

NEW JERSEY DIVISION OF FIRE SAFETY

Firefighter Fatality and Serious Injury Report Series

Firefighter Receives Severe Respiratory Injuries While Operating at a Structure Fire

**North Bergen, New Jersey
October 24, 2004**

***Report Issued
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**STATE OF NEW JERSEY
Jon Corzine, Governor**



**DEPARTMENT OF COMMUNITY AFFAIRS
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INTRODUCTION

The investigation of this incident was conducted by the New Jersey Division of Fire Safety / Office of the State Fire Marshal in conjunction with the New Jersey Department of Labor. This report was prepared in accordance with N.J.S.A. 52:27D – 25d, Duties of the Division. The purpose of these firefighter casualty investigations is to report the causes of serious firefighter injuries or deaths and identify those measures which may be required to prevent the future occurrence of deaths and serious injuries under similar circumstances. In some cases new information may be developed, or old lessons reinforced, in an effort to prevent similar events in the future.

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EXECUTIVE SUMMARY

On October 24, 2004 at 0402 hours, North Hudson Regional Fire & Rescue (NHRFR) responded to a working structure fire at 1412 44th Street in North Bergen. Upon arrival, initial companies found a working fire on the 1st floor of a 2 story wood-frame residence, with occupants trapped. Firefighters (FFs) had great difficulty entering the structure for search and suppression operations due to extreme amounts of storage obstructing the front door and stairway. Acting Battalion Chief (BC) Robert D'Antonio arrived and assumed Incident Command (IC), requesting a second alarm. While firefighters were still attempting to advance the 1-3/4" hoseline inside the structure, ground ladders were being positioned to the front windows on the 2nd floor for rescue operations.

Upon transferring IC to Deputy Chief (DC) Frank Montagne, Acting BC D'Antonio made entry alone through a 2nd floor window via the ground ladder to rescue the trapped occupants. Upon making entry, he encountered heavy heat and smoke conditions. His helmet and air mask became dislodged due to the small window size, and he began free-flowing air as he attempted to replace his air mask. He immediately located a male victim, and then a female victim frantically approached him. She grabbed his air mask before he could fully replace it; however, he was able to re-don it while attempting to move both victims. FF James Corso was sent up the ladder and through the window to assist Acting BC D'Antonio.

Acting BC D'Antonio stated that after struggling to eventually remove both victims, he felt that the interior conditions were worsening and he told FF Corso to exit the structure. Following FF Corso's exit, Acting BC D'Antonio continued to search the 2nd floor area alone, but soon became disoriented and low on air. He soon ran out of air, placed his face inside his turnout coat, and located the front window. He dove for the window, jumping through it, but got hung-up by the waist strap on his air pack. He was dangling unconscious from the top of the ladder; FFs ascended the ladder, cut his strap free, and brought him top street level. He was immediately assessed by NHRFR personnel, and turned over to EMS personnel for transport to Jersey City Medical Center. He was then transferred to St. Barnabas Medical Center for further treatment due to the severe respiratory injuries he sustained.

The origin and cause investigation for this incident was conducted by the North Bergen Fire Prevention Bureau. The fire was determined to be accidental in nature, originating on the 1st floor of the structure in the hallway adjacent to the interior stairway. Although the ignition source was listed as "undetermined", an extension cord used to power a hallway light was found underneath heavy amounts of combustible storage and could not be ruled out as a potential ignition source.

In order to minimize the risk of similar incidents, the New Jersey Division of Fire Safety identified key issues that must be addressed and remedies that should be implemented within all departments.

1. FACTOR:

Acting BC D'Antonio was conducting a rescue operation on the 2nd floor (above the fire) prior to the hose crew performing any effective fire suppression operations.

REMEDY:

A hose crew with a fully charged hose line should be in place to control the fire prior to personnel operating above the fire. Further, communication must be maintained between these personnel, reporting their status, progress, and observations.

2. FACTOR:

Acting BC D'Antonio's air supply rapidly decreased due to his strenuous activity, and his air mask becoming dislodged and free-flowing. Beyond this, he failed to continually monitor his air supply gauge, he was not cognizant that his low air alarm had activated, and he did not set-off his PASS device upon coming under distress.

REMEDY:

Firefighters must continually monitor their SCBA air supply gauges while conducting operations in an IDLH atmosphere; the low air pressure alarm should not be solely relied upon to advise the user when to exit. Additionally, PASS devices must be provided, used, and maintained in accordance with PEOSH regulations under N.J.A.C. 12:100-10 et seq. Although many departments still rely on PASS devices that must be turned "on" manually – devices that are acceptable by PEOSH regulations – they are not ideal because the firefighter must remember to activate the PASS device. For this reason, fire departments should strongly consider upgrading their SCBA to those employing automatic PASS devices.

3. FACTOR:

In following the concept of crew integrity, firefighters are paired in teams that enter the hazardous area together, perform their assigned task together and exit together. Crew integrity was not maintained by Acting BC D'Antonio during his rescue operation, as he entered the 2nd floor alone and did not exit later with FF Corso.

REMEDY:

Fire departments must take all possible measures to ensure that firefighters maintain crew integrity to provide for their safety and to prevent freelancing during fireground operations.

4. FACTOR:

The personnel accountability system utilized by the NHRFR was not capable of effectively tracking the location, function, and time of personnel operating at the incident scene.

REMEDY:

Fire departments shall adopt and utilize a personal accountability system that is compliant with the current IMS regulations under N.J.A.C. 5:75. Departments shall further designate personal accountability officers (PAOs) to monitor each entry point into a structure so as to monitor the locations, functions, and times of personnel.

5. FACTOR:

An interim NHRFR Rapid Intervention Team (RIT) was not established during initial operations. The dedicated RIT was dispatched on the 2nd alarm, and despite being on scene during Acting BC D'Antonio's distress, they went unutilized because his distress was not readily apparent.

REMEDY:

IMS regulations under N.J.A.C. 5:75 require that fire departments utilize a properly equipped and trained RIT to rescue distressed firefighters when operating in a hazardous atmosphere. An interim RIT must be established using on-scene personnel prior to the arrival of a dedicated RIT.

6. FACTOR:

Multiple building and occupancy characteristics greatly effected the fireground operations, including narrow roadways that hampered response, exposure problems to the neighboring structure, extreme amounts of storage that delayed interior and exterior operations, an open interior stairway that allowed fire to spread to the 2nd floor, small window size that hampered rescue operations and overhead power lines that prevented aerial ladder operations.

REMEDY:

Emergency responders must anticipate a wide range of dangerous conditions in/around private residences. It is critical that firefighters avoid complacency when responding to fires in such occupancies, and remain vigilant for conditions that will cause them to alter normal fireground tactics and strategies.

7. FACTOR:

Low staffing levels on each NHRFR unit made it difficult to effectively perform both rescue and fire suppression operations until the arrival of additional units.

REMEDY:

Staffing must be maintained at a level that allows for teams of at least 2 FFs to perform all vital fireground tasks, including search and rescue, fire suppression, and ventilation. Additionally, tests conducted with the Dallas, Texas Fire Department indicated that staffing below a crew size of four can quickly overtax the operating force and lead to higher losses.

8. FACTOR:

Issues were identified with regard to the NHRFR radio communications system and the procedures of the department regarding communications. They included the use of only one radio channel for all fire department operations on a particular scene, a high amount of “open-mic” transmissions, and dispatch and apparatus high power radios that overpowered hand-held radios with lower power capabilities. These issues hampered the ability for important messages to be transmitted. Also, an interagency communication problem was noted with EMS personnel; multiple requests had to be made for them to respond, and it was unknown by the IC if EMS was initially on scene or simply failed to communicate with the IC or report to the command post, causing much confusion as to their status on the scene.

REMEDY:

Incident Management System (IMS) regulations under N.J.A.C. 5:75 require that larger fire departments have multiple radio channels, including a main dispatch channel and separate channels that can be used on the incident scene. The NHRFR has the capability of utilizing multiple tactical/fireground radio frequencies at incidents and should develop operational procedures for the utilization of such; and that the concept of Unified Command shall be utilized when multiple agencies respond to an incident. Also, personnel must utilize their portable radios in a manner to minimize the risk for unintended radio transmissions.

9. FACTOR:

Although multiple NHRFR units were equipped with Thermal Imaging Cameras (TICs), they were not utilized by personnel during initial operations, including by Acting BC D’Antonio during his rescue operation, or by firefighters attempting to make entry for fire suppression.

REMEDY:

Fire departments that possess TICs should routinely employ their use during structural firefighting operations. Furthermore, the TIC should be an integral part of rescue operations, as it can save precious time in locating and removing victims.

10. FACTOR:

Although Acting BC D'Antonio reported issuing a "Mayday" on his portable radio, his message was never heard or recognized by personnel, even upon listening to the dispatch tape during this investigation.

REMEDY:

It is recommended that fire departments train all personnel on procedures for issuing a "Mayday", and also on the proper actions to be taken following the receipt of a "Mayday."

11. FACTOR:

The NHRFR failed to conduct the required annual fit testing of all FFs, whereas the SCBA face mask seal is analyzed to measure how well the FFs can maintain a proper seal under various physical conditions. It should be noted that although this factor did not play a role in the injuries sustained at this incident, it was nevertheless discovered by investigators.

REMEDY:

All departments shall perform annual SCBA "fit testing" on all FFs in accordance with Respiratory Protection Standards under 29 CFR 1910-134.

12. FACTOR:

During the course of this investigation, a dispatch tape of the fireground operations was obtained from the NHRFR Fire Control (dispatch center). Investigators from this agency were unable to obtain accurate timeframes for operations during this incident, as times were not given out over the radio from the dispatcher(s), and the recording of the fireground communications as provided by the NHRFR was abridged (not real-time). Therefore, it is not possible to state with any reasonable certainty the timeframes involved in any operations, including exactly how long Acting BC D'Antonio was operating inside the structure prior to becoming distressed.

REMEDY:

All departments should possess communications recording equipment capable of recording multiple frequencies simultaneously in various formats - abridged, real-time, merged with dispatch phone calls. Also, dispatchers must make it standard practice to continually update times over the radio upon receipt of "significant" fireground transmissions. NFPA 1221; Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems recommends that communications centers shall have a logging voice recorder, with one channel for each of the following:

- *Each transmitted or received radio channel or talk group*
- *Each dispatch alarm circuit*

- *Each telecommunicator telephone*

Additionally, NFPA 1221 recommends that records of the dispatch of emergency response units in response to alarms shall be maintained and shall identify the following:

- *Units*
- *Companies and supervisors for emergencies and subsequent emergencies*
- *Supervisory officers for alarms and subsequent alarms*
- *Time of acknowledgment by each unit*
- *Time of arrival of each unit at the scene*
- *Time each unit returned to service*

INVESTIGATION

Note: During the course of this investigation, a dispatch tape of the fireground operations was obtained from the NHRFR Fire Control (dispatch center). It should be noted that no times were given by the dispatcher over the radio, and that the tape was abridged, as it did not record in "real-time". Therefore, it is not possible to state with any reasonable certainty the timeframes involved in any operations, including exactly how long Acting BC D'Antonio was operating inside the structure prior to becoming distressed.

To provide for uniform identification of locations and operational forces within an incident scene, the scene is divided geographically into smaller parts which are designated as divisions. Specific areas of the incident scene are to be designated as follows:

- *Sides of incident scenes shall be identified as letters of the alphabet beginning with the letter "A."*
- *The side of the incident scene that bears the postal address of the location shall be designated as Division "A" by the Incident Commander. Where the incident scene has no postal address, the Incident Commander shall select any side to designate Division "A"*
- *Continuing in a clockwise rotation, the side adjacent to the Division "A" side shall be designated as Division "B."*
- *Continuing in a clockwise rotation, the side adjacent to the Division "B" side shall be designated as Division "C."*
- *Continuing in a clockwise rotation, the side adjacent to the Division "C" side shall be designated as Division "D."*

The Incident

On October 24, 2004 at 0402 hours, North Hudson Regional Fire & Rescue (NHRFR) responded to a working structure fire at 1412 44th Street in North Bergen. Initial response for NHRFR consisted of Engines(E) 5,6,9, each staffed by 2 firefighters and an officer or acting officer; Squad(SQ) 1, staffed by 2 firefighters and an officer or acting officer; Ladders(L) 3,4, each staffed by 2 firefighters and an officer or acting officer; Rescue(R) 1, staffed by 2 firefighters and an officer or acting officer; Battalion Chief(BC) 2; Deputy Chief(DC) 1; and Safety 1.

E-6 was first to arrive on scene, reporting a working fire in a 2-story wood-framed dwelling with heavy smoke showing and people visible in the 2nd floor windows. Upon exiting the apparatus, the E-6 crew encountered a woman standing on an air conditioning unit mounted through the wall between the 1st and 2nd floors. She was screaming that her parents were trapped upstairs and that the stairs were blocked by debris; she then jumped into the arms of a FF from E-6. The crew continued to deploy a 1-3/4" hoseline to attack the fire, and the driver of E-6 placed a ground ladder to a 2nd floor window on the Div. A side for rescue operations. Initially, the hose crew had trouble advancing inside due to extreme amounts of storage blocking the interior; they tried to darken down the visible fire from the doorway, but had little success.

While this was occurring, E-5 and BC-2 arrived on scene (it should be noted that BC-2 was Captain Robert D'Antonio; he was filling-in as Acting Battalion Chief during this shift). BC-2 established Incident Command (IC), radioed a size-up of a working fire in a 2 story wood-framed dwelling with people trapped, and a severe exposure problem on the Div. D side; he also requested a 2nd alarm be dispatched. E-5 personnel established a water supply from a nearby fire hydrant, assisted the crew from E-6 in attempting to advance the hoseline into the structure, and began rescue operations via the exterior ladder.

L-4 and L-3 arrived shortly thereafter; their crews were instructed to conduct rescue operations. They tried to access the interior through the front door, but also could not advance inside. They tried to get around to the rear of the structure for access, but were significantly delayed due to extreme amounts of storage around the entire property. Upon finally getting to the rear, they ventilated windows and gained rooftop access for ventilation. By this time, E-9 and DC-1(Frank Montagne) had arrived on scene; BC-2 met with DC Montagne to transfer Command while the E-9 crew deployed additional 1-3/4" hoselines and placed an additional ground ladder to another Div. A 2nd floor window for rescue. DC Montagne soon radioed for a 3rd alarm, and for multiple EMS ambulances to respond.

Acting BC D'Antonio was now assigned to interior operations; he saw that little progress was being made in advancing through the front door, and that the personnel on the ladders were having difficulty removing the victims. He ascended one of the ground ladders and made entry into the 2nd floor through the window, encountering heavy smoke and heat conditions. Upon entry, his helmet and air mask became dislodged due to the small window size, free-flowing air as he attempted to replace his air mask. He immediately located a male victim, and then a female victim frantically approached him. She grabbed his air mask before he could fully replace it, however, he soon redonned it while attempting to move both victims. Acting BC D'Antonio called for an SCBA (Self-Contained Breathing Apparatus) to be passed into the structure for the woman to breathe from, as he had difficulty moving her. Capt. George Lang from E-9 was positioned on the ground ladder for assistance; he removed his SCBA and passed it inside. FF James Corso from E-9 ascended the ladder to assist D'Antonio inside the structure. He and D'Antonio soon brought the woman to the window, eventually passing her out to personnel still on the ladders, where she was removed and treated by EMS personnel. They then went back to remove the male victim; after struggling to get him up to the window sill, he too was eventually removed down the ladder, where he was given CPR by FFs on the scene and turned over to EMS personnel. By now, SQ-1 and R-1 had arrived on scene, with their crews assisting in interior search and rescue operations; despite being delayed by the interior conditions, these crews finally gained 2nd floor access via the interior stairs, however, they never encountered Acting BC D'Antonio or FF Corso.

Acting BC D'Antonio knew that the interior conditions were deteriorating rapidly, and his low-air alarm was activated. He instructed FF Corso to exit the structure through the window, which he did. Prior to D'Antonio exiting, he thought that there was another victim in the area; he continued searching, but quickly became disoriented, again dislodging his air mask, which quickly ran out of air. Without air, he placed his face into his turnout coat to attempt to breathe; he now saw a light toward the front of the structure, which he quickly dove toward. With that, he dove out the window and got hung-up by his SCBA strap on the tip of the ladder. Now dangling unconscious in the air, FFs ascended the ladder and cut his strap free; he was brought down to the street where he was treated by FFs and EMS personnel.

Following Acting BC D'Antonio's transport to the hospital, firefighting operations continued. The fire was eventually successfully extinguished without further incident, and no additional victims were located.

The Casualty Scenario

At the time of this incident, Captain Robert D' Antonio was a 45-year-old member of North Hudson Regional Fire & Rescue, with approximately 17 years of experience, 9 of which as a Captain, and was Acting Battalion Chief on many occasions.

D'Antonio was initially transported to Jersey City Medical Center prior to being treated at St. Barnabas Medical Center in Livingston, NJ. It was found that he received severe smoke inhalation, and the heat he inhaled caused permanent damage to his respiratory system and vocal cords.

ANALYSIS

The following items are areas identified by investigators as impacting directly upon this incident.

Fire Department Profile

North Hudson Regional Fire and Rescue was formed in 1999 as a merger of the individual fire departments in the towns of Guttenberg, North Bergen, Union City, Weehawken, and West New York. Two Co-Directors oversee NHRFR, while Chief of Department Brion McEldowney commands a staff of approximately 316 Firefighters, 75 Captains, 14 Battalion Chiefs, and 6 Deputy Chiefs. NHRFR operates out of 17 stations, housing a fleet of 12 engines, 5 ladders, 2 rescues, and multiple specialty vehicles including a fire boat. The department also maintains its own dispatch center known as "Fire Control", and fleet services repair shop which houses 5 reserve engines and 3 reserve ladders. Records indicate that NHRFR responded to 8227 calls for service last year (2005).

Searching Above Fire Floor

It is characteristic of a spreading fire for smoke, heat, and flames to travel upward. It is, therefore, a very hazardous environment for personnel operating above a fire.

During this incident, the occupants of the building were trapped on the 2nd floor not only by the fire itself, but also due to the extreme storage conditions that prevented normal egress. Given these conditions, FFs also could not utilize the interior stairway; therefore the only means for rescue was to make entry directly into the 2nd floor from the exterior ground ladders. In doing this, Acting BC D'Antonio was placed in a very unstable situation; he was operating alone above the fire, which was still burning unchecked due to the problems with advancing the hoseline.

Self-Contained Breathing Apparatus (SCBA) Issues

During this incident, the NHRFR 2216 psi / "30-minute" SCBAs manufactured by SCOTT. It should be noted that 30 minutes refers to the theoretical amount of air supply in the tank, however, this amount can be drastically reduced depending on many factors, any of which can exhaust the air supply much sooner. These factors include amount of physical exertion, an improper facepiece seal, loose valve or hose connections, or activating the air bypass on the facepiece regulator. Thus, it can be reasoned that Acting BC D'Antonio's strenuous

exertion, combined with his air mask free-flowing while dislodged/loose caused his air supply to rapidly deplete.

NHRFR SCBAs are checked at the beginning of each shift. Acting BC D'Antonio reported that he personally checked his SCBA, and no problems were found. His SCBA was also equipped with two safety devices: an integrated Personal Alert Safety System (PASS), and a low air pressure alarm. A PASS device is designed to assist rescuers in locating a downed or disoriented firefighter even in dense smoke. It is worn on the SCBA or turnout coat and must be turned "on" prior to entering an atmosphere considered IDLH (immediately dangerous to life and health). Turning "on" the PASS is done manually on older models, however, newer integrated models are automatically activated. Should the firefighter collapse or remain motionless for approximately 30 seconds, the PASS will emit a loud, pulsating shriek. The alarm can also be sounded manually if the firefighter needs assistance. Rescuers will follow the sound to locate the distressed firefighter. Secondly, the low air pressure alarm is a device that will alarm once the air supply of the SCBA reaches approximately $\frac{1}{4}$ capacity, alerting the FF to begin exiting the structure prior to running out of air. Acting BC D'Antonio's SCBA was equipped with "VibraLert" which causes the regulator attached to the face mask to continually vibrate upon having low air pressure.

During this investigation, it was revealed that the NHRFR did not regularly perform the required SCBA "Fit Testing" for all FFs. This testing is mandated in the Respiratory Protection Standards under CFR 1910-134, and is performed to analyze how well a FF's face mask will maintain a positive seal under various conditions such as facial and bodily movements. Although all indications were that NHRFR had performed this procedure in the past, it was not performed on regular annual intervals.

From the abridged dispatch tape, it was estimated that Acting BC D'Antonio was operating inside the structure for at least 11 minutes before becoming distressed. However, as previously noted, this timeframe can not be viewed as accurate due to not being depicted in "real-time". He later reported that his low air pressure alarm activated during the rescue operations. Without continually monitoring his air supply gauge, he suddenly ran out of air completely after continuing to search alone and becoming disoriented. He never set-off his PASS device to alert personnel to his distress. His subsequent smoke inhalation caused him to lose consciousness upon diving through the 2nd floor window.

Crew Integrity

In following the concept of crew integrity, firefighters are paired in teams that enter the hazardous area together, perform their assigned task together and exit together.

During this incident, Acting BC D'Antonio attempted rescue operations by making entry directly into the 2nd floor structure via the ground ladders placed on the Division A side. He did this alone, without the benefit of a partner or utilizing specialized equipment such as a thermal imaging camera or search rope. Although he quickly located the victims, he was unable to effectively render assistance to them until FF Corso made entry to assist him. Upon removing both victims, Acting BC D'Antonio stayed inside the structure to continue searching; even after telling FF Corso to exit. Subsequently, upon becoming distressed himself, there was no one there to assist him in exiting safely.

Personal Accountability System

A personal accountability system is utilized to provide the IC with an improved means of tracking the location, function, and time of personnel operating at the incident scene.

NHRFR utilizes a "Command Technician", who responds with the Safety Officer to all working fires. This person assists the IC with monitoring radio transmissions and also acts as accountability officer, utilizing a command board to track units and assignments. At the time, NHRFR utilized a 2-tag accountability system in which one tag was kept on the firefighter's turnout gear at all times, and the other tag was placed on a ring in the apparatus.

However, during the interview process, it was revealed that many personnel had no definite idea on how the NHRFR accountability system worked. It was reported that 1st alarm companies would leave the ring on their apparatus, but companies responding on additional alarms would bring the ring and tags to the Command Technician for tracking. Personnel, including the Command Technician for this incident, were unsure as to whether the first alarm tags were to be collected or not. Many believed that the master riding lists, which were updated for each shift, were used to track the initial personnel.

Although this system could track personnel that are on the incident scene, and which apparatus they responded on, it does not allow for the tracking of their specific location or assignment at an incident scene. Although each apparatus has riding assignments based on seating positions, these assignments frequently change or overlap once on the scene.

Rapid Intervention Team (RIT)

In accordance with IMS regulations under N.J.A.C. 5:75, fire departments are required to provide at least two firefighters outside of an atmosphere that is immediately dangerous to life and health (IDLH). These firefighters are tasked with searching for and rescuing lost or trapped firefighters, should the need arise.

It is recommended that this concept be taken to a higher level with the establishment of Rapid Intervention Teams (RIT).

During this incident, the SQ-2, which responded on the 2nd alarm, was designated as the RIT. Although they were on scene during the removal of the 2 victims, they were not implemented as a RIT because it was unknown that Acting BC D'Antonio was in distress.

Building Considerations

Building and occupancy characteristics can play a significant role in both fire spread and personnel safety during incidents. Given this incident, some characteristics specific to this structure that played a role in this incident are as follows:

Narrow roadways – This structure was on a 1-way street which was very congested with parked vehicles. The surrounding roads were so difficult to navigate that L-3 should have been the 1st-due ladder, but they had to bypass many streets due to improperly parked vehicles blocking the roads. L-4, a tiller apparatus stationed further away, arrived prior to L-3.

Exposure problems – This structure was only inches away from the neighboring structure on the Division D side, giving the IC additional concerns for structure protection and evacuations.

Extreme amounts of storage – Photos of the structure show that the entire outside yard area around the structure was essentially utilized as a junk yard, with storage piled throughout, giving minimal access for personnel to operate on any other sides other than the front. Additionally, interior personnel reported that the storage inside this structure was piled to the ceiling throughout, and obstructed the front door and stairway to the 2nd floor. Many said that it was the worst storage conditions they had ever seen.

Open interior stairway – Like most residential structures, the main stairway in this building was unenclosed, providing unimpeded movement of the smoke heat and flames to the upper floor(s).

Small window size – This structure had small window openings which made it difficult for rescue operations to be made from the exterior ground ladders. Eventually, a larger adjacent picture window was broken out to provide adequate access to rescue personnel.

Overhead power lines – This structure had power lines running overhead across the front side, preventing personnel from using the aerial ladder to access the rooftop for ventilation.

Staffing Levels

During this incident, Captain D'Antonio was assigned as Acting Battalion Chief 2. In this capacity, he was the initial IC until the arrival of DC Montagne.

Furthermore, 3 out of the 7 first-alarm apparatus had firefighters serving as Acting Captains; the 2nd alarm companies had an Acting Battalion Chief and at least 1 Acting Captain.

Staffing levels of the NHRFR apparatus consisted of 3 personnel per unit; 2 firefighters (one was the driver) and an officer (who may be acting). On tiller apparatus, the 3rd firefighter would be the tiller operator; very rarely would a 4th FF be assigned to a ladder company. As such, for this incident, 21 personnel responded on 7 units in addition to the command officers. It was also noted that only 3 of the 7 initial apparatus were in position to be actively utilized for fireground operations. Most of the apparatus needed to park up to 2 blocks from the scene and went unused throughout the entire incident although in order to provide sufficient staffing on scene, it was necessary for a large number of apparatus to respond.

Many NHRFR personnel stated during interviews that staffing should be increased per unit. Several firefighters stated that they frequently operate alone, or quickly become overburdened performing their necessary fireground operations until the arrival of additional units. This was evidenced here as E-6 alone could not effectively perform basic fire suppression operations upon finding the imminent need to rescue trapped occupants. Thus, it can be reasoned that an increased number of personnel placed on a reduced amount of apparatus would increase the overall efficiency of response and operations.

Communications

This investigation revealed several issues with the NHRFR radio communications system and the procedures of the department regarding communications.

At this incident, the department operated primarily on one radio channel. That channel is also the channel over which all incidents are dispatched. Although there was another main channel that could have been utilized, it was reported that all other fire department apparatus and personnel not involved with this incident were directed to use the second channel. There were also five “tactical/fireground” channels that were available for use but were not used at this incident.

The problems involved with using only one channel on the incident scene were identified while listening to the recorded fireground communications of this incident during the investigation. As the incident escalated, this single radio channel became overburdened by the amount of transmissions occurring. So much, in fact, that many messages cut-out each other; many by dispatch and apparatus with high powered radios that overpowered hand-held radios with lower power capabilities. As a result, most of Acting BC D’Antonio’s transmissions prior to and during his distress went unheard or unacknowledged.

Another problem noted was the occurrence of “open-mic” transmissions. Many instances were noted where the radio would be unknowingly keyed-up, tying up the radio channel with background noise. This problem was acknowledged by department members, and was attributed to the way the personnel wear the portable radios. The FFs wear the radios in a radio strap and case underneath their turnout coats with the lapel mic stretched up near their face. The problem comes when the FFs perform various fireground operations such as searching or ventilation; their movement causes the mic buttons to depress, preventing others from transmitting messages.

There also appeared to be an inter-agency communication problem with EMS noted during the incident. DC Montagne requested on multiple occasions for EMS to respond to the scene, including upon the removal of Acting BC D’Antonio. This required multiple phone calls between the NHRFR dispatch center and the EMS dispatch center. NHRFR personnel appeared to be unsure as to the way EMS responds to fire incidents; some thought they automatically respond to working fires, some thought they only respond when requested by the IC, and some thought that it varied depending on which municipality the fire was in due to each town maintaining their own paid or volunteer EMS personnel despite the fire department being regionalized.

Further, investigators from this agency were unable to obtain accurate timeframes for operations during this incident, as times were not given out over the radio from the dispatcher(s), and the recording of the fireground communications as provided by the NHRFR was abridged (not real-time). Therefore, it is not possible to state with any reasonable certainty the timeframes involved in any operations, including exactly how long Acting BC D’Antonio was operating inside the structure prior to becoming distressed.

Thermal Imaging Cameras (TICs)

A TIC is a device that translates a thermal picture into an electrical picture and then a visual image for the human eye. This is accomplished because the TIC relies on the thermal energy emitted by all objects and not on reflected visible light, providing vision capability even with no light present. Thermal energy is characterized by its long wavelength, and the nature of this long wave thermal energy allows it to travel through smoke. The TIC generates a true black and white image; hotter objects appear white and cooler objects appear black to gray. It is this image that allows firefighters to “see” through the smoke, providing a more rapid means of locating victims or hidden areas of fire.

At the time of this incident, the NHRFR had multiple TICs; it was reported that every ladder, rescue, squad, and Battalion vehicle carries one on all responses. However, the TICs went unutilized during the initial stages when Acting BC D’Antonio made entry into the structure. It was not until additional companies made entry to the interior that they were utilized.

“Mayday” Procedures

During this incident, although Acting BC D’Antonio reported transmitting some sort of distress message over the radio, there was no message or formal “Mayday” heard upon review of the dispatch tapes. It is possible that this was due to the aforementioned problems with the radio traffic at this incident.

Public Employees Occupational Safety & Health (PEOSH) Inspections

Following this incident, there was no investigation performed by the NJ Department of Labor (DOL) PEOSH Unit.

LESSONS LEARNED

The following items are areas identified as ways to correct issues regarding this incident and other general items designed to make incident scenes safer and more efficient.

Searching Above Fire Floor

As previously noted, fire will cause smoke, heat, and flames to spread upward and outward from their source. This creates a hazard for anyone operating above a fire and should be avoided unless at least one ground ladder is placed to upper windows for emergency egress, a crew with a fully charged hoseline is in place to control the fire, and personnel are ready to perform ventilation to remove the smoke and heat. Rescue, suppression, and ventilation operations must be strictly coordinated by the IC or Operations officer, and communication must be maintained with personnel reporting their status, progress, and observations. Any changes in fire conditions or problems encountered while conducting these vital operations must be conveyed immediately to all those operating in the fire building. Failure to keep all members informed of changing conditions can, and often does, result in firefighter injuries and deaths.

Search team staff should be equipped with hand tools that can be used for forcible entry and tools that can extend a firefighter's reach. These tools will allow even a limited number of personnel to conduct an efficient search.

Self-Contained Breathing Apparatus (SCBA) Issues

As previously stated, the air supply of an SCBA can be drastically reduced depending on many factors, including physical exertion, which will exhaust the air supply much sooner. In fact, the Philadelphia Fire Department conducted extensive testing in a firefighting skills proficiency course with FFs using SCBA. For the 750 FFs tested, the average air consumption for a SCBA rated for 30 minutes was less than 15 minutes from full tank to low air pressure alarm.

Again, the low air pressure alarm is designed to activate when the air supply reaches approximately $\frac{1}{4}$ capacity. However, FFs should not rely solely on this alarm to alert them to exit the hazardous area, as all mechanical devices are subject to failure. Even with proper SCBA maintenance, FFs must periodically monitor their SCBA air pressure gauge during operations. Also, during routine checks, the SCBA air pressures should be logged to track any possible problems with air leaks.

PASS devices can save lives, however they must be provided by the employer and used and maintained in accordance with PEOSH regulations under N.J.A.C.

12:100-10 et seq. Although newer technology automatically activates an integrated PASS device upon turning-on an SCBA, many departments still rely on PASS devices that must be activated manually. Although these devices are acceptable by NFPA standards, the burden is on the firefighter to remember to activate the PASS device. As is the case with anything else, adding the human factor into the equation increases the chance for error.

Fire Departments must comply with Respiratory Protection Standards under 29 CFR 1910-134, whereas all FFs shall obtain a “fit test” annually, attesting to their ability to maintain a proper face mask seal. Should any FFs not receive a passing score on this analysis, they should be refitted with a different size / style SCBA face piece and retested until a passing score is obtained.

Current technology can assist with the communication difficulties typically encountered by FFs that have their SCBA facepiece donned. All SCBA manufacturers now offer voice amplification modules that are integrated on the facepiece to allow for normal-voice communication. This greatly increases the effectiveness of fireground communications by virtually eliminating the muffling and garbling that was commonplace. It is strongly recommended that all FDs consider upgrading their SCBAs with these devices for the safety of their personnel.

It is essential that fire departments preserve any equipment involved in firefighter injuries or fatalities so that a complete investigation of said equipment can be performed at a later date. This preservation should occur immediately following the incident, without cleaning or changing any components, such as to minimize the possibility of altering the conditions that may have contributed to the possible equipment failure.

Crew Integrity

The concept of crew integrity is paramount to ensuring the safety of FFs and helps to prevent freelancing. Simply stated, firefighters are paired in teams that enter the hazardous area together, perform their assigned task together and exit together. As a team, they formulate tactics that will most efficiently and safely accomplish what is to be done. Through continual training, the concept of crew integrity will become second nature and firefighters will understand that working as an individual is neither desirable nor tolerated.

Fire departments must take all possible measures to maintain crew integrity to prevent freelancing on the incident scene. Company officers and training officers should work within the context of ongoing training programs to create a culture in the department's ranks that freelancing is never acceptable or tolerated. Company officers and safety officers on incident scenes need to be constantly vigilant with respect to crew integrity and immediately intervene if they see that

freelancing is occurring.

Firefighter Survival Techniques

No matter how cautious firefighters are, fires are dynamic and conditions can deteriorate rapidly. It is imperative that firefighters be prepared for dire situations should they occur. Fire departments need to train firefighters to deal with the possibility of becoming lost or trapped. While it is difficult to simulate a training scenario in which a firefighter actually feels his/her life is threatened, creative, realistic and safe training exercises can be developed to help prepare firefighters for dire situations.

Through repetitive training, firefighters can learn such emergency survival techniques as “skip-breathing” to conserve precious air supply, entrapment self-extrication techniques, wall breaching techniques, ladder escape “bail-out” methods and so forth. It is also important that firefighters be equipped with small items such as wire cutters, personal flashlights and personal lengths of rope or nylon webbing.

Above all, firefighters must be conditioned to respond to individual emergencies calmly in order to make reasoned decisions. Firefighters must be taught that if they become lost or trapped the most important thing they can do is notify others of their plight and location as best they can. For this reason, every interior crew member should have a portable radio equipped with a sufficient number of operational frequencies and a dedicated command frequency. Further, they should use a pre-determined emergency term such as “May-Day” to notify the incident commander of their situation. Finally, firefighters need to immediately activate their PASS devices manually so that rescue crews can locate them quickly.

Personal Accountability System

Regulations for the NJ Personal Accountability System (NJPAS) under N.J.A.C 5:75 require that fire departments utilize a two-tag accountability system. The first tag is placed by the FF on the responding apparatus, and the second tag is given to a designated accountability officer prior to entering the IDLH. This system includes the use of Personal Accountability Reports (PARs) / roll calls, all within the framework of the IMS that is required to be utilized at all incidents.

The NJPAS is more than simply handing tags to the designated officer. It is also a system that requires communication between crews working inside the structure or hazardous area and company officers and the IC. Interior crews must continually apprise their company officers regarding conditions, location, and what they are doing. At the same time, company officers responsible for crews must solicit information from their crews and pass it along to the IC or

planning chief. With proper two-way communication, everyone on the incident scene is cognizant of what each team is doing and generally has a sufficient idea of where they are, thereby lessening the chances of firefighters freelancing.

Rapid Intervention Team (RIT)

As previously mentioned, IMS regulations under N.J.A.C. 5:75 require fire departments to provide at least two firefighters outside of an IDLH atmosphere. These FFs are tasked with searching for and rescuing lost or trapped FFs, should the need arise. It is recommended that this concept be taken to a higher level with the establishment of dedicated RIT.

These teams should be specially trained and equipped to deal with rescue of FFs under the worst possible conditions. The teams can be composed of departmental personnel or mutual aid personnel. It is important for the IC to request a RIT as soon as possible after dispatch to allow for the team to arrive quickly. Some fire departments have refined their response plans to dispatch a RIT automatically upon receipt of a report of a working fire.

If this concept is adopted by the fire department, it is crucial that the members of the RIT obtain all necessary training and equipment. Once on scene, team members should not be utilized for any other tasks. Other FD members need to be well versed in the duties, responsibilities and operations of the RIT.

Building Considerations

Fires that occur in one and two family residences may be some of the most hazardous for firefighters to battle, as these structures do not possess the same life safety or construction design features as commercial structures, nor are they subject to any regular fire safety inspections after initial occupancy. It is for this reason that firefighters must anticipate a wide range of dangerous conditions in private residences including hazardous materials storage, shoddy construction/alterations and high numbers of occupants.

Staffing Levels

Municipal officials, fire departments and IC's must remember that when determining staffing levels, it has been demonstrated that when staffing levels fall below four firefighters per company, critical fireground operations are not carried out when needed. Tests conducted with the Dallas, Texas Fire Department indicated that staffing below a crew size of four can overtax the operating force and lead to higher losses. Similarly, NFPA Standard 1710; *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* notes that

engine companies and ladder truck companies each “shall be staffed with a minimum of four on-duty personnel.”

Municipal officials need to understand that as the recognized employers of the department, they are legally responsible for inadequacies of a fire department. Elected officials can be cited for violations of laws and regulations and held liable in civil suits arising from departmental actions including those caused by inadequate staffing. Public officials need to adequately staff the fire department in order to assure fireground operations are conducted in a safer, more efficient and effective manner.

Communications

The aforementioned IMS regulations state that a communications system should meet the demands of the fire department for both routine and large-scale emergencies. The regulations further state that larger fire departments *shall* require several additional radio channels (in addition to the main dispatch channel) to provide for the volume of communications associated with multiple incident situations that can be common in larger municipalities. The communications system should be compatible with typical mutual aid departments, and should provide reserve capacity for unusually complex situations.

The radio is often the only link between personnel operating inside and outside of a hazardous area or situation. With this in mind, it is strongly recommended that the NHRFR communications system operating procedures be updated to provide a reliable method for their personnel to operate during emergency incidents utilizing various available radio channels, possibly determined by function or location on the fire ground. In this regard, excess radio traffic on a single channel will be reduced and the chances of urgent messages being received may be enhanced. Further, these procedures should include measures to allow for moving personnel off channels that are needed for exclusive use between the IC, RITs and trapped firefighters.

All fire departments should possess communications recording equipment capable of recording multiple frequencies simultaneously in various formats - abridged, real-time, merged with dispatch phone calls. Also, dispatchers must make it standard practice to continually update times over the radio upon receipt of “significant” fireground transmissions. NFPA 1221; *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems* recommends that communications centers shall have a logging voice recorder, with one channel for each of the following:

- Each transmitted or received radio channel or talk group
- Each dispatch alarm circuit
- Each telecommunicator telephone

Additionally, NFPA 1221 recommends that records of the dispatch of emergency response units in response to alarms shall be maintained and shall identify the following:

- Units
- Companies and supervisors for emergencies and subsequent emergencies
- Supervisory officers for alarms and subsequent alarms
- Time of acknowledgment by each unit
- Time of arrival of each unit at the scene
- Time each unit returned to service

While operating at scenes that require the response of outside agencies and/or departments, the concept of Unified Command must be utilized. Under this concept, a representative from each agency involved with an incident will contact and/or stand-by at the Command Post (CP) for orders from the IC. These representatives will exchange pertinent information with the IC to reduce the chance of freelancing and increase accountability of personnel on the scene.

Thermal Imaging Cameras (TICs)

Fire departments that possess TICs should routinely employ them during structural firefighting operations, as well as search and rescue operations. While TICs do not replace time-honored skills, they serve as an important tool to make searches for victims more efficient and result in a higher level of safety for firefighters. Just as firefighters outfit themselves with a set of irons and flashlight, they must equip themselves with a TIC every time they enter a situation where visibility is reduced.

The TIC must be an integral part of rescue operations for lost or trapped firefighters from the inception of the rescue, as it can help speed a RIT to the firefighter saving precious time in locating and removing the victim(s). Fire departments must continually train utilizing their TIC so that all firefighters become proficient in its use.

“Mayday” Procedures

Firefighters must be taught that if they become lost or trapped the most important thing they can do is notify others of their plight and their best guess of their location. For this reason, every interior crew should be equipped with a portable radio equipped with a sufficient number of operational frequencies as well as a dedicated command frequency. Utilizing their radio, they need to notify the incident commander of their situation using a pre-determined emergency term such as “Mayday”, and giving their name, location, and nature of the problem. Additionally, FFs need to immediately activate their PASS devices manually so

as to help rescue crews locate them quickly, and all non-essential radio transmissions should cease so that the IC or rescue personnel can communicate with the distressed FF(s).

The NJ Division of Fire Safety has proposed regulations pending approval for standardizing “Mayday” and evacuation procedures. These regulations will be added to the current IMS regulations under N.J.A.C. 5:75.

Emergency Care of Firefighters

While it was found during this investigation that the medical care provided to Acting BC D’Antonio was appropriate, it is important to note that the NJ Department of Health and Senior Services (NJ DOH) has issued a guide book, “Emergency Management Considerations for Firefighters” (also known as the “Pink Book”) to the emergency departments of all hospitals in the State. This book covers the proper medical procedures and considerations for treating and/or stabilizing various firefighter injuries. It should be noted that the NJ DOH is currently updating the “Pink Book”, and changing the title to “Guidelines for the Emergency Care of Firefighters”. All FDs should check their local hospitals to ensure that emergency room staff do possess, and are familiar with, this guide book.

In accordance with American Burn Association recommended guidelines, and in keeping with the policies of The Burn Center at Saint Barnabas, a certified burn treatment facility for care and transport of burn patients, all individuals meeting the following criteria should be referred to the nearest certified burn center:

- *All Partial thickness (2nd degree) burns \geq 10% TBSA*
- *All Full thickness (3rd degree) burns, regardless of size*
- *All chemical, inhalation and electrical burns*
- *Any burns to the face, feet, joints or genitalia*
- *Patients with pre-existing medical disorders compromising outcome*
- *Patients with burns and concomitant trauma (Follow regional medical control and triage protocols)*
- *Patients requiring extensive social, emotional or long-term rehabilitation*
- *Pediatric burns without qualified personnel or equipment*

In New Jersey, consult with The Burn Center directly at (973) 322-5920, or the NJ DOH at (609) 984-1863

Critical Incident Stress Debriefing (CISD)

The purpose of a CISD Team is to provide individual counseling, group sessions and, if necessary, referrals to members of an emergency response organization

involved in traumatic events. The teams are made up of specially trained fire, police and EMS personnel, along with mental health professionals who provide training and guidance to the team members and assist at the debriefing sessions.

The assistance provided by the CISD Team helps to sensitize the firefighters to the possibility of stress reactions, hopefully avoiding future stress related problems. It allows the members to understand the range of normal reactions and provides a method to deal with the incident and its after-effects. The use of a CISD Team in situations such as this is not a sign of weakness on the part of emergency personnel. Failure to deal completely with the emotional stress of such a traumatic occurrence can negatively affect both the professional and personal lives of those involved.

The Division of Fire Safety recommends the notification and use of CISD teams when the CISD trigger events are found to be present. Such significant events may include:

- *line of duty death of a co-worker*
- *mass casualty incidents*
- *death of a child*
- *death occurring after prolonged rescue efforts*
- *when a victim reminds an emergency worker of a loved one*
- *during highly dangerous or highly visible events*
- *when the emergency worker influences death or injury*
- *co-worker suicides*
- *any other unspecified highly traumatic event*

Currently, CISD Teams are regionalized in New Jersey and are part of a statewide network. These teams will respond on a 24-hour basis whenever requested. Emergency contact numbers for activation of a CISD team are as follows:

The Statewide CISD Network – (609) 394-3600

The NJ Fire & EMS Lifeline – (866) 653-3367

CONCLUSION

The injuries to Acting BC D'Antonio were found to be the direct result of issues involving his SCBA usage. The failure to continually monitor his rapidly depleting air supply and to not be cognizant of his low air alarm caused his "sudden" loss of air. However, other contributing factors were also found to have impacted upon the overall outcome of this incident including the lack of crew integrity, the non-use of thermal imaging cameras, radio communication issues, the lack of a dedicated rapid intervention team, and the lack of adequate staffing to accomplish all necessary fireground operations in an expedient and efficient manner.

In 1988 the then Bureau of Fire Safety, predecessor to the Division, conducted its first investigation of firefighter fatalities involving the deaths of five firefighters from the Hackensack Fire Department. Since then, in the dozens of investigations conducted by the Division, many, if not all of the issues identified in this report have been recognized as contributing factors with regard to the injuries and fatalities of firefighters throughout the state. Some more recent examples include 37 firefighter injuries in Newark in 1998; a firefighter injury in North Bergen in 1998; a firefighter fatality in Passaic in 2001; a firefighter fatality in Newark in 2001; a firefighter fatality in West Deptford in 2001; three firefighter fatalities in Gloucester City in 2002; and a firefighter injury in Englewood in 2003.

Firefighting is one of the most hazardous occupations that exists. It is understood that the fireground is not a normal static workplace where safety controls can be easily engineered into the work environment. Therefore, the primary way for safety to become an integral part of firefighting is through the establishment of a culture where firefighters conduct their operations in such a manner that safety is not just an afterthought; rather safety must be thought of as an operation to be performed, just as fire suppression and rescue operations are performed. There must be a conscious effort by firefighters and officers to place as much emphasis on safety as they do on the myriad of other operations that occur at emergency incidents.

It is the NJ Division of Fire Safety's sincere hope that the lessons learned from this and other similar incidents will serve to educate elected officials and the fire service and inspire them to take all necessary measures to reduce firefighter injuries and deaths to the greatest extent possible.

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