalion chief. This senior level shift command officer would have been available to assume, support, and manage this escalating and complex incident.

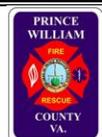
**9.8. The Department must perform a staffing position analysis to establish the shift staffing at all rank levels.**

**Discussion:** A staffing position analysis must be performed to examine all rank levels, shift assignments, station and unit configurations, and shift schedules. The supervision level must be evaluated at all levels to include details and back fills as there must be appropriate supervision of all personnel at all times (i.e. staffing practices should detail/back fill driver positions with drivers and officer positions with officers). This includes daily shift operations as well as during emergency response.

On the Marsh Overlook incident, there were two units on the first alarm assignment that operated with under filled positions. There are other shift occurrences where the amount of under filled officer positions, including the battalion commander, can be found.

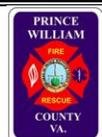
***Related recommendations in other sections:***

- **Develop a standardized field operations quick reference guide for low frequency/high risk events (i.e. mayday, RIT activation, unaccounted crews, active shooter, etc.) to be carried in all**



**command vehicles. See expanded discussion in Rapid Intervention Team and Rescue Operations Section.**

- **Increase the minimum qualified staffing of all fire suppression units to improve firefighter safety and operational effectiveness. See expanded discussion in Effective Firefighting Force Section.**
- **The dispatch complement must be increased to send an effective firefighting force capable of providing the amount of crews required to mitigate fires and other emergency incident types and increase firefighter and citizen safety. See expanded discussion in Effective Firefighting Force Section.**
- **Establish an internal task force and implement a system wide review of all procedure memorandums. This review must begin immediately and all efforts are to be taken to achieve it within a 90 day time period. See expanded discussion in General Section.**



# Communications

## **Section 10** **Communications**

### ***Overview:***

As identified in this report, the Office of Public Safety Communications (OPSC) is managed by a Joint Policy Authority. Both the Chief of the Department of Fire & Rescue and the Chief of Police have equal authority in Joint Policy Authority which oversees the administration and management of the Office of Public Safety Communications. Each Chief's area of responsibility is reserved solely for what is required by State law and County ordinances. The Fire and Rescue Chief retains sole authority for the Office of Emergency Services, Emergency Medical Dispatch (EMD), and the Fire and Rescue Dispatch policies. The Department of Fire and Rescue also provides a technical advisor (uniformed officer) in the OPSC Center on a 24 hour, 7 day a week basis to ensure oversight of fire and rescue resources. A battalion chief supervises the uniformed officers assigned to this function. However, this battalion chief is assigned to work a weekday (Monday through Friday) schedule only.

Effective, efficient, and clear communications regarding an incident is not the sole responsibility of the Office of Public Safety Communications. Effective and clear transmissions of messages and needs are the responsibility of everyone involved in an incident, beginning with citizens, then within OPSC, and finally with the responding emergency personnel.

### ***Findings:***

#### **Fire Ground Related**

- 1. Not all personnel had portable radios available for their apparatus riding positions.**

***Discussion:*** There were varied reasons why all personnel did not have a portable radio. Some portable radios were missing from their normal position as they had been moved to another unit within the station, or the amount of personnel on the unit exceeded the supply of radios.

- 2. Several units responding to and on the scene at Marsh Overlook were on the wrong incident radio channel.**

***Discussion:*** Several units transmitted important radio traffic on channels other than the one assigned to the incident. Wagon 512's driver repeatedly transmitted radio traffic on 5-A to Engine 520's driver during the establishment of the initial water supply. Safety 502 transmitted evacuation orders on 5-A before realizing the error and transmitted on the correct incident channel.



3. **Not all units arriving at the scene of Marsh Overlook verbalized their arrival over the radio.**

**Discussion:** Accountability on the fire ground is lost when the Incident Commander is not aware of a unit's arrival on the scene and they begin operations. By verbally marking on the scene, the Incident Commander can begin accounting for that unit and pre-assigned tasks.

4. **After the declaration of a mayday, units continued to make radio transmissions not related to the mayday event or items not of an emergent nature.**

**Discussion:** A majority of the unit officers and crew members stated after the incident that they heard one and/or both of the mayday transmissions over the radio. However, radio transmissions continued with much of the traffic not directly related to the mayday event or on-going rescue efforts, including calls to Command. This additional radio traffic takes the Incident Commander's attention away from the highest priority incident event and ties up air time that is needed by the Incident Commander, rescue teams, and/or the trapped or lost firefighter(s).

5. **Numerous personnel, including the Incident Commander, stated they were unable to transmit due to receiving a radio prohibit signal.**

**Discussion:** Portable and mobile radios will receive a radio prohibit signal described as a "bonk" when the radio system is in use. This prohibits any radio transmission until the radio channel is clear. Personnel on the Marsh Overlook incident reported a high occurrence of receiving the busy radio system tones. It was undetermined if the high amount of radio prohibit signals received was attributed to the radio system or if it was a radio user discipline issue.

6. **When receiving a transmission from another radio, portable and mobile radios only display a six digit number and not the user's riding position.**

**Discussion:** Currently, the Prince William County Fire and Rescue radios are programmed to display a unique six digit radio identifier. The numerical series is assigned by the radio's manufacturer, Motorola. Motorola provides the number identifiers for each of the products purchased. Each time a radio user attempts to communicate on an open radio channel, other radios operating on that channel will display the transmitting user's six digit number. It is impossible for personnel to know all the numerical radio identifiers as there are approximately 1,500 radios used in Prince William County's fire and rescue system.



Being able to only visualize a radio's numeric display is problematic for an Incident Commander when attempting to determine who is transmitting a mayday or other critical messages when the sender has not identified themselves or a portion of the message is not understood by the receiver. If the radios displayed a user position or call list, the visual display could provide a more accurate accounting for the position or the person who is assigned to any particular portable radio. OPSC's radios will display the riding position's identifier but field mobile and portable radios are not programmed to show the position identifier. Field mobile and portable radio identifiers can be programmed to display a user's riding position. The programming of approximately 1,500 radios presents a complex set of logistical challenges. The challenges are amplified when attempting to maintain the system regarding portable riding position accuracy as each time a single radio identifier required revision, the other 1,499 radios would also need to be individually reprogrammed to recognize the changes made. Current radio technology does not support any automatic or remote programming.

**7. There were occurrences where the same unit was called different radio designations.**

**Discussion:** The nomenclature of units with regards to nomenclature of wagon and engine complicate operations. The decision to identify the nomenclature of a wagon or engine is currently dependent on individual volunteer station policy. There is system inconsistency regarding the unit nomenclature for the first out and subsequent units responding from each station.

The Northern Virginia (or COG) region no longer recognizes "wagon" nomenclature. All jurisdictions have gone to using "engine" to refer to all pumpers. The COG region is evaluating adding alphabetical suffix to the unit identifier (i.e. Engine 512 and Engine 512-B) when there are multiple pieces of similar apparatus in the same station.

**8. Radio channel 5-O was not monitored at the command post**

**Discussion:** Fire and Rescue Association Procedure 10.1.7 titled Radio Operation instructs personnel when experiencing a personal emergency and inability to get access to the radio system due to radio prohibit tone, to switch to a talk-around channel (5-N or 5-O). However, in the same procedure it states Incident Commanders should monitor the talk around channels. Currently radio channel 5-N is used for the Knox Box channel but this is not reflected in Procedure 10.1.7. Incident Commanders must be required to monitor the talk around channel as personnel may attempt to transmit emergencies on that radio channel.



## 9. Numerous personnel reported operational problems with their portable radios.

**Discussion:** During the initial stages of fire ground and rescue operations, portable radio problems were encountered by numerous personnel. These problems were described as:

- Signal distortion and transmission capability failure.
- Receiving capability failure.
- Inoperable radio.
- One radio displayed “out of range.”
- Radios self transmitting (open microphones).
- Dead batteries that occurred during use on the fire ground.

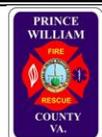
On the Marsh Overlook incident the following personnel reported portable radio failures during their interviews:

- Wagon 512 officer – stopped transmitting and receiving.
- Wagon 512 bucket – stopped transmitting.
- Rescue 510 officer – displayed out of range.
- Rescue 510 officer’s bucket – stopped transmitting and receiving.
- Rescue 510 driver’s bucket – stopped transmitting and receiving.
- Safety 502 – stopped transmitting and receiving.
- Battalion 502 – signal distortion and stopped transmitting.
- Wagon 502 officer – signal distortion.
- Tower 513 officer – stopped receiving.

## 10. The portable radios are extremely vulnerable to poor environmental conditions and interference of digital noise from ambient sources which negatively impact the ability of emergency personnel to effectively communicate.

**Discussion:** The Department took immediate action following the Marsh Overlook incident to further assess and identify the weaknesses of the portable radios by conducting a radio test procedure. All users were advised of the vulnerabilities of the radio. Procedures were identified to troubleshoot the device when operational difficulties are encountered. The following weaknesses and vulnerabilities were noted:

- When the Motorola ASTRO XTS 5000 Model II and ASTRO XTS 5000R Model III portable radios were exposed to water fog during testing, there was a significant loss of communication capability that is inconsistent with the needs of emergency responders.
- The loss of communication capability occurred with or without the use of any extended microphone accessories tested.
- Audio transmissions become distorted when water physically struck the radio.



- There was additional audio signal degradation when water continued to impact the speaker area of the portable radio. This condition was exacerbated when the extended microphones were utilized.
- Either one of these issues, independent of the other, can cause and affect communication failure during radio use. A failure was defined as preventing effective communications of simple messages from sender to receiver.

Currently, the International Association of Fire Chiefs has commissioned a digital noise interference task force which is evaluating industry wide concerns with the technology that is currently in use and available for the fire and rescue industry. Prince William County's findings have been forwarded to that group for inclusion in the process. Efforts to identify potential solutions to the communication issues continue to date.

For additional findings and expanded discussion, the Radio Test report is attached (Appendix F). The findings are consistent with the problems encountered on the Marsh Overlook incident.

### **OPSC Operations Related**

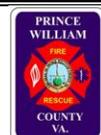
#### **11. The OPSC received nineteen 911 calls from citizens to report the structure fire.**

**Discussion:** The multiple 911 citizen calls were critical in determining an exact location of the reported structure fire.

#### **12. OPSC did not consistently dispatch the nearest units of the type needed nor fill all apparatus requests.**

**Discussion:** Listed below are specific findings:

- The first alarm (three engines, one Truck, one Ambulance or Medic Unit, and one Battalion Chief) was dispatched correctly.
- Engine 520's request for an additional pumper to assist with the establishment of a secondary water source was not dispatched prior to the second alarm. This resulted in one of the second alarm units having to fill the special request. The request for this additional pumper was to be above the alarm assignments.
- The dispatch complement per procedures for a second alarm is identified as three engines, one truck, one ambulance or medic unit, one battalion chief, one air unit, and one rehab unit. The CAD system recommended the following dispatch complement which included a rescue unit. The computer dispatch sent to mobile dispatch computers in the apparatus was:



*“Engine 502, Engine 517, Engine 513, Tower 513, Ambulance 515, Medic 552, Battalion Chief 502, Air Unit 512, Rescue 504, Rehab 520.”*

However, the verbal dispatch transmitted was:

*“Wagon 502, Tower 513, Ambulance 515, Medic 552, Air 512, Rescue, Rehab 520, Engine 502, and Engine 517.”*

OSPC personnel incorrectly verbalized the dispatch of units resulting in the dispatch of two engines from Station 502, of which one engine was not staffed. There was no verbal dispatch of Engine 513 or Rescue 504.

Units responded based on their mobile data computer receiving the CAD dispatch and not by the verbal announcement. If the mobile data computers had been out of service, a delay in response would have occurred until the verbal dispatch was recognized as incorrect.

- Mutual aid companies (Quantico Marine Corps Fire Department and Fairfax County Fire and Rescue) were closer to the Marsh Overlook incident and may have filled the resources requests faster than units traveling from distant Prince William County locations on the second and third alarm assignments. Mutual aid assistance was not consistently requested or utilized by OPSC.

Mutual aid companies are not automatically included in the dispatch complement therefore decisions regarding the requesting and utilization of these resources is independently performed without the assistance of the computer aided dispatch system.

### **13. OPSC and Fire and Rescue procedures regarding OPSC reaction to fire ground emergencies were not complied with.**

**Discussion:** Listed below are specific findings:

- OPSC Standard Operating Procedure title Emergency Activation – Fire Dispatch was not complied with as there was no confirmation with the Incident Commander that an emergency activation (EA) had occurred during the incident and from which unit it was received.
- Fire and Rescue Association Procedure 5.1.14 titled Emergency Evacuation was not complied with as the Incident Commander failed to request the sounding of the Alert II signal following the second emergency evacuation order of the structure. A dispatcher attempted



once to determine if Command wanted the alert sounded but did not pursue the communication prompt further when Command did not acknowledge the query.

- OPSC did not comply with their responsibilities as outlined in Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (RIT). The responsibilities stated for Communications' (OPSC) is to dispatch:
  - a) An additional engine company on any "working incident" where an IDLH atmosphere is present; and,
  - b) A RIT Task Force at either the request of the Incident Commander or upon the activation of the on-scene RIT.

A past revision to the dispatch complements increased the number of engine companies sent to structure fire incidents by one. Since that procedural revision, the practice of dispatching an additional engine company for "working incidents" apparently halted. Neither of these stated responsibilities was complied with and current dispatch practices do not match fire and rescue procedural direction.

- There are numerous Fire and Rescue Association Procedures and Communications Procedures that are outdated. These procedures do not necessarily reflect the radio system, procedures, or processes that are currently in use.

#### **14. OPSC staffing levels or resource allocations did not support the monitoring of all Fire and Rescue channels in use.**

**Discussion:** OPSC received the EA signal from Technician Wilson's portable radio on channel 5-C. The dispatcher working the radio channel visualized Technician Wilson's radio's riding position identifier on the radio console and heard the mayday radio transmissions. The uniform officer was alerted to a mayday situation based on radio transmissions from Rescue 510. The uniform officer did not hear the mayday transmission from Technician Wilson. At the time of the mayday transmissions, the uniform officer was processing incident notifications and evaluating resource deployment needs.

The staffing levels in OPSC did not support the monitoring of all active fire and rescue radio channels. This resulted in a single dispatcher monitoring more than one radio channel during the Marsh Overlook incident. The uniformed officer was focused on decision making regarding station transfers and required incident notifications. When a mayday situation occurs, the uniformed fire officer must focus solely on the mayday operation and



associated radio traffic. However, there is no depth to the uniform officer position with any other supervisory level personnel within OPSC.

**15. OPSC lacks a procedure and dispatch complement for RIT Level 2 or Level 3 Task Forces.**

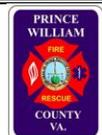
**Discussion:** Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (RIT) identifies a dispatch complement for additional resources, but the procedure has not been coordinated or implemented with OPSC.

**16. There are additional findings related to communications in the other sections of this report.**

**Recommendations:**

**10.1. Require all personnel engaged in emergency incident operations to have a portable radio with them at all times.**

- 10.1.1. Revise all associated policies and procedures to direct this change in practice and include direction on battery conditioning and replacement.
- 10.1.2. All portable radios are to have their battery replaced with a fully charged and conditioned battery at the beginning of each shift.
- 10.1.3. All portable radio batteries are to be placed in a charger and conditioned when indicated.
- 10.1.4. All portable radio batteries are to be taken out of service and replaced when capacity reading is at 70% or lower after a charging cycle.
- 10.1.5. Every riding position shall be equipped with a portable radio.
- 10.1.6. Each work site is to keep an appropriate number of spare portables and batteries for use on apparatus when normal radios are found missing or in need of repair.
- 10.1.7. Each work site is to keep an appropriate number of spare extended microphones for use on apparatus when extended microphones in use become affected by moisture, no longer operate, or require drying out.



**10.2. Reinforce the need that all personnel responding to and operating on an incident scene must:**

- 10.2.1. Have their mobile and portable radio selected to the correct tactical radio channel for that incident.
- 10.2.2. Ensure their portable radio batteries are fully charged at the beginning of each shift.
- 10.2.3. Ensure portable radio batteries are properly conditioned and charged appropriately.

**10.3. Require that all first alarm units announce their arrival on the scene and their assigned task.**

**Discussion:** Arriving units may either mark on the scene verbally on the tactical radio channel or utilize the mobile data computer (MDC). If the MDC is utilized, there is no radio report transmitted. The lack of this radio transmission results in crews not having awareness that additional resources have arrived or assumed task responsibility assigned by operational guidelines or initial radio instructions. Furthermore, the MDC computers do not automatically refresh with new information and are not positioned for access by incident commanders who are operating the command post from the rear of the vehicle.

**10.4. Require crew officers announce on the tactical radio channel when they are entering and exiting an incident's hot zone.**

**Discussion:** Accountability of crews and ensuring they are operating on the correct tactical radio channel is paramount for firefighter safety. Requiring crew officers to announce when their crew is entering a hot zone will ensure the officer is on the correct tactical radio channel, accounts for the crew's entry time, and provides accountability of the unit for the incident commander as it relates to procedures and operational guidelines. This practice is currently used when dealing with hazardous materials and technical rescue crew entries. Establishing this practice for all suppression incidents will serve as a cornerstone for future air management and crew resource practices. As the fire and rescue system develops a continuous quality improvement program for suppression operations, this time stamp will assist in analyzing fire ground reflex times. This is another function that the command post support team will have to manage.



## **10.5. Reinforce radio discipline procedures.**

- 10.5.1. The establishment of divisions and groups are to be announced and the assigned resources are to be identified.
- 10.5.2. Personnel are to report to their division/group supervisors.
- 10.5.3. Personnel are to operate on the correct radio channel identified for their incident.
- 10.5.4. In the absence of an official request for all units to maintain radio silence, unit officers and other personnel with portables must exercise radio discipline/radio silence and refrain from transmitting traffic unless the message has a direct immediate implication on a mayday and/or a firefighter rescue attempt.

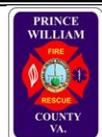
## **10.6. Program command vehicle mobile radios to identify the riding position making a radio transmission so that Incident Commanders can view this at the command post.**

## **10.7. Reinforce procedures for requesting additional radio channels.**

- 10.7.1. Clarify procedures for requesting command channels to include their use and monitoring requirements both at the command post and OPSC.
- 10.7.2. Each radio channel requested and assigned to an Incident Commander must have a dedicated person to monitor the radio channel at the command post.

## **10.8. Permanently identify the nomenclature of apparatus.**

- 10.8.1. The first out pumper from each station must be identified as an “Engine” followed by a three digit number. The first digit will be the COG jurisdiction number (5 for Prince William County) followed by the station number. If the station number is a single digit, then a zero would precede the station number (i.e. Engine 502, Engine 512).
- 10.8.2. The second and any subsequent pumper from each station must be identified as an “Engine” followed by a three digit number as described above but also include a suffix.
- 10.8.3. The same logic must be consistently applied to other apparatus types (i.e. ambulances, medics, etc.).



**10.9. Consolidate all the Fire and Rescue mayday operational procedures into a single procedure which is fully coordinated with OPSC.**

**10.10. OPSC procedures related to the handling of emergency activations and maydays are to be revised and fully coordinated with Fire and Rescue. Items to be included are:**

10.10.1. Procedure for handling maydays and radio emergency activations.

- Radio system “silencing and knockdown” of maydays.
- Standard procedure for all types of maydays (with or without emergency activation button).
- Incorporation of a ready reference guide card for this time critical, low frequency but high risk event.

10.10.2. Train all OPSC personnel on new or revised procedures to include the radio system’s capabilities and limitations, with focused attention to low frequency/high risk critical communication operations.

**10.11. Appropriate procedural memorandums, policies, and training shall be updated to reflect these recommendations.**

10.11.1. Coordinate all appropriate procedures among fire and rescue and other stakeholder agencies.

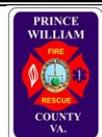
10.11.2. Perform cross agency training exercises on new procedures and policies.

**10.12. Perform an analysis of the radio system to determine why the system does not handle large volumes of fire ground communications from all radio sources on an incident.**

10.12.1. Identify, define, and evaluate how long the system will give a radio prohibit signal (i.e. bonk) following any push to talk activations from any source.

10.12.2. Identify, define, and evaluate all the factors that cause the radio system to send a radio prohibit signal (i.e. bonk, out of range tone, EA transmissions, multiple users, user reject, etc.) to users.

10.12.3. Identify, define, and evaluate any user input reasons that cause the radio system to send a radio prohibit signal (i.e. unintended



activations, bonk, out of range tone, EA transmissions, multiple users, user reject, etc.) to users.

10.12.4. Identify, define, and revise functional performance standards for the radio system.

10.12.5. Determine immediate, intermediate, and long term solutions to the issues identified.

**10.13. Evaluate and increase OPSC staffing and resource allocations as needed to support critical fire and rescue operations.**

10.13.1. All active fire and rescue radio channels must be monitored by a dedicated dispatcher.

10.13.2. Evaluate, define, and revise roles and responsibilities of the uniform officer and civilian supervisor positions regarding fire and rescue operations.

10.13.3. Determine if additional fire and rescue technical advisors are needed for the monitoring and support of incident operations.

10.13.4. There must be radio system technical support personnel immediately available on a 24/7 basis.

**10.14. Initiate a national fire service industry requirement for radio manufactures to develop radio and communications equipment that meet the needs of the fire and rescue industry.**

**Discussion:** Radio technology and engineering must improve and overcome the obstacles presented within the firefighting environment. Incident Commanders and firefighters rely on critical communications during emergency incidents to maintain accountability and tactical operations. The radio unit/user identifier display is important in knowing who and which unit is transmitting a message, emergency traffic, or mayday to command and/or on the tactical channel.

The best resolution to this challenge is for radio and communications manufacturers to collaborate with the fire and rescue industry and develop operational performance standards for radio equipment. Radio and communications manufactures must engineer radio equipment that can withstand severe cold and extreme heat temperature variances, operate without interference in high noise and wet environments, have controls that can be easily operated by personnel in full protective clothing (i.e. dexterity issues with gloved hand changing radio channels and depressing



the EA button), and have remote programming and/or auto-updating capabilities.

Prince William County has initiated efforts with Motorola to participate in the development of the next generation of radios. These efforts are encouraged to be continued.

***Related recommendations in other sections:***

- **Evaluate existing mutual aid agreement and pursue mutual aid response agreements as appropriate. See expanded discussion in Effective Firefighting Force Section.**
- **See other report sections for communication related recommendations.**



# Training

## **Section 11** **Training**

### **Overview:**

Career recruit training is a twenty-one week program that includes Virginia Emergency Medical Technician – Basic, Emergency Vehicle Operators Course (EVOC) III, Firefighter I and II, Hazardous Materials – Operations, and technical rescue training courses (i.e. Vehicle Extrication, Rope I, Trench Rescue, etc.). Included in the syllabus are firefighter safety and survival training, as well as public education and safety courses training.

Incumbent personnel receive training through a variety of sources including in-station, multi-company, and regional and conference attendance opportunities. Additionally, the Department of Fire and Rescue holds division wide, battalion level training twice a year. Topics in the spring sessions are EMS, hazardous materials, safety or other general topics. The fall sessions are live fire training evolutions.

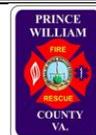
In spring 2006, battalion training focused on firefighter survival skills to include four different individual practical exercises and one team exercise. The fall 2006 battalion burns incorporated firefighter mayday and RIT activation into the live fire scenarios to capitalize and build upon the spring training. Again in spring 2007, the training session was dedicated to health, wellness and safety and included review of radio equipment and initiating mayday radio transmissions.

The Fire and Rescue Association Procedure 4.5.1 titled Uniform Rank Structure identifies the minimum certification levels for all fire and rescue personnel.

### **Findings:**

- 1. The minimum certifications and training per Fire and Rescue Association Procedure 4.5.1 titled Uniform Rank Structure were complied with by all first alarm officers with the exception of Medic 512's officer.**
- 2. Technician Wilson received Firefighter Survival Skills I and II and Flashover Survival with Simulator training during his recruit school.**
- 3. The Department has provided mayday, EA radio operation, and RIT training.**

**Discussion:** The Department's battalion training held in the Spring of 2006 and 2007 included didactic and practical scenario training with firefighter maydays, EA radio operation, and RIT training. Incorporating and focusing on mayday and EA radio operations during numerous training opportunities



were shown to be effective as Technician Wilson's and Rescue 510's transmissions were performed without hesitation or error. During the post incident investigation activities, all operational personnel expressed a thorough knowledge with these procedures.

**4. Rescue 510's mayday call transmitted on behalf of the missing firefighter was in accordance with training and procedures and critical in the chain of events.**

**Discussion:** Based on the information quickly gathered from Tower 512's officer, Rescue 510's officer transmitted a mayday for the missing firefighter. The mayday transmission identified the unit from which the firefighter was missing and the last known location of the missing firefighter.

**5. Technician Wilson transmitted a mayday call in accordance with his training and procedures.**

**Discussion:** Technician Wilson depressed his portable's EA button and transmitted his mayday call. His mayday call clearly identified his riding position, situation, the area where he believed he was located, and indicated his need for assistance.

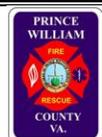
**6. Technician Wilson was unable to self rescue.**

**Discussion:** As previously mentioned in the Mayday Section, Technician Wilson's movements, activities, and self rescue efforts on the second floor during his mayday event are impossible to factually recreate.

The sampling of Department members that graduated recruit school before, with or after Technician Wilson indicated inconsistencies in understanding of when attempts to self rescue should be made versus when it is best to stay in a certain location and await rescue. There were also inconsistencies noted in applying those techniques in residential versus commercial structures.

**7. The Department lacks a method to ensure officer level competencies and lacks a process to ensure competencies are maintained.**

**Discussion:** Career personnel achieve officer ranks by demonstrating knowledge, skills, and abilities through an assessment center format process. Beyond the initial qualification through the promotional process, there is no structured on-going training or mentoring process prior to functioning at the tested position or the next higher officer rank. For example, a lieutenant that successfully qualifies in a captain's promotional process and is subsequently promoted to a captain will assume the position without any additional structured training or mentoring prior to their first day as a captain.



Furthermore, that same individual may be assigned to under-fill and function as a battalion chief on their first day as a captain.

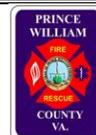
**8. The Department has not provided officer level training. This includes officer development, on-going training, and continuing education.**

**Discussion:** Firefighters and officers must be skilled in recognizing critical situations at emergency incident scenes. The ability to rapidly identify incidents as typical or non-typical and select actions that best satisfy the needs of the situation is gained through personal experience and intensive focused training. The effect of high wind conditions are often not highlighted during traditional structural fire suppression, command officer, or strategy and tactics training. Effects of wind are more detailed when training is related to wild land firefighting or exposure protection considerations. Fire training curriculums have not kept pace with the changes in the building construction methods, materials, and designs. Fire training curriculums also do not reflect the emerging data regarding detrimental environmental conditions that affect structural firefighting.

Currently, the officer level training is offered locally or by state level training classes. However, the majority of the training offered focuses on incident command and lacks detailed strategy, tactics, incident decision making, or information addressing changed or emerging building construction information. The lack of Department wide focused training coupled with changes in the building construction industry, and fire apparatus and equipment technology advances, have demonstrated a Department and system wide need to immediately focus training efforts on officer development training and continuing education.

**9. Battalion level training is mandatory for Operation Division personnel but not all personnel assigned to other divisions have been active participants in this training.**

**Discussion:** The Operations Section schedules semi-annual division wide, multi-company training. This training, referred to as “battalion training,” is mandatory for all operations personnel. Although encouraged, attendance at battalion training from other division personnel is optional. However, all Department personnel are subject to temporary details to operational positions and all are eligible for transfers among assignments at any given time. This creates a need for all personnel to maintain a base level of operational readiness and an understanding of expectations and procedures.



**10. The Department lacks a comprehensive training record system, policy, and process that documents all training that personnel receive.**

**Discussion:** As part of the investigation, an audit of training records for personnel on the Marsh Overlook incident was conducted. To perform the audit, it required searching through multiple databases to find information pertaining to personnel training records. Records existed in the Public Safety Training Academy record system, Telestaff (the Department's automated scheduling and time keeping system), and monthly productivity reports. The multiple methods, locations, and processes to collect all training activities result in convoluted and incomplete training records for personnel.

Some examples of the training that should be completed, but is not reflected in the training records, are:

- NOVA Training
- Annual Respiratory Refresher Training
- Battalion Training

**11. On the Marsh Overlook incident, there were numerous hose line deployment issues.**

**Discussion:** Hose lines and load configurations are established by each department and vary among the stations across the fire and rescue system. Firefighters not assigned to Station 12, but directed to pull hose lines from Wagon 512, had to stop and ask the driver operator to confirm the correct line selection. Personnel not familiar with the different hose line load configurations and nozzles contributed to delays in hose line deployment and distraction of the apparatus operator. An example of this was the deployment of the 300 foot 1 ¾ inch hose line which was dropped a short distance from the pumper due to the personnel being unfamiliar with the hose line load configuration and deployment method on this engine. To overcome this obstacle, the hose line had to be methodically untangled by the crew, creating further delays.

Training curriculums address some of the varying equipment and hose load configurations found in the field, but without system standardization, it is difficult to develop and deliver consistent training that addresses all of the different equipment configurations.

**12. There are insufficient personnel resources in the Training Division to develop, coordinate, and deliver on-going Department training and continuing education needs.**

**Discussion:** The Department lacks a consistent training plan and accountability of competencies at all rank levels. Currently, the Training



Division resources are dedicated to the coordination of volunteer and career basic entry level suppression and EMS related training needs. Due to the lack of personnel resources in the Training Division, the delivery of on-going incumbent training programs have been assumed by the Operations Section. The Operations Section assigns personnel at all rank levels to develop and deliver needed training programs. Examples where the Operations Section develops, augments, coordinates, and conducts training programs include battalion training, hazardous materials continuing education, incident officer, driver pump operator, probationary employee testing, basic and advanced life support protocols, advanced life support internship preparation, NOVA manual training, etc. Having multiple entities involved contributes to inconsistencies in program delivery, content, and accountability.

As discussed in several findings, there is a need to have a comprehensive plan for the development, coordination, and delivery of on-going Department training and continuing education. It is equally important to ensure the Training Division has the necessary staff with appropriate instructor certifications to accomplish the plan.

**13. There is no standard method for the implementation of Fire and Rescue Association and Department procedures.**

**Discussion:** There is no standard method to operationalize new procedures and policies as they are adopted. Frequently, new procedures are implemented without a system wide training plan. When there is a lack of a coordinated, comprehensive approach for the implementation of new procedures, there is inconsistent member knowledge, understanding, and compliance.

**Recommendations:**

- 11.1. Department must conduct an audit of all uniform employees for compliance with Fire and Rescue Association Procedure 4.5.1 titled Uniform Rank Structure.**
- 11.2. Department recruit school curriculum must continue to include, and revise as appropriate, the firefighter survival skills and flashover survival training.**
- 11.3. Department must provide firefighter survival skills and flashover survival training to all incumbent personnel.**
- 11.4. Review and evaluate current RIT training to:**



- 11.4.1. Ensure understanding of the role and expectations of the company officer and crew when assigned the RIT duties and responsibilities.
- 11.4.2. Ensure adequate discussion, lecture and practical time is focused on expected actions in all types of structures (single family dwellings, multi-family dwellings, commercial, etc.).
- 11.5. Review and evaluate current Firefighter Survival training to:**
  - 11.5.1. Ensure adequate discussion, lecture and practical time is focused on firefighter self rescue strategies and techniques. Specific focus should include locating windows, identification of temporary safe havens and decision making when to attempt self rescue versus remaining in place to await rescue.
  - 11.5.2. Ensure training addresses different types of structures (residential versus commercial) and the various types of building construction, designs, and materials.
- 11.6. Review and evaluate incident command level training for the following items:**
  - 11.6.1. Standardized, strategic approach in implementing operational guidelines.
  - 11.6.2. Incorporate low frequency/high risk training scenarios where mayday events must be reacted to by personnel and incident commanders.
  - 11.6.3. Incorporate training scenarios that include reaction to firefighters in trouble that are not readily located or not in their reported location.
  - 11.6.4. Incorporate training scenarios where PAR checks discover a missing firefighter in absence of a mayday transmission.
  - 11.6.5. Incorporate training scenarios that include reaction to multiple mayday transmissions and coordination of rescue operations where multiple units are required.
- 11.7. Reinforce training with officer qualified personnel to evaluate fire flow requirements for hose line selection when compared to available personnel resources and building construction.**



**11.8. Re-evaluate suppression training and adjust decision making, strategy, and tactics to react to lightweight building construction and tactical operations in extreme environmental conditions.**

**Discussion:** Prince William County fire and rescue has not kept pace with the building construction industry's use of lightweight and highly combustible materials that significantly contribute to fire spread and BTU production which impact firefighting operations. Additionally, extreme environmental factors impact and complicate strategy and tactics and must be examined and evaluated. Prince William County fire and rescue must examine their basic strategy and tactical training but revise it for today's building construction industry. A process to incorporate lessons learned from local, regional and industry wide reports must be identified to further refine and align strategic and tactical operations as external industries modify their practices.

**11.9. System wide firefighting, rescue and EMS equipment must be standardized so that training curriculums can prepare personnel for field operations.**

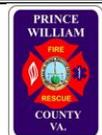
**Discussion:** Identifying the system wide standardized needs of fire fighting, rescue, and EMS equipment will improve the effectiveness and efficiency of all personnel and training can be enhanced. This would also streamline critical and time sensitive operations which would not be greatly impacted by changing personnel among various worksites or the continued introduction of new personnel. It is impossible to expect personnel to remain knowledgeable and proficient on all operational aspects and limitations of the varying amount of apparatus and equipment present in the system.

**11.10. Establish an officer development, and on-going training and continuing education program.**

**Discussion:** There are a numerous ways to accomplish this recommendation. One method is to develop an officer candidate school and curriculum to train personnel prior to their promotion. The on-going development and training needs may be administered through quarterly training or officer updates.

These programs should minimally address:

- Incident based decision making (strategy and tactics)
- Risk benefit analysis
- Personnel management
- Crew integrity
- Accountability



- Incident crisis management
- Forecasting and pre-planning
- Building construction
- Environmental impacts (i.e. high wind conditions)
- Mentoring plan for new officer qualified personnel
- Fire spread and extension (i.e. exterior fires with interior extension)
- Incident command system
- Command level officer decision making and incident command practices (i.e. escalating incidents with incident command structure expansion)
- Crew resource and situational awareness management
- Establishment of a system wide required reading reference list

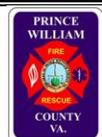
**11.11. Develop and implement a competency based process for all rank levels.**

**Discussion:** Each of the Department rank levels requires specific knowledge, skills, and abilities which are critical for the performance of the duties and responsibilities associated with each of those positions. Initial qualification testing is done for each rank level but the Department lacks an on-going competency assessment program.

The demonstration and evaluation of the competencies associated with each rank is critically important to ensure all personnel can perform the essential job tasks and functions. The program will increase personnel's confidence in their position. An all hazards competency evaluation for each position will certify each of the personnel for their specific rank. The annual competency evaluation and certification process must include all ranks from firefighter to chief.

**11.12. The Training Division must assume responsibility for the coordination and delivery of structured and formalized training for the Department.**

- 11.12.1. To initiate the infrastructure for this Training Division initiative, a position of Captain (at a minimum) shall be immediately identified and assigned.
- 11.12.2. An immediate priority of this position will be to develop an implementation plan which includes resource identification of the following:
  - Identify all expectations of the initiatives
  - Additional Training Division personnel required to develop, coordinate, and deliver training programs



- Equipment, apparatus, and technology needs to support training curriculums
- Resources to backfill positions or support in-service training (staffing, overtime, flex units, etc.)

**11.13. The Department must establish a policy, process, and mechanism to effectively track and assure that all training at all levels (unit, station, battalion, formal classroom, conference, etc.) is documented and recorded appropriately in personnel training histories.**

**11.14. All Department of Fire & Rescue uniformed personnel should be required to receive all operational training provided, regardless of rank and the division in which they are assigned.**

**11.15. Ensure universal understanding of terminology and application of RIT versus rescue. Training needs to be focused and delivered in this area system wide.**

**11.16. All new and revised policies, procedures, and directives must have an implementation plan that includes an impact analysis for any needed training components or requirements.**

***Related recommendations in other sections:***

- **Conduct a fire flow needs and capabilities assessment to identify the required apparatus and equipment to achieve the needed fire flow, application, and delivery method for structures within Prince William County. This assessment will serve as the cornerstone of establishing criteria for apparatus and equipment selection and standardization and future training requirements. See expanded discussion in Strategy and Tactics Section.**



**Personal  
Protective  
Equipment**

## **Section 12**

### **Personal Protective Equipment**

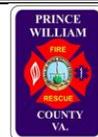
#### **Overview:**

The utilization of self-contained breathing apparatus (SCBA) is required by all fire and rescue personnel during operations involving an immediately dangerous to life and health (IDLH) environment. SCBA protects personnel from the acute and chronic health effects from exposure to the various inhalation and respiratory hazards present at a structure fire. The SCBA used in Prince William County for the Marsh Overlook incident was a Mine Safety Appliance (MSA) 4500 psi SCBA. This SCBA was equipped with an ICM 2000 Plus Personal Alert Safety System (PASS) which was incorporated into the pneumatics of the SCBA.

The Fire and Rescue Association has a Respiratory Protection Program required by the Occupational Safety and Health Administration (OSHA). The Respiratory Protection Program outlines the care, maintenance, and testing requirements for all SCBA in the system. A comprehensive maintenance, repair, and testing program will ensure that each SCBA will operate effectively and reduce the risk of failure and is required by OSHA, NFPA 1852 Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA), and Fire and Rescue Association Procedure 9.1.2 titled Respiratory Protection Program.

The personal protective clothing ensemble issued by the Department meets or exceeds NFPA 1971 Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting. Department members are issued two sets of personal protective ensembles which are either manufactured by Morning Pride or Globe, depending on the date of employment and outfitting of personnel. Helmets are manufactured by Cairns and structural firefighting boots are manufactured by Pro-Warrington. The protective hood and firefighting gloves have various manufacturers, depending on the date of employment and outfitting of personnel.

Protective clothing is designed to provide thermal protection to the firefighter. When the heat energy transferred through the protective clothing ensemble exceeds the body's ability to dissipate the heat to other areas, burn injuries will occur. For the average individual, pain is perceived when the skin temperature rises to 111°F, with second degree burns beginning to occur at 131°F. There are a number of reasons burns occur in selective areas of the firefighter's body. This can include areas that are less protected, as with the head and ears. Another cause can be from the protective clothing's fit or body position causing the garment to compress against the skin and reducing the air trapped between the clothing's layers. In January 2006, the National Institute of Standards and Technology (NIST) published Technical Note 1474 titled *Thermal Environment for Electronic Equipment Used by First Responders* in which it was identified that



at temperatures of 250°F and 300°F conditions were created within the protective clothing's inside layer to approach levels where human skin may perceive pain or sustain burn injuries.

**Findings:**

**SCBA Related**

- 1. Physical evidence indicated Technician Wilson's SCBA was worn properly.**

**Discussion:** The SCBA worn by both Technician Wilson and Tower 512's officer was manufactured by Mine Safety Appliances (MSA). The model was a mask mounted regulator air mask with *Firehawk™* regulator, 4500 psi, compliant with NFPA 1981, 2002 edition. The facepiece utilized was a MSA Ultra Elite.

- 2. The SCBA worn by Technician Wilson was extensively damaged beyond a point to render complete information regarding its functional operation.**

**Discussion:** Technician Wilson's SCBA was sent to the National Personal Protective Technology Laboratory/Technical Evaluation Branch for an independent examination and analysis. The laboratory's report documented the physical condition of the unit and individual components. No functional testing could be conducted due to the amount of heat and fire related damage to the unit.

Facts that were able to be determined were:

- The SCBA cylinder's hand wheel was in the fully on position.
- The SCBA cylinder was empty.
- The SCBA cylinder's burst disc was intact.
- The rubber low-pressure hose attaching the pressure reducer to the regulator was completely burned away.
- The exterior of ICM 2000 Plus Personal Alert Safety System (PASS) was extensively damaged. The internal circuit board had minimal damage and data was able to be extracted from the storage chip.
- The MSA Ultra Elite face piece was extensively damaged with significant portions burned away.

- 3. Facepiece fit testing was performed in accordance with NFPA 1852 standard and Fire and Rescue Association Procedure 9.1.2 titled Respiratory Protection Program.**

- a. Technician Wilson was fit tested on January 31, 2006.**



**b. Tower 512 officer was tested on April 18, 2006.**

**Discussion:** Prince William County Department of Fire & Rescue's Breathing Apparatus Services Shop performs annual fit testing of all career personnel. The Breathing Apparatus Service Shop schedules annual fit testing so that personnel are tested once during each calendar year.

**4. Facepiece flow testing was performed in accordance with NFPA 1852 standard and Fire and Rescue Association Procedure 9.1.2 titled Respiratory Protection Program.**

**a. Technician Wilson's facepiece was flow tested on January 31, 2006.**

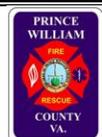
**b. Tower 512's officer's facepiece was flow tested on April 18, 2006.**

**Discussion:** Prince William County Department of Fire & Rescue's Breathing Apparatus Services Shop performs annual flow testing of all career personnel's SCBA face masks. The Breathing Apparatus Service Shop schedules annual flow testing so that personnel's facepieces are tested once during each calendar year.

**5. SCBA flow testing of Technician Wilson's air pack was not performed in accordance with NFPA 1852 standard, MSA manufacturer guidelines, and Fire and Rescue Association Procedure 9.1.2 titled Respiratory Protection Program.**

**Discussion:** There were multiple requests for copies of all SCBA records from the volunteer department which was responsible for maintenance and testing of the breathing apparatus assigned to Tower 512. Once obtained, records for the SCBA equipment on Tower 512 lacked documentation of any annual flow testing, maintenance, or repairs for calendar years 2005 and 2006. The SCBA technician for the volunteer company stated that flow testing for their three stations was not conducted in 2005 and 2006 due to a station renovation project which impacted their SCBA shop. This is not in accordance with NFPA 1852 Standard, Fire and Rescue Association Procedure 9.1.2 titled Respiratory Protection Program or MSA manufacturer recommendations.

Fire and Rescue Association Procedure requires all respirators to be maintained by appropriate contractors or certified team members in a certified shop as required by OSHA 29 CFR 1910.134 and MSA. MSA and NFPA 1852 standard require annual flow testing of all respirators.



**6. Daily SCBA inspections were not consistently performed or documented per procedure.**

**Discussion:** The Fire and Rescue Association Procedure 9.1.2 titled Respiratory Protection Program requires that each SCBA be inspected prior to use. The daily inspection must be documented on an inspection log. Tower 512's SCBA inspection log was reviewed and daily inspections were not documented on a regular basis. The inconsistency is noted with all shifts, career and volunteer.

The data recovered from Technician Wilson's and Tower 512 officer's ICM 2000 Plus contained files prior to April 16, 2007. While there are no data files indicating these air packs were inspected or used following April 13, 2007 until the incident date on April 16, 2007, a review of the station incident log indicates Tower 512 was in service and responded to nine calls from 1800 hours on April 13, 2007 until 0600 hours on April 16, 2007. The ICM data confirms daily inspections are not being conducted per procedure.

**7. The following data was collected from Technician Wilson's SCBA ICM 2000 Plus device by NIOSH with the assistance of MSA:**

**a. The ICM 2000 Plus' internal clock is not synchronized with Eastern Standard Time. Daylight saving time was also in effect.**

**Discussion:** The internal clock displays a time record beginning with 1114 hours when the SCBA pack was utilized on the Marsh Overlook incident. The reliability of Technician Wilson's timestamp is uncertain as the data storage chip had to be removed from the original circuit board and placed into another board to retrieve the data.

However, in review of other data files from this unit, as well as other SCBA units, the internal clock consistently displays records around the 1100 hour time frame that appear to correspond to the 0600 hour time frame. MSA representatives indicate the internal clock should be programmed to Eastern Standard Time (EST) upon shipping. However it appears that some of the units evaluated were not programmed to EST upon shipping and reflect the time zone of Berlin, Germany where they are manufactured. There is a six hour time difference between Berlin and EST. With the adjustment for daylight savings time, the internal clock display of 1100 hours would equate to the local 0600 hour time frame. It was noted there was a wide variance among all the clock readings of the packs for which data was downloaded. The clock readings ranged anywhere from 0700 to 1100 hour time frames when the packs were actually used during the 0600 hour local time frame.



- b. A pressurization of the SCBA was recorded at 1104 hours on April 16, 2007, ten minutes prior to being used on the Marsh Overlook incident.**

**Discussion:** Tower 512's officer stated Technician Wilson was in the process of the morning check out of his SCBA when the Marsh Overlook incident was dispatched.

Data indicated the cylinder's pressure was approximately 1,600 – 1,700 psi. It cannot be confirmed if Technician Wilson fully pressurized the pack prior to being interrupted by the dispatch for the Marsh Overlook fire. Data files ten minutes later record a cylinder pressure of approximately 4,100 psi. There were no reports of Technician Wilson re-filling or changing his cylinder from the time of the morning SCBA check to the incident use; therefore, a partial pressurization may have occurred during the morning check out.

Data also indicated a low battery warning. It cannot be confirmed that a visual low battery indicator was displayed or if Technician Wilson observed the warning.

- c. A pressurization of the SCBA was recorded at 1114 hours on April 16, 2007.**

**Discussion:** This SCBA pressurization and use was on the Marsh Overlook incident. Data files record a beginning cylinder pressure of approximately 4,100 psi. A low battery warning was recorded. It cannot be confirmed that a visual low battery indicator was displayed or if Technician Wilson observed the warning. The data record indicates an expected air consumption rate for firefighting activities.

- d. A low battery warning was indicated on Technician Wilson's SCBA ICM 2000 Plus device beginning on April 13, 2007.**

**Discussion:** The data recovered from Technician Wilson's ICM 2000 Plus by NIOSH and MSA contained files prior to April 16, 2007. The data file for April 12, 2007 records a cylinder pressurization of approximately 4,500 psi and a motion alarm was activated. There is no low battery warning recorded. There is less than one minute of data in this record.

On April 13, 2007, there are two separate data files that both record an ICM low battery warning. There is less than one minute of data in each of these two records. Technician Wilson is documented on the station's SCBA daily inspection log as performing the SCBA inspection on this air pack on April 13, 2007. While the data files indicated a low battery



warning, it cannot be confirmed that a visual low battery indicator was displayed or if Technician Wilson observed the warning.

**e. Technician Wilson's SCBA's ICM 2000 Plus Personal Alert Safety System (PASS) stopped recording data six minutes into use.**

**Discussion:** The ICM 2000 Plus model is powered by a single 9 volt battery. In normal operation, the battery powers a data capturing mechanism that logs the SCBA's cylinder's air pressure, low battery warning, dead battery indicator and alarm indicators for motion, low pressure and temperature. There is a battery back-up capacity that saves data files and clock programming in the occurrence of the ICM battery failure but the back-up battery does not power the ICM.

The data recovered from Technician Wilson's ICM 2000 Plus by NIOSH and MSA showed the ICM activated at the beginning of the air pack's use and continued for six minutes until the time the ICM stopped recording data.

**f. Technician Wilson's ICM 2000 Plus data shows no activation of the motion alarm/PASS alarm during the six minutes of data collection.**

**Discussion:** The data recovered from Technician Wilson's ICM 2000 Plus by NIOSH and MSA showed no activation of the motion alarm/PASS during the six minutes of recorded data.

**g. According to the data files, during Technician Wilson's mayday situation his SCBA's ICM 2000 Plus PASS was not functional.**

**Discussion:** As indicated by MSA, when the battery capacity powering the ICM 2000 Plus is exhausted, the functionality of the PASS ceases. When this occurs, no data is collected and no electronic alarms are capable of sounding. The SCBA is not equipped with a redundant PASS alarm. There is a redundant low pressure alarm (Audi-Larm) which is a mechanical bell, independent from the ICM and is powered by the bottle's air supply.

**h. Recovered data files included temperature reading information.**

**Discussion:** The ICM 2000 Plus is equipped with a heat sensor. The temperature sensing unit is a thermistor that measures heat on a time-weighted average. The sensor is located on the front surface of the ICM 2000 Plus and measures the amount of thermal heat transfer to the interior of the ICM case. The thermistor does not measure radiant heat load nor does it directly correspond to the ambient temperature. Since the



measurement is a time-weighted average, the thermistor does not record immediate changes in the thermal heat transfer. A MSA representative indicated numerous factors can effect the temperature readings which include the firefighter's position relative to a room's heat gradients (i.e. crawling versus standing) and if a firefighter's protective clothing is obstructing the sensor (i.e. lying on stomach with ICM underneath the firefighter).

The temperature feature is an option that can be enabled if the option is selected at purchase. This option is not currently activated in Prince William County's SCBA units but the ICM 2000 Plus data was recorded on the storage chip and recovered during the NIOSH and MSA examinations. Technician Wilson's data file indicated the time-weighted average temperature reading was initially at approximately 60°F upon entry into the structure which increased to 130°F within four minutes. It is known through the independent analyses of Technician Wilson's personal protective equipment, that he was exposed to ambient temperatures well in excess of 130°F.

**8. The following data was collected from Tower 512's officer's SCBA ICM 2000 Plus device:**

**a. The ICM 2000 Plus' internal clock is not synchronized with Eastern Standard Time. Daylight saving time was also in effect.**

**Discussion:** The internal clock displays a time record beginning with 1116 hours when the SCBA pack is utilized on the Marsh Overlook incident. In review of other data files from this unit and other SCBA units, the internal clock consistently displays records around the 1100 hour time frame that appear to match the 0600 hour time frame. The clock variances were discussed in detail in the previous Technician Wilson findings.

**b. A pressurization of the SCBA was recorded at 1116 hours on April 16, 2007.**

**Discussion:** This SCBA pressurization and use was on the Marsh Overlook incident. Data files record a beginning cylinder pressure of approximately 4,200 psi with no alarms or warnings recorded upon pressurization.



**c. Data records eighteen minutes of use after the air pack was pressurized.**

**Discussion:** The data record indicates an expected air consumption rate for firefighting activities. Air consumption continued from 1116 hours to 1129 hours. Data indicates the air pack was turned off at 1134 hours.

**d. A low battery warning activated eight minutes after the SCBA was pressurized.**

**Discussion:** While the data files indicated a low battery warning, Tower 512's officer stated the warning was not observed.

**e. Recovered data files included temperature reading information.**

**Discussion:** As explained in the similar Technician Wilson finding, Tower 512 officer's data file indicated the time-weighted average temperature reading was initially at approximately 60°F upon entry into the structure which increased to 90°F within two minutes. Tower 512's officer's temperature reading leveled off at 90°F and eventually returned to the 60°F reading eighteen minutes after pressurization and use.

**9. There were PASS devices sounding on the incident scene.**

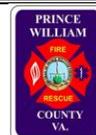
**Discussion:** Data from Wagon 512's officer's ICM 2000 Plus PASS indicated that the PASS was sounding for ten minutes while the air supply was in use. While the data files indicated the PASS was sounding, Wagon 512's officer does not recall hearing or activating their own PASS device.

Data from Wagon 512's bucket firefighter ICM 2000 Plus PASS indicates that the PASS was sounding for eight minutes while the air supply was in use and one minute when the air supply was exhausted. Wagon 512's bucket firefighter does not recall hearing or activating their own PASS device.

Data files from SCBA packs worn by the personnel from Tower 512 and Rescue 510 do not indicate any PASS activations.

During interviews, crews operating in the interior, or on the exterior of the structure, did not report hearing a PASS device sounding during the rescue operations. Only Engine 520's driver and driver shadow, positioned 500 feet away at the hydrant in front of 15489 Marsh Overlook, reported hearing a PASS device sounding from the incident location.

An analysis of scene video footage and radio transmissions indicate there was more than one PASS device sounding at given times during the incident,



with three PASS devices being discerned at points. Firefighters have become conditioned to the sound of PASS device activations during routine use resulting in the sounds becoming transparent on the incident scene.

**10. Data collected from SCBA ICM 2000 Plus from the four personnel on the initial entry crews of Wagon and Tower 512 recorded battery capacity issues:**

**a. Wagon 512's officer data recorded an ICM low battery warning two minutes after pressurization and fire ground use.**

**Discussion:** An ICM low battery warning for Wagon 512's officer was intermittently recorded during the SCBA's use. The initial warning was recorded two minutes following pressurization and fire ground use. This warning was displayed for three minutes.

The data record shows a subsequent two minute period of time where a low battery warning was not recorded. One minute into this time period, the motion alarm is recorded. After another minute of time (a full two minute time period from last low battery warning), a subsequent low battery warning was again displayed and lasted nine minutes until the data indicated a dead battery and stopped recording data.

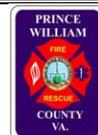
Wagon 512's officer changed the air pack's cylinder following these events and the ICM data shows a new cylinder pressure of approximately 4,000 psi but a low battery warning is again displayed.

**b. Wagon 512's officer's bucket data recorded an ICM low battery warning fifteen minutes after pressurization and fire ground use.**

**Discussion:** An ICM low battery warning for Wagon 512's officer's bucket was recorded during the SCBA's use. The warning was recorded fifteen minutes following pressurization and fire ground use and continued for twenty-seven minutes upon which time the air pack was no longer used.

**c. Tower 512's officer's data recorded an ICM low battery warning eight minutes after pressurization and fire ground use.**

**Discussion:** An ICM low battery warning for Tower 512's officer was recorded during the SCBA's use. The warning was recorded eight minutes following pressurization and fire ground use and continued for ten minutes upon which time the air pack was no longer used.



- d. Technician Wilson's data recorded an ICM low battery warning immediately upon pressurization and fire ground use.**

**Discussion:** An ICM low battery warning for Technician Wilson was recorded immediately upon pressurization and fire ground use. The warning continued for six minutes until the data indicated a dead battery and stopped recording data.

**11. The loss of battery capacity renders PASS devices unusable.**

**Discussion:** Of the four air packs used by the initial entry crews, two experienced dead batteries and lost total function of the PASS device. The other two air packs experienced low battery warnings and with continued use would have resulted in dead batteries and the loss of a functional PASS device.

**12. Some firefighters report hearing a sound described as a pressurized release of air coming from the area of the second floor windows near where Technician Wilson was found.**

**Discussion:** The source of this sound could not be factually determined. As previously mentioned, the analysis of the SCBA revealed the cylinder's relief disc was intact, therefore, can be ruled out as a source of this sound. If the integrity of any SCBA rubber lines or face mask components were lost, a rapid release of any remaining air cylinder supply could occur. However, it cannot be confirmed that any of these theories were the source of the sound heard by the firefighters.

**13. Air quality testing for the breathing air compressor at Station 12 could not be documented.**

**Discussion:** There were multiple requests to the volunteer department responsible for maintenance and air quality testing of the breathing air compressor at Station 12 for copies of air sample reports. The documentation submitted indicated a test date of June 2007 and no documentation prior to April 16, 2007 was received.

**Protective Clothing Related**

**14. Technician Wilson was found with his personal protective clothing ensemble in place except for his helmet.**

**Discussion:** Physical evidence indicated Technician Wilson's structural firefighting personal protective clothing ensemble consisting of turnout coat and pants, boots, gloves, and protective hood were properly worn and in place at the time of his death. Technician Wilson's helmet was located



approximately 6 feet from his body and is undetermined when, why, or how it was removed. The helmet strap was found unbuckled. The helmet was sitting upright on the brim, with the strap between the helmet and carpet underneath the helmet.

**15. The protective clothing worn by Technician Wilson was extensively damaged.**

**Discussion:** Technician Wilson's protective clothing was sent to International Personal Protection Incorporated for an independent examination and analysis. The company documented the physical condition of the protective clothing ensemble.

Facts that were able to be determined were:

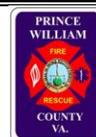
- No defects or problems were noted with the clothing that was able to be examined. Opinion could not be rendered on pieces that were destroyed.
- The near total destruction of clothing and equipment show complete disintegration of many textile elements of the clothing, including several portions of the coat, pants, and hood. The damaged impacted all three layers of the protective garments (outer shell, moisture barrier, and thermal barrier).
- The amount of protective clothing destruction indicated that much of the degradation took place after Technician Wilson succumbed to the effects of fire exposure.
- The protective clothing was exposed to extraordinary conditions that are well beyond the capabilities of any protective ensemble in existence today.

**16. The protective clothing worn by Tower 512's officer had varying degrees of damage.**

**Discussion:** Tower 512's officer's protective clothing was sent to International Personal Protection Incorporated for an independent examination and analysis. The company documented the physical condition of the protective clothing ensemble.

Facts that were able to be determined were:

- Damage to helmet, coat, hood, and gloves was found on the right side of the items.
- Helmet had bubbling of the shell and blackening of reflective trim on the right side. There was charring and embrittlement of the right ear flap.
- Charring and loss of material on right side of the hood towards the face opening.



- Coat had charring of the trim. The inside shell had char damage to the right sleeve over the entire length. The liner showed melting and charring on right sleeve and shoulder. There was no apparent damage to the thermal barrier.
- There was significant shrinkage of the right glove from heat exposure which effectively reduces the insulating air layer.

The location of the damage found on Tower 512's officer's protective clothing is consistent with the reported fire movement and conditions encountered on the second floor at the time of the mayday event.

**17. Tower 512's officer's protective clothing ensemble provided protection during the exit of the structure.**

**Discussion:** The officer was engulfed in and moved through an intense fire event before being removed from the structure. The protective ensemble received direct flame impingement and exhibited thermal transfer upon physical examination.

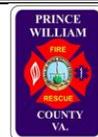
Tower 512's officer sustained partial thickness burns to the right ear. The burns sustained to the ear were attributed to the lower level of protection provided by the protective hood when compared to other portions of the ensemble. The independent analysis of the protective clothing determined that the helmet's ear flaps were not extended down over the protective hood. In addition, the coat's collar was not placed upright over the hood and ear flaps. Therefore, there was a lack of additional insulating layers which may have contributed to the ear burns.

Tower 512's officer also sustained partial thickness burns to the right index finger. The right glove had evidence of very high heat exposure with shrinkage of the leather. When the leather shrinks, it permits more rapid heat transfer which increases the likelihood of burns.

**18. PPE inspections were performed and documented in accordance with Fire and Rescue Association Procedure 9.1.1 titled Protective Clothing and Equipment:**

- Technician Wilson conducted and documented PPE inspections in January, February, and March 2007.**
- Tower 512's officer conducted and documented PPE inspections in January, February, and March 2007.**

**Discussion:** Fire and Rescue Association Procedure 9.1.1 titled Protective Clothing and Equipment requires an inspection of all PPE components.



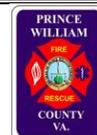
These inspections are to be performed monthly and documented on the inspection log. A review of the log indicated that both Technician Wilson and Tower 512's officer inspected their protective clothing.

**Recommendations:**

**SCBA Related**

- 12.1. Require that all SCBA units and breathing air compressors/systems within the Prince William County System be flow tested, repaired, and maintained according to federal regulations, NFPA standards, and manufacturer's recommendations.**
- 12.2. Require that the Department of Fire and Rescue maintain records of all flow testing, repair and maintenance for SCBA units and breathing air compressors/systems utilized by its employees.**
- 12.3. Require that all Department of Fire and Rescue employees who use breathing apparatus follow the inspection and use parameters outlined in the Fire and Rescue Association 9.1.2 titled Respiratory Protection Program.**
- 12.4. Require that all Department of Fire and Rescue employees who use breathing apparatus comply with NFPA 1582 standard and receive annual medical physicals.**
- 12.5. Develop a system-wide recordkeeping mechanism for all OSHA, NFPA, Department, and Fire and Rescue Association required inspections, testing, and maintenance of apparatus, SCBA units, air compressors/systems, ladders, hose, personal protective ensembles, and other equipment as required.**
- 12.6. The sounding of any PASS alarm must be investigated as a true emergency until proven otherwise. Outcome of any PASS alarm investigations must be reported to the incident commander.**
- 12.7. Ensure that all members who enter into an IDLH environment have a PASS device capable of alerting throughout the duration of their exposure in these environments.**

**Discussion:** The MSA SCBA PASS device used is an integrated component that operates by battery power. There is no redundant capability associated with the PASS device. If the PASS device's battery source loses capacity or there is a malfunction, the PASS device will not operate and there is no redundancy for this critical safety component of the SCBA for the firefighter.



**12.8. Initiate a national fire service industry requirement to mandate a redundant capability for PASS devices.**

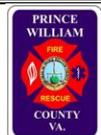
**Discussion:** The functionality of the PASS device in high temperature environments has been a national fire service industry concern. It has been well documented through investigative reports, including those conducted by Centers for Disease Control and the National Institute of Standards and Technology, that there are reported PASS failures possibly linked to water leakage or an inability to function as designed in high heat conditions. In 2005, the NFPA issued a notice to all fire departments advising that the PASS devices may experience sound reductions at temperatures of 300°F and may become indistinguishable from background noise. NFPA encouraged the continued use of PASS devices with an awareness of these limitations.

It is recommended that the fire service industry require regulations that mandate a redundant capability for the SCBA PASS device. In addition to the use of a SCBA integrated PASS device, a redundant capability is to be achieved by the use of a stand alone PASS device. This initiative would provide a second emergency alarm in the instance the primary device should fail. Considerations for redundant PASS devices may either be mechanically driven or have a power supply meeting the performance testing requirements in NFPA 1982.

If a battery operated device is used, it must have a redundant power supply capability. It is recommended that the primary power supply be batteries that withstand severe cold and extreme heat temperature variances and meet the operational performance standards of NFPA 1982. The redundant power supply must be a type of capacitor that can also withstand severe cold and extreme heat conditions. The batteries and redundant capacitor must be long duration and capable of operating for years without any required maintenance or change out of the batteries and or capacitor.

**12.9. Initiate a national fire service industry requirement to have all SCBA manufacturers standardize the PASS alarm sound to the international distress signal of S.O.S.**

**Discussion:** During the Marsh Overlook incident there were multiple PASS alarms sounding. While these alarms can be heard on the video footage, in the background of radio transmissions, and are supported by ICM 2000 Plus data downloads, only two personnel positioned 500 feet from the incident scene reported hearing them. Personnel operating in the immediate fire ground area have no recall of hearing any activated PASS



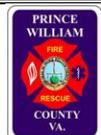
alarms following the mayday or during the initial rescue attempts. There are numerous factors that may contribute to the PASS devices not being recognized:

- There are a number of repeated alarms that routinely occur during fire ground operations. Repeated alarms occur when a firefighter's motion stops. Firefighters often do not immediately recognize their own SCBA PASS alarm has activated because their focus and attention are on other fire ground operations. This causes a frequent occurrence of alarms being heard but ultimately ignored as the cause is attributed to the lack of motion of firefighters who are not in distress.
- The noise level generated by other fire ground equipment and apparatus competes with the decibel output of the PASS alarm resulting in the alarm sound not always being actively recognized.
- The human ear along with the multiple layers of protective equipment cannot readily and easily detect the different sounds and decibels. Subsequently, the activated SCBA PASS alarm is often not heard, reacted to, or identifiable during incidents.
- There is a distinct possibility that the current electronic PASS alarm generated is similar in nature to many other electronic sounds. This has conditioned listeners to be desensitized to electronic noises.

Different SCBA manufacturers have their own distinct PASS alarm sound. Each unit has to emit a required decibel level but the "chirp" or "wail" sound of the PASS alarm activation varies among the manufacturers. The fire service industry and regulatory standards for respiratory protection does not require a "standardized" SCBA PASS alarm sound when activated. This is an interoperability issue when different manufactured SCBA units are in use on a single fire ground. The national fire service industry must require regulations that mandate the standardization of a universal PASS alarm sound that emits the proper decibel level and international distress signal of S.O.S. This specific requirement will provide personnel operating on an incident the ability to distinguish the SCBA PASS alarm from other background noises and it will universally standardize the distress alarm for all SCBA manufacturers.

**12.10. A review of the SCBA performance related to its battery powered components must be performed. This evaluation may have industry wide implications.**

**Discussion:** During the Marsh Overlook incident there were four personnel on the initial entry crews of Wagon and Tower 512 that recorded battery capacity issues. All four personnel recorded low battery warnings with two personnel experiencing dead batteries following a



variable amount of time. According to the ICM 2000 Plus data downloads, one battery died after twelve minutes of receiving a low battery warning with the other dying after a total time of eight minutes of use (from three days of data) receiving a low battery warning. The NFPA performance testing standard states that the unit is to function for two hours at full alarm, following the receipt of a low battery warning. The data downloaded from the two SCBA units with dead batteries did not show where the battery lasted for two hours of use following a low battery warning before all battery capacity was lost. An evaluation as to the cause of this situation and a review of the overall performance must immediately be performed. Reference documents for use in this evaluation may include the National Institute of Standards and Technology (NIST) Technical Note 1474 titled *Thermal Environment for Electronic Equipment Used by First Responders* and the NISTIR 7294 titled *Performance of Thermal Exposure Sensors in Personal Alert Safety System (PASS) Devices*.

**12.11. A review of the SCBA performance related to all the components must be performed. This evaluation may have industry wide implications.**

**Discussion:** Structure fires produce a tremendous amount of BTUs, and the heat and thermal energy produced are enormous. The current standards and regulations of the structural, integral, and ancillary components of the SCBA and its components, including the integrated PASS device, are not commensurate with the temperature ranges and BTUs that are produced at structure fires. Regardless of manufacturer, SCBAs and their components must be able to continue to function as long as there is a firefighter rescue potential and withstand extreme temperature ranges from 100 to 1,000°F. Requirements and standards for SCBAs and all its components must depend on the protection capability of the firefighter's protective clothing ensemble to sustain life in these adverse conditions.

**Protective Clothing Related**

**12.12. Reinforce proper wearing of protective clothing ensemble to include the proper donning of helmet ear flaps and coat collar.**

**12.13. Continue practice of monthly PPE inspections.**

**12.14. Revise Fire and Rescue Association Procedure 9.1.1 titled Protective Clothing and Equipment to identify standard method for performing inspections, determining clothing and equipment serviceability, and cleaning requirements.**



**12.15. PPE record keeping, retention, and centralized storage practices need to be further defined.**

***Related recommendations in other sections:***

- **Revise the Fire and Rescue Association procedure 5.5.2 titled Rapid Intervention Team (RIT) to address active fire ground listening for PASS devices and noises, as well as the expected actions to be taken upon hearing the activation of a PASS device. See expanded discussion in Rapid Intervention Team and Rescue Operations section.**



# Apparatus and Equipment

## **Section 13**

### **Apparatus and Equipment**

#### **Overview:**

The twelve individual volunteer departments own and maintain the majority of apparatus and equipment. Each volunteer department identifies their apparatus and equipment needs, as well as the physical location of apparatus within their station(s). There are numerous reports and plans (i.e. Blue Ribbon Commission, Tridata Study, Prince William County Strategic Plans, and Chapter 9 of the Prince William County Code) that identify the need to have standardized apparatus and equipment, but the system has not achieved the goal.

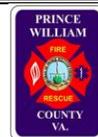
#### **Findings:**

- 1. During this incident there were several reports of poor water pressure on the 2 ½ inch (200 foot) and 1 ¾ inch (300 foot) hose lines supplied by Wagon 512. There were no other reports of poor water pressure on any other hose lines.**

***Discussion:*** Causes for poor water pressure on these two hose lines from Wagon 512 originated from numerous sources. To pinpoint a specific root cause is impossible in a retrospective format, as replication of all factors could not be fully achieved. The reported water pressure issues took place during a ten minute time period. Listed below are factors that may have contributed to the poor hose line pressure. Any single item or a combination of items may have contributed to the problem but cannot be factually identified:

- Pressure fluctuations in the water system – Prince William County Service Authority reported that there were no abnormal water system pressure fluctuations for the Dawson Landing neighborhood during the Marsh Overlook incident time period. The Service Authority was requested to perform water system testing on the hydrants located at 15455 and 15489 Marsh Overlook Drive. This testing was done on Monday, April 30, 2007 at 0600 hours with members of the LODD Investigation Team present. The selection of this date was done in an attempt to perform the test on the same day of the week and at the same time of the incident when neighborhood demands were reasonably similar. The results confirmed a more than adequate available fire flow supply from the water distribution system.

Engine 520 was the supply pumper for Wagon 512. Engine 520's driver operator reported an intake pressure of 105 psi from the hydrant with no fluctuations noted during the incident. Engine 520's driver operator also stated Wagon 512's supply line was being pumped at 150 psi with no fluctuation reported during the incident. There was 500 feet of 4 inch supply line between the two pieces of apparatus and Wagon 512's initial



estimated hose line flow was 600 gpm. These findings indicated there was a sufficient water supply to support the operation.

- Apparatus mechanical issues – Pressure governor operations vary among manufacturer and installation specifications. Wagon 512 is equipped with a Class 1 Captain Pressure Governor. After engaging the apparatus' pump, the driver must select the electronic throttle operational mode of either "RPM" or "Pressure", as this particular piece of apparatus does not automatically default to an operational mode. Wagon 512 differs in operation and controls from the other pumper in the station. If the module is not placed in either operational mode, water may flow through the pump and into the hose lines at the engine's idle pressure. However, if additional pressure is desired and the apparatus' throttle is increased, a corresponding pressure increase would not occur.

Wagon 512's driver operator reported the pump was set at normal start up pressures for the deployed hose lines. Wagon 512's driver was then instructed by Engine 520's officer to hand stretch a 4 inch supply line to Tower 512 and had to leave the pump panel to accomplish the task. During that time, two individuals (Engine 510's officer and Brush 512's driver) went to Wagon 512's pump panel in an attempt to troubleshoot causes of reported poor hose line pressures.

Engine 510's officer went to Wagon 512 and attempted to increase the pump pressure by using the electronic throttle pressure increase buttons, but did not note a corresponding increase in engine RPM's as normally expected to encounter. The officer was unfamiliar with Wagon 512's pump panel and electronic throttle device, as it differs from the apparatus the officer is normally assigned to. It is unknown what actions Brush 512's driver performed; as despite numerous attempts, the volunteer member failed to respond to requests to be interviewed to gather pertinent information, comments, or observations.

When Wagon 512's driver returned from hand stretching the supply line to Tower 512, the driver noted the two individuals at the pump panel. Wagon 512's driver reported the intake pressure was fluctuating ranging between 40 to 130 psi. The driver reported the fluctuating intake pressure eventually leveled out without any further occurrences during the remaining incident time.

Due to the requests to increase the pressure on the 2 ½ inch and 1 ¾ inch hose lines, Wagon 512's driver activated the pressure increase buttons on the governor and reported a corresponding increase in engine RPMs.



- Hose line condition – The multiple hose line pressure difficulties were not immediately identified at the incident scene; therefore, the involved sections of hose were not segregated for further inspection and became mixed with station supply.
- Low pressure nozzles – The configuration of Wagon 512’s hose lines with nozzles are listed below:
  - 200 foot 2 ½ inch hose line with an Akron Assault Breakaway fog Model 4827. The fog tip is rated to flow 300 gpm at 75 psi. The fog tip could be taken off leaving a 1 ¼ inch smooth bore.
  - 300 foot 1 ¾ inch hose line with an Akron Assault Breakaway fog Model 4817. The fog tip is rated to flow 150 gpm at 75 psi when connected to the 1 inch smooth bore.

On Wagon 512, the fog tip has a 15/16 inch reducer in place between the tip and 1 inch smooth bore. There may be an impact of reduced gpm flow when attached to a 15/16 inch adapter.

- 200 foot 1 ¾ inch hose line with an Akron Assault Breakaway fog Model 4817. The fog tip is rated to flow 150 gpm at 75 psi when connected to the 1 inch smooth bore.

On Wagon 512, the fog tip has a 7/8 inch reducer in place between the tip and the 1 inch smooth bore. There may be an impact of reduced gpm flow when attached to a 7/8 inch adapter.

Both of the 200 foot, 2 ½ inch and 300 foot, 1 ¾ inch hose lines were equipped with low pressure nozzles. Nozzle types vary among stations in manufacturer, required psi, and gpm flow. There is no standard approach to the nozzles and appliances used in Prince William County’s fire and rescue system. The fire and rescue system has not conclusively analyzed the fire flow gpm data requirements to standardize the use of low pressure nozzles with initial attack hose lines. The non-standardization of nozzles and appliances used in the system impacts the incident commander’s and personnel’s ability to determine and deploy strategies and tactics to support the confinement and extinguishment of a structure fire.

- Kinks in the hose lines – Low pressure nozzles require less pressure to be pumped on the attack lines than standard fog nozzles. The lower pressure makes the outside walls of the hose more pliable, which in turn makes them susceptible to kinks. The distance between the rear of Wagon 512 and the front door of the structure was approximately 65 feet. Therefore, the hose lines deployed from Wagon 512 needed to be



carefully deployed in a zigzag fashion within that distance. The amount of zigzag bends to deploy the 200 and 300 foot hose lines within a 65 foot distance were great. The amount of bends required to deploy these lines to the front door, along with the use of low pressure nozzles and their associated lower operating pressures, contributed to hose line kinks and a reduction of water pressure at the nozzle.

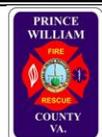
Kinks in the 2 ½ inch hose line were observed by Wagon 512's officer and caused the officer to leave the firefighter at the nozzle and retreat along the hose line to straighten out the kinks in an attempt to increase the water pressure. Wagon 512's officer reported that removing the kinks had a positive impact and improved the nozzle pressure and pattern.

The deployment of the 300 foot, 1 ¾ inch hose line resulted in the line being dropped in a hose bundle a short distance from the pumper. The lines had to be methodically untangled and stretched from that location to allow for the proper deployment without kinks and tangles. The cause for the incorrect deployment of the hose line was attributed to personnel unfamiliar with the hose load configuration.

- Relief valves – Wagon 520's driver operator and shadow operator recall seeing water discharging from Wagon 512's rear relief valve. Wagon 512's driver reported observing the rear relief valve operating and also indicated the pump panel's relief valve was discharging some water. Both relief valves were reported to be set at 150 psi.
- Driver operators – During the interviews of the driver operators of Wagon 512 and Engine 520, their procedures for pump operation were outlined and in accordance with their training and operation of the unit.

## **2. Engine company apparatus lack standardized approach and equipment for hydrant supported water supply activities.**

**Discussion:** The size of supply lines and use of four way hydrant valves are not standardized within Prince William County's fire and rescue system. While large diameter supply hose lines are used by all departments, there is no standardization and both 4 inch and 5 inch lines are used among the departments. Another inconsistency is the presence and use of four way hydrant valves. A four way hydrant valve permits the rapid initiation of water flow from the hydrant to the apparatus. Subsequent arriving apparatus can attach an additional line to the valve to boost the pressure initially being supplied (hydrant pressure) with no interruption of water flow.



The Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines identifies the priority and assignment for the establishment of an initial water supply source, but lacks the identification, priority and assignment for the establishment of secondary water supply sources.

The lack of a standardized approach to establishing water supply (hydrant supported) results in compromised and inconsistent water supply capabilities. This situation is exacerbated when personnel are detailed to a different station assignment or engaged in multi-company operations. The lack of a standardized water supply approach additionally complicates training curriculums and evolutions.

**3. Hose lines and load configurations are not standardized within the system.**

**Discussion:** Hose lines and load configurations are established by each department and vary among the stations across the fire and rescue system. The varying hose lines and hose load configurations found in the system create difficulties for personnel in tactical decision making and deployment. In addition, the variations are extremely inefficient to tactical operations and create training curriculum difficulties. The difficulties are exacerbated when personnel are detailed to a different station assignment or engaged in multi-company operations. Firefighters not assigned to Station 12, but directed to pull hose lines from Wagon 512, had to stop and ask the driver operator to confirm the correct line selection causing a distraction to the driver. The unfamiliarity of the different hose line load configurations contributed to delays in hose line deployment on the Marsh Overlook incident.

**4. Nozzles and appliances are not standardized within the system.**

**Discussion:** Nozzles and appliances are selected by, and vary among, the departments within Prince William County. The varieties of nozzles found in the system have different operational pressures and gpm flows associated with each type and model. Since structure fire incident scenes involve multi-company operations, it is impossible to fully know all the capabilities and limitations of the wide variety of nozzles. When personnel are unfamiliar with the nozzle gpm flow capability, it will compromise fire ground operations.

**5. Without system standardization for apparatus and equipment, personnel are unprepared to utilize the equipment in emergency situations.**

**Discussion:** Without standardization, incident commanders, unit officers, and other personnel cannot adequately address strategy and tactics without knowing the capabilities of the apparatus and equipment in use on the



emergency scene. Since structure fire incident scenes involve multi-company operations, it is impossible to fully know all the capabilities and limitations of the wide variety of apparatus and equipment in use in Prince William County. This situation can compromise firefighter safety and delay tactical operations.

**6. A deck gun (master stream) was requested to be positioned at the front door but was placed in operation on the top of Engine 510.**

**Discussion:** The following radio transmission occurred regarding the deployment of Engine 510's deck gun:

Division A transmitted the following message to Command:

*"Now if possible, I would love to get a uh deck gun to the front door if possible to get the bulk of the fire down, I don't want to potentiate more collapse."*

Command transmitted:

*"Engine 510, are you direct?"*

Engine 510's driver replied:

*"That's affirmative, deck gun to the front door."*

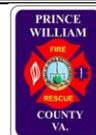
A misunderstanding of the order occurred. Division A wanted a deck gun to be placed on Side A at the front door. Engine 510's driver interpreted the order to initiate the flow of the deck gun with it aimed at the front door. When the misunderstanding was clarified, the Incident Commander decided to leave the deck gun in place versus shutting down the operation and relocating the device.

**7. Ladder trucks and towers performed aerial operations in a high wind environment.**

**Discussion:** Aerial devices are rated by the manufacturers to withstand wind forces from 35 mph up to 50 mph. Two of the aerial devices were rated for 50 mph (Tower 513 and Truck 511) and one was rated for 35 mph (Tower 512).

**8. The Marsh Overlook incident depleted all staffed specialty resources (Trucks, Towers and Rescues).**

**Discussion:** At the time of the Marsh Overlook incident, the Department staffed three ladder trucks/towers and two rescue units County wide.



**9. Lack of standardized apparatus and equipment has a negative impact on the speed and efficiency of firefighters to carry out actions to support tactical operations.**

**Discussion:** There is no formalized County wide policy which identifies the standard apparatus specification, configuration, or equipment complement to be carried. With a standardized apparatus and equipment policy that reflect current needs, all firefighters will be able to function effectively on any emergency incident with any unit.

**10. Wagon 512's pump test was performed in accordance with NFPA standard 1901 titled Standard for Automotive Fire Apparatus.**

**Discussion:** NFPA 1901 recommends annual testing of apparatus pumps. Wagon 512's pump was tested by a contractor on January 4, 2007.

**11. Wagon 512's hose test, maintenance, care and use records were reported as lost and were unavailable for review.**

**Discussion:** NFPA 1962 titled Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose recommends annual testing of fire hose. Wagon 512's hose test, maintenance, care and use records were requested but could not be reviewed as the responsible volunteer department reported the records as lost and unavailable.

**12. Safety 502's video footage was extremely beneficial in documenting the Marsh Overlook events.**

**Discussion:** The video footage was critical in providing factual documentation of events which assisted the Investigation Team's reconstruction of the incident time line.

**13. Thermal imaging cameras were used, but due to the high heat conditions encountered were limited in their application during the search and rescue attempt for the missing firefighter.**

**Discussion:** Several of the units utilized thermal imaging cameras during tactical operations. Tower 512 initially used their thermal imaging camera to aid in the search for occupants. Other units used their thermal imaging camera during the search and rescue attempts to locate Technician Wilson.

During the firefighter search and rescue efforts, Engine and Tower 513's officers reported their cameras' displayed a "white out" screen which corresponds to an extreme temperature rating that exceeds the temperature



reading capability. Neither of these cameras had the capability to record nor transmit the information gathered during its use. The cameras currently in use vary in their capabilities and options. Specifically, there are cameras that have color displays, while others have only black and white displays, as well as the ability or inability to record and/or transmit data.

***Recommendations:***

**13.1. Based on the fire flow needs and capabilities assessment (see expanded discussion in Strategy and Tactics Section), mandate the standardization of all new apparatus and equipment and identify methods to achieve standardization with existing apparatus and equipment.**

- 13.1.1. Evaluate best practices from other jurisdictions that have successfully achieved standardization of apparatus and equipment.
- 13.1.2. Develop a structured transition and implementation plan to achieve standardization of apparatus and equipment.
- 13.1.3. The structured transition and implementation plan must include a process for the removal of non-standardized apparatus and equipment from the system's inventory.
- 13.1.4. Resulting from the Marsh Overlook incident, the following engine company equipment items are recommended for priority evaluation:
  - Standard hose lines
  - Standard complement of nozzles (nozzle types, standardized pressure and gpm flow, etc.)
  - Standard hose loads configurations

***Discussion:*** A system wide standardized apparatus and equipment plan will enhance incident operations and improve firefighter safety as training can be focused and personnel can know equipment limitations.

**13.2. Establish a system wide standardized apparatus and equipment initiative.**

- 13.2.1. The system wide plan must identify a standardized type, configuration, and outfitting requirements for all apparatus.



13.2.2. The system wide plan shall identify the deployment and distribution of all apparatus.

13.2.3. The system wide plan is to be routinely evaluated for optimal strategic placement of apparatus and consider emerging technologies.

**13.3. Aerial ladder trucks/towers must have their operational limits clearly posted at the operator's pedestal.**

**Discussion:** The differences among the aerial devices and their operational limits in the system can create confusion among personnel, especially when personnel are detailed to a different station assignment or engaged in multi-company operations. Unfamiliarity of the apparatus' operational limits may result in inefficient tactical operations, cause personal injuries, and jeopardize the safe use and operation of the apparatus.

**13.4. Command and incident safety officers' vehicles must be equipped with video cameras with an option for stationary and remote capabilities.**

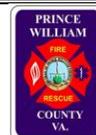
**Discussion:** The capability to capture incident events as they occur is critical for incident documentation, post incident analysis, and lessons learned for training purposes. The most current state of the art technology for video capabilities must be installed and a procedure for the use of this technology must be developed and incorporated as part of incident operations.

**13.5. Evaluate the operational use, training, and standardization of thermal imaging cameras.**

**Discussion:** There are numerous manufacturers and types of thermal imaging cameras. There is a need to standardize this important piece of equipment in order to standardize operational use and training requirements. The challenge in standardizing any type of technology is how to keep pace with industry advances while maintaining standardization. One option to addressing these types of issues may be in the evaluation and purchasing mechanisms utilized (i.e. leasing, replacement schedules, grant funding, etc).

***Related recommendations in other sections:***

- **Conduct a fire flow needs and capabilities assessment to identify the required apparatus and equipment to achieve the needed fire flow, application, and delivery method for structures within Prince William**



**County. This assessment will serve as the cornerstone of establishing criteria for apparatus and equipment selection and standardization, and future training requirements. See expanded discussion in Strategy and Tactics Section.**

- **System wide firefighting, rescue and EMS equipment must be standardized so that training curriculums can prepare personnel for field operations. See expanded discussion in Training Section.**
- **Revise Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines. See expanded discussion in Strategy and Tactics Section.**



**E f f e c t i v e**  
**F i r e f i g h t i n g**  
**F o r c e**

## **Section 14**

### **Effective Firefighting Force**

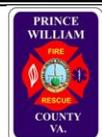
#### **Overview:**

The authority having jurisdiction must identify the service performance standards and expectations for all types of emergency incidents in their community. Factors that must be considered during this decision making process include local, regional, state, and industry standards. Once the jurisdiction's performance standards and expectations are identified, personnel and unit resources must be matched to properly support and achieve the response goals. As a community grows, this must be a dynamic process as service modifications will be required to meet the various operational challenges presented. Examples of these challenges that will affect service delivery include changes in population, demographics, business and residential development, traffic patterns, emergency incident volume, as well as community risk and homeland security threat analysis.

Fire and rescue work is task oriented and labor intensive. An illustrative example of this from the Marsh Overlook incident was the deployment of a 2 ½ inch hose line that weighs in excess of 500 pounds. Many fire and rescue tasks are performed in rapid sequence and in a coordinated manner to achieve efficiency and provide for safe incident operations. The speed, efficiency, and safety of fire ground operations are directly proportional to the amount of personnel available to perform the critical tasks. If staffing levels are deficient, then the time to accomplish necessary critical tasks lengthens, exposing firefighters and trapped civilians to increased dangers. Without adequate resources to control the incident, the fire continues to burn, increasing the chances of having a sudden change of conditions, especially in lightweight constructed structures.

The National Fire Protection Association (NFPA) is an international organization whose mission is to develop and advocate consensus based codes and standards. 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 was developed to apply documented and scientific-based fire behavior and emergency medicine to the basic resource requirements for effective fire and emergency service deployment.

NFPA 1710 is important as it applies the documented and proven science of fire behavior and emergency medicine to the basic requirements for effective fire and emergency service deployment. NFPA 1720 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments does not include the quantifiable method of measuring the basic requirements for effective fire and emergency service deployment.



NFPA 1710 applies to Prince William County fire and rescue system as the career and volunteer capabilities and resources are fundamentally the same. This includes the deployment, staffing, response times, and necessary support systems including safety and health, communications, incident command, pre-incident planning, and training.

The other key to effectively mitigate emergencies is the dispatch response complement utilized. Fire and rescue systems must carefully analyze their community needs, call types, and establish pre-configured dispatch complements that send the correct amount of initial resources to mitigate the emergency. OPSC selects a call type which determines the dispatch complement based upon the preliminary information that is gained from 911 callers. 911 caller information is vital to determine the type of incident involved, but the information gained is extremely subjective, open to interpretation by untrained individuals, and often technically incorrect. The fire and rescue department does not gain accurate and reliable information about any emergency incident until they arrive and perform their technical incident scene size up.

The goal is to adopt dispatch complements that are capable of achieving the system's performance expectations, provide for responder and citizen safety, and meet a community's risk tolerance. It is inevitable that the dispatch complement may at times send too many units for the given emergency incident, or may not send enough initial resources to gain control of the emergency incident. This determination can only be made by having accurate and reliable information directly gathered by on scene fire and rescue personnel. When the scene size up identifies a portion of the dispatch complement will not be needed, units are cancelled and returned to their station. Conversely, if upon scene size up it is determined additional units are needed, the resources can be requested.

System managers who want to avoid a frequent occurrence of units being placed in service and not utilized will recommend an adoption of a more conservative dispatch complement. Managers in this model will often highlight the dangers associated with emergency vehicle response and unnecessary vehicle wear and tear as justification to adopt their conservative approach. With this approach, the jurisdiction's risk tolerance must be willing to accept longer emergency service resource build-up times. As tragically illustrated in the Marsh Overlook incident, a firefighter mayday occurred only six minutes after the initial units' arrival. The risk associated with sending an inadequate initial dispatch complement for structure fires is the direct negative domino effect in resource utilization, creation of on scene resource depletion, and delayed assembly of an effective firefighting force. The system reflex time created by having units arrive on the scene, performing a size up, then subsequently requesting additional resources to assemble the effective firefighting force needed, cannot be overcome during initial incident operations. Therefore, it is prudent for system managers to initially



send a dispatch complement capable of supporting and achieving the expectations identified in local, regional, state, and industry operational guidelines and standards to provide for firefighter and citizen safety.

***Findings:***

- 1. Unit minimum qualified staffing and the dispatch complement are directly related to the assembly of an effective firefighting force.**
  - a. Current unit minimum qualified staffing levels provide an insufficient amount of qualified personnel to perform all the critical, concurrent tasks associated with firefighting activities.**
  - b. Current dispatch complement for structure fires does not support the rapid arrival of an adequate firefighter force.**

***Discussion:*** NFPA 1710 identifies the initial assembly of a firefighting force as a minimum of seventeen qualified firefighters based on a 2,000 square foot, two story, single family occupancy without a basement, and with no exposures. This amount of resources is required to achieve the following initial activities:

- Establish a primary water source.
- Deploy an initial attack and back up hose line.
- Ventilate the structure.
- Gain forcible entry into the structure.
- Perform search and rescue.
- Provide for an incident commander.
- Establish an initial rapid intervention crew (IRIC) to meet OSHA requirements (two-in/two-out).

Additional staffing is required above that level to accomplish other critical tactical priorities such as:

- Placing ladders.
- Controlling utilities.
- Providing emergency medical services for the responders and/or civilians.
- Placing additional hose lines in service.
- Handling multiple victims.
- Providing for a safety officer(s).
- Providing for incident command support.

The authority having jurisdiction must consider their community building demographics along with numerous other factors when applying the standard to their fire and rescue operations.



Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines, along with the Department of Fire and Rescue Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires identify the strategic and tactical approach, as well as the expectations for tactical unit assignments, in initiating actions at a structure fire. The Operational Guidelines identify and require the following activities to be performed by the initial arriving alarm complement:

- Establish a primary water source.
- Deploy an initial attack and back up hose line.
- Ventilate the structure.
- Gain forcible entry into the structure.
- Perform search and rescue.
- Provide for an incident commander who must also function as the safety officer.
- Establish two-in/two-out.
- Place ladders.
- Control utilities.
- Provide emergency medical services for the responders and/or civilians.
- Place additional hose lines in service.
- Provide for incident command support.
- Establish a formal RIT.

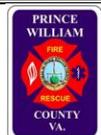
In addition, there is an expectation to establish a secondary water source which the procedure has not been formally revised to include. The Operational Guidelines identify tasks that exceed the personnel resources identified in NFPA 1710 for initial assembly of a firefighting force.

The current initial residential structure fire dispatch complement (for municipal water supply areas) and minimum staffing of three engines, one truck, one EMS transport unit, and one battalion chief provides the following resources:

<b>Unit</b>	<b>Engine</b>	<b>Engine</b>	<b>Engine</b>	<b>Truck</b>	<b>EMS</b>	<b>BC</b>	<b>Total</b>
<b>Staffing</b>	3	3	3	4 <sup>1</sup>	2	1	16

<sup>1</sup> The Department is in the final stage of a multi-year initiative to increase the minimum staffing on specialty apparatus (Trucks, Towers and Rescue units) from three to four. Tower 512 is currently minimally staffed with only three personnel. This staffing initiative affects career minimum staffing of specialty apparatus only.

These personnel resources effectively provide six crews that are expected to meet the tactics identified in the Operational Guidelines. In an effort to spread the resources and create the availability of a seventh crew, the system adopted a practice of splitting specialty piece staffing (Trucks, Towers and Rescue units) into two crews. This split crew results in an interior crew and an exterior crew referred to as the “X-ray crew.” In practice, the X-ray crew



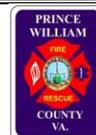
often splits again to provide for an apparatus operator, resulting in a loss of the X-ray crew's integrity on the fire ground by placing a solo crew member operating alone in a hot zone.

Fire and Rescue Procedure 5.5.3 titled Personnel Deployment during the Initial Stages of Interior Structural Firefighting and IDLH Incidents identifies resources that may be utilized to satisfy the two-in/two-out criteria. These resources include the incident commander, apparatus driver operators, X-ray crews, or EMS units staffed with qualified personnel. All uniform Department members are minimally cross trained to Virginia Firefighter II and Emergency Medical Technician – Basic. Relying on apparatus driver operators to fill this function is a risky practice as the driver operator is required to perform and monitor critical water supply and hose line deployment operations for the duration of a structure fire incident. If a driver operator is not maintained at the engine company's pump controls, it compromises the life safety of crews operating hose lines in an IDLH atmosphere. The same analogy is applicable to the incident commander. Without the consistent presence of an incident commander, it compromises the life safety of all crews operating on the fire ground as there is a loss of incident control and supervision.

Through the NFPA studies, it has been clearly demonstrated that for safe, effective and efficient fire suppression activities to be performed, each responding company needs a minimum staffing of at least four qualified firefighters. The current unit minimum staffing does not meet this standard and does not provide enough personnel to perform all the necessary, concurrent operational tasks associated with firefighting activities. The dispatch complement does not provide enough resources to effectively and safely accomplish the expectations within the Operational Guidelines. The dispatch complement configuration further lacks any reserve resources to operationalize alternative plans or initiate proactive strategies or tactics. The Operational Guidelines lack direction required to accomplish other initial tactical priorities such as secondary water sources, handling multiple victims, providing for an incident command support team, or addressing complex or rapidly changing incident scene situations.

## **2. The Marsh Overlook incident depleted all staffed specialty piece resources.**

**Discussion:** Currently, the Department staffs three trucks/towers and two rescue units. All of these units were dispatched and responded to the incident depleting these specialty piece resources County wide.



**Recommendations:**

**14.1. Increase the minimum qualified staffing of all suppression units to improve firefighter safety and operational effectiveness.**

- 14.1.1. All engine companies are to have at least four qualified personnel.

**Discussion:** The task oriented and labor intensive firefighting work involves the wearing of heavy personal protective equipment and the use of heavy and difficult to maneuver equipment. When compared to the current minimally staffed engine company crew of three, a crew of four can perform tasks faster, with more efficiency, and can improve the amount of weight stress and strain on individual team members during the deployment and maneuvering of equipment.

It is recommended by NFPA 1710 within the initial assembly of an effective firefighting force that an apparatus driver should be at each engine company performing water supply or hose line deployment operations for the duration of a structure fire incident. Not maintaining a driver operator at the engine company's pump controls seriously compromises the life safety of crews operating hose lines in an IDLH atmosphere.

When the unit officer functions as a part of a two person crew, it diminishes the ability of the officer to maintain supervision, monitor, and report overall condition changes. It is difficult, if not impossible, for an officer functioning as part of a two person crew to concurrently function as a tactician, supervisor, provide direction and guidance for the tactical assignment, evaluate condition changes, and provide command with on-going status reports. Increasing the minimum staffing to at least four qualified personnel on every engine company will provide for a driver, a properly supervised tactical crew, and improve capability to evaluate incident conditions and communicate vital information to the incident commander.

Another consideration to increase minimum staffing of the engine companies involves the establishment of the RIT function and secondary water supply lines. A crew that is assigned the RIT function is required to be at least three qualified personnel. The establishment of a secondary water supply is another incident priority to proactively prepare for fire attack needs that may exceed the capability of the initial supply line. In areas serviced by hydrants, this is achieved by a later arriving engine company



deploying a second supply line from another hydrant to the scene. This requires a driver operator to be maintained at the apparatus pump panel. If the engine company is at current minimum staffing levels, the remaining two crew members will report to the command post for a tactical assignment. This situation forces the incident commander to either delay the initiation of the RIT function or delay the establishment of a secondary water supply capability. Increasing the minimum staffing to at least four qualified personnel on every engine company will provide, at a minimum, a crew capable of assuming the RIT function as well as maintaining a driver at the apparatus for the secondary water supply function without experiencing delays in either tactical requirement.

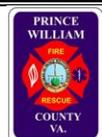
- 14.1.2. Evaluate increasing specialty pieces (trucks/towers/rescue) qualified staffing from four to five or six.

**Discussion:** It is recommended by NFPA, within the initial assembly of an effective firefighting force, to maintain an apparatus driver at the truck/tower for the duration of a structure fire incident. This apparatus requires specific preparation to properly and safely operate. The preparation takes several minutes to accomplish and necessitates the focused attention from the driver operator. Proper preparation and the constant presence of the driver operator is required if the apparatus' aerial ladder capabilities are selected to be utilized for civilian and/or firefighter rescue access, or deployed as an elevated master stream. The decision to utilize the apparatus' capabilities may be rapidly ordered to respond to changing incident conditions.

When the driver functions as a portion of a split crew (x-ray crew member), a conflict arises in the crew's priorities. The crew must either:

- Delay the preparation and set-up of the truck/tower for aerial operations; or
- Delay initiating other time critical fire ground operations such as placing ground ladders or controlling exterior utilities; or
- Sacrifice crew integrity while a single crew member performs the time critical fire ground operations and operates alone in the hot zone around the exterior of a structure as the driver stays with the apparatus and prepares for aerial operations.

Rescue units contain specialized technical rescue equipment that exceeds the minimum equipment capabilities found on pumpers and trucks/towers. The technical rescue equipment is used to



mitigate a wide variety of civilian and firefighter rescue situations such as rope rescue, extrication situations, and collapse or confined space rescues. Mitigating these events is extremely labor intensive and training evolutions have shown that additional specialty trained personnel are required to rapidly operationalize rescue attempts.

If the practice of splitting specialty crews (X-ray) is continued, the minimum staffing of these units must be increased from four to at least five qualified personnel.

**14.2. Evaluate and consider discontinuing the practice of splitting a single specialty crew into an inside and outside crew (X-ray).**

**Discussion:** The practice of splitting specialty piece crews lends itself to developing conflicts in performing the X-ray crew's fire ground priorities. This concept and practice must be re-evaluated.

If the practice of splitting specialty crews (X-ray) is continued, the minimum staffing of these units must be increased from four to at least five qualified personnel. If this practice is continued at the current minimum staffing levels of four qualified personnel, then the Operational Guidelines must identify tactical priorities in which X-ray crew functions are accomplished, or a second specialty piece must be added to the dispatch complement.

X-ray crews shall maintain crew integrity and not allow a single crew member to operate alone in a hot zone while the specialty piece operator is donning personal protective equipment or preparing the truck/tower for aerial operations.

**14.3. Perform a specialty service (trucks/towers/rescue) resource allocation study.**

**Discussion:** Currently the Department staffs three trucks/towers and two rescue units. A fourth truck has been temporarily placed in service with personnel originally funded to staff an engine company at a new fire station that is not yet constructed and behind schedule. Once the station is opened, the fourth truck will be placed out of service to support the staffing of the new station. With the exception of Rescue 504, all of the trucks/towers and Rescue 510 are staffed Monday through Friday, 0600 – 1800 hours. Only Rescue 504 is staffed with 24-hour career personnel.



There are three additional trucks (Stations 3F, 14, 25), one quint (Station 4), and four rescue units (Stations 2, 3R, 6, 8) that are in place but are not funded to be staffed by career personnel.

A formal and focused specialty service resource allocation study should begin with a zero base resource level and evaluate incident information, population density, and response times to determine the optimal resource placement to achieve response coverage. An assessment of current resource locations, along with other station location sites, are to be considered in determining if existing apparatus placement is optimal. The plan should be operationalized with performing any needed resource relocations and obtaining staffing to achieve the recommendations.

**14.4. The dispatch complement must be increased to send an effective firefighting force capable of providing the amount of crews required to mitigate fires and other emergency incident types and increase firefighter and citizen safety.**

14.4.1. Evaluate and implement a standard structure fire dispatch complement. A review of NFPA 1710 Standard and the Northern Virginia (NOVA) Fire Service Coalition dispatch complements is to be considered in the development of this objective.

14.4.2. Discontinue practice of graduated dispatch complements based on the type of structure (residential versus commercial).

**Discussion:** The dispatch complements and Operational Guidelines identify different resource allocations and expectations for different types of structures (i.e. single family, townhouse, multi-family, commercial structure, etc.). The current computer aided dispatch (CAD) system contains mixed use response box assignments and the system cannot distinguish addresses that are either a single or multi-family structure. In addition, the categorization of structures by occupancy type has no correlation to the structure's size or protective systems that may be in place (i.e. sprinkler systems). Currently, a fire in a 6,000 square foot residential structure will receive fewer units on the dispatch complement than that of a 1,000 square foot commercial structure. The protective systems and construction methods vary widely, each creating unique and significant hazards to emergency responders. This dispatch complement practice does not effectively match the resources required to address life safety measures or mitigate fires. Therefore, a standardized structure fire dispatch complement should be instituted. This standard structure fire dispatch will be increased



when specialized resources are required to perform rural water supply operations.

- 14.4.3. Adopt a standard dispatch complement for all structure fires that include rescue units.

**14.5. Evaluate existing mutual aid agreements and pursue mutual aid response agreements as appropriate.**

**Discussion:** Mutual aid companies (Quantico Marine Corps Fire Department and Fairfax County Fire and Rescue) were closer to the Marsh Overlook incident and may have filled the resource requests faster than units traveling from distant Prince William County locations. Mutual aid assistance was not consistently requested or utilized by OPSC.

Mutual aid companies are not automatically included in the dispatch complement therefore decisions regarding the requesting and utilization of these resources is independently performed without the assistance of the computer aided dispatch system. Adopting mutual response agreements and programming these resources in the computer aided dispatch (CAD) system would assist in the rapid filling of dispatch complements with the closest available units. Filling of unit types should always be with the closest available units to ensure incident operations are safely and efficiently implemented.

The interoperability of communication systems must always be considered when evaluating mutual aid agreements and response plans.



**General**

## Section 15 General

### **Overview:**

The Marsh Overlook event and related investigation activities identified deficiencies with processes that contribute to a lack of system efficiency and effectiveness. The items included in this section are the systemic and ancillary needs that are general in nature and not specific to any of the previous report sections. These items identify various administrative requirements, process improvements, health and safety issues, community involvement issues, and areas for new fire service initiatives at the local, regional, and national levels.

### **Findings:**

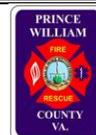
#### **Administrative Issues**

- 1. The system lacks a mechanism to collect, catalog, and assimilate various reports that are currently independently produced.**

**Discussion:** Each individual fire and rescue entity within Prince William County collects, analyzes, publishes, and distributes reports or informational items. Without central collection and analysis of these independently created reports (i.e. close calls, equipment failures, apparatus mechanical issues, lessons learned reports, etc.), trend analysis cannot be performed. Lacking the ability to monitor and trend information, individual entities do not have a comprehensive awareness of current issues within the system and will be unprepared to take action in the avoidance of experiencing a similar issue or repeated mistake(s). For example, the communication equipment failures were reportedly identified by station personnel and may have been addressed in previous post incident analysis reports. However, the post incident analysis reports are not centrally collected nor are organizational lessons learned institutionalized.

- 2. Gathering documentation for the numerous items required to be reviewed for this report was difficult and protracted at times.**

**Discussion:** Numerous fire and rescue items and processes have industry requirements and/or standards, to include OSHA and NFPA. Compliance with this requires monitoring, personnel accountability, maintenance, and testing. The Department of Fire and Rescue does not control many of the items involved in the provision of fire and rescue services but has a responsibility and obligation to ensure the safety of its personnel. Numerous requests were made in an attempt to receive documentation regarding apparatus and equipment records. Some documentation was ultimately reported as being unavailable. There was also one volunteer member who



could not be interviewed and failed to respond to several requests for information.

Complex incidents such as the Marsh Overlook fire require extensive internal and external resources to thoroughly investigate, document, and manage the process. Due to the competing need to investigate other incidents, along with case load and management issues, the information gathering and investigation process experienced delays.

**3. There are Fire and Rescue Association and Departmental policies and procedures in effect that contain contradictions, inconsistencies, and outdated information.**

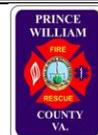
**Discussion:** Policies and procedure memorandums have a section which identifies the role and responsibility of all entities (personnel or groups) in complying with the document. However, policies and procedures are often put in place without full coordination and training of all these entities. This is extremely evident among the operational procedures that identify an OPSC component within the action steps and/or responsibilities. There is a lack of consolidation of information on similar topics which creates confusion among personnel and may have a detrimental impact on training curriculums and emergency operations.

**4. There is no standard method for the implementation of Fire and Rescue Association and Department procedures.**

**Discussion:** There is no standard method to operationalize new procedures and policies as they are adopted. Frequently, new procedures are put into operation without a system wide training and implementation plan. When there is a lack of a comprehensive approach for the implementation of new procedures, there will be inconsistent member knowledge, understanding, and compliance.

**5. Fire and Rescue Association and Departmental policies and procedures inconsistently contain references and adoption to portions of the NOVA manuals.**

**Discussion:** There is a formally recognized regional coalition of fire & rescue departments within Northern Virginia. The NOVA Fire Service Coalition is primarily responsible for analyzing, evaluating, and providing policy recommendations concerning regional public safety issues related to fire and emergency medical services, hazardous materials emergencies, technical rescue, fire prevention and code enforcement, homeland security and infrastructure protection, emergency response to weapons of mass destruction, and all hazards disaster response. This coalition is organized into



several committees and working groups and has produced numerous comprehensive operational manuals and training materials.

- 6. Personnel arrived early to work and were in the process of getting prepared with the majority of apparatus and equipment checks in progress prior to 0600 hours.**

**Discussion:** There is an inconsistent and informal manner of morning line up and shift information exchange. This is further complicated when apparatus may not be consistently staffed the previous day or shift period. All units except for Engine and Rescue 510 knew their complete riding assignments prior to the shift beginning. Engine 510 and Rescue 510 were in the process of discussing officer riding assignments for the day when the incident occurred.

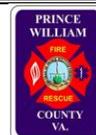
#### **Health and Safety Issues**

- 7. Personnel were exposed to a high stress event involving a death of a co-worker and substantial personal risk causing the need for immediate and long term behavioral health resources.**

**Discussion:** Behavioral health resources include, but are not limited to, critical incident stress management (CISM), chaplain programs, family support services, counseling and therapy or clinical related services. There are voids in the Department's and system's ability to support the immediate and long term mental health needs of our personnel and their families. An example is the lack of coordination and cross functionality among the various independent programs (i.e. EAP, CISM, chaplain services, etc.). Another example is the lack of behavioral health resources beyond the employee assistance program. The employee assistance program is inadequate due to limited amount of visits and lack of clinical specialists in trauma induced and post traumatic stress as experienced in fire and rescue personnel.

- 8. The Investigation Team discovered other fire department investigative reports that contained similar findings and recommendations identified in the Marsh Overlook line of duty death report.**

**Discussion:** There is no central information warehouse or resource that is available for fire departments to access the immense amount of firefighter investigative reports to review findings, recommendations, near miss, safety notifications, device failure reporting, or line of duty death reports.



### Community Involvement Issues

#### **9. Neighbors discovered the Marsh Overlook fire and accessed the 911 system.**

**Discussion:** On the Marsh Overlook incident, neighbors discovered the fire. There were nineteen 911 calls to report the fire. 911 callers could not confirm if all occupants were out of the house.

#### **10. Neighbors responded to the Marsh Overlook residence to assist with family notification and evacuation.**

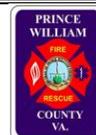
**Discussion:** Citizens alerted the sleeping family of the fire and assisted with their evacuation from the structure. As the time of the incident was early morning, the occupants were dressed in varying amounts of clothing and given the environmental conditions, were initially sheltered in a nearby home and in a car parked near the house.

One of the citizens who assisted with the family evacuation recognized their vehicle was parked in a manner that would impede incoming apparatus. The citizen elected to relocate the vehicle by driving it further north of the house. It was at that time Wagon 512 and Tower 512 arrived, approaching the house from the south. The citizen, who relocated their personal vehicle, returned to the immediate area of the involved house and reported their belief that everyone was out of the house to the driver of Engine 510. At this point, Wagon 512 and Tower 512's crews were actively engaged in search and rescue operations in the interior of the house. The first arriving units were not aware of the civilian activities to successfully remove the occupants from the house.

Following the arrival of Ambulance 510, another citizen notified one of the crew members that an occupant was in the car in front of the house. The crew member removed the occupant from the car and had them join a group of individuals later identified as family members in a nearby garage. This action occurred just prior to the initial order for the emergency evacuation of the structure.

#### **11. Neighbors successfully alerted the Marsh Overlook occupants to the fire by blowing car horns and knocking on the door.**

**Discussion:** The Marsh Overlook occupants reported their smoke detectors were not sounding at the time the neighbors awoke and alerted them to the fire on the exterior of their house. The sounding of loud noises is an effective measure in alerting occupants of danger.



**Recommendations:**

**Administrative Issues**

**15.1. Immediately establish a resource to monitor the implementation of the LODD report recommendations in order to achieve improvements and increase personnel safety.**

**15.2. Establish an internal task force and implement a system wide review of all procedure memorandums. This review must begin immediately and all efforts are to be taken to achieve it within a 90 day time period.**

15.2.1. Ensure all appropriate revisions are performed and fully coordinated throughout the system.

15.2.2. All procedure memorandums written in previous formats are to be revised to the current format or formally rescinded.

15.2.3. Ensure all operational procedures are standardized and consolidated.

**Discussion:** There must be one set of operational procedures and guidelines that are used within the system.

15.2.4. Ensure all procedures and training curriculums related to operations in environmental extremes address all conditions, to include high wind environments.

15.2.5. Clarify and consolidate all procedures related to incident command.

**Discussion:** The Fire and Rescue Association has adopted the incident Command System as defined in the COG Field Operation Guide. Fire and Rescue Association Procedure 5.1.16 titled PWC Specific Additions to COG's Fire and Rescue Services Mutual Aid Operational Plan (ICS) also addresses incident command procedures. However, there are additional references to portions of NOVA's incident command system found in other Association procedures. All procedures related to incident command must be clarified and consolidated.

15.2.6. Ensure appropriate use of Informational Bulletins as a communications tool only.

**Discussion:** Procedural related direction shall come from adopted policy and procedures.



15.2.7. Upon completion of this task, a standing policy committee is to be established to continue efforts in the on going coordination, maintenance, and implementation of all policies and procedures.

**15.3. Continue efforts for Fire and Rescue Association adoption of NOVA manuals with appropriate modifications as permitted for local resource allocation.**

**Discussion:** While Prince William County is an active participant with the NOVA Fire Service Coalition, it remains as the only jurisdiction in the region that has not become a signatory with the coalition, or fully adopted the NOVA manuals. This isolates Prince William County with these regional efforts and can adversely impact interoperability with mutual aid companies during large scale, multi-jurisdictional emergency incidents and training events. Prince William County needs to become a cooperative partner with the coalition and capitalize on the strength of this initiative. Beginning in October 2007, the Association initiated action to begin the NOVA manual adoption and efforts must continue until all manuals are adopted.

**15.4. The Systems Support and Community Safety Sections must be evaluated and a strategic staffing plan developed that organizes and/or expands resources to support the increased service delivery demands.**

15.4.1. Efforts for community life safety educational programs must be continued.

**Discussion:** Community life safety education programs must be focused on prevention of the 911 call, the early detection of fires with smoke detectors, and injury prevention efforts. Other critical initiatives include installation of residential sprinkler systems, prevention of fires, home safety measures, carbon monoxide detectors, residential exit drills, actions to take to help control the spread of fires, and appropriate actions to take when fire and EMS services arrive. These efforts must have a multicultural and multigenerational approach.

With the rapid fire development and spread, it is critically important to have early fire detection and suppression systems in place and operational. These detection and life safety systems provide the early notification and protection of occupants during their exit of the structure.



- 15.4.2. Resources dedicated to the Fire Marshal's Office for fire investigations and related case management should be reviewed and an implementation plan developed for needed improvements.

**Discussion:** The investigation of the Marsh Overlook fire required extensive Department and external resources. Having only three fire investigators with no back fill capacity results in a large case load management situation and creates competing priorities to investigate other incidents. Mutual aid resources were initially used to assist with the fire investigation. However, mutual aid resources are extremely limited and are only available on a relative short term basis.

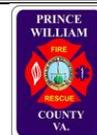
- 15.4.3. Resources dedicated to Health and Safety should be reviewed and an implementation plan developed that addresses the resource needs identified in this report.

**Discussion:** There are numerous findings and recommendations contained in this report that will need to be coordinated and managed by the Health and Safety group. The Health and Safety resource needs must be evaluated. Examples of these items include:

- Annual physical requirements to meet respiratory protection program requirements.
- Fire department clinical support service section to include behavioral health needs.
- Suppression and safety continuous quality improvement program.
- It is essential that Incident Safety Officers be a mandatory staffed position.

**15.5. Establish a standard process for morning line up and shift change information exchange.**

**Discussion:** Adopting a standard informational exchange process for shift change and morning line up provides for an increased understanding for all personnel regarding riding positions, apparatus and equipment issues, weather concerns, and daily activity planning. An additional line up should occur any time there is a significant personnel complement change during the shift.



### Health and Safety Issues

- 15.6. Implement a continuous quality improvement program aimed at the collection, cataloging, and assimilation of post incident analysis, near miss reports, injury information, and other appropriate reports in an effort to improve personnel safety and revise procedures and training curriculums as needed.**
- 15.6.1. A continuous quality improvement program is to be developed to record, monitor, and track the various suppression and safety related reports being produced.
- 15.6.2. This continuous quality improvement program item should be tasked as a responsibility of the Health and Safety group.
- 15.6.3. The information must be shared system wide and integrated into training curriculums and operational procedures as applicable.
- 15.7. Immediately require a centralized reporting and record keeping mechanism for all industry standard maintenance and testing.**
- 15.7.1. To ensure the safety of personnel, work environments and compliance with all standards, a centralized reporting and record keeping mechanism is to be immediately established.
- 15.7.2. An audit of all records is to be performed and items found not in compliance are to have corrective actions taken.

### New Initiatives

- 15.8. The fire service should evaluate their initial occupant rescue attempts to include external alerting procedures such as the sounding of the initial arriving apparatus air horns.**

**Discussion:** The sounding of apparatus air horns is an effective mechanism to alert firefighters of the need to evacuate the structure during firefighting activity. The same principle should be considered to be used by the first arriving piece of apparatus to alert occupants to the same need.

- 15.9. Prince William County needs to adopt crew resource and situational awareness management models.**

**Discussion:** Crew resource and situational awareness management are terms and practices that have been utilized in other high risk industries, most specifically the airline and military industries. The airline industry performed extensive crash research and determined that human error



accounted for the 70% of airplane crashes. When examining the human errors closer, it was determined that the majority of errors were in leadership, coordination of the team, or the decisions being made.

The concept behind these terms can easily be applied to the fire service. Firefighters employ “can do” attitudes and often become focused on their tasks they lose situational awareness of everything taking place around them and fail to fully and/or rapidly recognize changing conditions. Not recognizing the signs of developing or presenting threats during an incident jeopardizes firefighter safety.

Incorporating situational awareness and crew resource management practices must be used in all training and operational settings. Utilizing these concepts will enhance effective communications, aid in the development of plans, increase task management efficiencies, provide for continuous assessment of potential threats and changing conditions, and identify areas of omission. These are proven concepts that can be applied and utilized by the command post support team and incident commanders.

**15.10. A national fire service initiative is needed to develop and establish an information warehouse to collect, analyze, catalog, and provide a single resource and access point for firefighter safety related issues.**

**Discussion:** While there are vast quantities of fire service information available regarding fire and rescue injuries, illnesses, and deaths, there is no standardized report format or centralized collection point. The lack of a standardized method and central location causes fire and rescue personnel to spend an enormous amount of time and effort to research industry trends or learn about emerging or current difficulties being experienced. For example, there are numerous entities requesting, gathering, or reporting product related information which makes the identification and trending of product related issues a maze to navigate, understand, have awareness of, or take appropriate action to avoid experiencing a similar issue.

There is a need to develop a national level standard reporting system and information warehouse for firefighter safety related issues. This system would support the national level assimilation, monitoring, and trending analysis of fire service related injuries, deaths, equipment malfunctions or failures that are associated with fire department activities. An independent entity should be the resource to develop, implement, and manage this initiative (i.e. National Fallen Firefighters Foundation).

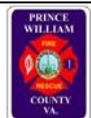


# Appendices

# Appendix A

## Diagrams

<b>Title</b>	<b>Page</b>
Apparatus Placement (First Alarm)	A-2
Hose and Ladder Deployment	A-3
Wall Profile	A-4
Roof Profile	A-5
First Floor	A-6
Second Floor	A-7
Basement	A-8
Master Bedroom	A-9



**APPARATUS PLACEMENT**  
**First Alarm**  
 15474 Marsh Overlook Drive



NOTE:  
 A510 was positioned  
 further North on Marsh  
 Overlook

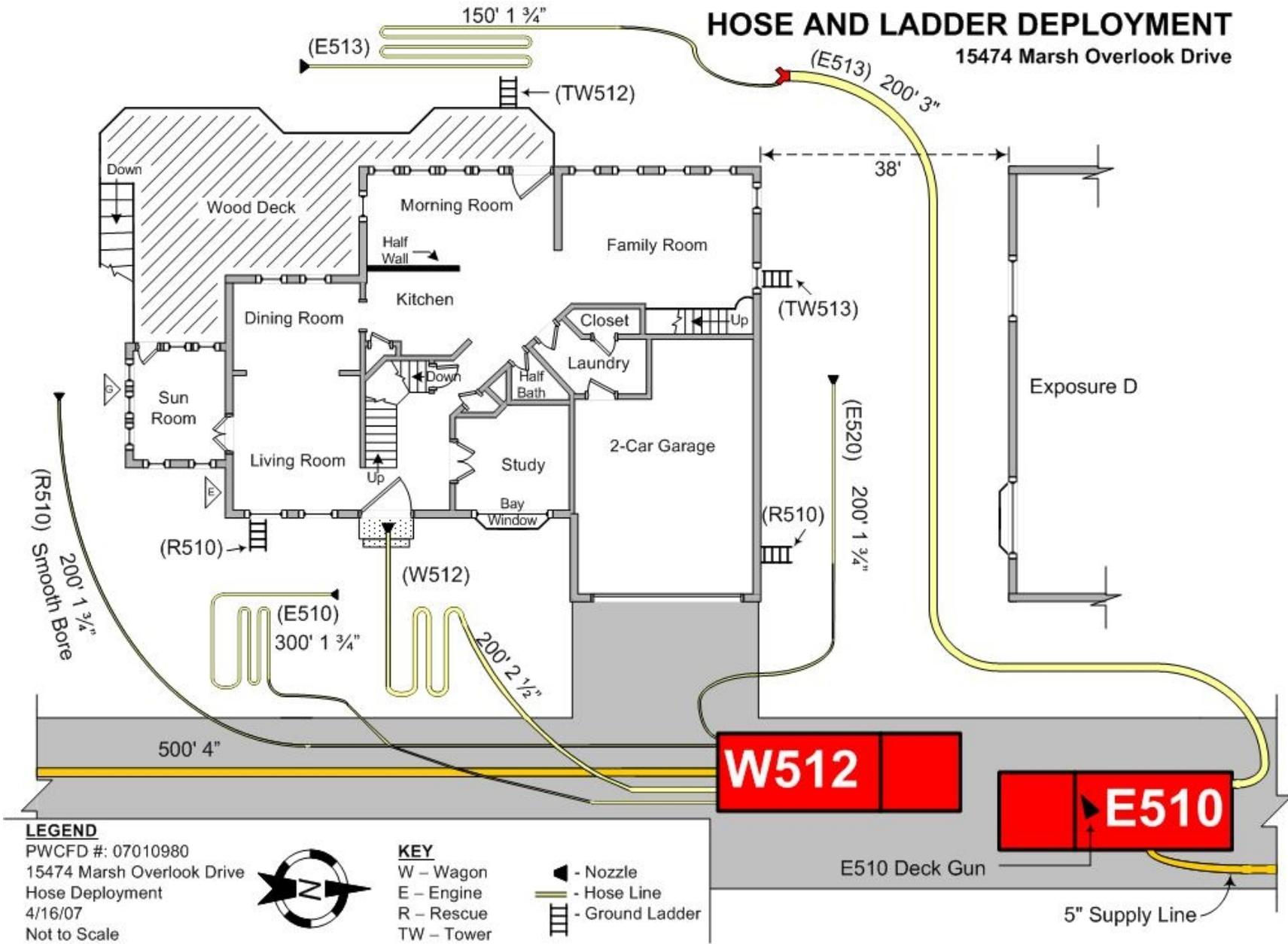
**LEGEND**  
 PWCFD #: 07010980  
 15474 Marsh Overlook Drive  
 Apparatus Placement  
 4/16/07  
 Not to Scale  
 DFW 12/04/07



**KEY**  
 CP – Command Post  
 W – Wagon  
 E – Engine  
 SAF – Safety  
 BC – Battalion Chief  
 TW – Tower  
 M – Medic  
 R – Rescue  
 A – Ambulance

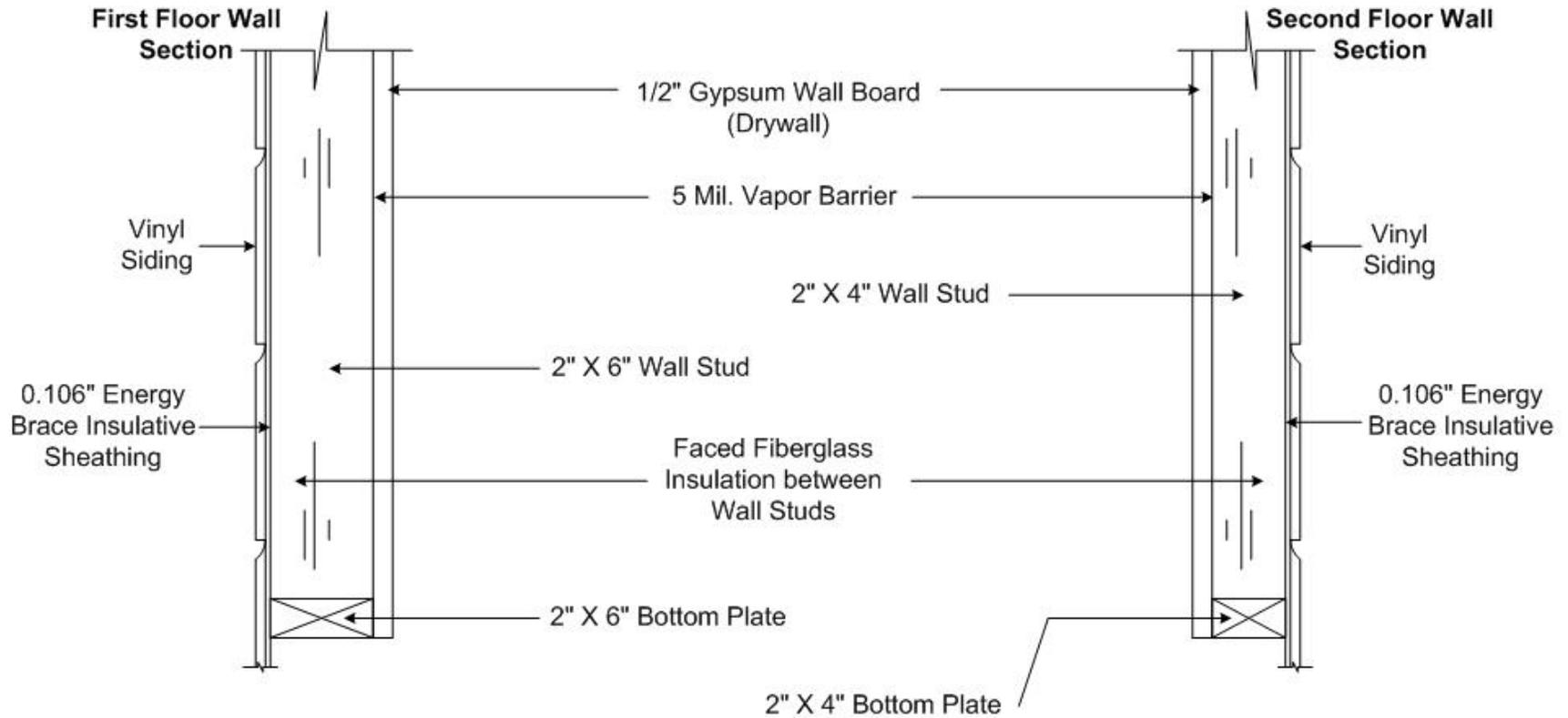
# HOSE AND LADDER DEPLOYMENT

15474 Marsh Overlook Drive



# WALL PROFILE

15474 Marsh Overlook Drive



**LEGEND**

PWCFD#: 07010980  
15474 Marsh Overlook Drive  
Roof Profile  
4/16/07  
Not to scale  
JBC 12/7/07

**ROOF PROFILE**  
15474 Marsh Overlook Drive

Shingles per Elevation  
on #15 Roof Felt on  
7/16" Sheathing w/ Clips

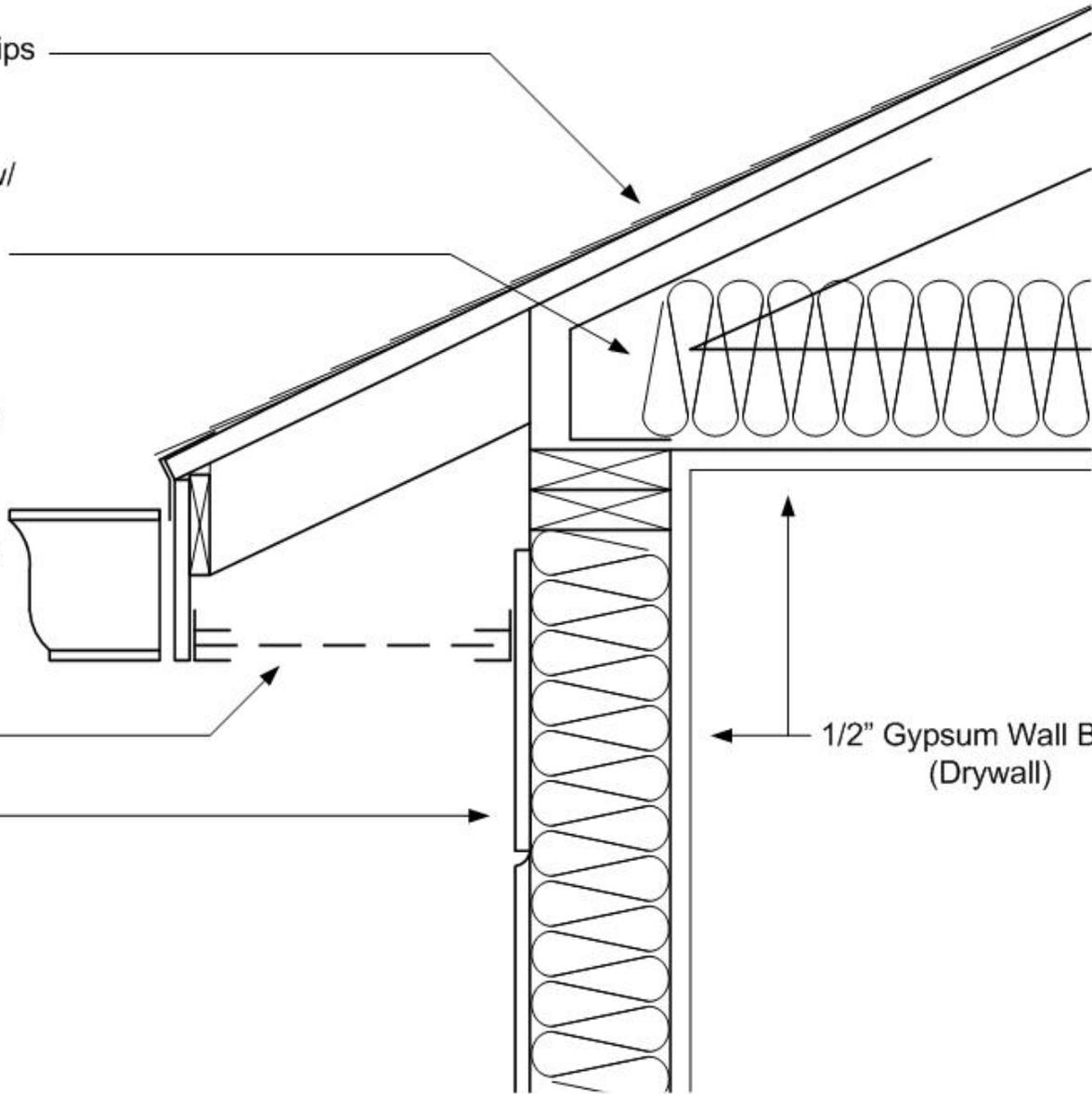
R-30 Attic Insulation w/  
Cardboard Baffles to  
Provide 1" Air Space

Aluminum Gutter and  
Downspout on Fascia  
Board

Vented Soffit

Frieze Board

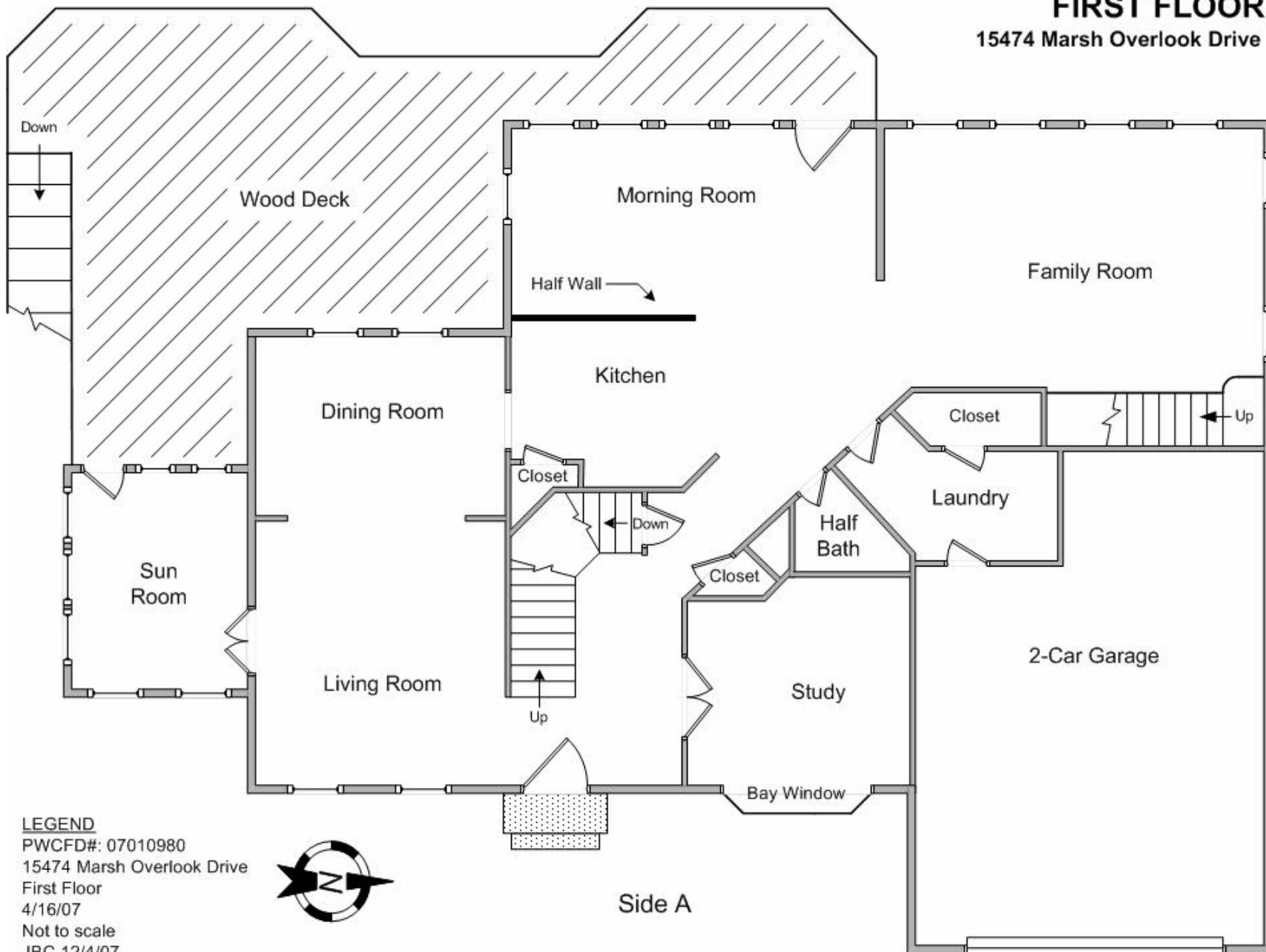
1/2" Gypsum Wall Board  
(Drywall)



**LEGEND**

PWCFD#: 07010980  
15474 Marsh Overlook Drive  
Roof Profile  
4/16/07  
Not to scale  
JBC 12/7/07

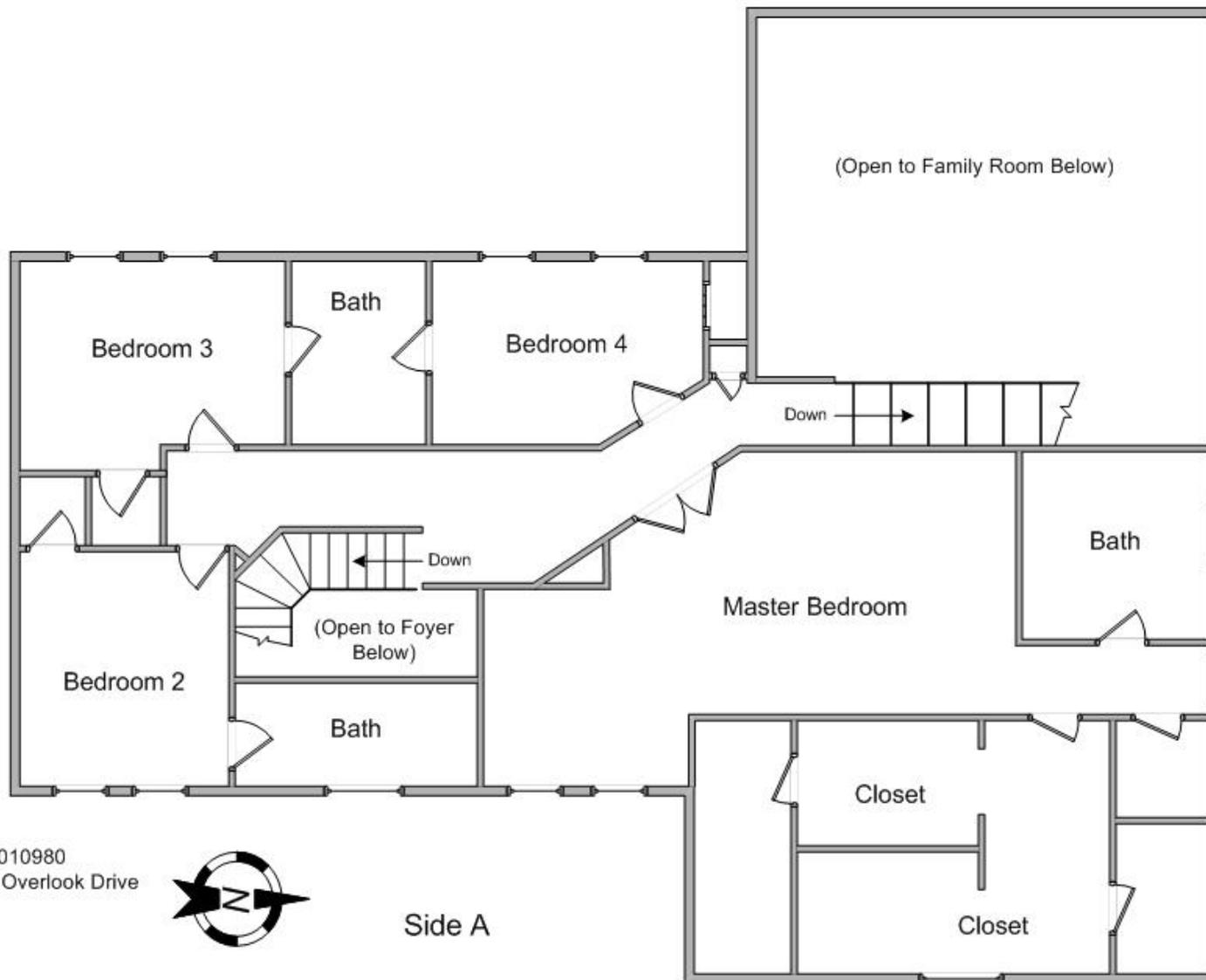
**FIRST FLOOR**  
15474 Marsh Overlook Drive



**LEGEND**  
PWCFD#: 07010980  
15474 Marsh Overlook Drive  
First Floor  
4/16/07  
Not to scale  
JBC 12/4/07

Side A

**SECOND FLOOR**  
15474 Marsh Overlook Drive

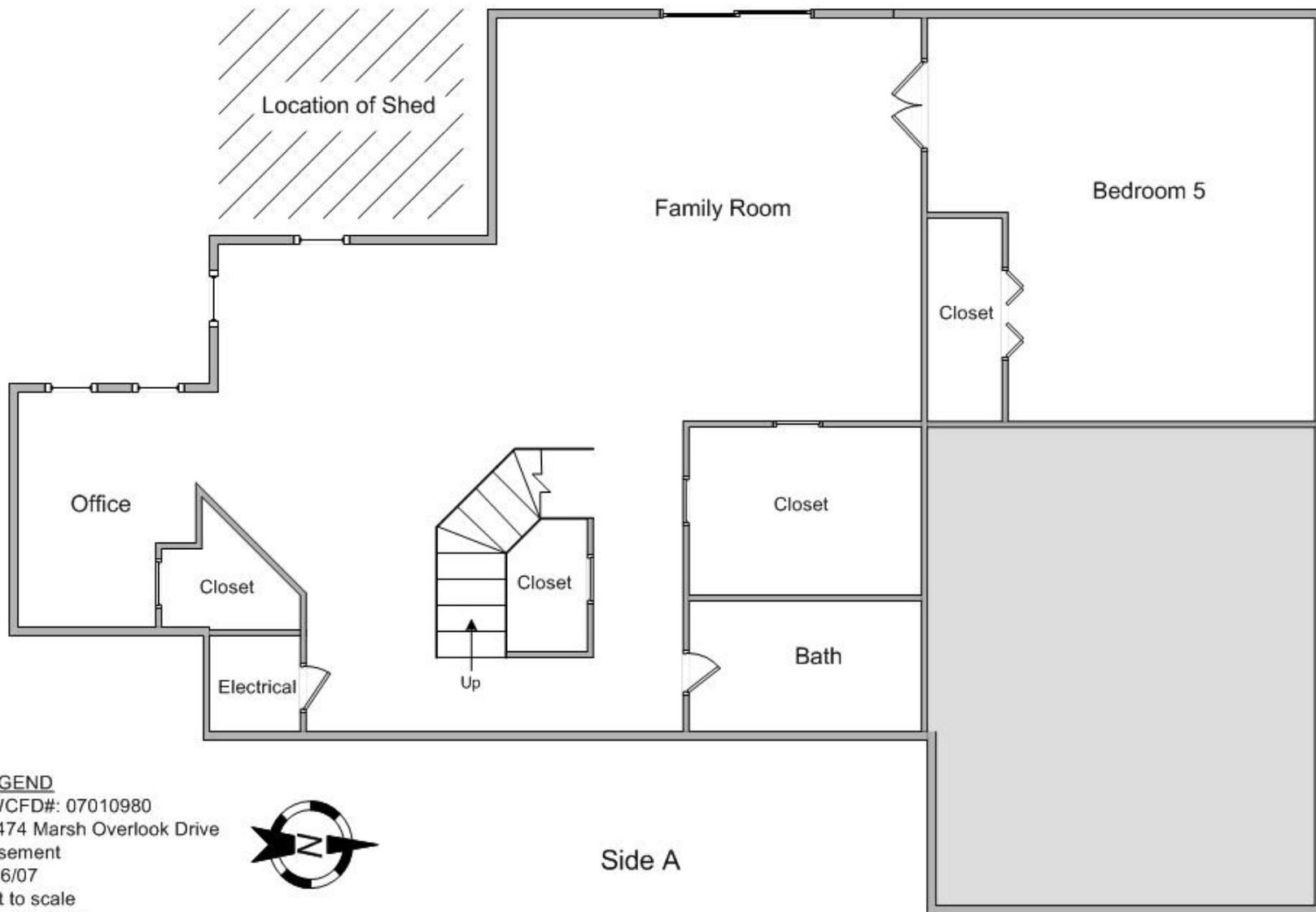


**LEGEND**  
PWCFD#: 07010980  
15474 Marsh Overlook Drive  
Second Floor  
4/16/07  
Not to scale  
JBC 12/4/07



Side A

**BASEMENT**  
15474 Marsh Overlook Drive



**LEGEND**  
PWCFD#: 07010980  
15474 Marsh Overlook Drive  
Basement  
4/16/07  
Not to scale  
JBC 12/4/07



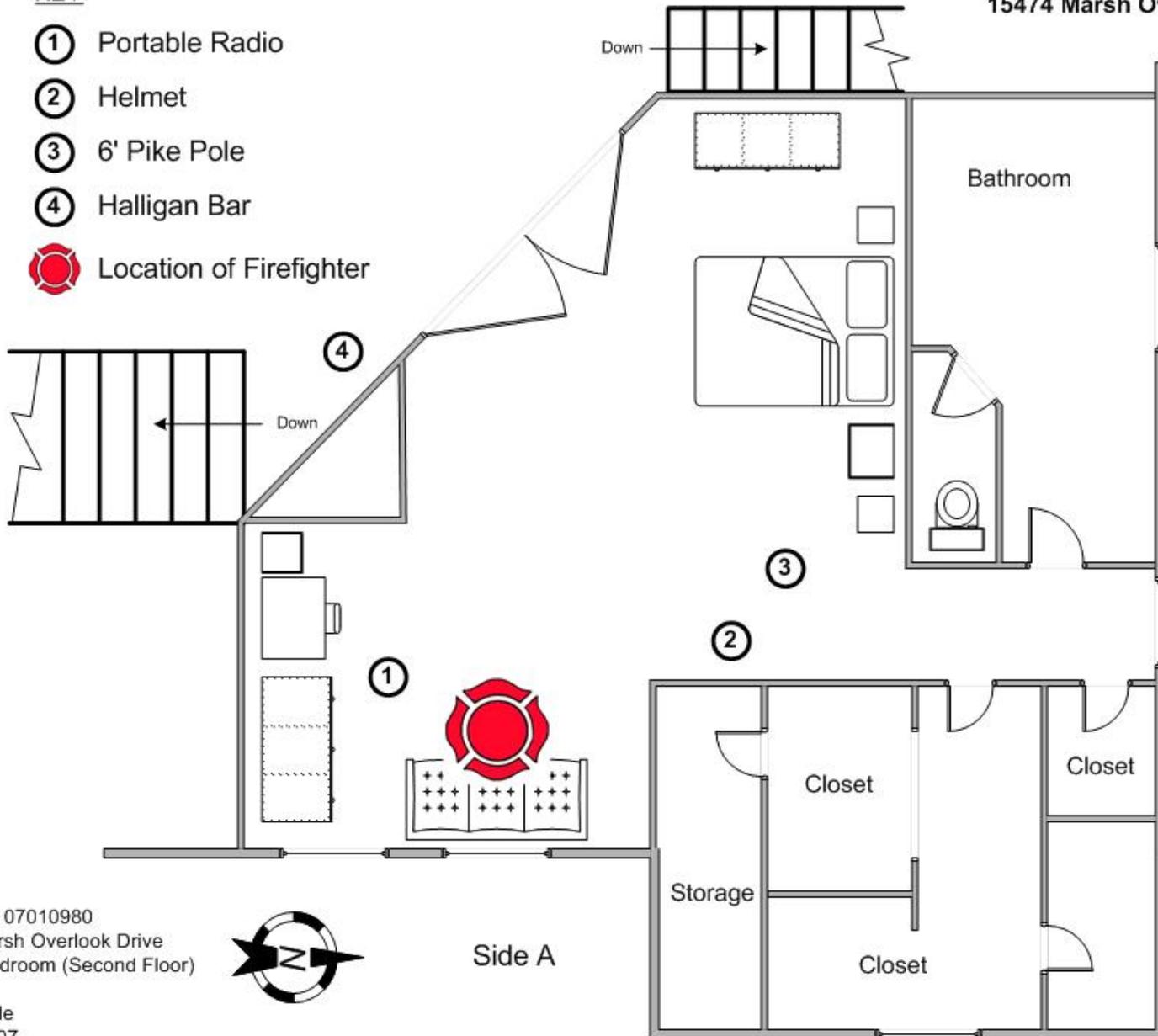
Side A

# MASTER BEDROOM

15474 Marsh Overlook Drive

## KEY

- ① Portable Radio
- ② Helmet
- ③ 6' Pike Pole
- ④ Halligan Bar
-  Location of Firefighter



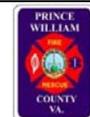
## LEGEND

PWCFD#: 07010980  
15474 Marsh Overlook Drive  
Master Bedroom (Second Floor)  
4/16/07  
Not to scale  
JBC 12/4/07

**Appendix B**  
**Consolidated**  
**Recommendation**  
**Matrix**

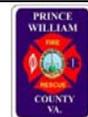
**Consolidated Recommendation Matrix**

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>Section 1: Building Construction</b>				
<b>1.1. Revise Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines to:</b>				X
1.1.1. Consolidate Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires and Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines into a single procedure.				X
1.1.2. Address strategy and tactics for rapidly progressing fires on the exterior of a structure.				X
1.1.3. Address the application of the strategy and tactics for modern construction methods and designs.				X
<b>1.2. Company officers need to visit new construction sites and observe the type of building components and construction methods being used.</b>				X
<b>1.3. Develop a process of identifying and maintaining institutional knowledge and training regarding the residential construction methods and designs as it relates to the time period in which they were built.</b>				X
1.3.1. Develop a building construction training package focused on structures in Prince William County that were built in the last five decades.				X



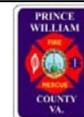
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>Section 2: Environmental Conditions</b>				
2.1. Review and revise all existing Fire and Rescue and OPSC procedures related to operations in environmental extremes, to include high wind environments.				X
2.2. Evaluate adjustment of dispatch complements when experiencing extreme environmental conditions.				X
2.3. Develop a method of communicating important and timely weather related information to all fire and rescue worksites and on duty personnel. There needs to be a process of confirming receipt of the information.				X
2.4. Develop a policy regarding the expectations of the wireless device use and programming. This includes receipt of RSAN messages and group distribution lists.				X
<b>Section 3: Accountability</b>				
3.1. Ensure compliance with Fire and Rescue Association Procedure 5.1.1 titled Personnel Accountability Reporting System (PARS).				X
3.1.1. All apparatus driver's doors are to have appropriate Velcro mounted for passport drop off.				X



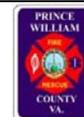
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
3.1.2. All passports are to be in compliance with procedures.				X
3.1.3. Stress the organizational importance to produce the passports at the designated location at the incident scene.				X
3.1.4. Ensure that all passports are updated at each shift change.				X
3.1.5. Ensure that all personnel reporting to the incident scene comply with the procedure.				X
3.1.6. During PAR checks, ensure the unit officer provides the Incident Commander with the number of personnel assigned to the unit, the area they are operating in, and the number of personnel operating outside the hazard zone.				X
3.1.7. The Incident Commander is to provide any division or group supervisor with units assigned to their location.				X
3.1.8. Division or group supervisors must maintain accountability of the units assigned to their area of responsibility.				X
3.1.9. Any change of operational mode and formation of divisions or groups is to be communicated to units operating on the fire ground with a confirmation of receiving the message.				X



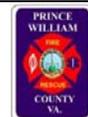
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
3.1.10. An unaccounted member or crew shall not stop a PAR check from other elements of the command structure. The Incident Commander can assign a resource to check on the unaccounted crew in their last known location, while the PAR check continues to determine if more than one person or crew is unaccounted for.				X
<b>3.2. If the Incident Commander is attempting to address another situation on the incident scene, the PAR check is to be assigned to another resource to be completed.</b>				X
<b>3.3. Fire and Rescue Association Procedure 5.1.1 titled Personnel Accountability Reporting System (PARS) must be reviewed to ensure all expected actions for unaccounted and missing crews are clear.</b>				X
<b>3.4. Research should continue to refine the Personnel Accountability Reporting System (PARS) for increased efficiency and improve ease of use.</b>	X	X	X	X
<b>Section 4: Crew Integrity</b>				
<b>4.1. Unit officers must ensure that crew integrity is maintained during operations within a hazardous environment.</b>				X
4.1.1. Crew members shall not operate alone in the hazard zone.				X
4.1.2. Crews shall not operate without a portable radio.				X



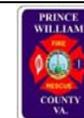
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
4.1.3. Crews shall always enter and exit the hazard zone together.				X
4.1.4. Each crew member operating in a team shall maintain contact with the team leader by sight, voice, or physical contact.				X
4.1.5. Each crew member must be able to provide direct help, call for help, or go get help for an injured member if needed.				X
4.1.6. Ensure operational discipline is maintained.				X
<b>4.2. Ensure that all personnel operating in and around the hazard zone carry an operating portable radio.</b>				X
<b>4.3. Ensure all fire ground activities are coordinated to prevent freelancing and improve the safety, efficiency, and effectiveness of operations. Operational discipline must be maintained, especially during responder emergencies.</b>				X
<b>Section 5: Emergency Evacuation</b>				
<b>5.1. Ensure that the Incident Commander performs a Personnel Accountability Report (PAR) check when incident conditions change.</b>				X
<b>5.2. Revise procedures and training curriculums to address the monitoring of incident conditions and need for operational mode changes prior to the occurrence of an emergency evacuation.</b>				X



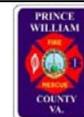
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
5.3. Ensure all crew supervisors and crew members adhere to any and all orders to evacuate a hazard zone.				X
5.4. Command shall order OPSC to sound the Alert II tone signal for every emergency evacuation order encountered on an incident. If Command does not transmit the order, then OPSC personnel must query the Incident Commander regarding the sounding of the Alert II tone signal until a decision is obtained.				X
5.5. When an emergency evacuation order is given, all crews are to immediately evacuate without delay. Personnel are not to retrieve or remove equipment or hose lines, unless needed for protection while exiting.				X
5.6. When an emergency evacuation order is given, all crews are to comply unless a specific division or separate location is identified for a particular evacuation.				X
5.7. Revise appropriate operational procedures to address crew re-entry into a structure following an emergency evacuation. Revisions shall address: <ul style="list-style-type: none"> <li>• Personnel accountability.</li> <li>• Size up and reassessment of the structure and conditions.</li> <li>• Declaration of mode of operation from the Incident Commander and include any safety considerations or instructions.</li> </ul>				X
5.8. Appropriate procedural memorandums, policies, and training regarding all evacuations shall be updated to reflect these recommendations.				X



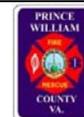
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
5.8.1 Coordinate all appropriate procedures among fire and rescue and OPSC.				X
5.8.2 Perform cross agency training exercises on new procedures and policies.				X
<b>5.9. Pursue regional and industry standardization of audio warnings (i.e. radio alert tones, apparatus air horn sounding, mechanical signaling, etc.) to alert firefighters to an emergency evacuation regardless of the authority having jurisdiction.</b>	X	X	X	X
<b>Section 6: Mayday</b>				
<b>6.1. Revise Fire and Rescue Association procedure memorandums and associated training curriculums to reflect expected reactions when a unit recognizes another crew is in trouble.</b>				X
6.1.1. Specific language should be added directing units to initiate a mayday call on behalf of crews that are threatened by a fire's spread, rapid growth, or changing conditions that may not be evident to crews on other locations.				X
<b>6.2. Consolidate the mayday actions that appear in various procedure memorandums into a single procedure. The following Fire and Rescue Procedures all contain guidance for personal emergencies and mayday situations:</b> <ul style="list-style-type: none"> <li>• Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team (Section 3.4).</li> <li>• Fire and Rescue Association Procedure 5.5.3 titled Personnel Deployment during the Initial Stages of Interior Structural Firefighting</li> </ul>				X



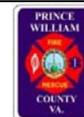
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<p>and IDLH Incidents (Section 5.2.4).</p> <ul style="list-style-type: none"> <li>• Fire and Rescue Association Procedure 10.1.7 titled Radio Operation (Section 4.4).</li> </ul>				
<p><b>6.3. Revise Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team to require the Incident Commander, or another person assigned by Command, to acknowledge any mayday transmissions and maintain communications with a lost or trapped firefighter(s).</b></p>				X
<p><b>6.4. Laminate the Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team, Addendum 1 (Lost or Trapped FF Command Check List) for use at the command post for this low frequency/high risk activity as a ready reference guide card.</b></p>				X
<p><b>6.5. Radio discipline and radio silence must be exercised by all personnel on the fire ground radio channel when a firefighter mayday transmission has occurred.</b></p>				X
<p>6.5.1. It is the Incident Commander's responsibility to decide which fire ground activity will move to the alternate radio channel. The Incident Commander may elect to maintain all units on the same tactical channel due to unavailability of command post support personnel.</p>				X
<p><b>6.6. Perform continuous training of command level officers to reinforce required actions to mayday events, especially when personnel calling the mayday are not located in their reported position and alternative rescue plans must be developed.</b></p>				X
<p>6.6.1. Perform cross agency training exercises on new procedures and policies.</p>				X
<p><b>6.7. Review and evaluate current mayday, Firefighter Survival, and RIT training to ensure adequate discussion, lecture, and practical time is</b></p>				X



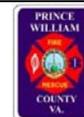
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>focused on:</b>				
6.7.1. Building construction methods, designs, and materials of single family dwellings and commercial buildings and the strategies and tactics associated with each.				X
6.7.2. Self rescue strategies and techniques in various types of structures.				X
<b>6.8. Review and revise as necessary Fire and Rescue Association Procedure 5.5.2 titled Rapid Intervention Team which states that OPSC should dispatch an additional engine company on any “working incident” where an IDLH atmosphere is present to reflect current dispatch complements and procedures (Section 6.4).</b>				X
<b>6.9. Evaluate OPSC staffing to:</b>				X
6.9.1. Determine appropriate depth and breadth of uniform fire and rescue presence in OPSC to provide needed technical expertise and support activities to ensure the appropriate resource utilization, reaction to emergencies, and procedure compliance.				X
6.9.2. Provide for a dispatcher to monitor, record, and react to each active fire and rescue radio channel.				X
<b>6.10. Develop an OPSC reference guide card for dispatcher use for this low frequency/high risk situation.</b>				X



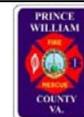
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>6.11. Ensure that the appropriate OPSC actions are clearly outlined and taken when mayday transmissions have occurred.</b>				X
6.11.1. This includes the identification of the firefighter position transmitting the mayday call, what information was reported, and the requested needs.				X
6.11.2. An announcement must be made over the tactical radio channel indicating a mayday situation has occurred.				X
<b>Section 7: Rapid Intervention Teams and Rescue Operations</b>				
<b>7.1. Revise Fire and Rescue Association Procedure 5.5.3 titled Personnel Deployment during the Initial Stages of Interior Structural Firefighting and IDLH Incidents to the first arriving company actions. Examples of clarification needed include:</b>			X	X
7.1.1. The procedure addresses when three or four personnel are on the scene. Clarification is needed for circumstances when there are more personnel operating on a fire ground prior to the arrival of the RIT pumper. There needs to be alignment between OSHA, NFPA, local procedures, and operational practices.			X	X
7.1.2. The procedure needs to identify what is the acceptable practice when more than one team is operating in an IDLH atmosphere when no RIT has been established. There needs to be alignment between OSHA, NFPA, local procedures, and operational practices.			X	X
7.1.3. The two-out crew must be announced on the tactical radio channel.			X	X



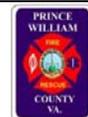
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>7.2. Standardize procedures designating the RIT crew.</b>			X	X
7.2.1. It is recommended that the third due engine be designated as RIT due to the critical need to have it in place when multiple crews are operating on the fire ground.			X	X
7.2.2. The unit assigned as RIT shall be announced on the tactical radio channel by the Incident Commander.			X	X
<b>7.3. Develop a standardized field operations quick reference guide for low frequency/high risk events (i.e. mayday, RIT activation, unaccounted crews, active shooter, etc.) to be carried in all command vehicles.</b>			X	X
<b>7.4. Evaluate the concept of staffing and deploying pre-established RIT resources that have specialized training in firefighter rescue operations.</b>				X
7.4.1. All crews shall be trained and maintain the ability to function as a RIT.				X
7.4.2. A minimum of one staffed specialized unit should be placed mid-County, with the ultimate goal of staffing one per battalion.				X
<b>7.5. A RIT Level 2 should automatically be dispatched on all second or greater alarm fires and whenever firefighter mayday calls are encountered.</b>				X
<b>7.6. A RIT Level 2 should be requested by the Incident Commander on incidents which have deteriorating conditions, large structures, or other complex incidents.</b>				X



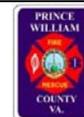
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
7.7. RIT needs to be identified, announced, and re-established when deployed.				X
7.8. When a firefighter rescue operation is identified and implemented, the following Incident Commander actions shall take place:				X
7.8.1. A division within the incident command structure for rescue must be established.				X
7.8.2. Resources must be identified.				X
7.8.3. Firefighter rescue operations must be fully coordinated and communicated.				X
7.8.4. Alternative firefighter rescue plans must be developed for rapid implementation if situation changes or alternative solutions are required.				X
7.8.5. A RIT Level 2 Task Force is to be requested if not dispatched by OPSC.				X



## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
7.9. Ensure universal understanding of terminology and application of RIT versus rescue. Training needs to be focused and delivered in this area system wide.				X
7.10. Ensure confirmations of radio and face to face communications have occurred by echoing the message.				X
7.11. Establish an OPSC procedure for dispatch complement of RIT Level 2 and Level 3 Task Forces.				X
7.12. Revise the Fire and Rescue Association procedure 5.5.2 titled Rapid Intervention Team (RIT) to address active fire ground listening for PASS devices and noises, as well as the expected actions to be taken upon hearing the activation of a PASS device.				X
<b>Section 8: Strategy and Tactics</b>				
8.1. Reinforce the need to perform and complete an accurate incident size up.				X
8.1.1. Implement a procedural change to require the transmission of an on scene report followed by a size up report.				X
8.1.2. Implement a procedural change to require a size up report to be transmitted from the unit assigned to Side C operations.				X



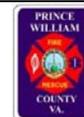
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>8.2. Ensure the mode of operation and incident action plan are communicated over the radio on every incident.</b>				X
8.2.1. Any changes to the mode of operation must be announced on the radio tactical channel.				X
<b>8.3. Reinforce the need to communicate delays in implementing coordinated incident operations. Significant delays in implementing tactical operations may require the size up to be reevaluated.</b>				X
<b>8.4. Reinforce all search and rescue tactical operations are fully coordinated with and have adequate hose line protection.</b>				X
<b>8.5. Reinforce the need to secure raised ground ladders during fire ground operations in high wind environments.</b>				X
<b>8.6. Revise Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines to:</b>				X
8.6.1. Address the establishment of secondary water sources.				X
8.6.2. Fully coordinate the dispatch complement resources needed to achieve the operational guidelines.				X
8.6.3. Ensure resource assignment to Side C.				X



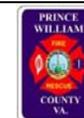
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
8.6.4. Consolidate Department Procedure 5.5.1 titled Standardized Strategic/Tactical Activity Guides for Structure Fires and Fire and Rescue Association Procedure 5.1.6 titled Operational Guidelines into a single procedure.				X
8.6.5. Evaluate NOVA operational guidelines for adoption and consolidation.				X
8.6.6. Address the strategy and tactics for a rapidly progressing fire on the exterior of a structure.				X
8.6.7. Address the strategy and tactics for lightweight construction structures.				X
8.6.8. Address the strategy and tactics for extreme environment conditions.				X
8.6.9. Clarify expectations of EMS transport units, especially regarding the need to prepare for victim and/or firefighter medical care and coordination of activities when multiple EMS units are present.				X
<b>8.7. Conduct a fire flow needs and capabilities assessment to identify the required apparatus and equipment to achieve the needed fire flow, application, and delivery method for structures within Prince William County. This assessment will serve as the cornerstone of establishing criteria for apparatus and equipment selection and standardization. Items for inclusion in the study are:</b>				X



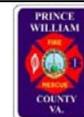
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
8.7.1. Establish hose line flow and pressures to be used and standardize nozzles.				X
8.7.2. Standardize hose line sizes.				X
8.7.3. Standardize hose load configurations.				X
8.7.4. Standardize appliances to be used (i.e. four way hydrant valves, blitz nozzles).				X
8.7.5. Standardize apparatus and location of all equipment.				X
8.7.6. Evaluate the validity of Iowa Fire Flow Formula based on current building construction methods, designs, materials and fuel loads.				X
8.7.7. Identification of training curriculum revisions and/or requirements.				X
<b>Section 9: Incident Command</b>				
<b>9.1. Evaluate the options to augment the existing regional command board system with a tactical worksheet or other mechanism to capture historical incident information.</b>			X	X



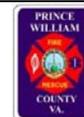
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
9.2. Evaluate the Department's current vehicle and outfitting for command post operation.				X
9.3. There needs to be an immediate resource assigned to arrive with the Battalion Commander to initiate command post support activities.				X
9.4. Develop and implement an incident command support team.				X
9.5. Reinforce importance for the Incident Commander and responding units to have shared responsibility when considering and selecting the most advantageous command post location and apparatus positioning.				X
9.6. Ensure an appropriate span of control (5-7) is maintained throughout the incident.				X
9.6.1. Change the dispatch complement for structure fire responses to include an additional battalion chief or command level officer.				X
9.6.2. Expand and reduce the command structure as needed to accommodate effective communications, operations, and maintain the appropriate span of control.				X
9.7. The Department must establish a senior shift operational command officer level.				X



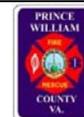
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>9.8. The Department must perform a staffing position analysis to establish the shift staffing at all rank levels.</b>				X
<b>Section 10: Communications</b>				
<b>10.1. Require all personnel engaged in emergency incident operations to have a portable radio with them at all times.</b>				X
10.1.1. Revise all associated policies and procedures to direct this change in practice and include direction on battery conditioning and replacement.				X
10.1.2. All portable radios are to have their battery replaced with a fully charged and conditioned battery at the beginning of each shift.				X
10.1.3. All portable radio batteries are to be placed in a charger and conditioned when indicated.				X
10.1.4. All portable radio batteries are to be taken out of service and replaced when capacity reading is at 70% or lower after a charging cycle.				X
10.1.5. Every riding position shall be equipped with a portable radio.				X
10.1.6. Each work site is to keep an appropriate number of spare portables and batteries for use on apparatus when normal radios are found missing or in need of repair.				X



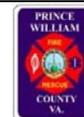
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
10.1.7. Each work site is to keep an appropriate number of spare extended microphones for use on apparatus when extended microphones in use become affected by moisture, no longer operate, or require drying out.				X
<b>10.2. Reinforce the need that all personnel responding to and operating on an incident scene must:</b>				X
10.2.1. Have their mobile and portable radio selected to the correct tactical radio channel for that incident.				X
10.2.2. Ensure their portable radio batteries are fully charged at the beginning of each shift.				X
10.2.3. Ensure portable radio batteries are properly conditioned and charged appropriately.				X
<b>10.3. Require that all first alarm units announce their arrival on the scene and their assigned task.</b>				X
<b>10.4. Require crew officers announce on the tactical radio channel when they are entering and exiting an incident's hot zone.</b>				X
<b>10.5. Reinforce radio discipline procedures.</b>				X



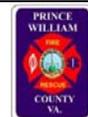
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
10.5.1. The establishment of divisions and groups are to be announced and the assigned resources are to be identified.				X
10.5.2. Personnel are to report to their division/group supervisors.				X
10.5.3. Personnel are to operate on the correct radio channel identified for their incident.				X
10.5.4. In the absence of an official request for all units to maintain radio silence, unit officers and other personnel with portables must exercise radio discipline/radio silence and refrain from transmitting traffic unless the message has a direct immediate implication on a mayday and/or a firefighter rescue attempt.				X
<b>10.6. Program command vehicle mobile radios to identify the riding position making a radio transmission so that Incident Commanders can view this at the command post.</b>				X
<b>10.7. Reinforce procedures for requesting additional radio channels.</b>				X
10.7.1. Clarify procedures for requesting command channels to include their use and monitoring requirements both at the command post and OPSC.				X



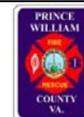
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
10.7.2. Each radio channel requested and assigned to an Incident Commander must have a dedicated person to monitor the radio channel at the command post.				X
<b>10.8. Permanently identify the nomenclature of apparatus.</b>			X	X
10.8.1. The first out pumper from each station must be identified as an “Engine” followed by a three digit number. The first digit will be the COG jurisdiction number (5 for Prince William County) followed by the station number. If the station number is a single digit, then a zero would precede the station number (i.e. Engine 502, Engine 512).			X	X
10.8.2. The second and any subsequent pumper from each station must be identified as an “Engine” followed by a three digit number as described above but also include a suffix.			X	X
10.8.3. The same logic must be consistently applied to other apparatus types (i.e. ambulances, medics, etc.).			X	X
<b>10.9. Consolidate all the Fire and Rescue mayday operational procedures into a single procedure which is fully coordinated with OPSC.</b>				X
<b>10.10. OPSC procedures related to the handling of emergency activations and maydays are to be revised and fully coordinated with Fire and Rescue. Items to be included are:</b>				X



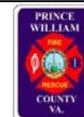
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
10.10.1. Procedure for handling maydays and radio emergency activations. <ul style="list-style-type: none"> <li>• Radio system “silencing and knockdown” of maydays.</li> <li>• Standard procedure for all types of maydays (with or without emergency activation button).</li> <li>• Incorporation of a ready reference guide card for this time critical, low frequency but high risk event.</li> </ul>				X
10.10.2. Train all OPSC personnel on new or revised procedures to include the radio system’s capabilities and limitations, with focused attention to low frequency/high risk critical communication operations.				X
<b>10.11. Appropriate procedural memorandums, policies, and training shall be updated to reflect these recommendations.</b>				X
10.11.1. Coordinate all appropriate procedures among fire and rescue and other stakeholder agencies.				X
10.11.2. Perform cross agency training exercises on new procedures and policies.				X
<b>10.12. Perform an analysis of the radio system to determine why the system does not handle large volumes of fire ground communications from all radio sources on an incident.</b>				X
10.12.1. Identify, define, and evaluate how long the system will give a radio prohibit signal (i.e. bonk) following any push to talk activations from any source.				X



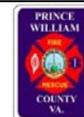
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
10.12.2. Identify, define, and evaluate all the factors that cause the radio system to send a radio prohibit signal (i.e. bonk, out of range tone, EA transmissions, multiple users, user reject, etc.) to users.				X
10.12.3. Identify, define, and evaluate any user input reasons that cause the radio system to send a radio prohibit signal (i.e. unintended activations, bonk, out of range tone, EA transmissions, multiple users, user reject, etc.) to users.				X
10.12.4. Identify, define, and revise functional performance standards for the radio system.				X
10.12.5. Determine immediate, intermediate, and long term solutions to the issues identified.				X
<b>10.13. Evaluate and increase OPSC staffing and resource allocations as needed to support critical fire and rescue operations.</b>				X
10.13.1. All active fire and rescue radio channels must be monitored by a dedicated dispatcher.				X
10.13.2. Evaluate, define, and revise roles and responsibilities of the uniform officer and civilian supervisor positions regarding fire and rescue operations.				X
10.13.3. Determine if additional fire and rescue technical advisors are needed for the monitoring and support of incident operations.				X



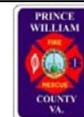
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
10.13.4. There must be radio system technical support personnel immediately available on a 24/7 basis.				X
<b>10.14. Initiate a national fire service industry requirement for radio manufactures to develop radio and communications equipment that meet the needs of the fire and rescue industry.</b>	X	X	X	X
<b>Section 11: Training</b>				
<b>11.1. Department must conduct an audit of all uniform employees for compliance with Fire and Rescue Association Procedure 4.5.1 titled Uniform Rank Structure.</b>				X
<b>11.2. Department recruit school curriculum must continue to include, and revise as appropriate, the firefighter survival skills and flashover survival training.</b>				X
<b>11.3. Department must provide firefighter survival skills and flashover survival training to all incumbent personnel.</b>				X
<b>11.4. Review and evaluate current RIT training to:</b>		X	X	X
11.4.1. Ensure understanding of the role and expectations of the company officer and crew when assigned the RIT duties and responsibilities.		X	X	X
11.4.2. Ensure adequate discussion, lecture and practical time is focused on expected actions in all types of structures (single family dwellings, multi-family dwellings, commercial, etc.).		X	X	X



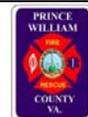
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>11.5. Review and evaluate current Firefighter Survival training to:</b>		X	X	X
11.5.1. Ensure adequate discussion, lecture and practical time is focused on firefighter self rescue strategies and techniques. Specific focus should include locating windows, identification of temporary safe havens and decision making when to attempt self rescue versus remaining in place to await rescue.		X	X	X
11.5.2. Ensure training addresses different types of structures (residential versus commercial) and the various types of building construction, designs, and materials.		X	X	X
<b>11.6. Review and evaluate incident command level training for the following items:</b>		X	X	X
11.6.1. Standardized, strategic approach in implementing operational guidelines.		X	X	X
11.6.2. Incorporate low frequency/high risk training scenarios where mayday events must be reacted to by personnel and incident commanders.		X	X	X
11.6.3. Incorporate training scenarios that include reaction to firefighters in trouble that are not readily located or not in their reported location.		X	X	X
11.6.4. Incorporate training scenarios where PAR checks discover a missing firefighter in absence of a mayday transmission.		X	X	X



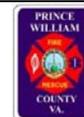
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
11.6.5. Incorporate training scenarios that include reaction to multiple mayday transmissions and coordination of rescue operations where multiple units are required.		X	X	X
<b>11.7. Reinforce training with officer qualified personnel to evaluate fire flow requirements for hose line selection when compared to available personnel resources and building construction.</b>				X
<b>11.8. Re-evaluate suppression training and adjust decision making, strategy, and tactics to react to lightweight building construction and tactical operations in extreme environmental conditions.</b>		X	X	X
<b>11.9. System wide firefighting, rescue and EMS equipment must be standardized so that training curriculums can prepare personnel for field operations.</b>				X
<b>11.10. Establish an officer development, and on-going training and continuing education program.</b>				X
<b>11.11. Develop and implement a competency based process for all rank levels.</b>				X
<b>11.12. The Training Division must assume responsibility for the coordination and delivery of structured and formalized training for the Department.</b>				X
11.12.1. To initiate the infrastructure for this Training Division initiative, a position of Captain (at a minimum) shall be immediately identified and assigned.				X



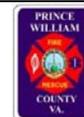
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
11.12.2. An immediate priority of this position will be to develop an implementation plan which includes resource identification of the following: <ul style="list-style-type: none"> <li>• Identify all expectations of the initiatives</li> <li>• Additional Training Division personnel required to develop, coordinate, and deliver training programs</li> <li>• Equipment, apparatus, and technology needs to support training curriculums</li> <li>• Resources to backfill positions or support in-service training (staffing, overtime, flex units, etc.)</li> </ul>				X
<b>11.13. The Department must establish a policy, process, and mechanism to effectively track and assure that all training at all levels (unit, station, battalion, formal classroom, conference, etc.) is documented and recorded appropriately in personnel training histories.</b>				X
<b>11.14. All Department of Fire &amp; Rescue uniformed personnel should be required to receive all operational training provided, regardless of rank and the division in which they are assigned.</b>				X
<b>11.15. Ensure universal understanding of terminology and application of RIT versus rescue. Training needs to be focused and delivered in this area system wide.</b>		X	X	X
<b>11.16. All new and revised policies, procedures, and directives must have an implementation plan that includes an impact analysis for any needed training components or requirements.</b>				X



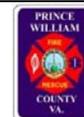
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>Section 12: Personal Protective Equipment</b>				
12.1. Require that all SCBA units and breathing air compressors/systems within the Prince William County System be flow tested, repaired, and maintained according to federal regulations, NFPA standards, and manufacturer's recommendations.				X
12.2. Require that the Department of Fire and Rescue maintain records of all flow testing, repair and maintenance for SCBA units and breathing air compressors/systems utilized by its employees.				X
12.3. Require that all Department of Fire and Rescue employees who use breathing apparatus follow the inspection and use parameters outlined in the Fire and Rescue Association 9.1.2 titled Respiratory Protection Program.				X
12.4. Require that all Department of Fire and Rescue employees who use breathing apparatus comply with NFPA 1582 standard and receive annual medical physicals.				X
12.5. Develop a system-wide recordkeeping mechanism for all OSHA, NFPA, Department, and Fire and Rescue Association required inspections, testing, and maintenance of apparatus, SCBA units, air compressors/systems, ladders, hose, personal protective ensembles, and other equipment as required.				X
12.6. The sounding of any PASS alarm must be investigated as a true emergency until proven otherwise. Outcome of any PASS alarm investigations must be reported to the incident commander.				X



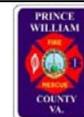
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
12.7. Ensure that all members who enter into an IDLH environment have a PASS device capable of alerting throughout the duration of their exposure in these environments.				X
12.8. Initiate a national fire service industry requirement to mandate a redundant capability for PASS devices.	X	X	X	X
12.9. Initiate a national fire service industry requirement to have all SCBA manufacturers standardize the PASS alarm sound to the international distress signal of S.O.S.	X	X	X	X
12.10. A review of the SCBA performance related to its battery powered components must be performed. This evaluation may have industry wide implications.	X	X	X	X
12.11. A review of the SCBA performance related to all the components must be performed. This evaluation may have industry wide implications.	X	X	X	X
12.12. Reinforce proper wearing of protective clothing ensemble to include the proper donning of helmet ear flaps and coat collar.				X
12.13. Continue practice of monthly PPE inspections.				X
12.14. Revise Fire and Rescue Association Procedure 9.1.1 titled Protective Clothing and Equipment to identify standard method for performing inspections, determining clothing and equipment serviceability, and cleaning requirements.				X



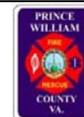
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
12.15. PPE record keeping, retention, and centralized storage practices need to be further defined.				X
<b>Section 13: Apparatus and Equipment</b>				
13.1. Based on the fire flow needs and capabilities assessment (see expanded discussion in Strategy and Tactics Section), mandate the standardization of all new apparatus and equipment and identify methods to achieve standardization with existing apparatus and equipment.				X
13.1.1. Evaluate best practices from other jurisdictions that have successfully achieved standardization of apparatus and equipment.				X
13.1.2. Develop a structured transition and implementation plan to achieve standardization of apparatus and equipment.				X
13.1.3. The structured transition and implementation plan must include a process for the removal of non-standardized apparatus and equipment from the system's inventory.				X
13.1.4. Resulting from the Marsh Overlook incident, the following engine company equipment items are recommended for priority evaluation: <ul style="list-style-type: none"> <li>• Standard hose lines</li> <li>• Standard complement of nozzles (nozzle types, standardized pressure and gpm flow, etc.)</li> <li>• Standard hose loads configurations</li> </ul>				X



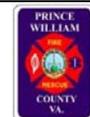
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>13.2. Establish a system wide standardized apparatus and equipment initiative.</b>				X
13.2.1. The system wide plan must identify a standardized type, configuration, and outfitting requirements for all apparatus.				X
13.2.2. The system wide plan shall identify the deployment and distribution of all apparatus.				X
13.2.3. The system wide plan is to be routinely evaluated for optimal strategic placement of apparatus and consider emerging technologies.				X
<b>13.3. Aerial ladder trucks/towers must have their operational limits clearly posted at the operator's pedestal.</b>				X
<b>13.4. Command and incident safety officers' vehicles must be equipped with video cameras with an option for stationary and remote capabilities.</b>				X
<b>13.5. Evaluate the operational use, training, and standardization of thermal imaging cameras.</b>				X



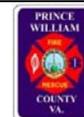
**Consolidated Recommendation Matrix**

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>Section 14: Effective Firefighting Force</b>				
<b>14.1. Increase the minimum qualified staffing of all suppression units to improve firefighter safety and operational effectiveness.</b>				X
14.1.1. All engine companies are to have at least four qualified personnel.				X
14.1.2. Evaluate increasing specialty pieces (trucks/towers/rescue) qualified staffing from four to five or six.				X
<b>14.2. Evaluate and consider discontinuing the practice of splitting a single specialty crew into an inside and outside crew (X-ray).</b>				X
<b>14.3. Perform a specialty service (trucks/towers/rescue) resource allocation study.</b>				X
<b>14.4. The dispatch complement must be increased to send an effective firefighting force capable of providing the amount of crews required to mitigate fires and other emergency incident types and increase firefighter and citizen safety.</b>				X
14.4.1. Evaluate and implement a standard structure fire dispatch complement. A review of NFPA 1710 Standard and the Northern Virginia (NOVA) Fire Service Coalition dispatch complements is to be considered in the development of this objective.				X



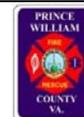
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
14.4.2. Discontinue practice of graduated dispatch complements based on the type of structure (residential versus commercial).				X
14.4.3. Adopt a standard dispatch complement for all structure fires that include rescue units.				X
<b>14.5. Evaluate existing mutual aid agreements and pursue mutual aid response agreements as appropriate.</b>			X	X
<b>Section 15: General</b>				
<b>15.1. Immediately establish a resource to monitor the implementation of the LODD report recommendations in order to achieve improvements and increase personnel safety.</b>				X
<b>15.2. Establish an internal task force and implement a system wide review of all procedure memorandums. This review must begin immediately and all efforts are to be taken to achieve it within a 90 day time period.</b>				X
15.2.1. Ensure all appropriate revisions are performed and fully coordinated throughout the system.				X
15.2.2. All procedure memorandums written in previous formats are to be revised to the current format or formally rescinded.				X
15.2.3. Ensure all operational procedures are standardized and consolidated.				X
15.2.4. Ensure all procedures and training curriculums related to operations				X



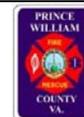
## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
in environmental extremes address all conditions, to include high wind environments.				
15.2.5. Clarify and consolidate all procedures related to incident command.				X
15.2.6. Ensure appropriate use of Informational Bulletins as a communications tool only.				X
15.2.7. Upon completion of this task, a standing policy committee is to be established to continue efforts in the on going coordination, maintenance, and implementation of all policies and procedures.				X
<b>15.3. Continue efforts for Fire and Rescue Association adoption of NOVA manuals with appropriate modifications as permitted for local resource allocation.</b>				X
<b>15.4. The Systems Support and Community Safety Sections must be evaluated and a strategic staffing plan developed that organizes and/or expands resources to support the increased service delivery demands.</b>				X
15.4.1. Efforts for community life safety educational programs must be continued.				X
15.4.2. Resources dedicated to the Fire Marshal's Office for fire investigations and related case management should be reviewed an implementation plan developed for needed improvements.				X
15.4.3. Resources dedicated to Health and Safety should be reviewed and an implementation plan developed that addresses the resource needs identified in this report.				X



## Consolidated Recommendation Matrix

Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>15.5. Establish a standard process for morning line up and shift change information exchange.</b>				X
<b>15.6. Implement a continuous quality improvement program aimed at the collection, cataloging, and assimilation of post incident analysis, near miss reports, injury information, and other appropriate reports in an effort to improve personnel safety and revise procedures and training curriculums as needed.</b>				X
15.6.1. A continuous quality improvement program is to be developed to record, monitor, and track the various suppression and safety related reports being produced.				X
15.6.2. This continuous quality improvement program item should be tasked as a responsibility of the Health and Safety group.				X
15.6.3. The information must be shared system wide and integrated into training curriculums and operational procedures as applicable.				X
<b>15.7. Immediately require a centralized reporting and record keeping mechanism for all industry standard maintenance and testing.</b>				X
15.7.1. To ensure the safety of personnel, work environments and compliance with all standards, a centralized reporting and record keeping mechanism is to be immediately established.				X
15.7.2. An audit of all records is to be performed and items found not in compliance are to have corrective actions taken.				X



## Consolidated Recommendation Matrix

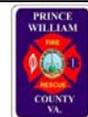
Recommendation	National Initiative	State Initiative	Regional Initiative	PWC Initiative
<b>15.8. The fire service should evaluate their initial occupant rescue attempts to include external alerting procedures such as the sounding of the initial arriving apparatus air horns.</b>	X	X	X	X
<b>15.9. Prince William County needs to adopt crew resource and situational awareness management models.</b>				X
<b>15.10. A national fire service initiative is needed to develop and establish an information warehouse to collect, analyze, catalog, and provide a single resource and access point for firefighter safety related issues.</b>	X	X	X	X



**Appendix C**  
**Reconstructed**  
**Timeline**

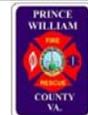
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:00:00	Task		Career staff on duty and begins morning apparatus and equipment checks. Tower 512's driver's bucket gives their portable radio to Technician Wilson as it is noted the officer's bucket portable radio is missing.
06:01:31	9-1-1	Civilian	First 9-1-1 call is received reporting a house fire; a total of nineteen 9-1-1 calls are received. Call dispatch location is taken from the second caller which is received at 06:02:07. Last call came into center at 06:08:47. No occupant disposition information is available to dispatchers.
06:03:08	CAD	OPSC	CAD recommends dispatch compliment – W512, E510, E520, TW512, A510-A, M512-C, BC503.
06:03:28	CAD	OPSC	CAD Dispatch stamp
06:03:48	5A	OPSC	<b><i>“Box 1209 on 5-Charlie for a house fire; 15492 Marsh Overlook Dr., cross street of Herring Way; Wagon 512, Engine 510, Engine 520, Tower 512, Ambulance 510-A, Medic 512-C, Battalion 503 at 0604 hrs.”</i></b>
	5C	OPSC	<b><i>“E510; E520; A510-A; Box 1209 on 5-Charlie for a house fire; 15492 Marsh Overlook Dr., cross street Herring Way; Wagon 512, Engine 510, Tower 512, Medic 512-C, Battalion 503 responding at 0605 hrs. This is the house next door to the uh, address, can see flames from the bottom part of the house, believes it might be on the deck.”</i></b>
	5C	A510's Officer	<b><i>“Ambulance 510-A responding”</i></b>



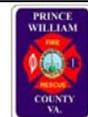
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	5C	OPSC	<i>“OK Ambulance 510-A”</i>
	5C	R510’s Officer	<i>“Rescue 510.”</i>
	5C	OPSC	<i>“OK Rescue 510, I’ll add you to the call.”</i>
	5C	SAF 502	<i>“Safety 502 to the 12 box”</i>
06:08:32	5C	W512’s Officer	<i>“Wagon 512 is on the scene, we have 2 story single family, heavy fire showing Side B and C. Have next in pumper pick up hydrant at 15169.” (Transmission done at hydrant)</i>
	Task	W512’s Driver	Dismounts apparatus and wraps hydrant with supply line.
	Task	W512’s Officer	Wagon 512’s Officer directs Wagon 512’s Bucket to pull 2 ½ inch hose line.
06:08:57	5C	OPSC	<i>“On scene Wagon 512, two story single family, heavy fire Side B and C at 0609. Battalion 503 direct?”</i>



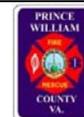
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:09:10	5C	Batt 503	<b><i>“Battalion 503 direct.”</i></b>
06:09:15	5C	W512’s Officer	<b><i>“Truck there should be a hydrant for 10 to get you if you need the ladder pipe.”</i></b>
	Task	TW512	Tower 512 pulls past Wagon 512 (at the hydrant) and stops to position short of the house (Side B area).
06:09:21	5C	TW 512’s Officer	<b><i>“Tower 512 on scene, on scene, B Side.”</i></b>
06:09:28	5C	OPSC	<b><i>“On scene Tower 512 Side B.”</i></b>
	Task	W512’s Driver	Wagon 512 begins to lay out supply line, pulls past Tower 512 and positions at the A/D corner laying out 500’ of 4” supply line. Distance between Wagon 512’s back step and front door is approximately 60 feet.
	Task	TW512 X-ray	TW 512’s X-ray crew begins setting up for anticipated aerial master stream operations.
	Task	TW512’s Officer	Begins walk down Side B to B/C corner.



## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	W512's Officer	Begins walk down Side D to C/D corner.
	Task	W512's Bucket	Begins to pull 200 foot, 2 ½ inch hose line to front yard.
06:09:34	5C	M512-C Officer	<b><i>"Medic 512-C on scene, staged."</i></b>
06:09:41	5C	W512's Officer	<b><i>"Wagon 512 to third in pumper, go ahead and come off the first Marsh Overlook and lay in from the hydrant from the other way."</i></b>
	Task	W512's Officer	Walk down to C/D corner complete. After looking down Side C from the C/D corner, observes Tower 512's Officer at opposite rear corner and returns to Side A.
	Task	TW512's Officer	After looking down Side C from the B/C corner, returns to Side A.
	Task	W/TW 512	Wagon and Tower 512's Officers meet in front yard – develop incident action plan of primary objective of victim search starting on second floor, Wagon crew to take 2 ½ inch hose line to second floor, if no victims then fire attack by pulling ceilings to access fire in attic. Engine and Tower personnel plan to coordinate entry with the hose line. Wagon 512's Officer waits for Engine 520's radio traffic to be complete before giving the next order.



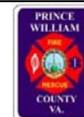
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:09:50	5C	E520's Officer	<i>"Engine 520 is OK on the third pumper assignment coming in the first Marsh Overlook."</i>
06:10:06	5C	E520's Officer	<i>"Engine 520 to Prince William; go ahead and dispatch additional pumper for a uh, secondary water supply."</i>
06:10:15	5C	W512's Officer	<i>"Wagon 512 to Prince William we have cars in the driveway, unknown if anyone home, go ahead and hit the second alarm."</i>
06:10:25	5C	R510's Officer	<i>"Rescue 510 on scene."</i>
06:10:31	5C	OPSC	<i>"Sending a second alarm."</i>
06:10:37	5C	W512 Driver	<i>"Wagon 512 ready for water."</i>
06:10:54	5C	E510's Officer	<i>"Engine 510 on scene; 520 you're gonna have to take second Marsh Overlook, second Marsh Overlook to pick up their line."</i>
06:10:55	CAD	OPSC	CAD recommends dispatch compliment for second alarm – E502, E517, E513, TW513, A515, M552, BC502, AIR512, R504, RH520.
06:11:04	5C	E520's Officer	<i>"You didn't take it?"</i>



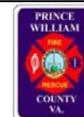
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	W512's Officer	Wagon 512's Officer does face-to-face with W512's Driver to request the 2 ½ inch hose line be charged because smoke conditions in front yard prohibit driver seeing hand signal and radio traffic prohibits use of radio.
	Task	W512	Wagon 512's Officer and Bucket personnel don their SCBA face pieces.
	Task	TW512 inside crew	Tower 512's Officer gets acknowledgement that engine personnel are ready to enter. Tower 512's inside crew enters the structure; front door closes behind them. Tower 512's Officer stops so Technician Wilson can open door behind them; crew continues to second floor.
	Task	W512's Officer	Wagon 512's Officer is on front exterior steps, preparing to enter, looks up and sees Tower 512's inside crew ascend stairs. Front door gently swings shut without latching.
06:11:16	5C	Batt 503	<b><i>"Battalion 503 on scene; Battalion 503 to uh, Wagon 512."</i></b>
06:11:36	5C	W512's Officer	<b><i>"Go ahead chief."</i></b>
06:11:38	5A	OPSC	<b><i>Alert tone. "Box 0209 for a second alarm to a house fire; 15492 Marsh Overlook Drive, cross street of Herring Way; Wagon 502, will be on 5-Baker, mark up on 5-Baker, Wagon 502, Tower 513, Ambulance 515, Medic 552, Air 512, Rescue, Rehab 520, Engine 502, Engine 517 at 0612."</i></b>



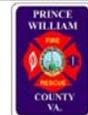
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:11:39	5C	Batt 503	<i>“Alright, whatcha got going on?”</i>
06:11:40	5C	W512’s Officer	<i>“Outside fire started outside, right outside the house, in the attic right now, the Tower’s in there on the second floor, we got vehicles in the driveway and out front, searching for victims, we’re going in with a 2 ½.”</i>
06:11:55	5C	Batt 503	<i>“Copy Tower on second floor, you’re going in with a 2 ½ doing a search.”</i>
	Task	TW512	Tower 512 is conducting search of second floor, Quadrant Delta, in a right hand search pattern. Conditions on second floor are good visibility, low heat and smoke hanging about three to four feet from the ceiling.
	Task	R510’s inside crew	Rescue 510’s inside crew reports to front of structure and does a face to face with Wagon 512’s Officer. Wagon 512’s Officer reports Tower 512 is on second floor and Rescue 510 is assigned first floor primary. Rescue 510’s Driver (part of x-ray crew) is dressing out at this time.
	Task	E510’s Driver	Citizen appears at Engine 510’s Driver door and reports “I’m not sure but I think everyone is out of the house.”
	Task	E510’s Driver	Engine 510 begins to back up to hydrant to lay out for secondary water source.



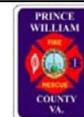
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	E510	Engine 510's crew reports to front of structure.
	Task	W512/E510	Wagon 512's Officer does face to face with Engine 510's Officer and orders crew to pull 300 foot, 1 ¾ inch hose line to rear of structure.
	Task	W512's Officer	Opens front door, immediately hit with black smoke and fire.
	Task	R510 X-ray	Rescue 510 X-ray crew member retrieves 24' ladder off Wagon 512 and throws it to Side A, second floor, Quadrant A.
	Task	TW512 X-ray	Tower 512 X-ray retrieves 14 foot ladder off Wagon 512 and throws it to Side C, deck area.
	Task	M512	Medic 512's Driver flushes hydrant in preparation for establishing Wagon 512's water supply.
06:12:13	5C	E520's Officer	<b><i>"Engine 520 on scene, we got the water supply for 12."</i></b>
06:12:20	5C	OPSC	<b><i>"On scene Engine 520."</i></b>
06:12:26	5C	A510's Officer	<b><i>"Ambulance 510-A on scene."</i></b>



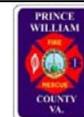
Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:12:29	5C	OPSC	<i>“On scene Ambulance 510-A.”</i>
06:12:32	5C	Batt 503	<i>“Battalion 503 to Prince William.”</i>
06:12:35	5C	OPSC	<i>“Battalion 503.”</i>
06:12:37	5A	W512’s Driver	<i>“Wagon 512 Driver to Engine 520 Driver, ready for water.”</i>
	Task	E510’s Bucket	After checking with Wagon 512’s driver to determine correct line, Engine 510’s Bucket pulls 300 foot, 1 ¾ inch hose line from Wagon 512. Hose load falls off their shoulder and onto sidewalk causing the hose line to be flaked out from that location.
06:12:38	5C	Command (Batt 503)	<i>“Establishing Marsh Overlook Command.”</i>
06:12:44	5A	OPSC	<i>“Wagon 512 switch to Charlie.”</i>
06:12:45	5C	OPSC	<i>“OK.”</i>



## Reconstructed Timeline

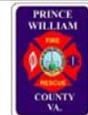
Time	Channel or Task	Unit	Message or Task
06:12:50	5C	OPSC	Alert tone
	5A	Air 512	<i>"Air 512 responding to Old Marsh, switching to Charlie."</i>
	5A	OPSC	<i>"OK Air 512."</i>
06:12:55	CAD	OPSC	Air 512 logged enroute.
06:12:56	5C	Command (Batt 503)	<i>"Command to Engine 520."</i>
	Task	M512/E520	Medic 512's Driver attaches Engine 520's front intake to hydrant; Wagon 512's supply line is attached to officer side's discharge.
06:13:00	5C	E520's Officer	<i>"Engine 520."</i>
06:13:04	5C	Command (Batt 503)	<i>"I need your crew in here with a exposure line on exposure D as in dog."</i>



## Reconstructed Timeline

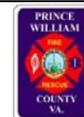
Time	Channel or Task	Unit	Message or Task
06:13:06	MDC	SAF 502	Safety 502 on scene (MDC)
06:13:09	5C	E520's Officer	<i>"OK, exposure David."</i>
	Task	E510's Officer	Engine 510's Officer sees a family in the window of Exposure D and goes to evacuate family from exposure.
	Task	E520's crew	Engine 520 pulls 200 foot, 1 ¾ inch hose line from Engine 510 to Side D.
	Task	E520's Bucket	Engine 520's Bucket observes family in window of Exposure D and goes to evacuate occupants. As the bucket person reached the front door of the house, Engine 510's Officer is already there and giving the evacuation instructions.
	Task	TW512 inside crew	While conducting search of master bedroom, conditions rapidly deteriorate to heavy, dark smoke and high heat. There is zero visibility in bedroom. Tower 512's crew begins evacuation of bedroom.
	Task	TW512 inside crew	Tower 512's Officer and Technician Wilson begin evacuation of master bedroom. Crew is in constant verbal communication and Tower 512's Officer directs Technician Wilson to move back toward doorway. Technician Wilson states he is on his way and reports he is behind Tower 512's Officer. Tower 512's Officer locates bedroom door and moves into the second floor landing area where the officer becomes entangled in a hall table and falls down stairs to the curve of the

C-11

*We will never forget*

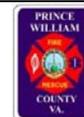
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
			stairwell. Tower 512's Officer calls back to Technician Wilson to come toward the stairs. Technician Wilson replies that he cannot find the stairs. Tower 512's Officer replies to come toward the officer's voice and shined a flashlight toward the second floor landing area.
06:13:16	5C	W512's Officer	<b><i>"Wagon 512 to Command, we have a crew upstairs, the stairs are burned out, hit the evacuation tones!"</i></b>
	Task	A510's crew	A510's equipment is loaded onto their cot and staged at A/D corner.
06:13:26	5C	Command (Batt 503)	<b><i>"Command to Prince William, please hit the evacuation tones."</i></b>
	Task	A510's crew	Ambulance cot is loaded with equipment and staged at the A/D corner; A510's apparatus is re-positioned further up the street.
06:13:37	5C	W512's Driver	<b><i>"Wagon 512's Driver ready for water."</i></b>
06:13:45	5C	OPSC	<b>Evacuation tones sound</b>
	Task	TW 512's X-ray crew	Tower 512's Driver raises and extends the aerial ladder. A volunteer member who arrived separately arrives and joins Tower 512's X-ray crew. The volunteer member ascends the ladder and into the bucket.



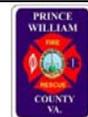
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	W512/R510	Wagon 512's Officer observes a white helmet appear within orange flames in the staircase area. Members from Wagon 512 and Rescue 510 reach into black smoke/fire and locate Tower 512's Officer who is immediately moved to the house's exterior. Tower 512's Officer is yelling that Technician Wilson is still inside on the second floor, in the staircase area. Crew members from Wagon 512 and Rescue 510 attempt to make entry into the house.
	Task	W512/R510	Members from Wagon 512 and Rescue 510 attempt to ascend the foyer staircase but are pushed back by intense heat encountered at the curve of staircase.
	Task	A510's Driver	Ambulance 510's Driver is approached by a citizen who states there is a family member sitting in a vehicle parked in the street near the on A/D corner.
	Task	A510's Officer	Ambulance 510's Officer begins to collect accountability passports.
06:14:02	5C	Command (Batt 503)	<b><i>"Command to Wagon 512, are you par?"</i></b>
	Task	W512/R510	2 ½ inch hose line begins to flow into front door/foyer.
06:14:09	5C	OPSC	<b><i>"Attention all units on scene of the house fire at 15492 Marsh Overlook, Marsh Overlook Command has ordered an emergency evacuation."</i></b>



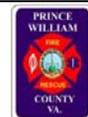
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:14:22	5C	TW512's Driver	<b><i>"Tower 512 to command, I need a water source for if, your gonna use the ladder pipe."</i></b>
	Task	W512/TW512 R510	Tower 512's Officer is yelling that Technician Wilson is still inside on the second floor, in the stairwell area. The officer attempts to re-enter the building but is stopped by Wagon 512's Officer and told to stay out. Tower 512's Officer gives his thermal imaging camera to Wagon 512's Officer.
06:14:29	5C	Command (Batt 503)	<b><i>"Copy you need a water source; Command to Wagon 512 are you par and out of the building?"</i></b> (Air horns sounding in the background)
06:14:39	5C	Unknown	Several mic keys
06:14:47	5C	Command (Batt 503)	<b><i>"Repeat?"</i></b>
	Task	E510's Officer	Engine 510's Officer tells Engine 510's Driver (face to face communication) to position apparatus close to Wagon 512 for anticipated deck gun operations.
	Task	E510's Driver	Engine 510's Driver positions apparatus, exits, and sprints back to hydrant and charges the supply line. The driver then runs back to apparatus' pump panel.
06:14:50	5C	R510's Officer	<b><i>"Rescue 510 Officer to..."</i></b> (carries into Mayday traffic)



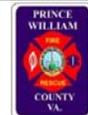
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:14:53	5C	R510's Officer	<i>"Mayday, mayday, mayday, Tower 512 is missing one firefighter; we have a firefighter missing, in the stairwell."</i>
06:15:06	5C	TW512's Bucket Technician Wilson	<i>"Mayday, mayday, mayday, Tower 512 Bucket, I'm trapped inside, I don't know where I am, I'm somewhere in the stairwell, I need someone to come get me out."</i>
06:15:20	5C	OPSC	<i>"Mayday traffic" (interrupted)</i>
06:15:23	5C	Command (Batt 503)	<i>"Repeat last message?"</i>
	Task	E520	Engine 520's crew begin to flow 1 ¾ inch hose line on Side D.
	Task	W512/R510	Wagon 512 and Rescue 510's crews are forced out of the foyer area and out the front door as the heat and fire are too intense and overwhelming the 2 ½ inch hose line.
	Task	W512/R510	2 ½ inch hose line flows into the front door area but due to zero visibility conditions the crew does not immediately realize the front door had shut. Hose line is shut down to facilitate door opening.



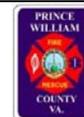
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	A510's Driver	Ambulance 510's Driver removes citizen from vehicle and directs the citizen to join other citizens that are assembled in the garage of Exposure D.
06:15:32	5C	Command (Batt 503)	<b><i>"Command to Rescue Squad 510, repeat last message?"</i></b>
	Event	SAF 502	Safety 502 placed video camera on dash and video tape comes into focus.
06:15:45	5C	R510's Officer	<b><i>"Tower 512 Bucket portable is in the stairwell, he is lost, we have a RIT operation."</i></b>
	Task	E510	Flows 1 ¾ inch hose line on Side A, Quadrant A. Low pressure in encountered on hose line.
06:15:53	5C	Command (Batt 503)	<b><i>"That's affirmative; do you have a crew going inside right now?"</i></b>
06:15:59	5C	Unknown	<b>Mic click</b>
	Task	R510	Rescue 510's crew member attempts to re-open front door, door is difficult to open.



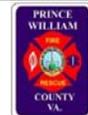
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	R510	Crew members get front door to open
06:16:10	5C	Command (Batt 503)	<b><i>“Command to Rescue Squad 510, do you, is your crew going in?”</i></b>
06:16:15	5C	R510’s Officer	<b><i>“We’re trying to make entry now with the hose line.”</i></b>
	Task	W512/R510/ E510	Entry made with Wagon 512 and Rescue 510 – 2 ½ inch hose line is advanced into front door to the left; 1 ¾ inch hose line is advanced into front door to the right.
	Task	E510’s Officer	Engine 510’s Officer reports to Side A; states visibility in front yard is extremely poor; follows hose line to house to locate his crew member who reports low pressure on hand line.
	Task	R510/W512	Wagon 512 and Rescue 510 crew members ascend foyer stairs and a Rescue 510 crew member searches the second floor landing area; the crew is forced back down due the stairs due to high heat.
06:16:20	5C	Command (Batt 503)	<b><i>“OK, do you need another crew to help?”</i></b>
06:16:27	5C	R510’s Officer	<b><i>“Not at this time.”</i></b>



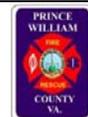
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	W512/R510/ E510	Crews re-group in foyer to make another push to second floor. Rescue 510's crew ascend foyer stair case to second floor landing when ceiling and/or roof structural members begin to collapse onto them. Crew is forced to retreat back down the stairs.
06:16:36	5C	W512's Officer	<i>"Wagon 512 Officer to Driver, we need more pressure on these lines now!"</i>
06:16:47	5A	Unknown	<i>"You got more pressure?"</i>
	Task	R510 X-ray	R510 X-ray crew member retrieves 16' ladder from Tower 512 and walks toward structure (seen on video). Ladder is thrown to Side D, second floor, master bedroom.
06:16:52	5C	Wagon 510's Officer	<i>"Wagon 510 to Prince William; responding on Charlie, house fire 12's due."</i>
06:17:00	5C	OPSC	<i>"OK Wagon 510."</i>
06:17:07	5C	TW512's Driver	<i>"Tower 512 to command, we still don't have water supply for ladder pipe if we need it."</i>



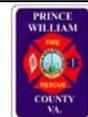
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	W512's Driver	Engine 520's Officer directs Wagon 512's Driver to hand lay a 4 inch supply line back to Tower 512 (instruction given face to face).
06:17:22	5C	Command (Batt 503)	<b><i>"Command to Engine 520."</i></b>
06:17:27	5C	E520's Officer	<b><i>"Go ahead."</i></b>
06:17:30	5C	Command (Batt 503)	<b><i>"Did you all lay in for the Tower?"</i></b>
	Task	TW512 X-ray	Tower 512 X-ray crew member secures gas at meter (seen on video).
06:17:35	5C	E520's Officer	<b><i>"Negative, we picked up 12's line, I just told 12's Driver to hand jack a 4 inch back to the Tower."</i></b>
06:17:42	5C	Command (Batt 503)	<b><i>"Copy on that. Command to Rescue Squad 510."</i></b>
06:17:51	5C	R510's Officer	<b><i>"Go ahead."</i></b>
06:17:55	5C	Command (Batt 503)	<b><i>"Status report?"</i></b>



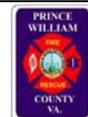
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	W512's Driver	Stretches 4 inch supply line to Tower 512 (shadow can be seen on video).
	Task	E510's Officer	Engine 510's Officer goes to Wagon 512's pump panel to check for cause of low water pressure problems. Observes all discharge gauges reading 90-100 psi.
	Task	Brush 512	Brush 512's Driver goes to Wagon 512's pump panel to troubleshoot cause of low water pressure problems.
	Task	W512's Driver	Wagon 512's Driver returns from hand laying supply line to Tower 512 and observes two personnel at the pump panel. Wagon 512's Driver observes wide fluctuations on the intake gauge ranging from 40 – 120 psi. Wagon 512's Driver trouble shoots and increases pressure on all lines.
	Task	E510's Officer	Engine 510's Officer returns to Side A, due to crowding at front door/foyer area, he stages at front steps and observes for signs of collapse.
<b>06:18:02</b>	<b>5C</b>	<b>Unknown</b>	<b>Mic click</b>
<b>06:18:07</b>	<b>5C</b>	<b>Unknown</b>	<b>Mic click</b>
<b>06:18:14</b>	<b>5C</b>	<b>W502's Officer</b>	<b><i>"Wagon 502 on scene, second water."</i></b>



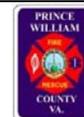
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	W502's Driver	Drops a supply line at Marsh Overlook and Bald Eagle and forward lays to Engine 520. Supply line is never charged or used.
06:18:26	5C	Command (Batt 503)	<b><i>"Command to Rescue Squad 510."</i></b>
06:18:31	5C	W512's Officer	<b><i>"Command, I need more pressure on those lines" (PASS device sounding in background).</i></b>
06:18:41	MDC	M552	Medic 552 marks on the scene via MDC.
	Task	M552's Officer	Medic 552's Officer reports to Command Post and sets up rear of command vehicle and begins utilizing command boards.
	Task	A510's Officer	Ambulance 510's Officer drops off collected passports at Command Post.
	Task	M552's Driver	Medic 552's Driver retrieves additional passports and drops off collected passports at the Command Post. The driver then begins to ready the medic unit with assistance from Ambulance 510's personnel.
06:18:45	5A	SAF 503	<b><i>"Safety 503 to Marsh Overlook."</i></b>



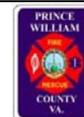
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:18:49	5A	OPSC	<i>"OK Safety 503."</i>
06:18:51	5C	E510's Driver	<i>"Engine 510 Driver to Command, we got a deck gun in service if you're ready for it."</i>
06:18:57	5C	Command (Batt 503)	<i>"Stand by, stand by. We still have a crew inside; I need to find out their status. Command to Rescue Squad 510."</i>
06:19:05	MDC	E513	E513 on scene (MDC).
06:19:06	5C	TW512's Bucket Technician Wilson	<i>"I need water (garbled) Tower 512 Bucket. I need water, I'm burning up in here, I need water fast!"</i> (PASS device sounding)
		TW513	Tower 513 on scene (MDC not functioning at the time and CAD report has late time stamp).
06:19:15	5C	Command (Batt 503)	<i>"Engine, Wagon 512 are you direct?"</i>
06:19:19	5C	Unknown	<i>"What did you say?"</i> (garbled)



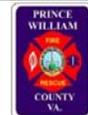
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:19:23	5C	Command (Batt 503)	<i>"Got a firefighter in the stairwell, need water."</i>
06:19:42	5C	Command (Batt 503)	<i>"Battalion 502 on scene."</i>
06:19:46	5C	Command (Batt 503)	<i>"Battalion 502, I need you to be uh, Division A, Division A please."</i>
	Event		Side B roof members collapse onto gas meter area (video)
06:19:56	5C	Batt 502	<i>"OK, I'm on the upper end; I'll be uh, dressing out."</i>
	Task	E513	Engine 513 reports to command post and assigned task to find missing firefighter.
06:20:04	5C	W517's Officer	<i>"Wagon 517 on scene, we have another water supply if you need us to lay in."</i>
06:20:10	5C	OPSC	<i>"On scene Wagon 518, on scene Engine 502."</i>
06:20:15	5C	Command (Batt 503)	<i>"Command to Rescue Squad 510."</i>



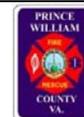
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:20:36	5C	W512's Officer	<i>"Wagon 512 Officer to command, the roof is coming in right now!"</i> (PASS device sounding in background).
06:20:37	5A	W512's Driver	<i>"Wagon 512's Driver to Engine 520's; can you give me any more water?"</i>
06:20:43	5A	OPSC	<i>"Wagon 512 switch to 5-Charlie please."</i>
06:20:43	5C	Command (Batt 503)	<i>"Copy, do we still have a firefighter in the stairwell?"</i>
	Event		Side B wall collapses (video).
06:20:58	5A	SAF 502	<i>"Safety 502 to Command – pull everyone out of the house!"</i>
06:21:03	5C	TW513's Officer	<i>"We got rope (garbled) if you (garbled)."</i>
06:21:08	5A	OPSC	<i>"Safety 502..."</i> (interrupted)



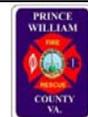
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:21:12	5A	SAF 502	<b><i>“Safety 502 to Command – pull everybody out of the house!”</i></b>
06:21:12	5C	TW513’s Officer	<b><i>“Tower to Battalion 3, Tower 13 we got rope and equipment on Side A, do you need us to enter?”</i></b>
06:21:14	5A	OPSC	<b><i>“Safety 502 switch to 5-Charlie.”</i></b>
06:21:20	5C	Command (Batt 503)	<b><i>“I need to find out the status of Rescue Squad 510, they are in the stairwell.”</i></b> (air horns sounding in background)
06:21:27	5C	Safety 502	<b><i>“Safety 502 to Command, pull everybody out of the house now!”</i></b> (air horns sounding in background)
	Task	W502	Wagon 502’s Officer stages crew at A/D corner. Crew members take pictures and capture a short video segment on the camera. Wagon 502’s Officer reports to Command Post and is assigned RIT by Command (face to face).
	Task	W502	Wagon 502’s Officer and crew perform a walk around of structure. They make contact with Safety 502 on Side D. They continue on with their size up and make contact with Tower 513’s Officer on Side A. They continue to Side B where they note the side wall of the sunroom had collapsed. They deem Side C is the best avenue for entry.



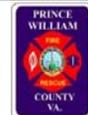
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	W502	Wagon 502's crew gains access to first floor via ladder to deck on Side C; Engine 520 passes 1 ¾ inch hose line. Crew enters first floor for search and fire attack.
06:21:33	5C	Command (Batt 503)	<i>"Attention all units, get out of the house now. Evacuate the building now."</i>
06:21:56	5C	OPSC	<i>"Prince William to Marsh Overlook Command, do you want me to sound emergency evacuation tones again?"</i>
06:22:04	5C	Division A (Batt 502)	<i>"Division A to Command."</i>
06:22:10	5C	Command (Batt 503)	<i>"Go ahead."</i>
06:22:12	5C	Division A (Batt 502)	<i>"OK, I'm in position on Side A."</i>
06:22:20	5C	Unknown	Mic clicks
06:22:25	5C	Command (Batt 503)	<i>"Command to Division A, we're ready to hit this with water pipe but we're looking for status of Rescue Squad 510."</i>
06:22:35	5C	Unknown	(Garbled/noise)



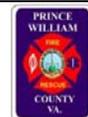
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:22:42	5C	Unknown	(beep and open mic continues)
06:23:48	5C	Division A (Batt 502)	<i>"Division A to Command."</i>
06:23:57	5C	Command (Batt 503)	<i>"Command, go ahead."</i>
06:24:01	5C	Unknown	Mic clicks
06:24:18	5C	W510's Officer	<i>"Wagon 510 on scene, we picked up hydrant at Marsh Overlook and Duckling Place; Wagon 17 layed out to the fire."</i>
06:24:20	5C	OPSC	<i>"On scene Wagon 510."</i>
06:24:31	5C	Command (Batt 503)	<i>"Attention all units on the fire ground, hold your traffic, hold your traffic. Command to Division A."</i>
06:24:40	5C	Division A (Batt 502)	<i>"Division A; Situation is confirmed we still have one firefighter inside unaccounted for, last seen second floor, Division Charlie." (PASS device intermittently sounding in background)</i>



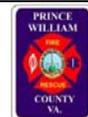
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:24:52	5C	Command (Batt 503)	<i>"Copy, I have Engine 513 and Engine 502 as RIT teams."</i>
06:25:00	5C	Division A (Batt 502)	<i>"OK sir at this time, uh we are not going to re-enter the building, it is uh subject to collapse, all units operating near the fire ground, back up out of the collapse zone now!" (PASS device sounding in background)</i>
06:25:15	5C	TW512's Aerial Bucket	<i>"Tower 512 Bucket, the operation, I was going to say the same thing from my aerial position, Side A extremely weak, I can see it going."</i>
06:25:30	5C	Division A (Batt 502)	<i>"Division A to Command, as soon as we get the bulk of this fire knocked down, we're try to get access."</i>
06:25:36	5C	Command (Batt 503)	<i>"Copy, we're ready with the deck guns and ladder pipes."</i>
06:25:42	5C	Unknown	Mic clicks
06:25:46	5C	Division A (Batt 502)	<i>"Now if possible, I would love to get a uh deck gun to the front door if possible to get the bulk of the fire down, I don't want to potentiate more collapse."</i>
06:25:56	5C	Command (Batt 503)	<i>"Engine 510, are you direct?"</i>



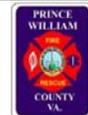
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:26:00	5C	E510's Driver	<i>"That's affirmative, deck gun to the front door."</i>
06:26:08	5C	Unknown	Mic click
06:26:12	5C	Division A (Batt 502)	<i>"Division A to Command, what unit, where you at, no where..."</i> (garbled) (Note: On video overhead from Safety 502's mobile radio – <i>"Division A to command, what unit, where you at?"</i> Response from Engine 520's Officer <i>"We're in the warm zone."</i> )
06:26:19	5C	Command (Batt 503)	<i>"Repeat?"</i>
06:26:22	5C	Division A (Batt 502)	<i>"What unit is bringing that over? I'll send Tower 13 over to assist."</i>
06:26:27	5C	Command (Batt 503)	<i>"Engine 10, Engine 10."</i>
06:26:30	5C	Division A (Batt 502)	<i>"Tower assist Engine 10 with the deck gun."</i>
	Task	A510/E510	Engine 510's Driver requests Ambulance 510's Driver to staff the deck gun.



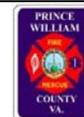
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	Task	E510	Engine 510's deck gun starts flowing from atop the apparatus.
06:26:42	5C	Tower 512's Aerial Bucket	<i>"Tower Bucket to Tower Driver; see if you can find me some water."</i>
06:26:46	5C	Division A (Batt 502)	<i>"Division A to command."</i>
06:26:50	5C	Command (Batt 503)	<i>"Division A go ahead."</i>
06:26:56	5C	Division A (Batt 502)	<i>"Gonna need uh, two to three relief crews in front of Tower 512 for redeployment. I've got uh, I've got low air alarms sounding on several units now."</i>
06:27:10	5C	Command (Batt 503)	<i>"Command to Engine 517 report to the front of Tower 512."</i>
06:27:15	5C	W512's Officer	<i>"Command, (garbled) W512 to Division 1, we've got a good knock, let's get back in there!" (PASS device sounding in background)</i>
06:27:16	5C	TW512 Driver	<i>"Tower 512 to Command; are we ready for that ladder pipe?"</i>



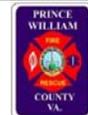
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:27:33	5C	W502's Officer	<i>"Wagon 502 to Command."</i>
06:27:37	5C	Command (Batt 503)	<i>"Wagon 502."</i>
06:27:40	5C	W502's Officer	<i>"The knock down to Side Adam is a false knock down; the house is fully involved from Division Charlie, basement side to and include..." (garbled)</i>
06:27:55	5C	Division A (Batt 502)	<i>"Division A to Command."</i>
06:28:07	5C	Division A (Batt 502)	<i>"Division A to Command."</i>
06:28:12	5C	Command (Batt 503)	<i>"Command, go ahead."</i>
06:28:15	5C	Division A (Batt 502)	<i>"I want to confirm I got two RIT teams in the front yard ready to go. I'm getting ready to send..." (garbled)</i>
06:28:25	5C	Command (Batt 503)	<i>"Copy two RIT teams in front yard ready to send in. I'm gonna do a PAR check."</i>
06:28:32	5C	Command (Batt 503)	<i>"Command to Engine 512, are you PAR?"</i>



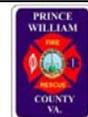
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:28:51	5C	Command (Batt 503)	<i>"Command to Engine 510, are you PAR?"</i>
06:28:57	5C	Division A (Batt 502)	<i>"Engine 17 I need you in the front yard right now!"</i>
06:29:10	5C	E517's Officer	<i>"Engine 517 at the front yard, who repeat?"</i>
06:29:29	5C	TW512's Driver	<i>"Tower 512 to Command, are we ready to use the ladder pipe?"</i>
06:29:36	5C	Command (Batt 503)	<i>"Command to Prince William"</i>
06:29:40	5C	OPSC	<i>"Command"</i>
06:29:46	5C	Command (Batt 503)	<i>"Need uh, chaplain on the scene please."</i>
06:29:50	5C	OPSC	<i>"Direct, we have one enroute."</i>



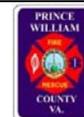
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:29:53	5A	W512's Driver	<i>"Wagon 512 to Tower 512, are you ready for water?"</i>
06:29:58	5A	OPSC	<i>"Wagon 512 switch your traffic to 5-Charlie."</i>
	Task	E513 & E520	Engine 513 and Engine 520 go to Side C; Engine 513's Officer has crew retrieve leader line and high rise pack from Engine 510.
06:30	Fairfax Landline	OPSC	PWC Communications request an engine company from Fairfax County to fill fire station 502.
06:30:02	5C	Unknown	<b>Mic click</b>
06:30:06	5C	Division A (Batt 502)	<i>"Division A to Engine 512, you need to boost your pressure on your 1 ¾ line, so we can make entry." (PASS device intermittently sounding in background)</i>
06:30:17	5C	Unknown	<i>"He's not answering, get..." (garbled and PASS device sounding in background)</i>
06:30:28	5C	W502's Officer	<i>"RIT 2 is getting a knock on Side Charlie, looking for the victim."</i>
06:30:36	5C	Division A (Batt 502)	<i>"What unit was that there on 5-Charlie?"</i>



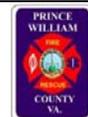
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:30:40	5C	W502's Officer	<b><i>"Wagon 502, RIT 2 we're making a knock on Side Charlie, looking for victim one floor, first floor."</i></b>
	Task	W502	Wagon 502's crew performs search of first floor, Quadrant Charlie.
06:30:58	5C	Division A (Batt 502)	<b><i>"Division A to Command."</i></b>
06:31:03	5C	Command (Batt 503)	<b><i>"Division A go ahead."</i></b>
06:31:18	5C	Division A (Batt 502)	<b><i>"Division A to Command."</i></b>
06:31:21	5C	Command (Batt 503)	<b><i>"Command go ahead Division A."</i></b>
	Task	E517	Engine 517 retrieves 14 foot ladder from Engine 510 and takes it to front door on Side A. The ladder is given to Tower 513 who places it on foyer stairs for weight distribution due to earlier reports of stair collapse.
06:31:25	5C	Division A (Batt 502)	<b><i>"OK, I've got Tower 513 making entry on Side A with Engine 517 to attempt a search. We need (garbled) lights in front of the building."</i></b>



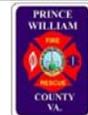
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:31:40	5C	Command (Batt 503)	<i>"I copy you have 5, Tower 513 with Engine 517 and I didn't hear your last transmission."</i>
06:31:51	5C	Division A (Batt 502)	<i>"I have Tower 513 making entry with protection from hose line from Engine 517 try to make entry on Side A to do a search." (PASS device sounding in background)</i>
	Task	TW513	Tower 513 attempts to make foyer stairs, ascends approximately five steps but is forced back due to intense heat and fire.
06:32:05	5C	Command (Batt 503)	<i>"Copy."</i>
06:32:11	5C	OPSC	<i>"Prince William to Marsh Overlook Command, you're 20 minutes into your incident."</i>
06:32:16	5C	Command (Batt 503)	<i>"Copy that, thank you."</i>
06:32:24	5C	Division A (Batt 502)	<i>"Division A to Command."</i>
06:32:28	5C	Command (Batt 503)	<i>"Division A go ahead."</i>



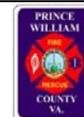
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:32:32	5C	Unknown	Mic click
06:32:35	5C	Division A (Batt 502)	<i>"I need to confirm, Side Charlie is clear, no one else operating; don't want to get opposing hose lines. To continue with operations, I need two units in front yard, uh, in case we have secondary collapse."</i>
06:32:50	5C	Command (Batt 503)	<i>"Alright, I'll get you two more units to the front yard."</i>
06:32:56	5C	Unknown	Mic click
06:32:58	5C	Unknown	Mic click
06:33:04	5C	Unknown	Mic click
06:33:10	5C	Division A (Batt 502)	<i>"Division A to Command, I need two additional relief units to front yard to relieve Rescue 510, in case we have a second, correction..." (garbled)</i>
06:33:39	5C	Command (Batt 503)	<i>"Division A please repeat."</i>



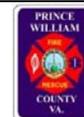
Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:33:43	5C	Division A (Batt 502)	<i>"Yes I need two relief crews in the front yard to relieve Rescue 510, give me a level two RIT established in the front yard."</i>
06:33:58	5C	Command (Batt 503)	<i>"Copy two relief crews to the front yard."</i>
	Task	TW513	Tower 513 performs search of first floor Quadrants Delta and Charlie; meets Wagon 502's Officer who reports search of Quadrant Charlie is accomplished. Tower 513 continues first floor search of Quadrants Alpha and Baker; discovers burn through in Quadrant Baker. Tower 513's Officer's feet held by crew members as the officer crawls to edge of burn through and sweeps hole with TIC, finding no evidence of missing firefighter. Reports findings to Division A.
06:34:02	5C	Command (Batt 503)	<i>"Command to Prince William."</i>
06:34:05	5C	OPSC	<i>"Command."</i>
06:34:08	5C	Command (Batt 503)	<i>"Go ahead and give me a third alarm please."</i>
06:34:13	5C	OPSC	<i>"Direct."</i>



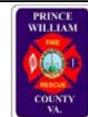
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:34:20	5C	E520's Officer	<i>"Engine 520's portable to Engine 510, charge the booster line."</i>
06:34:27	5C	E520's Officer	<i>"Charge the leader line."</i>
06:34:30	5C	E510's Driver	<i>"OK on leader line."</i>
	Task	E513	Engine 513's crew advances 1 ¾ inch hose line (hooked to leader line) into basement from Side Charlie; makes fire attack and assists with search of basement.
06:34:39	5C	Unknown	Mic click
06:34:46	5C	Unknown	Mic click
06:34:52	5C	Division A (Batt 502)	<i>"Division A to Command."</i>
06:34:56	5C	Command (Batt 503)	<i>"Division A go ahead."</i>



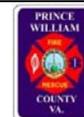
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:34:58	5C	Division A (Batt 502)	<i>"I want to keep this channel for my operations for RIT, if you can switch over to another channel for your fire ground operations. I have Engine 517, Tower 513 with me."</i>
06:35:12	5C	Command (Batt 503)	<i>"OK, I'll switch over to a command channel."</i>
	Task	TW513	TW513 makes stairwell to second floor; scans area with TIC but screen is white out due to high heat. High heat and fire conditions push crew back down stairs.
06:35:29	5C	Command (Batt 503)	<i>"Command to Prince William."</i>
06:35:31	5C	OPSC	<i>"Marsh Overlook Command."</i>
06:35:35	5C	Command (Batt 503)	<i>"Need another channel for command."</i>
06:35:39	5C	OPSC	<i>"Take David."</i>
	5C	Batt 502-1	<i>"Battalion 502-1 to the third alarm."</i>



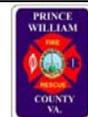
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:36:05	5C	TW512's Aerial Bucket	<i>"Tower 512 X-ray to Command, uh, do you still need us to do ladder pipe?"</i>
06:36:17	5C	Command (Batt 503)	<i>"Command to Division A."</i>
06:36:21	5C	Division A (Batt 502)	<i>"Go ahead."</i>
06:36:25	5C	Command (Batt 503)	<i>"You gonna stay on Charlie?"</i>
06:36:28	5C	Division A (Batt 502)	<i>"Yeah, like to stay on Charlie."</i>
06:36:32	5C	Command (Batt 503)	<i>"Alright 5-David is gonna be command channel."</i>
06:36:37	5C	Unknown	Mic click
06:36:55	5C	RIT Command (Batt 502)	<i>"RIT Command to Command."</i>



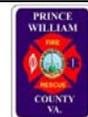
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:37:01	5C	Command (Batt 503)	<i>"RIT Command go ahead."</i>
06:37:04	5C	RIT Command (Batt 502)	<i>"OK, Tower 513, and Engine 517 are out of building, we have a burn through the floor into the basement, we're gonna try to relocate to Charlie (garbled) to make entry on Charlie Side."</i>
06:37:18	5C	Command (Batt 503)	<i>"Copy floor collapse down to basement, your trying to make entry on Charlie Side."</i>
06:37:25	5C	W502's Officer	<i>"Wagon 502 to Command."</i>
06:37:27	5C	E520's Officer	<i>"20's portable to Command."</i>
06:37:35	5C	E520's Officer	<i>"Engine 520's portable to Command."</i>
06:37:39	5C	Command (Batt 503)	<i>"Engine 520's portable switch to 5-David. All units on the fire ground, except for the RIT team, switch to 5-David."</i>
06:37:50	5D	E520's Officer	<i>"Engine 520's portable to Command."</i>



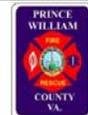
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:37:51	5C	Unknown	Mic click
06:37:54	5D	Command (Batt 503)	<i>"Engine 520's portable."</i>
06:37:59	5C	W502's Officer	<i>"Wagon 502 to Command, RIT 2."</i>
06:38:05	5C	Unknown	Mic click
06:38:07	5D	Command (Batt 503)	<i>"Engine 520's portable."</i>
06:38:24	5D	W512's Officer	<i>"Wagon 512 to Command, we're both low on air, we're going to switch our bottles and reposition at the front door." (low air alarm sounding in background)</i>
06:38:26	5C	Unknown	Mic click
06:38:35	5D	Command (Batt 503)	<i>"Wagon 512 are you saying that you are repositioning to the front door?"</i>



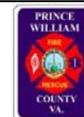
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:38:37	5C	Unknown	Mic click
06:38:40	5C	Unknown	Mic click
06:38:40	5D	W512's Officer	<i>"We're low on air, we need to get our air bottles filled up."</i> (low air alarm sounding in background)
06:38:48	5D	Command (Batt 503)	<i>"Copy."</i>
06:38:51	5C	Unknown	Mic click
06:38:56	5D	Unknown	Open mic
06:39:13	5D	Unknown	Mic click
06:39:22	5D	Command (Batt 503)	<i>"Command to Wagon 520's portable."</i>



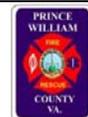
Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:39:27	5C	Unknown	Mic click
06:39:29	5D	Unknown	Open mic
06:39:30	5C	Unknown	Mic click
06:39:33	5C	Unknown	Mic click
06:39:49	5C	Unknown	Mic click
06:39:54	5C	Unknown	Mic click
06:40:00	5C	Unknown	Mic click
	Task	TW513, E517, E520	Tower 513, Engine 517 and Engine 520's crews enter basement to perform search; check basement stairwell.



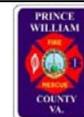
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:40:09	5D	Command (Batt 503)	<i>"Command to Engine 520's portable."</i>
06:40:16	5D	E520's Officer	<i>"Engine 520's portable."</i>
06:40:19	5D	Command (Batt 503)	<i>"Did you have traffic?"</i>
06:40:20	5C	RIT Command (Batt 502)	<i>"RIT to Command."</i>
06:40:23	5D	E520's Officer	<i>"I've already done a face to face with Division A."</i>
06:40:24	5C	Command (Batt 503)	<i>"Go ahead."</i>
06:40:27	5C	RIT Command (Batt 502)	<i>"OK at this time I have Tower 513, Engine 520, Engine 517 in the basement, we're trying, correction Engine 513 in the basement, we're trying to make the stairwell where the fire fighter last scene."</i>
06:40:46	5C	Command (Batt 503)	<i>"Engine 513, Tower 513, yourself and who else?"</i>



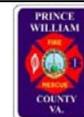
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:41:05	5C	RIT Command (Batt 502)	<i>"OK, radio was busy, uh, Engine 520, Engine 513, Engine 517 that have made entry, Charlie Side in the basement, we're trying to make the stairwell."</i>
06:41:17	5C	Command (Batt 503)	<i>"OK copy 517, 513, Tower 513."</i>
06:41:25	5D	W512's Officer	<i>"Wagon 512 to Command."</i>
06:41:30	5D	Command (Batt 503)	<i>"Wagon 512."</i>
	Task	TW513 & E517	Tower 513 and Engine 517 exit basement to change air bottles.
	Task	E513	Engine 513 exits basement and relocates to Side D.
06:41:30	5C	TW513 Officer	<i>"Tower 513 Officer to command searched basement, Quadrant Alpha, Bravo."</i>
06:41:34	5D	W512's Officer	<i>"Our air bottles are changed, ready for reassignment."</i>



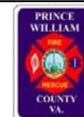
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:41:40	5D	Command (Batt 503)	<i>“Repeat?”</i>
06:41:41	5C	Unknown	Open mic
06:41:44	5D	W512’s Officer	<i>“Our air bottles are changed over, ready for reassignment.”</i>
06:41:49	5C	Unknown	Mic click
06:41:50	5D	Command (Batt 503)	<i>“Alright, I need you to stand by in front yard.”</i>
06:41:57	5C	Unknown	Mic click
06:42:14	5C	Unknown	Mic click
06:42:30	5C	E517’s Officer	<i>“E517 to uh, Alpha Division.”</i>



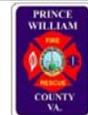
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:42:36	5C	TW513's Officer	<i>"Tower 513 to Command."</i>
06:42:47	5C	TW513's Officer	<i>"Tower 513 to Command."</i>
06:42:56	5C	Unknown	Mic click
06:43:00	5D	TW513's Officer	<i>"Tower 513 Officer to Command."</i>
06:43:02	5C	RIT Command (Batt 502)	<i>"RIT to Command."</i>
06:43:06	5C	Command (Batt 503)	<i>"Command go ahead."</i>
06:43:10	5D	TW513's Officer	<i>"Get everyone out of the structure, been too long."</i>
	Task	TW513	Tower 513 enters first floor, Side Alpha; ascends foyer stairs.



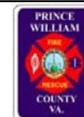
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:43:10	5C	RIT Command (Batt 502)	<i>"OK, I've got Engine 513 making entry on Delta Side, first floor."</i>
06:43:17	5C	Command (Batt 503)	<i>"Copy by ladder, I see them."</i>
06:43:21	5D	E531's Officer	<i>"Engine 531 on the scene."</i>
06:44:01	5D	Command (Batt 503)	<i>"Command to Assistant Chief 514."</i>
06:44:08	5D	AC514	<i>"Go ahead."</i>
06:44:13	5D	Command (Batt 503)	<i>"I need your crew to become Division A and let me know what you need."</i>
06:44:18	5C	Unknown	Mic click
06:44:21	5D	Division A (AC514)	<i>"I'm direct."</i>



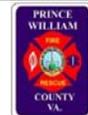
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:44:44	5D	E531's Officer	<i>"Engine 531 on the scene, staging at Marsh Overlook and Duckling."</i>
06:44:49	5C	OPSC	<i>"OK, Engine 531 on scene."</i>
06:44:49	5D	OPSC	<i>"OK Engine 531 on scene."</i>
06:44:55	5D	Command (Batt 503)	<i>"Command to Wagon 512."</i>
06:45:00	5D	Unknown	<i>"Go ahead." (garbled)</i>
06:45:25	5D	Command (Batt 503)	<i>"Command to Wagon 512's crew."</i>
	5C	RIT Command (Batt 502)	<i>"RIT to Command."</i>
06:45:43	5C	Command (Batt 503)	<i>"RIT you calling?"</i>



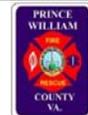
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:45:51	5D	M553's Officer	<i>"Medic 553 on the scene."</i>
06:45:52	5C	RIT Command (Batt 502)	<i>"Disregard. I got another crew to assist, uh, we're gonna try to make this stairwell, up into the Charlie Division, in order to search that bedroom where fire fighter last seen, trying to breach through the wall to access."</i>
06:46:20	5C	Command (PLN 501)	<i>"Command direct, Charlie Quadrant."</i>
	Task	E513	Engine 513 breaches family room/rear staircase wall into master suite area; determine breach is in master bathroom and Engine 513's Officer performs visual check of bathroom through hole. Crew moves further up rear staircase and breaches a second location which is determined to be in master bedroom; unable to perform visual check due to conditions and area is swept with TIC but no shapes identified due to room containing high heat conditions.
	Task	E513 & TW513	Engine 513's and Tower 513's Officers meet at second floor landings of foyer and rear staircases. All angles of master bedroom are scanned with TICs but high heat conditions cause a white out on the screens. Unable to visualize room due to poor conditions. Crews back down due to high heat and fire conditions.
06:46:28	5D	Command (Batt 503)	<i>"Command to Engine 504, correction Engine 518."</i>



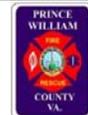
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:46:35	5C	RIT Command (Batt 502)	<i>"OK, RIT to Command."</i>
06:46:37	5D	E518's Officer	<i>"Go ahead chief, Engine 518."</i>
06:46:41	5D	Command (Batt 503)	<i>"Come over here to the driver's side."</i>
	5C	Command (PLN 501)	<i>"Go ahead RIT."</i>
06:46:41	5C	RIT Command (Batt 502)	<i>"I need a fresh crew assigned to me on David Side of structure."</i>
06:46:48	5C	Command (PLN 501)	<i>"Command direct, fresh crew David Side of structure."</i>
06:46:55	5C	W502's Officer	<i>"Wagon 502 RIT to Command."</i>
06:47:06	5C	W502's Officer	<i>"W502 RIT to RIT Command."</i>



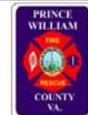
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:47:16	5D	SAF 502	<i>"Safety 502 to Command."</i>
06:47:18	5C	Command (PLN 501)	<i>"Command to RIT, you've got Engine 518 coming to your location."</i>
06:47:24	5D	Command (Batt 503)	<i>"Command to Safety 502, go ahead."</i>
06:47:24	5C	W502's Officer	<i>"Wagon 502 RIT someone set off pass 5-Charlie, 5-Charlie (garbled), 5-Charlie, number two floor searching for victim." (garbled)</i>
06:47:29	5D	SAF 502	<i>"Make sure we keep crews out of uh, Alpha and Bravo Quadrant, they look like they are going to collapse, uh Charlie and Delta should be OK for now."</i>
06:47:39	5C	Unknown	<i>"Engine 512."</i>
06:47:40	5D	Command (Batt 503)	<i>"OK, copy no crews on Alpha, Bravo; Charlie, Delta are OK."</i>
06:47:52	5D	Command (Batt 503)	<i>"Command to Rescue Squad 504."</i>
06:47:58	5D	R504's Officer	<i>"Rescue 504 Officer go ahead."</i>



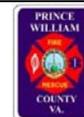
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:48:03	5D	Command (Batt 503)	<i>"Report to the Command Post."</i>
06:48:07	5C	RIT Command (Batt 502)	<i>"OK RIT to Command."</i>
06:48:16	5D	W512's Officer	<i>"Wagon 512 to Command, (garbled) Engine 518 told us to report to rehab, where is that located?"</i>
06:48:23	5C	Unknown	Mic click
06:48:27	5C	Unknown	Mic click
06:48:51	5C	Command (PLN 501)	<i>"Command, go ahead RIT."</i>
06:48:53	5D	W512's Officer	<i>"Wagon 512 to Command."</i>
06:48:56	5C	RIT Command (Batt 502)	<i>"OK uh, is someone on Side A monitoring any master streams? We are operating Charlie Quadrant right now where bulk of collapse was and firefighter last seen."</i>



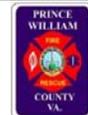
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:48:58	5D	Command (Batt 503)	<i>“Wagon 512.”</i>
06:49:01	5D	W512’s Officer	<i>“Engine 518 advised us we are suppose to report to rehab, where is that located?”</i>
06:49:08	5D	Command (Batt 503)	<i>“At the Command Post on Side A, other side of Engine 510.”</i>
06:49:09	5C	W502’s Officer	<i>“Wagon 502 RIT to Command.”</i>
06:49:13	5C	Command (PLN 501)	<i>“Alright I have you in the Charlie Quadrant, what floor?”</i>
06:49:14	5D	W512’s Officer	<i>“We just got new bottles, we’re ready, can we stay up here and help?”</i>
06:49:18	5C	RIT Command (Batt 502)	<i>“Second floor is where they are searching right now, that’s where the collapse is.”</i>
06:49:20	5D	Command (Batt 503)	<i>“Negative, I want you to report to the Command Post.”</i>



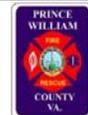
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:49:26	5C	W502's Officer	<i>"We started on the main floor, number one floor, we've gone to two floor but running out air, we're exiting the building. This is Wagon 502."</i>
06:49:39	5D	Command (Batt 503)	<i>"Command to all units operating master streams, do not place them at Charlie and Delta Sides at this time."</i>
06:49:41	5C	RIT Command (Batt 502)	<i>"OK RIT to Command uh, the other collapse in the upper bedroom is in Quadrant B. Uh, we have attempted to search that but there is too much collapse up there to continue."</i>
06:49:55	5C	Command (PLN 501)	<i>"Command's direct. We've got the guys watching the master stream, you should get some relief."</i>
06:50:03	5C	Unknown	Mic click
06:50:13	5C	Command (PLN 501)	<i>"Command to RIT. Did you have uh, Engine 518 report to you?"</i>
06:50:20	5C	RIT Command (Batt 502)	<i>"Negative, have not seen them. I have Rescue Squad 4 on Side David with their extrication equipment, trying to breach some of this collapse."</i>
06:50:58	5C	W502's Officer	<i>"Wagon 502 RIT to Command."</i>



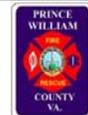
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:51:04	5D	Command (Batt 503)	<i>“Unit calling Command?”</i>
06:51:07	5C	W502’s Officer	<i>“Wagon 502 RIT on 5-Charlie.”</i>
06:51:12	5C	RIT Command (Batt 502)	<i>“Who’s calling RIT?”</i>
06:51:13	5C	Unknown	Mic click
06:51:13	5D	Command (Batt 503)	<i>“Go ahead Wagon 502.”</i>
06:51:18	5C	W502’s Officer	<i>“Wagon 502 RIT, 5-Charlie we are PAR, out of building, out of air, getting new bottles and will be ready for reassignment.”</i>
06:51:27	5C	RIT Command (Batt 502)	<i>“Copy Engine 502 you are out of the building. You advise you are low on air?”</i> (Low air alarm sounding in background)
06:51:37	5C	W502’s Officer	<i>“Affirmative, we’re changing bottles and will be ready for reassignment.”</i>



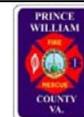
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:51:45	5C	Unknown	Mic click
06:51:48	5C	Unknown	Mic click
06:51:52	5C	Unknown	Mic click
06:51:59	5D	R504's Officer	<i>"Rescue 504's Officer to Command."</i>
06:52:01	5C	Unknown	Mic click
06:52:11	5D	Division A (AC514)	<i>"Chief 514's crew to Command."</i>
06:52:16	5D	Command (Batt 503)	<i>"Command to all units on third alarm, report to Command Post."</i>
06:52:35	5D	E520's Officer	<i>"Engine 520's portable to Division A."</i>



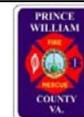
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:52:42	5D	Division A (AC514)	<i>"Division A."</i>
06:52:46	5D	Unknown	<i>"Stairwell going to the second floor from the front door, had that been checked?"</i>
06:52:55	5D	Unknown	<i>"At this time, making entry with a 1 ¾." (garbled)</i>
06:52:56	5C	Unknown	Mic click
	5C	Unknown	Mic click
06:53:05	5C	RIT Command (Batt 502)	<i>"RIT to Engine 513's Officer."</i>
	5C	Unknown	Open mic
06:53:14	5D	Command (Batt 503)	<i>"Command to Division A, meet up with Safety 504 in the front yard."</i>



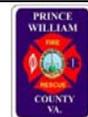
Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	5C	Unknown	Mic click
	5C	Unknown	Mic click
	5C	Unknown	Mic click
06:53:25	5D	Division A (AC514)	<i>"Division A to Command, who do I need to meet up with?"</i>
06:53:31	5D	Command (Batt 503)	<i>"Repeat Division A?"</i>
06:53:36	5D	Division A (AC514)	<i>"Who do I need to meet up with?"</i>
06:53:40	5D	Unknown	Mic clicks
06:53:43	5D	Command (Batt 503)	<i>"Safety 504."</i>



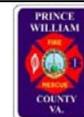
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:53:50	5D	Command (Batt 503)	<i>“Command to Engine 531.”</i>
06:53:57	5D	E531’s Officer	<i>“Go ahead.”</i>
06:54:01	5D	Command (Batt 503)	<i>“Need you to report to Side David and report to RIT Command.”</i>
06:54:09	5D	E531’s Officer	<i>“Direct.”</i>
06:54:58	5D	OPSC	<i>“Prince William to Marsh Overlook Command.”</i>
06:55:17	5C	Unknown	Mic click
06:55:31	5D	OPSC	<i>“Prince William to Marsh Overlook Command, call Fire Lieutenant at 6813.”</i>
06:55:38	5D	Command (Batt 503)	<i>“Copy.”</i>
06:56:13	5D	Unknown	Several mic clicks



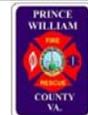
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:56:18	5D	Unknown	Mic click
06:56:26	5C	RIT Command (Batt 502)	<i>"OK RIT to Command."</i>
06:56:30	5C	Unknown	Open mic
06:56:35	5D	W520's Officer	<i>"Wagon 520's on the scene."</i>
06:56:38	5C	Unknown	Mic click
06:56:40	5D	OPSC	<i>"On the scene Wagon 520 at 0656."</i>
06:56:40	5C	OPSC	<i>"On scene Wagon 520 at 0656."</i>
06:56:51	5C	Unknown	Mic click



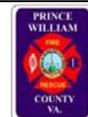
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:56:56	5D	Unknown	Mic click
06:57:29	5C	Unknown	Mic click
06:57:34	5D	Division A (AC514)	<i>"Division A to Command."</i>
06:57:39	5D	Command (Batt 503)	<i>"Division A."</i>
06:57:42	5D	Division A (AC514)	<i>"We have found the missing firefighter; second floor Quadrant, between Quadrant Alpha and David."</i>
06:57:42	5C	Unknown	Mic click
06:58:00	5D	Command (Batt 503)	<i>"Alright, can you remove him?"</i>
06:58:03	5C	Unknown	Mic click



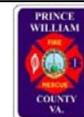
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	5C	Unknown	Mic click
06:58:08	5D	Division A (AC514)	<i>"We, stand by."</i>
06:58:11	5C	Unknown	Open mic (at 06:58:29 – background traffic includes <i>"stand-by, incident command third floor"</i> )
06:58:12	CAD	OPSC	"Found missing ff 2 <sup>nd</sup> floor quad a & d"
	5C	Unknown	Mic click
	5C	Unknown	Mic click
06:58:20	5D	Unknown	Open mic
06:58:25	5D	Division A (AC514)	<i>"I need to do a face to face with RIT Command, first floor, Side A. I need to do a face to face with RIT Command, first floor, Side A."</i>



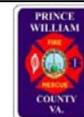
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
06:59:33	5C	Unknown	Open mic. (background traffic includes <i>"I want to get in there"</i> )
07:00:14	5C	Rehab 520	<i>"Rehab 520 on scene, I'll be setting up behind Rescue Squad 4."</i>
07:00:24	CAD	OPSC	Rehab 520 logged on scene.
07:00:26	5C	TW513's Officer	<i>"Tower 513's Officer to x-ray (garbled) traffic to Side A."</i>
07:00:43	5C	RIT Command (Batt 502)	<i>"RIT to Command."</i>
07:00:51	5C	Command (PLN 501)	<i>"Go ahead RIT."</i>
07:00:55	5C	RIT Command (Batt 502)	<i>"I'm pulling all crews out, I need them to go to rehab, we're go into recovery mode at this time. I'm holding Wagon 512, (garbled), 04 only in the building."</i>
07:01:14	5C	Command (PLN 501)	<i>"Command's direct."</i>



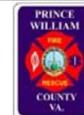
Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
07:01:18	5C	RIT Command (Batt 502)	Open mic
07:02:20	5C	RIT Command (Batt 502)	<i>"RIT to Wagon 512's Officer."</i>
07:02:30	5C	Command (Batt 503)	<i>"Command to Prince William on Charlie."</i>
07:02:38	5C	RIT Command (Batt 502)	Open mic
07:02:40	5C	OPSC	<i>"Prince William to Marsh Overlook Command, do you need a helicopter?"</i>
07:02:41	5C	Unknown	Open mic
07:02:43	5C	OPSC	<i>"Prince William to Batt 5, excuse me, correction Marsh Overlook Command, do you need a helicopter?"</i>
	5C	Unknown	Open mic



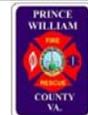
Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
	5C	Unknown	Mic click
	5C	Unknown	Mic click
	5C	Unknown	Open mic
07:07:17	5C	R504's Officer	<i>"Rescue 504's crew come around out front."</i>
07:07:33	5C	OPSC	<i>"Prince William to Marsh Overlook Command."</i>
07:08:18	5C	OPSC	<i>"Prince William to Marsh Overlook Command."</i>
07:08:44	5C	Unknown	Mic click
07:08:48	5C	W512	Open mic (engine noise in background)



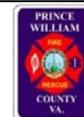
## Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
07:09:10	5C	OPSC	<i>"Prince William to Wagon 512." (garbled &amp; barely audible)</i>
07:09:23	5C	OPSC	<i>"Prince William to Wagon 512 you have an open mic." (barely audible).</i>
07:09:58	5C	OPSC	<i>"Prince William to Wagon 512, you have an open mic."</i>
07:11:28	5C	Unknown	Mic click
07:11:33	5C	E513's Officer	<i>"Engine 513 to Division A."</i>
07:11:57	5C	Unknown	Mic click
07:14:07	5C	OPSC	<i>"Marsh Overlook Command."</i>
07:14:12	5C	Unknown	Open mic



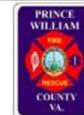
Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
07:14:23	5C	OPSC	<i>“Direct.”</i>
07:14:48	5C	Unknown	<i>“Division A, go ahead.”</i>
07:14:52	5C	Unknown	Mic click
07:15:36	5C	Unknown	Mic click
07:15:56	5C	Unknown	Mic click
07:28:17	5C	RIT Command (Batt 502)	<i>“RIT to Safety.”</i>
07:28:25	5C	RIT Command (Batt 502)	<i>“RIT to Command.”</i>
07:28:30	5C	Command (PLN 501)	<i>“Go ahead RIT.”</i>



Reconstructed Timeline

Time	Channel or Task	Unit	Message or Task
07:28:34	5C	RIT Command (Batt 502)	<i>"We've had collapse on Side A of the structure, everyone's OK, I need Safety, to mark off this area as a restricted area of collapse."</i>
07:29:12	5C	Unknown	Mic click



# Appendix D

## Glossary

## Glossary

**Accountability:** A system to track the number of members and their areas of operation.

**Alert II Signal:** The tone used by OPSC to signal an emergency evacuation.

**Ambulance:** A transport unit that provides basic life support (BLS) care to patients. The letter "A" is in their unit designation.

**Authority Having Jurisdiction:** An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or procedure.

**Battalion:** A geographical area containing a group of stations within the County.

**British Thermal Unit (BTU):** Amount of energy that is required to raise one pound of water one degree Fahrenheit.

**Command:** An incident command system position responsible for overall management of the incident. The term Command is synonymous with the Incident Commander.

**Computer Aided Dispatch (CAD):** A system that assists dispatchers in the proper recommendation of units based on location and call type.

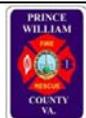
**Chaplain:** A member of the clergy, who is a County volunteer that serves to assist fire and rescue personnel and citizens experiencing public safety related emergencies.

**COG:** Acronym for Council of Governments. COG is a regional organization of Washington area local governments. COG is composed of 21 local governments surrounding the nation's capital, plus area members of the Virginia and Maryland legislatures, the U.S. Senate, and the U.S. House of Representatives.

**Command Post (CP):** Location at which primary command functions are executed.

**Department Rank Levels:** The following rank levels are utilized in the Prince William County Department of Fire and Rescue:

**Chief:** The highest ranking officer in the Department of Fire and Rescue. The Fire and Rescue Chief also serves as the Chairman of the Fire and Rescue Association.



## Glossary

**Assistant Chief (AC):** The second highest ranking officer level in the Department of Fire and Rescue and is responsible for the oversight of a division.

**Battalion Chief (BC):** The third highest ranking officer level in the Department of Fire and Rescue and is responsible for the oversight of a battalion or major program area.

**Captain (Capt):** An officer level that functions as a station commander or is assigned to assist oversight and coordination of a major program area.

**Lieutenant (Lt):** An officer level that functions as a unit supervisor or is assigned to assist captains in program area coordination.

**Technician II (Tech II):** A technical rank that primarily functions as a driver operator and is capable of performing as a unit leader in absence of an officer. A Technician II may also be assigned to assist with program areas.

**Technician I (Tech I):** An entry level technical rank that is primarily assigned to emergency response apparatus.

**Division:** An incident command system organization level. Divisions are used to divide an incident into geographical areas of operation.

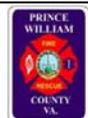
**Division/Group Supervisor:** An incident command system position responsible for supervising personnel and resources assigned to a division or group.

**Emergency Evacuation:** The immediate withdrawal of personnel from a structure or area.

**Engine:** Name given to fire apparatus in Prince William County that is used to supply hose lines and/or supply lines at a working fire. The letter "E" is used in their unit designation. The name "Engine" and "Wagon" are interchangeable in reference to fire ground capabilities.

**Fire and Rescue Association Written Direction System:** A written direction system promulgated by the Fire and Rescue Association for its members (twelve volunteer and one career department). The written direction system applies to and organizes the material by functional area for any retrieval and reference.

**Policy:** A form of written direction document which provides general statements of a course of action or desired effect which guides decision making to accomplish the organization's mission. A policy establishes



## Glossary

parameters within which a decision shall be made. It establishes the "what to do." Policies do **not** include detailed instruction on how to carry out activities.

**Procedure:** A form of written direction document which provides a series of detailed steps which instruct the user of the desired way to implement policy. It establishes the "how to do it." Procedures can specify either **mandatory actions** or provide **guidelines for actions**.

**Directive:** A form of written direction, either regulatory or discretionary in nature, which specifies the desired way to implement policy. Directives also are "how to do it" documents. Directives are issued instead of procedure for one of three reasons:

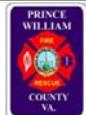
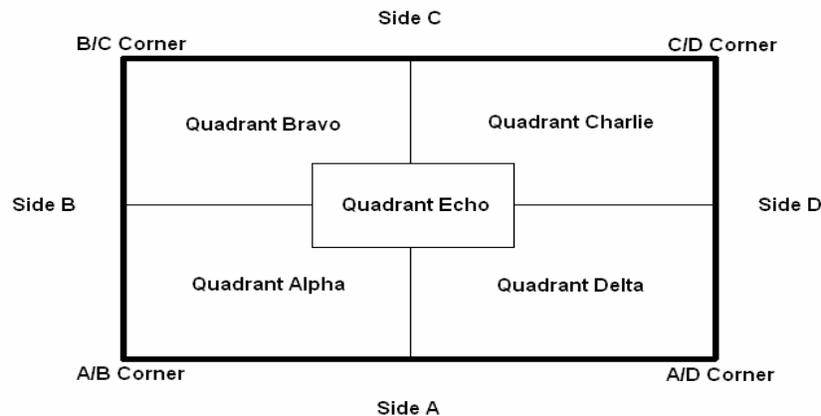
- The contents are of an emergency nature which does not allow following the development process for procedures.
- The contents apply to a limited part of the organization.
- The contents have a limited effective life.

**Note:** In addition to the Fire and Rescue Association written direction system, the Department of Fire and Rescue maintains an additional written direction system for those policies, procedures, and directives specific to the career department only.

**Fire Flow:** The result of calculations made to determine the number gallons of water per minute needed to extinguish a fire.

**Gallon Per Minute (GPM):** A unit of measurement to calculate fluid flow, such as water or pump capacity.

**Geographical Designations:** Terminology to identify a location in and around a structure.



## Glossary

**Side A:** The term used to name the address side of a structure. This side has Side B and Side D bordering it.

**Side B:** The term used to name the side of the structure that is located clockwise from Side A. This side has Side A and Side C bordering it.

**Side C:** The term used to name the side of the structure that is located clockwise from Side B. This side has Side B and Side D bordering it.

**Side D:** The term used to name the side of the structure that is located clockwise from Side C. This side has Side C and Side A bordering it.

**Group:** An incident command system organization level. Groups are used to divide an incident into functional assignments (i.e. rescue, ventilation, salvage, water supply, etc.).

**Hose Line:** Hose is the tool used to move water from one place to another. Hose lines are described by their size (diameter).

**1 ¾ inch hose line:** Primary fire attack hose line used in Prince William County.

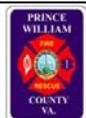
**2 ½ inch hose line:** Primary large flow attack hose line used in Prince William County.

**Immediately Dangerous to Life and Health (IDLH):** An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

**Incident Action Plan:** The incident action plan contains general control objectives reflecting the overall incident strategy and specific action plan for the given operational plan.

**Incident Commander (IC):** An incident command system position responsible for overall management of the incident. The term Incident Commander is synonymous with Command.

**Incident Command System:** A standardized on-scene emergency management concept specifically designed to allow it user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.



## Glossary

**Mayday:** The term used only to report firefighters who are lost, trapped, disoriented, or in a life threatening situation.

**Medic:** A patient transport unit that provides advanced life support (ALS) care to patients. The letter “M” is in their unit designation.

**Nomex®:** Trade name for fire resistant synthetic material used in the manufacturing of PPE used by firefighters.

**Mode of Operation:** A strategic plan for the initiation of operations based on size up of incident conditions.

**NOVA:** Acronym for Northern Virginia. In this document it is referring to the Northern Virginia Fire Services Coalition.

**OPSC:** Acronym for the Office of Public Safety Communications. OPSC is a separate entity and provides for the command, control, and information support services that are needed by fire and rescue services and the police department. OPSC telecommunicators answer 911 and non-emergency public safety calls and dispatch fire, rescue, emergency medical services (EMS), police, and animal control services for Prince William County, the towns of Dumfries, Haymarket, Occoquan, and Quantico.

**PAR Check:** PAR is an acronym for Personnel Accountability Report. A PAR check is the process where the Incident Commander or division/group leader calls all assigned units to ensure the accountability of their personnel.

**PASS Device:** Acronym for a personal alert safety system. A PASS device is a personal safety piece of equipment used by firefighters entering a hazardous environment such as a burning building, which sounds a loud audible alert to notify others in the area that the firefighter is in distress. PASS devices may be integrated within the SCBA equipment or worn as a separate device.

**Personal Protective Equipment (PPE):** Equipment and clothing required to reduce the risk of injury from, or exposure to, hazardous conditions encountered during the performance of duty.

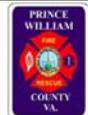
**Pressure Governor:** An electronic control device for an engine’s pump which is designed to maintain a selected pressure or engine speed setting. The control device can be set to a RPM or Pressure Mode.

**Radio Channel:** A radio channel assigned to organize a group of radio users who share a need to communicate with each other.



## Glossary

- 5-Alpha (5A):** The radio channel that all incidents are initially dispatched on in Prince William County.
- 5-Charlie (5C):** A tactical radio channel that incidents can be moved to consolidate radio users. 5 Charlie is the primary incident channel used in Prince William County.
- 5-David (5D):** A tactical radio channel that an incident can be moved to consolidate radio users. 5 David is a secondary incident channel used in Prince William County.
- Rapid Intervention Team (RIT):** A team consisting of at least three firefighters, one of which is an officer that is immediately available to respond to requests for help from lost, trapped or incapacitated firefighters.
- Rescue:** Name given to fire apparatus in Prince William County that is used to carry specialty equipment such as vehicle extrication equipment, rope rescue equipment, and confined space equipment. The letter “R” is used in their unit designation.
- RSAN:** Acronym for the Roam Secure Alert Network. RSAN is a third party emergency notification system that sends text messages to e-mail accounts and wireless devices.
- Safety Officer:** Responsible for monitoring and assessing safety hazards, unsafe conditions, and developing measures for ensuring personnel safety during an incident.
- Self Contained Breathing Apparatus (SCBA):** An atmosphere supplying respirator for which the breathing air source is designed to be carried by the user.
- Situational Awareness:** The knowledge of being aware of a situation as it actually exists.
- Size Up:** The objective of the size-up is to identify the nature and severity of the immediate problem and gather sufficient information to formulate a valid action plan.
- Span of Control:** A supervisor’s functional ability to monitor the activities of assigned subordinates and to communicate effectively with them. An effective span of control is between three and seven subordinates, with five being optimum and seven being the maximum.



## Glossary

**Thermal Imaging Camera (TIC):** A camera that uses infrared technology to locate victims during search and rescue operations and locate hidden fire.

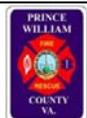
**Truck:** Name given to fire apparatus in Prince William County that has an aerial device, but does not have a bucket on the end of its aerial. It is also used to carry specialty equipment such as vehicle extrication equipment, rope rescue equipment, and confined space equipment. The letter “T” is used in their unit designation.

**Tower:** Name given to fire apparatus in Prince William County that has an aerial device as well as a bucket on the end of its aerial. It is also used to carry specialty equipment such as vehicle extrication equipment, rope rescue equipment, and confined space equipment. The letters “TW” is used in their unit designation.

**Type V-B Construction:** Type V construction is typically wood frame construction. Type V-B construction does not require any fire rating of the building elements.

**Wagon:** Name given to fire apparatus in Prince William County that is used to supply hose lines and/or supply lines at a working fire. The letter “W” is used in their unit designation. The name “Wagon” and “Engine” are interchangeable in reference to fire ground capabilities.

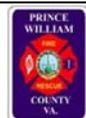
**Walk Around:** The act of walking around an emergency incident to conduct a scene size up.



**Appendix E**  
**Reference**  
**List of**  
**Procedural**  
**Memorandums**

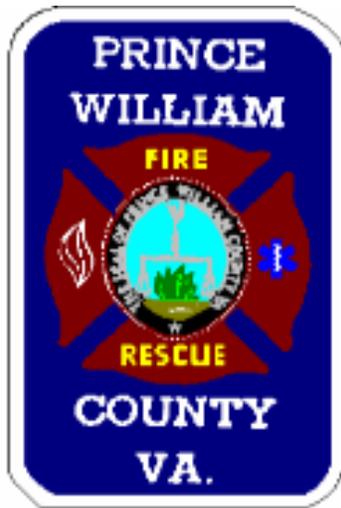
Reference List of  
Procedure Memorandums

Type	Number	Title	Effective Date
Association	4.5.1	Uniform Rank Structure	03/15/05
Association	5.1.1	Personnel Accountability Reporting System (PARS)	07/01/06
Association	5.1.6	Operational Guidelines	06/19/96
Association	5.1.14	Emergency Evacuation	03/19/03
Association	5.1.16	Prince William County Specific Additions to COG's Fire and Rescue Services Mutual Aid Operational Plan (ICS)	06/01/03
Association	5.1.18	Building Preplan	09/15/04
Association	5.3.3	Dispatch Complements	07/17/02
Association	5.5.2	Rapid Intervention Team	07/01/06
Association	5.5.3	Personnel Deployment during the Initial Stages of Interior Structural Firefighting and IDLH Incidents	07/01/97
Association	9.1.1	Protective Clothing and Equipment	04/16/97
Association	9.1.2	Respiratory Protection Program	10/16/02
Association	10.1.1	Establishment of Additional Operations Channels	04/20/94
Association	10.1.7	Radio Operations	10/20/04
Department	4.0.4	Line of Duty Death/Serious Injury	03/17/04
Department	5.5.1	Standardized Strategic/Tactical Activity Guides for Structure Fires	11/01/01
Fire & Rescue	C-85-72	Weather Watch, Warning and Emergencies	07/15/86
OPSC		Emergency Activation – Fire Dispatch	06/08/05 (Amended 09/12/05)
OPSC		Incident Time Stamps and Progress Reports	01/20/06



**Appendix F**  
**Radio Test**  
**Report**

# RADIO TEST



May/June 2007

## **Table of Contents**

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**PRINCE WILLIAM COUNTY  
DEPARTMENT OF FIRE AND RESCUE**

**December 12, 2007**

**RADIO TESTS - MAY 22, JUNE 7 AND JUNE 15, 2007**

**RECAP OF OBSERVATIONS**

**Department of Fire and Rescue**

Assistant Chief Brett Bowman	Technician II Ray Perez
Battalion Chief Jennie Collins	Technician II Chris Alloway
Battalion Chief Steven Kersse	Technician I Walter Burkart
Battalion Chief Jerry Shepherd	Technician I William Carson
Battalion Chief Matt Smolsky	Technician I Daniel McGee
Captain Rob Clemons	Technician I Mitch Nason
Captain Brian Cooke	Recruit Jack Brennan
Captain Bill Walker	CIP Coordinator Donna Poillucci
Lieutenant Erick McCoy	

**Office of Public Safety Communications (OPSC) Staff**

Captain Ted McInteer  
John Maddox  
Joe Mize  
Linda Norman  
Sheila Ragan

**Office of Information Technology (OIT) Communications Team**

Alex Barton  
Steven Day  
Wayne Newton  
Sam Somers  
Dave Summerfield

**Motorola**

Mark Waters  
Edward Shock

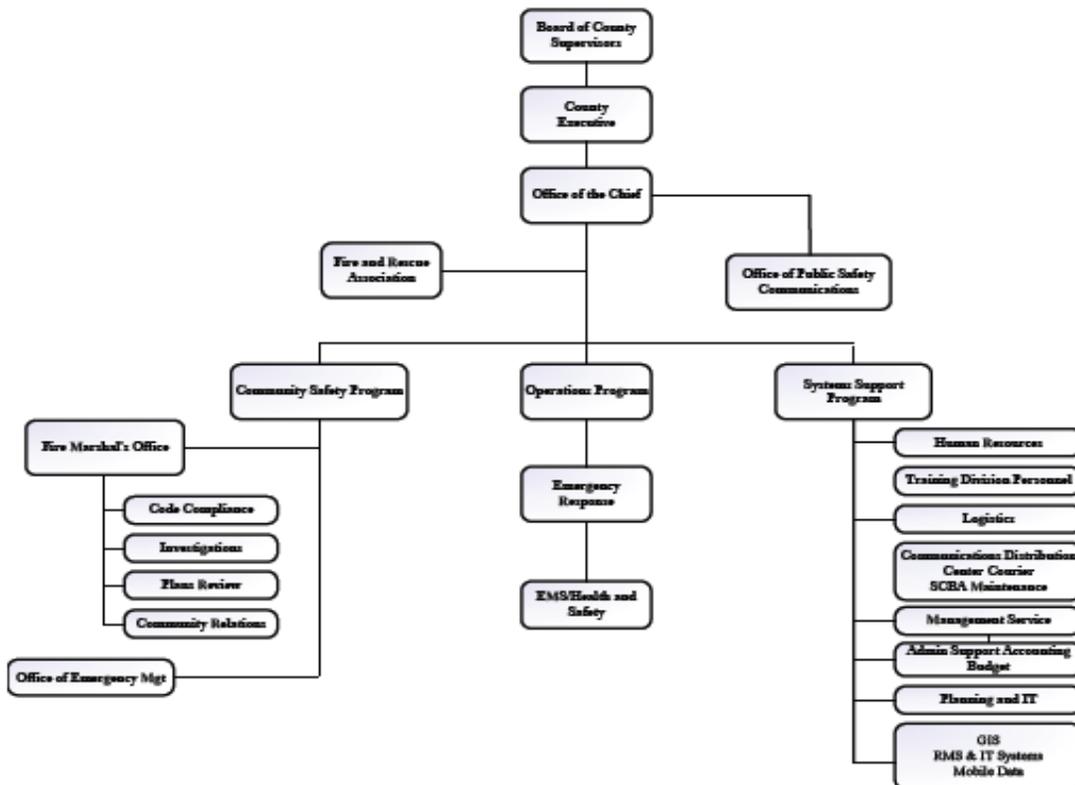


## Fire and Rescue Service Delivery Overview

The vision of the Board of County Supervisors includes that . . .Prince William County (County) is a premier community where we treasure the richness of our past and the promise of our future. We are diverse and dynamic with a thriving economy where citizens and businesses grow and succeed together. We are a global business and technology leader for the 21st century.

The delivery of fire and emergency medical services within the County are provided by the Department of Fire and Rescue (DFR) and twelve independent volunteer fire and rescue organizations. The Fire and Rescue Association (FRA) provides for the administration and coordination of fire and rescue services in the County. The mission of the FRA is to ensure the delivery of quality, efficient, and effective fire protection, emergency medical services, and safety education to the community of Prince William County.

Prince William County, Virginia, is a rapidly developing urban fire community located 35 miles southwest of Washington, D.C. The County encompasses 348 square miles with two independent cities, a Marine Corps base, and two National Parks. The current population is estimated at 387,714. Fire and Rescue had 80,136 unit responses answering approximately 38,345 incidents in Fiscal Year 2006. The Service also provides programs as outlined in the DFR organizational chart below.



## **Radio Field Test**

The Department of Fire and Rescue conducted four field tests of the Motorola portable radios and accessories on May 22, June 7, June 15 and June 28, 2007. The Motorola Astro XTS 5000 Model II and an extended microphone model NMN6191C was used for the tests on May 22, 2007. The Motorola Astro XTS 5000 Model II and 5000R Model III were used during testing on June 7, 2007. The extended microphones NMN6193C and NMN6193BSP03 were used in addition to the NMN6191C. The Motorola Astro XTS 5000 Model II was used during testing on June 15, 2007. The testing on June 28, 2007 utilized the Motorola Astro XTS Model II. The extended microphones used included model numbers MNM6193C, NMN6193BSP03, NMN6191C, RMN5088A and RMN5066A.

The purpose of these tests was to address numerous comments from field providers that were shared with the Marsh Overlook Investigation Team and to follow-up on the information gained in each of the previous tests. Personnel involved with the testing included members of the Marsh Overlook Investigation Team, Fire and Rescue Planning and Information Group (PIG), Fire and Rescue Health and Safety, Fire and Rescue administrative staff and Fire and Rescue field team members, as well as personnel with the Office of Public Safety Communications (OPSC – the dispatch center) and Office of Information Technology (OIT) Communications Team. The test incorporated multiple scenarios that were repeated several times, and each was documented. Motorola sent representatives to observe the June 7, 2007 testing and supplied additional radios, accessories and insight during the testing.

The scope of the testing was to:

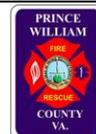
- Identify strengths and weaknesses of the portable radios and accessories (to include extended microphones);
- Determine what impact, if any, water has on the portable radios and/or accessories;
- Evaluate system performance with a single Emergency Activation (EA), as well as with multiple Emergency Activations (EAs).

The test results and data have been compiled and are included in this report. Based upon the results of the first test, other tests were conducted to obtain a better understanding of the radios, extended microphones and their capabilities.

### **Definitions**

Emergency Activation (EA) – With the radio turned on, press the orange Emergency Button. This sends an emergency transmission to the OPSC and identifies the radio sending the signal.

Evacuation Tone – Tone sent from the OPSC to notify on scene emergency personnel to



evacuate a structure.

Failure – Preventing effective communications of simple messages from sender to receiver.

Knock Down – Action from the OPSC that clears the Emergency Activation(s).

Silence – Action from the OPSC that stops the audible tone of the Emergency Activation at the dispatchers' consoles. The Emergency Activation is still visualized on the console.

### **Test Setup / Overview**

The testing was performed at the Owens Building at the McCoart Complex and Dale City Volunteer Fire Station 18. The OPSC staff occupied the Communications Center using the overflow position for Fire and Rescue. The remainder of the test participants were at the field sites directly behind the Owens building near the loading ramps for the first two tests and then at Fire Station 18 for the final test. In each test an engine was hooked to a hydrant and flowed a wide fog nozzle master stream to produce a heavy rain environment using only hydrant pressure. Testing on June 28, 2007 was limited to EA testing with mutual aid departments only.

The test radios were in standard radio pouches, worn on the outside of the firefighters' personal protective equipment (PPE). No attempt was made to artificially shield or increase the water exposure to the radios. Late in the first test, after failure of the extended microphone had already occurred, the radios were purposefully placed in a puddle of dirty water.

Failure initially manifested in cracks and pops, which caused significant distortion and full failure of the extended microphone. Upon failure, the EA was activated. Failure of the portable radio without the extended microphone also occurred by definition of this test. The push to talk feature continued to operate but effective communications was not achieved as the portable radios transmissions were unintelligible and the portable radio could not understand simple commands received on the portable radio. This occurred in all three testing dates.

The primary findings of this test include the following. (This list is not in priority order.)

### **Strengths**

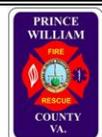
- The portables obtain the best signal strength when operated with the antenna in a vertical position.
- In all tests, for all radios utilized, all EAs were successful in a non-talk-around channel. This included an EA with a mutual aid department.



- When multiple EAs are activated, all transmit; however, the radio with the strongest signal will have priority when transmitting voice simultaneously.
- The dispatchers can hear the EA and open microphone at the dispatch console even with the evacuation tones being sounded.
- The portable radios are very resilient and recover from being wet in a short period of time even after submersion in dirty water.
- You can possibly improve the quality of a wet radio by attempting to eliminate water from the radio by turning it over and shaking or hitting the microphone against your hand. This helps drain the water from the speaker area and may improve performance.
- Changing the head of the speaker microphone will also allow the radio to function again. This appears to narrow the issue to the head portion of the speaker microphone.

### Weaknesses

- Operating the radio with the antenna in a horizontal position or covered by heavy clothing/coats will diminish some of the signal strength. While this impedance is not usually noticeable, it could make a difference if you are in a marginal signal strength area.
- Evacuation tones prevent field units from hearing an EA and the open microphone regardless if the EA occurs prior to, or after, initiation of the evacuation tones.
- The EA will not work when using talk-around channel (“50” for PWC).
- “50” cannot be monitored or recorded in the OPSC
- The portable radio with an extended microphone was negatively affected by water, including complete failure of the extended microphone to transmit or receive. Although the extended microphone failed, the radio's EA continued to work. There was no appreciable difference in performance of any of the extended microphones used for these tests.
- The portable radio without the extended microphone was also negatively affected by water. This affected the speaker quality. The radio became very difficult, if not impossible, to understand. There was no appreciable difference in performance of any of the radios used for these tests.
- When the radios, with or without an extended microphone, are wet, voice transmission and reception are extremely difficult and at times impossible to understand.
- The extended microphone failed completely and gave a “squeal” sound, it would then no longer transmit or receive.
- Background noise affects radio performance. Water directly hitting the speaker area caused a great deal of noise to be transmitted along with the voice. The user can attempt to shield the speaker area with the other hand to improve the sound quality.
- Batteries for the portable radios that read 70% or less capacity need to be replaced.

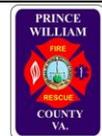


- OPSC personnel have difficulty hearing the 10-second open microphone. This is due to the audible tone for EA and voice transmission simultaneously.
- OPSC needs to silence an EA in order to hear the open microphone.
- If OPSC knocks down any single EA, displays on field units go back to normal operations. If OPSC knocks down an individual EA during multiple EAs, all of the EAs are knocked down.
- After an EA is silenced, no automated mechanism re-alarms the dispatcher. OPSC staff stated that just silencing the EA alone should trigger a re-alarm in 45 - 60 seconds if the EA is not knocked down. During our testing, a re-alarm only occurred one time but could not be replicated through any other testing. It is unclear what caused the re-alarm.
- After removing the power from a portable radio that had transmitted an EA (battery removed) and then replacing the battery, the field units reset, the consoles continue to show EA.
- Activation of an EA over a mutual aid talk group only allows the mutual aid department to identify their radio identification number. This number is not the same identification number assigned to the radio from the originating department. (example - PWC assigned radio identification number 716090 to one of PWC radios. Fairfax County has assigned number 00750061 to the same radio. Manassas City has another number for this radio and so on). It does not allow the mutual aid department to identify what position, unit, or County the activation is from.

## **Overall Findings**

The overall finding of this field test is that the Motorola ASTRO XTS 5000 Model II and ASTRO XTS 5000R Model III portable radios, when exposed to water fog as presented in these three tests, experience a significant loss of communications capability that is inconsistent with the needs of emergency responders. This occurred with and without the use of any of the extended microphone accessories tested. These same problems were expressed by emergency responders during the investigation of the Marsh Overlook Fire. The distortion of the audio from the water physically hitting the radio prevents effective communications. The additional degradation of the audio from water getting into the speaker area of both the portable radios and the extended microphones exacerbated communications capabilities. Either one of these issues, independent of the other, can and did cause communications failure during these field tests. For the purposes of this test, failure was defined as preventing effective communications of simple messages from sender to receiver.

The EA function of the portable radios worked without failure on every occasion except one that was attributed to the user not hitting the EA button. The EA does not work when using talk-around channel (“50” for PWC). This was true even after audio transmit or receive capabilities had already failed. When the transmit/receive function had already failed, there was, of course, no 10-second open microphone capability. The portable radio



that initiates the EA takes priority over all other portable and mobile radios. It does not have priority over the OPSC.

When using a talk-around channel (“50” for PWC), there is no EA functionality. The radio will not transmit an EA while in a talk-around channel. The OPSC cannot hear or record “50”.

The dispatcher in the OPSC cannot hear the open 10-second microphone due to the tone that is transmitted during the EA. The dispatcher needs to silence an EA alarm in order to effectively hear the open microphone traffic. The physical process to accomplish this takes several seconds during which the open microphone is difficult, if not impossible, to understand. During multiple EAs, each individual EA must be silenced.

When multiple EAs are activated and a dispatcher knocks down an EA, all EAs are knocked down. Retransmitting on any of the EA portables will cause the “emergency alert” to again be displayed.

Activation of an EA over a mutual aid talk group only allows the mutual aid department to identify their radio identification number. This number is not the same identification number assigned to the radio from the originating department.

**Recommendations**

<b><u>Recommendation</u></b>	<b><u>Responsible Person in PWC</u></b>
The Department should explore improved portable radios that are resistant to the effects described in this field test (water percussion, water in the speaker/microphone resulting in communications failure, background noise interference, and digital voice recognition/transfer).	Battalion Chief Kersse
The Department should contact the manufacturer to express concerns over the functionality of this radio for emergency communications for fire and rescue services.	Assistant Chief Bowman
The Department should amend the policy, procedures and directives to assure that EAs are coordinated with OPSC.	Assistant Chief Culp
OPSC should provide a consistent process concerning EAs to assure the best possible tracking of emergency personnel during an EA.	Captain McInteer Shelia Ragan Battalion Chief McCleese



<b><u>Recommendation</u></b>	<b><u>Responsible Person in PWC</u></b>
All fire and rescue uniformed staff should be retrained in the new procedures and/or operational recommendations developed.	Battalion Chief Shepherd  Operations Training Coordinators  Volunteer Training Officers
All OPSC staff assigned to duties that include the handling of EAs should be retrained in the new procedures developed.	Captain McInteer  Shelia Ragan
The Department should direct OPSC staff and OIT to determine a resolution to the dispatcher's inability to hear the radio transmissions during the hot microphone of an EA.	Captain McInteer  Battalion Chief McCleese  Sam Somers  Shelia Ragan  John Maddox
The Department should direct OPSC staff and OIT to determine why, after silencing an EA, the re-alarm feature does not consistently work.	Captain Ted McInteer  Battalion Chief McCleese  Sam Somers  Shelia Ragan
The Department should make a formal recommendation concerning the specific time duration for the hot microphone feature.	Assistant Chief Culp



<b><u>Recommendation</u></b>	<b><u>Responsible Person in PWC</u></b>
<p>The Department should use its findings to encourage other fire and rescue departments to explore similar field testing and share their information with Prince William County and the manufacturer.</p>	<p>Chief Michos</p> <p>Assistant Chief Culp</p> <p>Assistant Chief Bowman</p> <p>Assistant Chief McGee</p>
<p>The OPSC staff should develop policy concerning when and how to initiate the collection of system technical information and time frames to assure that information is not lost due to delays in requesting information. The use of additional software may be required to accomplish this.</p>	<p>Captain McInteer</p> <p>Battalion Chief McCleese</p> <p>Shelia Ragan</p> <p>John Maddox</p> <p>Joe Mize</p> <p>Consult with Police and Fire/Rescue Chiefs</p>
<p>The Department should direct OIT to provide information concerning what it would take to initiate and maintain changing the display on the radios to include a call list. This recommendation should include at a minimum: costs to implement such as time, equipment, personnel, administrative and any procedural changes that would need to be made.</p>	<p>Battalion Chief Kersse</p>



<b><u>Recommendation</u></b>	<b><u>Responsible Person in PWC</u></b>
The Department should direct OIT to requests a response from Motorola to provide the capability of originating radio to send "2" pieces of information instead of the current "1" which would eliminate the need for a call list.	Battalion Chief Kersse





Radios carried in pouch worn on outside of gear for field testing.



Radios used for field testing Motorola XTS 5000 Model II and XTS 5000R Model III with and without a variety of Motorola extension microphones



Motorola extended microphones used in testing model numbers NMN6193C, NMN6193BS03, NMN6191C, RMN5088A and RMN5066A



May 22, 2007, Radio Test  
Hydrant pressure through master stream fog nozzle –  
Radios worn over turnout gear – Heavy rain simulation



May 22, 2007, Radio Test  
Hydrant pressure through master stream fog nozzle – Heavy rain simulation

**Appendix G**  
**PPE**  
**Examination**  
**Report**

**EXAMINATION OF  
FIREFIGHTER PROTECTIVE CLOTHING  
WORN BY [REDACTED] AND TECHNICIAN WILSON  
DURING APRIL 2007 FIRE**

**Final Report  
July 13, 2007**

**Summary**

This report covers my examination of the protective clothing and equipment worn by [REDACTED] and Technician I Kyle Wilson of Prince Williams County Department of Fire and Rescue during the structure fire at Marsh Overlook on April 16, 2007. This examined compared the condition of the firefighter clothing and equipment against both specifications.

In my examination of the protective clothing and equipment worn by [REDACTED], damage to the helmet, coat, hood, and gloves was found on the right side. It appears that while the hood was worn to cover [REDACTED] head, the helmet ear flaps or collar or both were not fully deployed. Given the light thermal insulation qualities of the hood relative to other parts of the protective ensemble and extreme fireground conditions faced by [REDACTED] during [REDACTED] escape, it is possible to rationalize the burns to [REDACTED] ears. The right glove worn by [REDACTED] showed extreme shrinkage, which is characteristic of leather response to very high heat over extended periods of time. The shrinkage reduced the overall insulation provided by the glove and is responsible for the severe burns to [REDACTED] right index finger. The lack of burn injuries to other portions of [REDACTED] body is consistent with the expectations that firefighter protective clothing certified to NFPA 1971 should permit the firefighter to escape extreme fireground conditions and provide protection with a minimum of injury for limited period of time (tens of seconds). The department should ensure that all protective clothing is properly worn, in accordance with manufacturer instructions including the full deployment of collars (turned up) and helmet ear flaps.

Very little intact clothing for Technician Wilson remained for examination. Even items that generally survive extreme conditions intact, such as footwear, were severely affected by the exposure environment. Certainly, much of the damage that occurred happened after Technician Wilson succumbed to the effects of an extraordinary fireground exposure. There were no specific problems evident for the clothing system or its protective qualities. The overall protective ensemble was simply overwhelmed and could not provide protection under such extreme conditions for an extended period of time.



## Objective

I was asked by [REDACTED] of the Prince William County Fire & Rescue to examine the protective clothing worn by [REDACTED] and Technician I Kyle Wilson during the structure fire at Marsh Overlook Drive on April 16, 2007. The purpose of this examination was to determine if any conditions of the clothing or equipment might have contributed to the injuries of [REDACTED] and the fatality of Technician Wilson.

## Description of the Incident

The following information about the incident was provided by [REDACTED]

[REDACTED] and Technician I Kyle Wilson were assigned to Tower 512 for the shift. [REDACTED] was the officer and Technician Wilson was riding in the officer's bucket which is part of the inside crew. They both had just started their morning checkout routine when at approximately 0602 Tower 512 was dispatched to the structure fire on Marsh Overlook Drive. When the tower arrived on the scene, [REDACTED] and Technician Wilson entered the structure through the front door wearing full PPE, SCBA, and breathing air. They observed light smoke and no fire inside the structure. They proceeded to the second floor to search the bedrooms for victims. While in the master bedroom conditions rapidly deteriorated and went from clear visibility, to black smoke, to heavy fire in a matter of seconds. At this point [REDACTED] and Technician Wilson became separated and [REDACTED] fell down a set of stairs and Technician Wilson became disoriented on the second floor.

Before they became separated, both [REDACTED] and Technician Wilson were attempting to locate the stairs. While [REDACTED] was trying to locate the stairs [REDACTED] encountered high heat on [REDACTED] right side. [REDACTED] then fell down the stairs to the bottom of the first floor and was assisted outside by other crews. [REDACTED] sustained second degree burns to [REDACTED] ears and second and third degree burns to [REDACTED] right index finger.

Technician Wilson was still on the second floor while conditions were still deteriorating. Winds that morning were recorded as being sustained at 40mph with gusts up to 60 mph. This caused the fire to grow rapidly and spread throughout the structure. While rescue attempts were still being made, the roof of the structure started to collapse and the whole second floor was engulfed in flames. At approximately 0615 an emergency evacuation of all crews was ordered and defensive operations began. At approximately 0630 the crews on the scene gained control of the fire and were able to start searching for Technician Wilson once more. A short time after that Technician Wilson was found upstairs in the master bedroom, deceased. His autopsy results are still pending from the state medical examiner's office.

## Items Examined and Observations

Protective clothing and equipment items were provided for both [REDACTED] and Technician Wilson. For [REDACTED] these items included:

- Protective coat

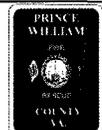


- Protective pants
- Protective helmet
- Protective gloves
- Protective footwear
- Protective hood
- Utility gloves

There were also items found in the pockets of the coat that included cutting tool in the left side pocket, tinted safety glasses, and utility gloves. All of the items in each of the pockets were undamaged.

The identification, description, and observation for each item is provided in Table 1 below.

Item	Description	Observations
Protective coat	Model # BPR4232TZ Mfr Date: 3-3-2005 Shell PBI Ripstop Advanced DWR Liner 3 layer E89 Barrier Nomex Crosstech PJ Serial # 0503001528 Size chest 42; length 29/35; sleeve 33½ Flashlight Big Ed	<ul style="list-style-type: none"> <li>• Moderate to heavy soiling over entire coat</li> <li>• Blackened trim on lower right sleeve and lower right cargo pocket, tar spots on right side</li> <li>• Collar appears to have been down during wear</li> <li>• Light melting of collar hook and loop closure</li> <li>• Damage to trim right side back</li> <li>• Trim on back charred and broken</li> <li>• Inside shell: soiled, char damage on right sleeve over entire length</li> <li>• Liner: melting and light charring on right sleeve and right shoulder</li> <li>• No apparent damage to thermal barrier</li> </ul>
Protective pants	Morning Pride Model #BPR4232PZ Shell PBI Ripstop Advanced DWR Liner 3 layer E89 Barrier Nomex Crosstech PJ Heat channel knees Size: 38 waist X 31 in seam	<ul style="list-style-type: none"> <li>• Moderate soiling</li> <li>• Worn right pocket (near bottom grommet)</li> <li>• Small tar spots on right front upper</li> <li>• Hook and closure tape – good condition</li> <li>• Minor heat damage lower trim right front</li> <li>• Pants corridor serviceable</li> <li>• No soil inside pant shell except at bottom hem</li> <li>• Liner moisture barrier side light soiling front (couple of places)</li> <li>• Pants appear serviceable</li> </ul>



Item	Description	Observations
Protective helmet	Cairns Helmet Shop Order # 101038880 Order #1720246 Sequence Count 20-15 Color: White Ear flap L655X Chin Strap PC922 Eye Protection 100296 Liner PLK 28 Model Weight: 61 oz Misc 37469 Customer # 300827 Date of Mfg: 05/24/2006 NFPA 1971, 2000 Edition Emblem (Inside of Helmet) showed “ [REDACTED] PWCLT”	<ul style="list-style-type: none"> <li>• Bubbling of shell crown; worse on right</li> <li>• Blackening of reflective trim right side</li> <li>• Hook/loop closure tape melted on both sides; worse on right</li> <li>• Shield blackened with number curled</li> <li>• Ear flaps show charring; embrittlement of lower right ear flap</li> </ul>
Protective gloves	Could not be identified: label cut out Brown cow hide back; black leather palm and gauntlet; brown leather reinforcement on palm	<ul style="list-style-type: none"> <li>• Severe soiling of both gloves</li> <li>• Significant shrinkage of right glove</li> <li>• Charring of leather reinforcement on palm towards thumb side of glove</li> <li>• Residue on back side right glove</li> </ul>
Protective footwear	Pro-Warrington Serial #WP310223488 Model #4132SG Size 9-1/2 Order #4G02015C NFPA 1971, 2000 Edition	<ul style="list-style-type: none"> <li>• Some soiling</li> <li>• Little wear</li> <li>• Small puncture right boot above steel toe</li> </ul>
Protective hood	Lifeliners 40-60 P84 FR Lenzing (2 layers navy blue) Item # P849723ES Lot #738 Manufacturer Date 1998 NFPA 1971, 1997 Edition	<ul style="list-style-type: none"> <li>• Charring, loss of material on right side outer layer towards face opening</li> </ul>
Utility gloves	Mechanix M-Pact	<ul style="list-style-type: none"> <li>• Light wear;no apparent damage</li> </ul>

Photographs were taken to show the condition of the clothing when examined. Figures 1 and 2 show the front and back exterior of the protective coat worn by [REDACTED]. A closer examination of the collar shows a soiling pattern that suggests that the collar may not have been fully deployed. A close up of the charring on the right sleeve of the coat is provided in Figure 3. The right sleeve was the area of the coat most damaged by heat exposure. This charring extends through the outer shell of the coat as can be seen in Figures 4 and 5 where the coat shell has been separated and inverted,



show both the front and back of the coat. Figure 6 shows the shell product label. Charring on the same right sleeve is evident on the liner, moisture barrier side, which is pictured in Figures 7 and 8. Similar pictures of the thermal barrier side of the liner (inverted) are shown in Figure 9 and 10. Figure 11 provides a photograph of the product label in the coat lining.

protective pants are shown in Figures 12 through 22. Figures 12 and 13 provide the exterior view of the shell, while the shell interior is displayed in Figures 15 and 16, and the product label on shell is provided in Figure 17. Figure 14 shows a close up of damage (wear through and fraying) on the right pants pocket. The moisture barrier side of the lining is shown in Figures 18 and 19, the thermal barrier side of the lining is shown in Figures 20 and 21, and the product label on the lining is provided in Figure 22. There was no specific heat damage to the pants, except to the trim on the right side.

The helmet worn by is shown in Figures 23 through 25, showing the front, left side, right side, and interior. These photos show charring and bubbling over the entire helmet shell, but the damage is greatest to the right side where the reflective material is totally blackened. The ear flaps show some charring with embrittlement of the lower right ear flap. It is not clear whether the ear flaps were fully deployed by.

For , two photographs are provided showing the back and palm sides of the gloves in Figures 27 and 28, respectively. A ruler is provided in Figure 28 to show the difference in apparent glove dimensions between the left and right hand where the right gloves has shrunk significantly from high heat exposure. There was a large difference in the glove dimension in comparing the length of the gloves at the index finger.

Other than a minor puncture to the right boot above the top cap, no apparent damage was found in the footwear worn by as shown in Figures 29 through 32.

Figures 33 through 35 show the condition of hood on the left and right sides as well as the label in the hood. Given the dark navy color of the hood material, it is difficult to see the char damage around the face opening on the right side of the hood.

The last two photographs for gear are a pair of utility gloves (Figures 36 and 37) that were undamaged.

For Technician Wilson, the following items were made available:

- Protective coat
- Protective pants
- Protective helmet
- Protective gloves
- Protective footwear
- Protective hood
- Station/work uniform and other under clothing

The following table provides a description of these items and their condition.



Item	Description	Observations
Protective coat	Morning Pride Serial cannot be located Apparent same composition and design as pants of [REDACTED]	<ul style="list-style-type: none"> <li>• Heavily embrittled and in pieces</li> <li>• All layers burned through in several places</li> <li>• Only intact area front mid torso next to closure</li> <li>• Coat cannot be assembled back to original shape without significant further damage</li> </ul>
Protective pants	Morning Pride Serial # 06080178 Apparent same composition and design as pants of [REDACTED]	<ul style="list-style-type: none"> <li>• Heavily embrittled and in pieces</li> <li>• All layers burned through in several places</li> <li>• Only intact area of liner appears to be in the crotch area</li> <li>• All layers burned through in several places</li> <li>• Pants cannot be assembled back to original shape without significant further damage</li> </ul>
Protective helmet	No identification information	<ul style="list-style-type: none"> <li>• Destroyed; melted to carpet</li> </ul>
Protective gloves	No identification information	<ul style="list-style-type: none"> <li>• Charred on all 3 layers</li> </ul>
Protective footwear	Warrington Pro Style #4132SG Model # 6F060443C 2000 Edition	<ul style="list-style-type: none"> <li>• Severely charred right and back sides of both boots</li> <li>• Material broken throughout</li> <li>• Broken open several places particularly along seams and front side of boots</li> <li>• Outer sole charred breaking away in pieces</li> </ul>
Protective hood	Label on Hood intact – Quest Fire Apparel NFPA 1971, 2000 Edition Other information cannot be made out	<ul style="list-style-type: none"> <li>• Only one side of hood remains; other parts cannot be found</li> <li>• Part that remains is just fragments</li> </ul>
Station/work uniform and other under clothing	No identification information	<ul style="list-style-type: none"> <li>• Charred and embrittled; broken in several places</li> <li>• Fragments only remain</li> </ul>

As with [REDACTED] gear, several photographs of the remnants of Technician Wilson's clothing were taken; however, given the level of destruction for nearly all types of gear and the inability to manipulate the gear with causing further extensive damage, it is difficult in many cases to distinguish all the features of the clothing – many have been destroyed and some are missing. Many of the items are unrecognizable in the photographs.



The condition of the coat and pants worn by Technician Wilson are shown in Figures 38 and 39, respectively. These photographs depict garments where much of the three layer construction of the garment has disintegrated, being fully charred and embrittled. The only recognizable features of the coat and pants are the front closure and crotch area. These two areas would have been most protected of all parts of the ensemble if Technician Wilson was found prone (on his stomach) when his body was recovered. Figure 40 displays the helmet as it has melted and adhered to a section of the carpet. Though it is known for this examination, it is suspected that the helmet fell off Technician Wilson's head during the collapse and that under these conditions melted onto the carpet. The remnants of Technician Wilson's gloves and hoods are shown in Figure 41. Portions of these ensemble elements are missing; the leather is clearly broken open for the gloves though not apparent in the photograph. Figures 42 through 44 show the level of destruction for the footwear, which is one of the few recognizable elements of Technician Wilson's ensemble. Even so, portions of the leather are broken open from high heat exposure and the outer soles have undergone significant degradation. Figure 45 provides a photograph of the remnants of Technician Wilson's station/work uniform shirt and pants. Like the protective coat and pants, these items of clothing show significant effects from high heat.

### The Fireground Environment

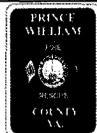
One manner of analyzing the protective clothing and equipment is to examine industry information that shows the range of fireground conditions that can be experienced and relate these conditions to the types of damage that can occur to clothing and equipment.

The relationship between increasing thermal radiation (expressed in  $\text{cal}/\text{cm}^2\text{s}$ ) and the resulting rise in air temperature (expressed in degrees Celsius and degrees Fahrenheit) is presented in Figure 46. Possible structural fire fighting situations are illustrated in this figure:<sup>1,2</sup>

- The **Routine** region describes conditions where one or two objects, such as a bed or waste basket, are burning in a room. The thermal radiation and the air temperatures are virtually the same as those encountered on a hot summer day. As shown in Figure 17, **Routine** conditions are accompanied by a thermal radiation range of 0.025 to 0.05  $\text{cal}/\text{cm}^2\text{s}$  and by air temperatures ranging from 68 to 140°F. Protective clothing for fire fighters typically provides protection under these conditions, but excessively long exposure times may create a burn injury situation.
- The **Ordinary** region describes temperatures encountered in fighting a more serious fire or being next to a "flash-over" room. **Ordinary** conditions are defined by a thermal range of 0.05 to 0.6  $\text{cal}/\text{cm}^2\text{s}$ , representing an air temperature range of 140 to 571°F. Under these conditions, protective clothing may allow sufficient time to extinguish the fire or to fight the fire until the nominal air supply is exhausted (usually less than 30 minutes).
- The **Emergency** region describes conditions in a severe and unusual exposure, such as those caused inside a "flash-over" room or next to a flame front. In **Emergency**

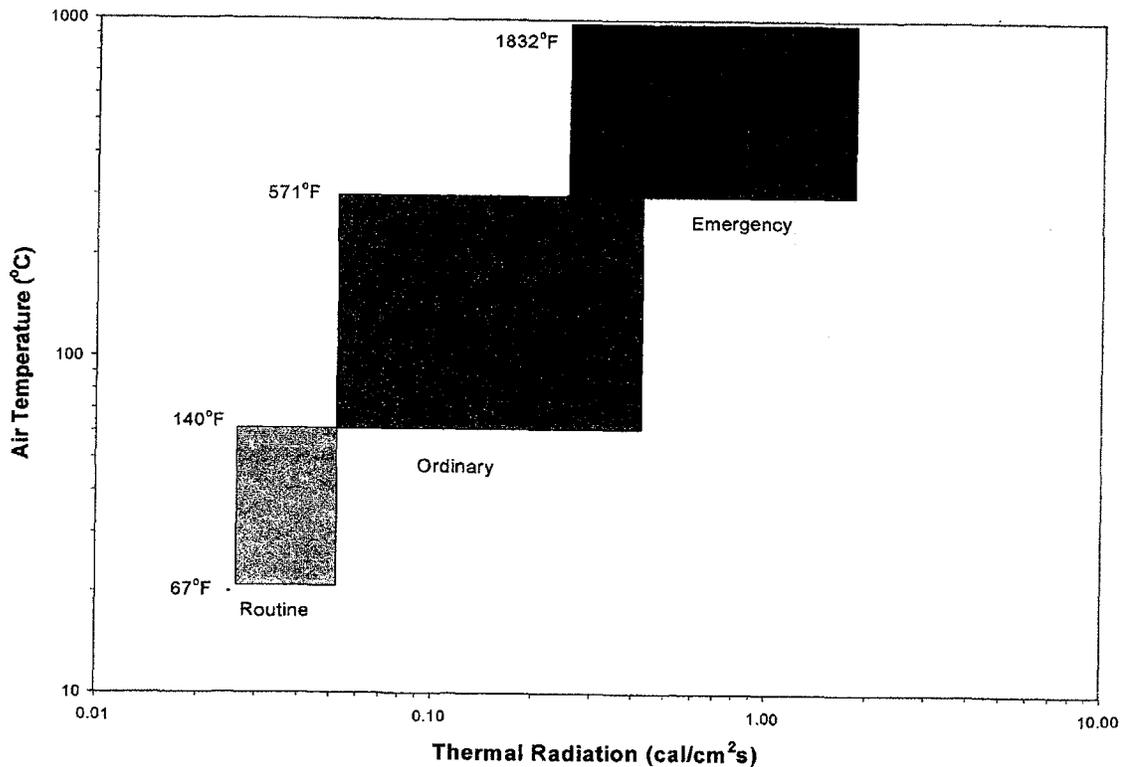
<sup>1</sup>N. J. Abbott and S. Schulman, "Protection from Fire: Nonflammable Fabrics and Coatings, *Journal of Coated Fabrics*, Vol. 6, July 1976, pp. 48-64.

<sup>2</sup>H. P. Utech, "High Temperatures vs. Fire Equipment," *International Fire Chief*, Vol. 39, 1973, pp. 26-27.



conditions, the thermal load exceeds  $0.6 \text{ cal/cm}^2\text{s}$  and temperatures exceed  $571^\circ\text{F}$ . In such conditions, the function of firefighters' clothing and equipment is simply to provide protection during the short time needed for an escape without serious injury.

**Figure 46 – Classification of Fireground Conditions**



The fireground event at Marsh Overlook Drive on April 16, 2007 as described would have involved conditions that could be classified in emergency range of exposure. The fire did not start this way, but by the time that [REDACTED] and Technician Wilson were trapped on the second floor, the fire transitioned from the routine to emergency region in a relatively short period time. Under emergency conditions, clothing is only expected to provide tens of seconds of protection to allow the fire fighter to escape. In general, when protective clothing and equipment is exposed to emergency conditions, it becomes damaged. Those components that are most susceptible to damage include trim and the plastic components of helmets. Charring of outer shell textiles in clothing, bubbling of helmet shells, and shrinkage of leather in gloves are typical outcomes for any extended exposure under emergency conditions. The relative damage to protective clothing and equipment will depend on the actual radiant and convective temperatures combined with the length of exposure. It is not so much the temperature of exposure but rather the exposure energy that is received, which is the product of both time and temperature.



Burn injuries are sustained with the energy absorbed by the skin can no longer be dissipated in the body. In essence, the rate of heat (energy) transfer into the body at a particular location overwhelms the body's capacity to remove that heat to other portions of the body. In general, when the energy transferred through the clothing to the skin is able to cause the skin temperature to rise to 111°F (44°C), pain is felt by the average individual person. If the skin temperature increases to 131°F (55°C), the onset of second degree burn injury occurs.

Any number of reasons can exist for burn injury to occur in selective locations over the firefighter's body or for the severity of the injury to vary at different locations. Unexposed or less protected areas of the firefighter's body are more susceptible to burn injury than other areas. These areas may include the portions of the head or ears. Where clothing compresses against the skin either by fit or wearing position, heat transfer to the skin can occur at higher rates. The phenomenon of stored energy can also be a factor where heat energy that accumulates in clothing from continued radiant exposure can quickly transfer to the skin when the clothing is compressed suddenly. This compression can happen simply from bending a joint (a knee or elbow) or otherwise positioning the body to stretch the clothing across the body so that more intimate contact is made with the skin. If shrinkage of an item occurs, which effectively reduces the insulating air layer between the clothing and the skin, increased heat transfer to the skin will occur. This type of heat transfer can occur when a glove, constructed of leather, shrinks from a high, extended heat exposure. Finally, wherever damage occurs that causes severe charring, embrittlement, and break open of materials or components, protection is lessened and the potential for burn injury is increased.

### **Analysis and Findings**

The fact that [REDACTED] was able to escape provides insight as to the fire ground conditions that existed at the time for both firefighters as they tried to make their way out of the fire structure. While it is not known exactly how long [REDACTED] was present on the second floor and in the fire structure before being able to escape, it is speculated that this time frame was relatively short (approximately 30 seconds, but less than a minute). Based on the information provided, the amount of heat exposure during the initial entry and the start of the search effort on the second floor of the fire structure would have been at relatively low temperatures, consistent with the routine region of fireground conditions described above. Once the master bedroom erupted in flames, it anticipated that the exposure environment changed to ordinary where high radiant and convective temperatures were sustained and that these conditions would have approached the emergency region with temperatures over 571°F (300°F) and energy transfer rates greater than 0.6 cal/cm<sup>2</sup>sec. This finding is reached based on the examination of [REDACTED] gear, which shows damage characteristic of exposures that reach emergency fireground conditions.

The principal damage to [REDACTED] protective clothing and equipment is found on the top and right side of the ensemble; this damage includes:

1. Bubbling of the helmet shell, worse on the right side
2. Blackening and melting of helmet trim, worse on the right side
3. Charring and embrittlement of the right ear flap
4. Charring and embrittlement of the right side of the hood face opening
5. Charring of the outer shell and moisture barrier on the right arm and shoulder



## 6. Significant shrinkage of right glove

The locations of this damage are consistent with a firefighter exiting the upper floor of a structure that is engulfed in flames. Further, the report of burn injuries to ears (as being lesser protected areas of ■ body) and ■ right index finger (from glove shrinkage) partly collaborate this finding.

The stages of clothing outer shell degradation are known to occur at certain energies and it is further possible to estimate the temperatures reached by specific clothing and equipment components from the level of degradation that takes place. For example, certain trims begin to melt at temperatures less than 391°F (200°C) but blacken and char beginning at 500°F (260°C).<sup>3</sup> Similarly, charring of PBI/Kevlar fabrics as represented by the outer shell of ■ protective coat and pants begins to occur when the material reaches temperatures between 1000 and 1200°F (540-650°C). This charring did not result in embrittlement or break open, nevertheless, the heat transferred through the material was sufficient to cause charring of the moisture barrier material in the lining, which starts at lower temperatures. Prior experiments I have conducted show that the total energy transfer required to cause charring and damage to the moisture barrier layer underneath the outer shell to be in the range of 30-40 cal/cm<sup>2</sup>. This level of exposure is equivalent to 10 seconds of an average flashover exposure, though a flashover is not suspected in the case. The reported absence of burns on ■ torso, arms and legs is indication that the transferred energy was not sufficient to cause burns in these areas of ■ body.

The near total destruction of clothing and equipment worn by Technician Wilson show complete disintegration of many textile elements of the clothing, including several portions of coat, pants, and hood and all three layers of the protective garments. Temperatures in excess of 1500°F (820°C) cause severe embrittlement of the PBI/Kevlar outer shell material. Yet the materials are layered in the protective coat and pants and there was destruction of all three layers in many areas of the clothing. In addition, there is charring and embrittlement of the underlying station/work uniform. Prior work has shown that energy levels of 50-60 cal/cm<sup>2</sup> for external conductive and radiant heat exposures can cause charring of the underlying station/work uniform materials. In all likelihood, both the temperatures and energy levels for this degradation were exceeded given the timeline for the recovery of Technician Wilson's body by the responding firefighters. Likewise, the deterioration of the leather in the gloves and footwear shows extreme temperature conditions. Footwear typically survives emergency fire conditions intact. In this case, the footwear leather was split open in several places and there was significant degradation of outer sole. Another telltale sign for the several of fire exposure is the condition of the helmet with it having melted to the carpet section that was provided for examination. While the exact temperature for this deterioration to take place is not known, it is understood that the temperatures reached for this part of the ensemble were well over 1500°F (820°C) and it is likely that exposure at this temperature or above was sustained for relatively long period of time. The gear was subjected to conditions well below any reasonable level of expected protection.

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<sup>3</sup> These temperatures represent the temperatures of the material not the air or exposure temperature, which generally must be higher to cause the level of damage consistent with the observed degradation temperature.



## Conclusions

I could not find any defect or problems with the clothing that I examined. In the case of protective clothing and equipment worn by [REDACTED], the gear was subject to fireground conditions where the clothing is intended to provide limited protection allowing escape. The fact that there were no burns to [REDACTED] torso, arms, legs, and feet are an indication that the garments (protective coat and pants) and footwear performed as expected. The burns sustained to [REDACTED] ears are due to the lower level of protection that is provided by the hood relative to other parts of the ensemble. For example, hoods are required by NFPA 1971-2000 to meet a thermal protective performance (TPP) requirement of 20 cal/cm<sup>2</sup> as compared to a requirement of 35 cal/cm<sup>2</sup> for garments.<sup>4</sup> The lower level of protection to the ears is provided directly by the hood with partial additional protection supplied by the helmet ear flaps. This portion of the head may further be protected by the collar, but the collar does not appear to be in its upright position (the collar extends to 4 inches above the top of the coat when fully deployed). It also appears that during the most serious parts of the exposure the hood ear flaps may not have been full extended down over the hood. The lack of these additional insulating layers may have contributed to the ear burn injuries sustained by [REDACTED]. The right glove in particular shows evidence of a very high heat exposure. Leather shrinkage, while common, can be particularly dangerous because the shrinkage reduces the air insulation layer inside the gloves for a body area that is already very difficult to protect consistent with the rest of the ensemble. In many cases, glove thermal protective performance ratings are artificially high since in testing the leather puckers creating air gaps that increase insulation. However, when gloves are used, the leather simply shrinks uniformly permitting more rapid transfer and increasing the likelihood of burns. For [REDACTED], the exposure circumstances appear to have been well beyond the provision of protection by the gloves. Of the major elements in the ensemble (garments, helmet, gloves, and footwear), gloves generally have the lowest insulation and can be an area of the body that is burned easiest depending on the exposure conditions.

[REDACTED] pants are serviceable. A portion of the trim on the lower leg must be replaced and the hole in the cargo pocket must be repaired. While a detailed visual inspection of the liner was not conducted, hydrostatic testing was not performed. The coat should be subjected to an advanced inspection by a facility that is qualified to ascertain the barrier performance of the lining. The coat likely should be retired. The entire coat liner needs must be replaced and the entire right sleeve of the coat must also be replaced along several portions of coat trim. The relative costs of these repairs would warrant retirement. Likewise the helmet and gloves should be retired. The footwear is the only that I examined that does not appear to need repair.

The protective clothing and equipment worn by Technician Wilson was exposed to extraordinary conditions that are well beyond the protective capabilities of any protective ensemble in existence today. It is likely that if Technician Wilson had been able to escape at approximately the same time that [REDACTED] that he would have similarly sustained only minor burns to the more vulnerable portions of his body. However, with the extended period of time on the second floor that was engulfed in flames, it is likely that the protective capabilities of [REDACTED] protective ensemble would have been exceeded in the first few minutes, if not first minute of extended

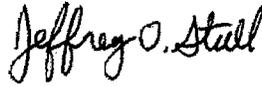
<sup>4</sup> The actual TPP ratings for the garments and hood are in excess of minimum requirements set forth in NFPA 1971-2000, which applied for the subject clothing. The specific TPP rating for the composite used in [REDACTED] coat was approximately 45 cal/cm<sup>2</sup>.



exposure. The level of destruction of the protective clothing or equipment worn by Technician Wilson indicates that much of the clothing degradation took place after he succumbed to the effects of fire exposure. It is impossible to discern any specific facts in which the clothing was worn or how the clothing performed with respect its exposure conditions, other than to conclude the clothing was simply overwhelmed and the extreme circumstances led to the fatality of Technician Wilson. For example, the adherence of the helmet to a carpet segment suggests that Technician Wilson's helmet became dislodged during the structural collapse, further diminishing whatever protective qualities of his ensemble that would have remained at the time.

The clothing and equipment for [REDACTED] and Technician Wilson should be retained because of its involvement in a situation where injuries and a fatality were sustained. The clothing should retained be retained by the department for a period of at least 2 years with an appropriate chain of custody. Records should be kept of any further evaluations.

Respectfully submitted,



Jeffrey O. Stull, President  
International Personnel Protection, Inc.  
Austin, Texas



**The photographs  
that were contained  
in this document  
were removed for  
reprinting of  
this report.**



**Appendix H**  
**SCBA**  
**Examination**  
**Report**



*National Personal Protective Technology Laboratory  
Technology Evaluation Branch*

Status Investigation Report of One  
Self-Contained Breathing Apparatus  
Submitted by the  
Prince William County Department of Fire and Rescue  
Manassas, Virginia

NIOSH Task No. TN-15210

September 28, 2007

## **Disclaimer**

The purpose of Respirator Status Investigations is to determine the conformance of each respirator to the NIOSH approval requirements found in Title 42, *Code of Federal Regulations*, Part 84 (42 CFR 84). A number of performance tests are selected from the complete list of Part 84 requirements and each respirator is tested in its “**as received**” condition to determine its conformance to those performance requirements. Each respirator is also inspected to determine its conformance to the quality assurance documentation on file at NIOSH.

In order to gain additional information about its overall performance, each respirator may also be subjected to other recognized test parameters, such as National Fire Protection Association (NFPA) consensus standards. While the test results give an indication of the respirator’s conformance to the NFPA approval requirements, NIOSH does not actively correlate the test results from its NFPA test equipment with those of certification organizations which list NFPA-compliant products. Thus, the NFPA test results are provided for information purposes only.

Selected tests are conducted only after it has been determined that each respirator is in a condition that is safe to be pressurized, handled, and tested. Respirators whose condition has deteriorated to the point where the health and safety of NIOSH personnel and/or property is at risk will not be tested.

## **Investigator Information**

The SCBA inspection and performance tests were conducted by and this report was written by Vance Kochenderfer, Quality Assurance Specialist, Technology Evaluation Branch, National Personal Protective Technology Laboratory, National Institute for Occupational Safety and Health, located in Bruceton, Pennsylvania.

**Status Investigation Report of One  
Self-Contained Breathing Apparatus  
Submitted By  
Prince William County Department of Fire and Rescue  
Manassas, Virginia**

**NIOSH Task No. TN-15210**

**Background**

As part of the *National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program*, the Technology Evaluation Branch agreed to examine and evaluate one Mine Safety Appliances 4500 psi self-contained breathing apparatus (SCBA).

This SCBA status investigation was assigned NIOSH Task Number TN-15210. The Prince William County Department of Fire and Rescue was advised that NIOSH would provide a written report of the inspections and any applicable test results.

The SCBA, sealed in a corrugated cardboard box, was delivered to the NIOSH facility in Bruceton, Pennsylvania on May 25, 2007. Upon arrival, the sealed package was taken to the Firefighter SCBA Evaluation Lab (Building 108) and stored under lock until the time of the evaluation.

**SCBA Inspection**

The package from the Prince William County Department of Fire and Rescue was opened and the SCBA inspection was performed on June 20, 2007. The SCBA was inspected by Vance Kochenderfer, Quality Assurance Specialist, of the Technology Evaluation Branch, National Personal Protective Technology Laboratory (NPPTL), NIOSH. The SCBA was examined, component by component, in the condition as received to determine its conformance to the NIOSH-approved configuration. The entire inspection process was videotaped. The SCBA was identified as a Mine Safety Appliances (MSA) model; however, the damage was too extensive to determine the exact type.

The complete SCBA inspection is summarized in **Appendix I**. The condition of each major component was also photographed with a digital camera. Images of the SCBA are contained in **Appendix III**.

The unit is extremely fire-damaged. Most of the plastic, rubber, and fabric components of the SCBA have been consumed. No performance testing could be conducted on the unit.

### **Personal Alert Safety System (PASS) Device**

An ICM 2000 Plus Personal Alert Safety System (PASS) device was incorporated into the pneumatics of the SCBA. During the inspection, the PASS device could not be activated. The case was opened and representatives of MSA were able to retrieve stored data from the unit, and the last five uses are presented in **Appendix II**. The data indicate that the unit's battery was exhausted six minutes into the last use while the cylinder pressure was 3350 psi and the internal temperature 130°F. From the limited data available there is no indication of unusual performance of the SCBA.

### **Summary and Conclusions**

An SCBA was submitted to NIOSH by the Prince William County Department of Fire and Rescue for evaluation. The SCBA was delivered to NIOSH on May 25, 2007 and inspected on June 20, 2007. The unit was identified as an MSA 4500 psi SCBA, but the exact model and NIOSH approval number could not be determined. The SCBA has suffered severe fire damage and is not functional.

It is difficult to draw conclusions about the unit given its state. The cylinder valve was found to be fully open and the cylinder empty, which would be consistent with the SCBA being used to cylinder exhaustion. Data retrieved from the ICM 2000 Plus PASS device do not suggest any malfunction during the last recorded use.

In light of the information obtained during this investigation, the Institute has proposed no further action at this time. Following inspection and testing, the SCBA was returned to the package in which it was received and stored under lock in Building 108 at the NIOSH facility in Bruceton, Pennsylvania, pending return to the Prince William County Department of Fire and Rescue.

Due to the extensive damage to the unit, it does not appear possible for it to be returned to service and it should be replaced.

# **Appendix I**

## **SCBA Inspection Report**



National Personal Protective Technology Laboratory / Technology Evaluation Branch

**Respirator Field Problem**  
**Incoming Inspection Report Summary**

<b>Task Number:</b> TN-15210	<b>Requestor:</b> Prince William County Department of Fire and Rescue
<b>Date Received:</b> 25 May 2007	
<b>Dates Inspected:</b> 20 June, 6 and 25 July 2007	<b>Description:</b> Fatality
<b>Manufacturer:</b> Mine Safety Appliances	<b>Inspected by:</b> Vance Kochenderfer
<b>Approval Number:</b> undetermined	<b>SCBA Type:</b> Open Circuit, Pressure-Demand

The SCBA was received in a corrugated cardboard box. The box contained three plastic bags; one containing the facepiece, one containing the rest of the SCBA, and one containing some small parts (refer to **Figures 1 and 2 in Appendix III**).

**Components and Observations**

NOTE: All references to “right” or “left” are from the user’s perspective.

**1. Facepiece (Refer to **Figures 3 through 8 in Appendix III**):**

The facepiece is an MSA Ultra Elite facepiece assembly which consists of a black rubber facepiece seal, lens, lens frame, and mesh head harness. The upper half of the facepiece is absent, and the remainder is heavily fire-damaged. As received, the air pressure regulator was attached to the facepiece.

Most of the facepiece lens has been burned away. Only small portions of the bottom edge remain trapped in the lens frame. Likewise, much of the lens frame is missing and the remainder is heavily charred.

Only a portion of the facepiece seal in the chin area remains. Much of the rubber material is charred. A nose cup assembly is installed in the facepiece. Similar to the other components, the upper half of the nose cup has been burned away.

The mesh head harness is also heavily damaged. The only portions which remain are those surrounding the two adjustment straps and the vertical seam. The lower strap remains attached to the adjustment buckles on the facepiece and has been cut, apparently during rescue operations—the cut edges are not singed. A short length of the upper adjustment strap is retained in the mesh headnet. Both of its ends have been burned away. One of the head

harness adjustment buckles was found loose inside the bag.

The assembly that houses the second-stage regulator port, speech diaphragm, and exhalation valve is present but has been extensively charred and distorted. The speech diaphragm is installed and appears intact. A microphone assembly installed inside the diaphragm is charred. The regulator has been melted to the housing and cannot be removed. Although much of the neckstrap has been burned away, both ends are still attached to the housing. There are the charred remnants of a voice amplifier attached to the left side of the facepiece and a heads-up display attached to the right side.

**2. Mask-Mounted Regulator and Hose (Refer to Figure 9 in Appendix III):**

The mask-mounted regulator assembly exhibits similar heat damage to the facepiece. The exterior is charred and distorted. The front cover has separated from the regulator body exposing the diaphragm inside; it is also charred. It is impossible to tell the position of the donning switch and bypass valve.

The low-pressure hose running from the pressure reducer to the regulator has been completely burned away. Its attachment to the regulator is no longer visible.

**3. Air Pressure Reducer (Refer to Figure 10 in Appendix III):**

The air pressure reducer housing is securely fastened to the backframe. Although very sooty and evidently exposed to heat, it does not appear to have been scraped, struck, or otherwise mechanically damaged.

**4. Remote Air Pressure Gauge and PASS Device (Refer to Figures 11 and 12 in Appendix III):**

This SCBA is equipped with an ICM 2000 Plus combination air pressure gauge and PASS device. The rubber boot surrounding the housing is charred and partially burned. The housing itself is heavily distorted and charred, but most of it appears to be present. The device is not operational. The gauge lens is absent and the gauge face damaged—the pointer currently indicates empty.

At the base of the housing is a high-pressure air fitting; its rubber dust cover has been burned away. The gauge hose runs to the pressure reducer. Its outer jacket has been consumed by flame, exposing the metal braid underneath. There is some rust on the ferrules at both ends of the hose.

**5. High Pressure Hose, Audi-larm Assembly and Cylinder Coupling Nut (Refer to Figures 13 and 14 in Appendix III):**

The outer jacket of the high pressure hose running from the compressed air cylinder to the air pressure reducer has been burned away exposing the inner metal braid. It remains securely fastened to the Audi-larm assembly and reducer.

The Audi-larm housing is extremely dirty. There is molten plastic and some fabric adhered to the interior of the bell. The bell gong remains securely fastened to the housing. The cylinder coupling nut as received is approximately ¼ turn from fully tightened to the cylinder valve. The internal threads of the nut appear to be undamaged. The sealing o-ring is absent, and there is some brownish molten plastic material present inside the connection.

**6. Carrier and Harness Assembly (Refer to Figures 15 through 19 in Appendix III):**

The SCBA includes a Black Rhino style carrier. The carrier is made of formed sheet metal which, while dirty, remains intact. A thin metal cylinder retention band runs across the frame, and the tightening mechanism works properly. All of the labels affixed to the carrier have been destroyed by heat. The rubber bumper at the bottom of the carrier for supporting the cylinder has likewise been burned away.

Most of the shoulder straps have been consumed by flame; all that remains are the steel cables embedded in the straps and small portions of webbing attached to the length adjustment buckles. Some of the waistbelt webbing and rubber back support remains, but most of it has burned. Separate from the carrier is the waistbelt buckle and some webbing attached to each half; the buckle couples and releases properly. There is what appears to be the melted remains of a regulator storage point attached to one of the straps.

A pouch containing a high-pressure hose quick-connect assembly was included with the SCBA. Much of the pouch fabric has been burned away, as has the hose jacket, exposing the underlying metal braid.

**7. Compressed Air Cylinder (Refer to Figures 20 through 25 in Appendix III):**

The cylinder is a fully-wound composite type. It is heavily fire-damaged and much of the outer epoxy layer has been burned away. The reinforcing fibers are exposed and are peeling away from the cylinder in places. The cylinder's Department of Transportation label is not legible, nor are any other markings apparent.

The cylinder valve has also been exposed to extreme heat. The plastic valve handwheel is charred and somewhat distorted, and there are what appear to be metal bedsprings embedded in the plastic. The handwheel could not be easily operated, and to avoid damage it was not forced. The pressure gauge lens is missing, and the gauge face is unreadable. The rubber pressure gauge cover and end bumper has been burned away. The valve outlet threads do not appear to be damaged, although there is molten brownish plastic material in the outlet similar to that in the cylinder connector nut.

**8. Additional Miscellaneous Components (Refer to Figures 26 and 27 in Appendix III):**

Part of a charred and melted plastic housing along with a damaged circuit board appearing to be part of a radio is contained in the plastic bag with the SCBA. A separate, smaller clear plastic bag contains what appears to be a speaker component from the facepiece voice amplifier, a component of the low-pressure hose connection to the regulator, and a low-pressure hose Extend-Aire quick-disconnect coupling. Only the metal parts of these components remain, the rest having been consumed by flame. The quick-disconnect coupling can be easily separated and joined again.

**9. Compressed Air Cylinder Reexamination (Refer to Figures 28 and 29 in Appendix III):**

After the initial examination, the Prince William County Department of Fire and Rescue requested that NIOSH determine the position of the cylinder valve, whether any air remained in the cylinder, and the condition of the cylinder's burst disc. Further evaluation was undertaken on July 6, 2007. Greater force was applied to the cylinder valve handwheel, and it was found that it could be operated with some difficulty. The handwheel is in the fully open position as received, and the cylinder is empty. The burst disc retainer was removed and the disc found to be intact, with a dished appearance typical of discs that have seen normal service.

**ICM 2000 Plus Evaluation**

In normal operation, the ICM 2000 Plus PASS device incorporated into MSA SCBA logs pressure, temperature, and PASS status data. It was additionally requested that NIOSH attempt to recover any data that might remain in the device. The SCBA was taken to MSA's facility in Cranberry, Pennsylvania on July 25, 2007, where Jeff Gutshall and Julian Möller of MSA assisted in opening the device. Once the case was opened, the circuit board inside bore relatively few signs of heat damage given the condition of the housing (refer to **Figures 30 through 32 in Appendix III**).

MSA was subsequently able to extract data from the storage chip in the device. Information from the last five uses is shown in **Appendix II**. The full data file will be provided on disc separately from this report. The reliability of the timestamps is not certain because it is not known whether the device's internal clock was synchronized with a reliable source and because it was necessary to remove the storage chip from the original board and solder it to another one to access the data. Data from the last recorded use indicate that the low battery alarm was active from the beginning of use and that 3350 psi remained in the cylinder and the internal temperature sensor reached 130°F at the point when the unit's batteries were exhausted. It does not appear that the air was being consumed at an unusual rate. It is difficult to draw any additional conclusions about the performance of the SCBA with the limited data available.

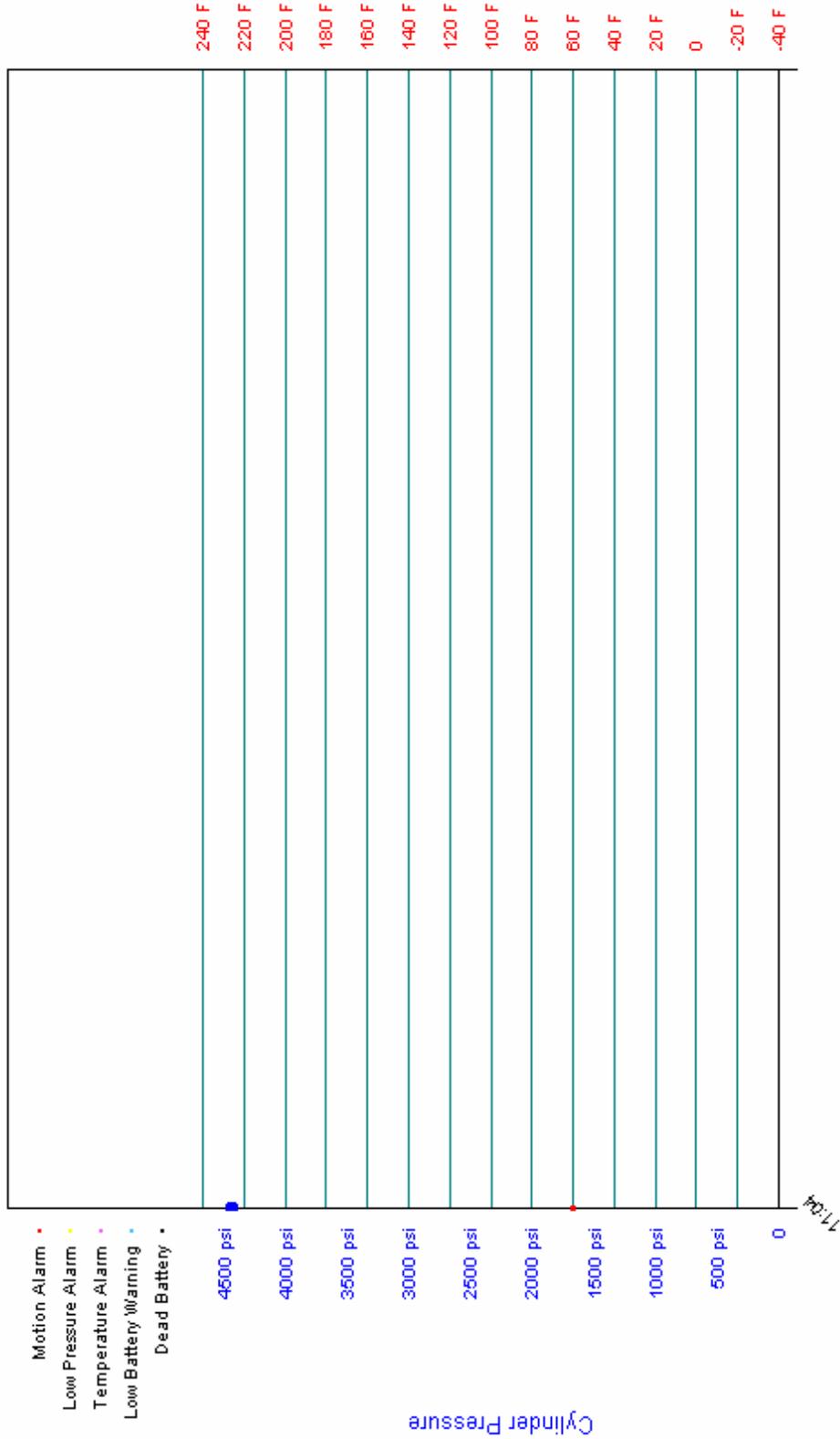
# **Appendix II**

## **ICM 2000 Plus Data**



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 Instrument Upload Time: 07-Nov-2007 19:45      Cumulative Time: 2203 minutes

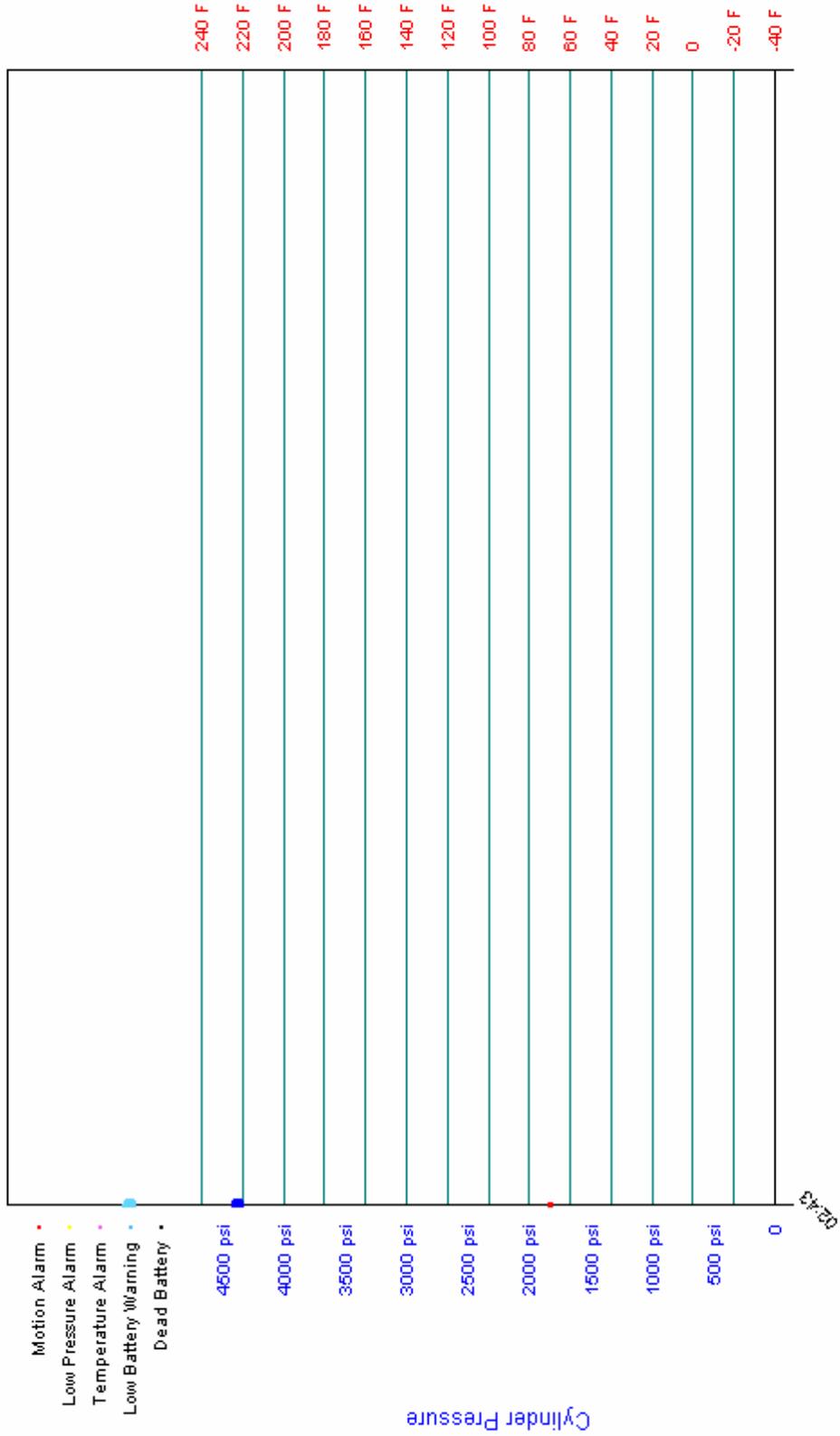
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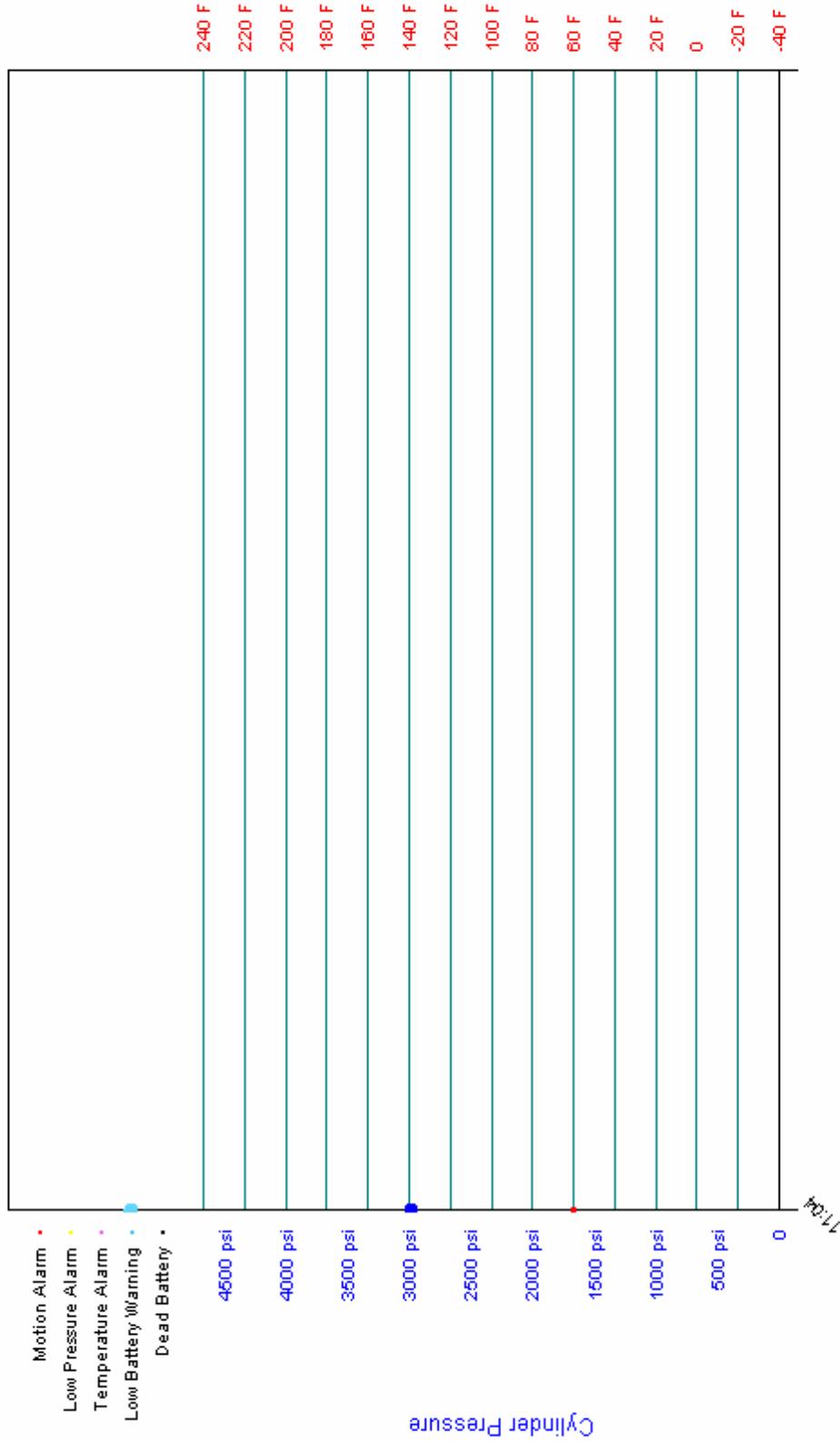
**Session: 13-Apr-2007 02:43      Duration: 1 minutes      Name:**





Serial #: 00037035      Cumulative Pressurisations: 571  
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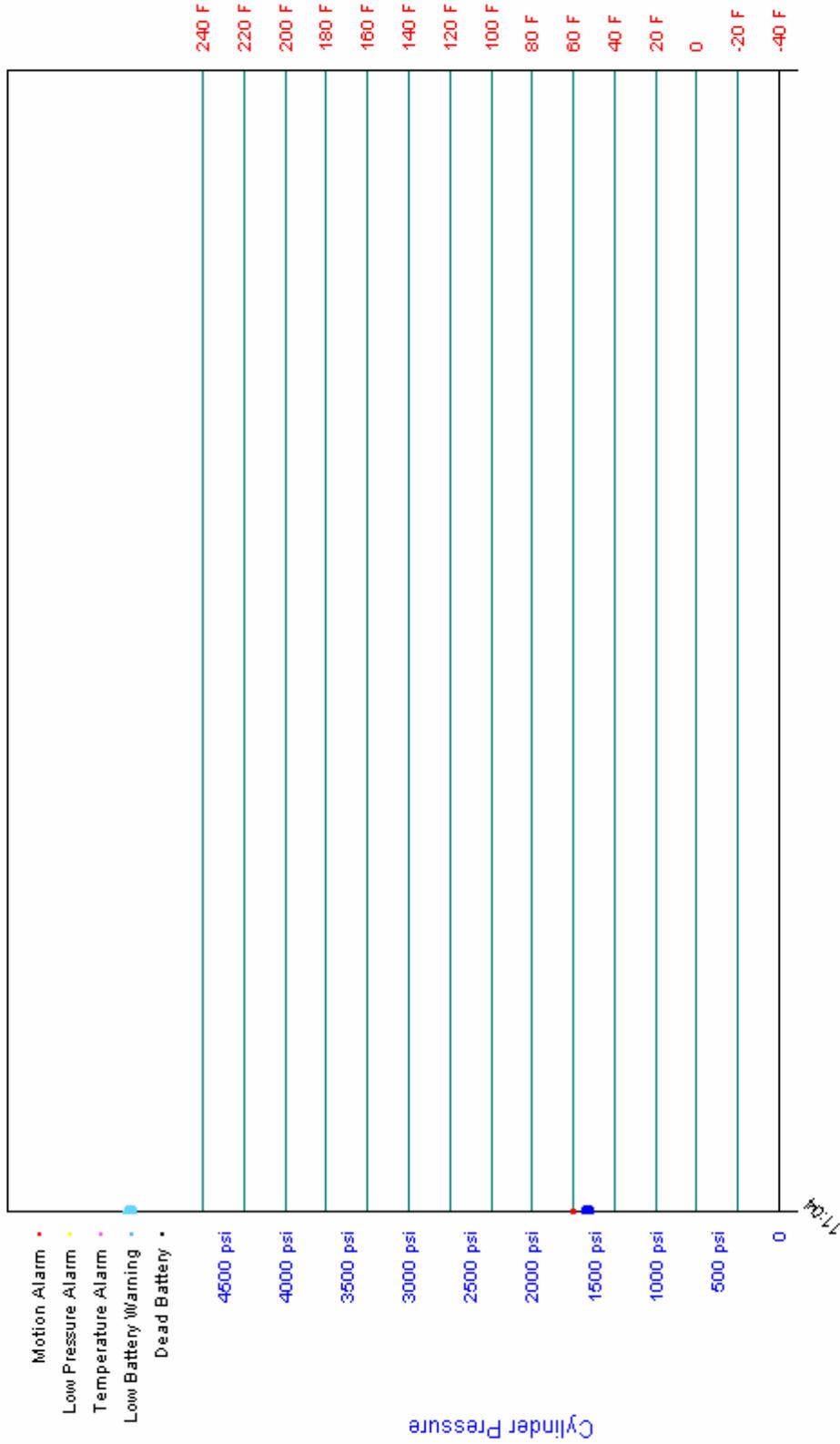
**Session: 13-Apr-2007 11:04 Duration: 1 minutes Name:**





Serial #: 00037035      Cumulative Pressurisations: 571  
 Instrument Upload Time: 07-Nov-2007 19:45      Cumulative Time: 2203 minutes

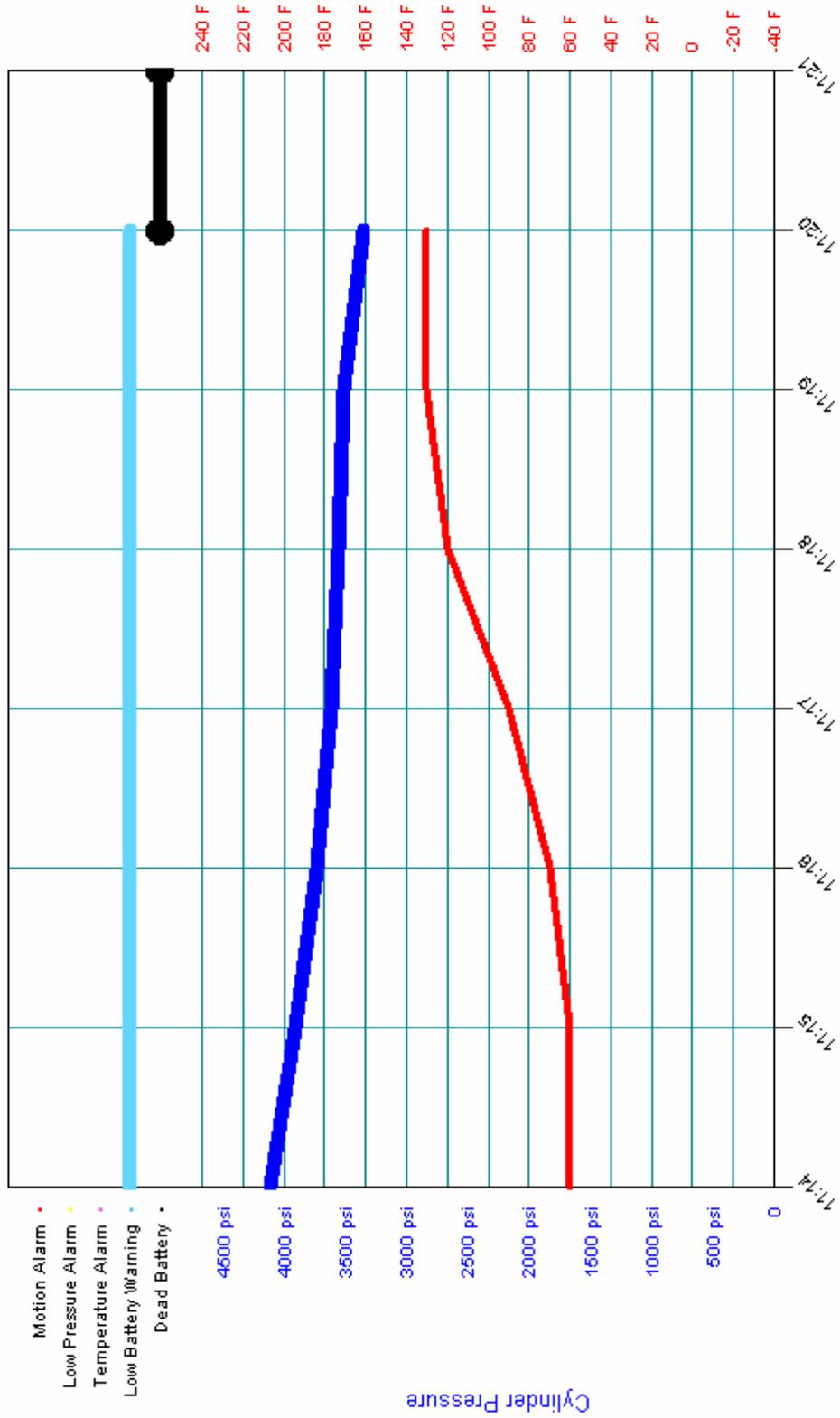
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Serial #: 00037035      Instrument Upload Time: 07-Nov-2007 19:45      Cumulative Pressurisations: 571      Cumulative Time: 2203 minutes

**Session: 16-Apr-2007 11:14    Duration: 8 minutes    Name:**



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*We will never forget*

*L K*  
*O Y*  
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*R O*  
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April 16, 2007

