Surviving the Hood:

Creating a Firefighting Hood Maintenance Policy

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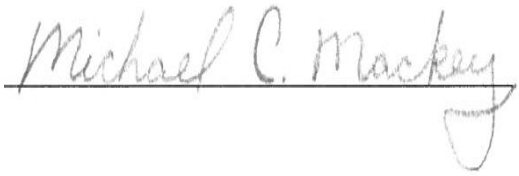
CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed:



Abstract

The fire service is beginning to understand the extent of how carcinogens can be absorbed through the skin. This startling revelation spotlights the need to properly maintain and clean bunker gear. The most permeable piece of personal protective equipment is the hood; this is the weakest link in the protective clothing ensemble. The problem is that Palm Beach County Fire Rescue does not have a policy to maintain its structural firefighting hoods. The purpose of this research is to develop a comprehensive policy to maintain firefighting hoods for Palm Beach County Fire Rescue. This applied research paper employed an action research methodology. The research questions used to guide this research were: a) What is the potential benefit for implementing a comprehensive firefighting hood maintenance policy? b) What is the National Fire Protection Association standard for firefighting hoods? c) What are the manufacturers' recommendations for cleaning and maintaining hoods? d) What are neighboring fire departments doing to maintain and clean their firefighting hoods? e) What are the budgetary impacts of implementing a firefighting hood maintenance policy? The procedures used to collect data to answer these questions came from an extensive literary review, information gained from a survey, a site visit, and multiple interviews. The research results revealed that the firefighter's protective hood can become a potential catch-all for contaminates and carcinogens after firefighting operations. Recommendations were to create written policy on the care and maintenance of firefighters' hoods as well as implement a hood exchange program.

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According to Harold A. Schaitburger, General President of the International Association of Fire Fighters, “the connection between firefighting and cancer is real, and there is scientific data to support our position. But we cannot stop there – we must continue to learn more so we can prevent our members from contracting this horrible disease and help them if they do” (IAFF, 2015).

According to a 2013 study by the National Institute for Occupational Safety and Health (NIOSH), firefighters have a higher risk of digestive, oral, respiratory, and urinary system cancers than the general population. Now, the University of Miami’s Sylvester Comprehensive Cancer Center wants to know why. Moreover, it is using Palm Beach County Fire Rescue as test subjects. In 2015, the state of Florida awarded the University of Miami a one million dollar grant to help pioneer this research, and Palm Beach County Fire Rescue has agreed to allow testing on its firefighters, equipment, and stations.

Fighting fire is an unavoidably dangerous activity. The number of hazards encountered at fire and emergency scenes is limitless and constantly changing. Firefighters are regularly exposed to smoke, soot, and toxic chemicals while fighting fires. These particulates remain on the surface of the firefighters’ gear and can penetrate into the fabric of their protective hoods. The hazards associated with inhaling smoke are well documented and understood in the fire service. Since the Occupational Health and Safety Organization (OSHA), in its Respiratory Protection standard (OSHA 29CFR 1910.134), made it a requirement to use positive pressure self-contained breathing apparatus (SCBA) over two decades ago, Palm Beach County Fire

Rescue made the needed changes to its written policies, training, and fire ground operations to ensure the safety of firefighters in the use SCBA's. The fire service is now beginning to understand the full extent of how carcinogens can be absorbed through the skin. This startling revelation is spotlighting the need to properly maintain and clean bunker gear. The protective hood is considered the weakest link in the protective clothing ensemble. The problem is that Palm Beach County Fire Rescue does not have a policy to maintain its structural firefighting hoods.

The purpose of this research is to develop a comprehensive policy to maintain firefighting hoods for Palm Beach County Fire Rescue. This applied research paper (ARP) employed an action research methodology. The procedures used to collect data for this project came from an in-depth literary review, a survey and site visit, and several interviews. The action research will be used to understand the issues of exposures as well as create a policy that instructs how to properly maintain and care for structural firefighting hoods.

The action research approach hinges on answering five questions. The research questions used to guide this research were: a) What is the potential benefit for implementing a comprehensive firefighting hood maintenance policy? b) What is the National Fire Protection Association's (NFPA) standard for firefighting hoods? c) What are the manufacturers' recommendations for cleaning and maintaining hoods? d) What are neighboring fire departments doing to maintain and clean their firefighting hoods? e) What are the budgetary impacts of implementing a firefighting hood maintenance policy?

A comprehensive literary review covering various updated textbooks, current medical studies found in professional journals, multiple scientific reports, along with an interview with Keith Tyson, the Director for the Firefighter Cancer Support Network, will be used to answer

question (a). A literary review covering pertinent sections within the 2014 edition of NFPA, standard 1851, will be conducted to answer question (b). Phone interviews and an onsite visit of Gloves, Inc., with the facility's manager, along with examining manufacturer's directions will provide the answers to question (c). To answer question (d), a combination of survey and telephone interviews will be conducted to ascertain information. The final question (e) will be answered by reviewing service agreements, contracts, and purchase orders.

Background and Significance

On October 1, 1984, Palm Beach County Fire Rescue (PBCFR) was officially established when twelve independent fire departments along with Palm Beach International Airport Fire Service merged into one department covering the unincorporated areas of Palm Beach County. Chief Herman W. Brice became the first administrator and with the help of the newly formed Union, Local 2928, he began the arduous task of unifying these diverse agencies into one cohesive fire department (Richard P. Lounsbury, personal communications, September 10, 2015).

With the successful creation of PBCFR back in 1984, the department started with a staff count of 490 total employees and 23 stations, which were divided into five geographic areas, as well as the Airport. PBCFR started off with 26 engines, 25 rescues, 3 aerial trucks, 2 hazardous materials units, 18 brush trucks, 6 tankers and 4 crash/fire/rescue units. Since then it has grown significantly; today PBCFR has over 1400 employees and covers 1822 square miles. Over the last decade, PBCFR has merged with five additional fire departments; these came from the western communities of South Bay, Belle Glade, and Pahokee in 2006. Subsequently, in 2009, the cities of Lake Worth and Palm Springs contracted fire and EMS services with the County, bolstering our station count to 49. In the most recent statistical information gleaned from our Planning Division, the current population of residents living in Palm Beach County is

approximately 840,000. In 2014, PBCFR units ran an estimated 117,000 calls. Today's daily minimum staffing is set at 285 combat personnel (Gregory, 2015).

Fire Administrator Jeff Collins explained that Palm Beach County Fire Rescue is proud of its many accomplishments, including additional city mergers, an enhanced communication center, and a forty million dollar, state-of-the-art training facility with an administrative building. However, our greatest asset is still, and always will be, the men and women who make up Palm Beach County Fire Rescue (Jeff P. Collins, personal communication, October 15, 2015).

In a recent CBS news story titled *Silent Killer: Spotlight on Firefighter Gear amid Health Concerns,* reporter Michele Gillen wrote that:

> Researchers said firefighters across South Florida are in a battle against cancer including alarming numbers of thyroid, colon, and brain cancer. Now all eyes are turning to the firefighters' personal protective gear. The spotlight is now shifting to the personal protective hood, a potential catch-all for contaminates and carcinogens. Miami Dade Fire Rescue is now issuing a second hood to their firefighters as a reminder that clean gear is the new normal (Gillen, 2015, p. 4). http://miami.cbslocal.com/2015/03/25/study-raises-questions-on-firefighters-gear/).

Statistics compiled by the International Association of Firefighters (IAFF) show that by the age of 60, twice as many firefighters died as a result of cancer, rather than heart attacks, the biggest killer among most Americans. Firefighter exposures include asbestos, diesel exhaust, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAH's). Smoke, soot, and toxic chemicals produced in structure fires are likely to contain additional carcinogens beyond the known ones identified to date (IAFF, 2015). Recently, an alarming number of Palm Beach County firefighters have been diagnosed with several different forms of cancer. The increasing awareness of firefighter cancer statistics, coupled with personal knowledge of friends and coworkers having been diagnosed with cancer has created fear and anxiety within the workplace. Factual or perceived threats to one's own safety have very real consequences that

can exacerbate the physical and mental wellbeing of the workforce. The fear associated with developing cancer will soon turn into anger if the administration is unwilling to take simple steps to reduce possible carcinogen exposures. This crisis surrounding each new firefighter being diagnosed with cancer will become deleterious to the morale of PBCFR.

In 2013, the leaders of PBCFR, composed of both union officials and top ranking administration chief officers, conducted a strategic planning session. During this summit, five primary goals were identified for the department to develop: employee safety, customer service, quality, efficiency, and fiscal sustainability (Chuck A. Lupo, personal communication, October 26, 2015). Under the goal of employee safety, a small group of volunteers comprised of retirees and active members came together in 2014 to discuss the alarming rate of firefighters diagnosed with multiple forms of cancer. This small group formed the FACE (Firefighters Attacking the Cancer Epidemic) team, and is currently working with Sylvester physicians and researchers on a design plan for a cancer survey and study. This study will look at rates of cancer in our firefighters relative to the broader population as well as occupational exposures that may influence cancer risk. This study will provide real data about the cancer burden in PBCFR's firefighters, and include potential strategies for cancer prevention and early detection. The group has been trying to connect with departments nationwide to raise awareness and educate firefighters. To that end, PBCFR has been trying to change the culture of its department. The goals of FACE are to bring about awareness, conduct research, and create change to reduce cancer rates among firefighters (Sam A. Eaton, personal communication, August 12, 2015).

The FACE team echoes the sentiment emphasized in the TAMPA2 report *Carrying the Safety Message into the Future,* from the 2014 Firefighter Life Safety Summit. "Firefighter health and fitness is one of the most talked about and most contentious topics in the fire service.

The issue of cancer within the fire service is also emerging as an undeniable priority. The additional area that requires immediate attention is the issue of what must be done to reduce exposures to carcinogens, beyond the steps that are already known" (National Fallen Firefighters Foundation, 2014, p. 36).

It is imperative that PBCFR take the necessary steps to help reduce dermal exposure to carcinogens. This action oriented research paper intends to reduce firefighters' exposures to carcinogens harbored in contaminated hoods. The risks for carcinogen exposure will continue if steps are not immediately taken to provide direction on cleaning and maintaining firefighters' hoods as well as implementing a hood exchange program immediately after working a fire. This ARP is significant in achieving employee safety, the first goal of the 2013 PBCFR Strategic Plan, and adds value to the mission of the FACE team.

The difference between adaptive problems vs. technical problems was covered in the last Executive Fire Officer Program (EFOP). Creating a comprehensive firefighting hood maintenance policy for PBCFR will require new ways of thinking and modification of firefighters' behavior; this is identified as an adaptive problem and shows a strong relationship to the information gleaned from the text, Leadership on the Line, a required reading for EFOP. One of the desired characteristics for Executive Fire Officers is to be an agent for change. The change model of analysis, planning, implementation, and evaluation (APIE) presented in class material will shape the process for creating a new policy. This research is directly linked to the United States Fire Administration (USFA) operational goal to "Improve the fire and emergency services' capability for response to and recovery from all hazards" and specifically, the objectives to "advocate a culture of health, fitness, and behavior that enhances emergency responders safety and survival" (United States Fire Administration, n.d., p. 20).

Literature Review

Until the last decade, the evidence of airborne contaminants and surface-sourced contaminants on firefighters' protective clothing during a fire has not received much attention. The vast majority of literature has focused on establishing the performance of protective clothing, including its design, performance, and protection afforded against flame and radiant heat (Perry, 1999). Much of the inferred knowledge about the transfer of contaminants through firefighting onto protective clothing was drawn from studies addressing the performance of clothing in other industries, such as the pesticide industry (Ness, 1994). Fortunately, in the last ten years, several medical studies on firefighters' exposure to products of combustion have been released. These scientific reports are presented in this ARP to determine any potential benefit for implementing a comprehensive firefighting hood maintenance policy for PBCFR.

Fire equipment manufacturers provide a large variety of what the fire service needs to minimize firefighter exposure to carcinogens, including NFPA-Compliant personal protective equipment. "Tremendous knowledge resides in these companies and their expertise needs to be embraced as the fire service moves forward to provide solutions to cancer prevention" ("Firefighter Cancer White Paper," 2013, p. 11). Currently, PBCFR only purchases firefighting hoods from Majestic, an American manufacturer of firefighting apparel. In the literature provided from Majestic, they state that by simply wearing a hood, there is some filtering of these "harmful elements" from the skin. This not only goes for actual firefighting, but training with live fire as well (Majestic, 2015).

The Occupational Safety and Health Standards (OSHA) defines a hood as: a respiratory inlet covering that completely covers the head and neck and may cover portions of the shoulders and torso (Occupational Safety & Health Administration [OSHA], 2015).

Corbett (2009), in *Fire Engineering's Handbook for Firefighter 1 and 2*, describes how structural firefighting hoods should be worn. Hoods are worn under a firefighter's helmet and over the self-contained breathing apparatus facepiece to protect the ears, neck, and any exposed skin not covered by the helmet, facepiece, or collar. Donned correctly, the hood is tucked into the coat and no visible skin will be exposed (Corbett, 2009 p. 172).

The surface area of the neck is 0.042 m^2. This was determined based on data from Lund and Browder (1944) showing that the neck accounts for 2% of the total body surface area, which is 2.1 m^2 for adult males 30–39 years of age (EPA, 2011).

Meyer (2010), in *Chemistry of Hazardous Materials,* describes how toxic substances enter the body. The text states: Some foreign substances penetrate the epidermis, the outermost layer of the skin, and enter the underlying dermis or subcutaneous tissue, from which they may be further absorbed into the circulatory system and spread throughout the body (Meyer, 2010 p. 392). Organic solvents, such as paint thinner or gasoline, are easily absorbed through the epidermis. Increasing the concentration of the toxic substance or the exposure time can increase the rate or amount of material absorbed. Contaminants, such as hydrocarbons, grease, and even carcinogens such as asbestos found in smoke can penetrate the PPE and must be removed from gear to ensure it is safe to wear (Corbett, 2009 p. 791).

Minerva, an independent service provider (ISP), is a national bunker gear cleaning company that services hundreds of fire departments across America. Minerva is fully compliant with the current NFPA 1851 standard. As such they are considered a subject matter expert in cleaning and repairing bunker gear. Their website states:

> Medical studies indicate that firefighters have a much higher risk of contracting cancer than the general population. Due to the nature of the profession, firefighters are constantly exposed to many harsh chemicals, toxins and carcinogens. These contaminants penetrate the protective clothing and are eventually absorbed by the skin.

> The most permeable piece of personal protective equipment is the hood (http://live.bunkergearcleaners.com).

These statements are in line with concepts garnished from numerous scientific reports and studies. The established research cited in this report lends credence to the concerns and warnings presented in Minerva's statement.

A 2006 meta-analysis by LeMaster et al., published in the Journal of Occupational and Environmental Medicine, is often referenced in articles regarding cancer rates of firefighters as compared to the general population. The objective of this meta-analysis study was to review 32 studies on firefighters and to both quantitatively and qualitatively determine the cancer risk. The results indicated that firefighters had a probable cancer risk for multiple myeloma, and a probable association with non-Hodgkin lymphoma, prostate, and testicular cancer (LeMasters et al., 2006).

In 2009, the National League of Cities (NLC) published a report titled, "*Assessing State Firefighter Cancer Presumption Laws and Current Firefighter Cancer Research*." The NLC report states, there is concern that conclusive evidence is lacking to demonstrate a causal relationship between firefighting and cancer. The NCL report later states that technological advancements such as self-contained breathing apparatus, and increased enforcement of personal protective equipment policies have reduced the risks of cancer for firefighters (NLC, 2009).

In a 2010 Fabian et al. conducted research on contact exposure resulting from residual contamination of personal protective equipment at Underwriters Laboratories Inc. (UL) facilities. This research was coordinated with the help of the Chicago Fire Department. Test sets were built to represent nine real-scale fires including single room, attic, deck, and automobile fires at UL's large-scale test laboratory. Researchers analyzed the dirty gloves and hoods used by Chicago firefighters for both inorganic and organic compounds. The chemical composition on the

firefighter gloves and hoods was virtually the same. The health implications found in this report state that carcinogenic chemicals might act topically following inhalation or following dermal absorption, including from contaminated gear (Fabian et al., 2010). What separated this research from others studies is the diverse fire scenarios used; the research explored not only smoke and soot produced from structural fires, but also included products of combustion from both automobile and deck fires. This knowledge influences the scope of the ARP to include possible hood contamination occurring from different types of fires.

A 2014 study by Alexander and Baxter titled *Plasticizer Contamination of Firefighter Personal Protective Clothing – A Potential Factor in Increased Health Risks in Firefighters,* characterized semi-volatile chemical contamination on firefighter personal protective clothing to assess exposure of firefighters to these chemicals. Samples from used firefighter protective clothing, including gloves and hoods were analyzed. Twenty-two of the chemicals of interest were found on at least one clothing swatch. Only di-(2-ethylhexyl) phthalate (DEHP), a plasticizer, was present on every swatch. DEHP concentrations were the highest of any chemical measured. These findings suggest that firefighters are exposed to high levels of DEHP, a probable human carcinogen (Alexander & Braxter, 2014).

The National Institute for Occupational Safety and Health (NIOSH), in collaboration with the National Cancer Institute (NCI) and the Department of Public Health Sciences at the University of California, produced the Daniels et al. study. This study analyzed cancers and cancer deaths among 29,993 firefighters from Chicago, Philadelphia, and San Francisco fire departments who were employed from 1950 through 2009. The sheer volume of data compiled in this massive research provided the much-needed panoramic backdrop to corroborate previous studies on firefighting and cancer risks. This commentary coming out of this report suggests that

firefighters do have a slightly elevated risk of cancer compared to the general population. The study in fact strengthened supporting evidence on the increased risk relating to firefighting and certain cancers. Cancers of the respiratory, digestive, and urinary systems accounted for the higher rates (Daniels et al. 2013).

The 2013 NLC report acknowledge that some studies did show a slightly elevated risk of cancer in firefighters, but they maintain that other studies show no such link. The report found that no study shows cancer occurring in firefighters at a significantly higher rate than in the general population. The NIOSH strength of association criteria thus appears to be significantly more liberal than those used in the NLC study, because they do not establish even a minimal buffer for sampling variability (Reiss, 2013).

In the meta-analysis of cancer studies in firefighters, LeMasters et al. (2006) found a probable or possible increase risk for 12 types of cancer, but a more recent firefighter cancer study by Daniels et al. found that firefighters had an increase incidence of 8 types of cancer, including lung and kidney cancer, but not leukemia or testicular cancer.

A short comparison of these two medical studies presented in this ARP demonstrates the diverse opinions held in the scientific community concerning this topic. Cause and effect is difficult to prove in the medical studies; cancer is a collection of various and different diseases and subtypes, and performing a study researching cancer for a single group across the country is technically difficult (Basri & Bergman, 2010).

NIOSH released another study titled *Evaluation of Dermal Exposure to Polycyclic Aromatic Hydrocarbons in Fire Fighters* in December 2013. This study aimed to find if airborne polycyclic aromatic hydrocarbons (PAHs), created during live fire training, pass through the skin of firefighters. This report explored dermal exposure and absorption in firefighters from turnout

gear contaminated from products of combustion. The tests consisted of controlled structural burns utilizing firefighters wearing full PPE, including SCBA. Biomarkers found in the firefighters' urine indicate that PAH's, including benzene, most likely entered the firefighters' bodies through their skin, with the neck being the primary site of exposure and absorption due to the lower level of dermal protection afforded by hoods. Although these exposures were considered low, the study recommends that firefighters wear full protective ensembles during all stages of firefighting, including a structural hood (Fent et al., 2013).

Laitinen et al. (2010) conducted similar research on firefighting trainers exposed to carcinogenic agents in smoke diving simulators, but provided an alternative theory. Researchers included the possibility that biomarkers present in trainers could have resulted from inhalation from off-gassing bunker gear after the firefighter removed their SCBA (Laitinen et al., 2010).

A 2015 study titled *Structural Fire Fighting Ensembles: Accumulation and Off-gassing of Combustion Products* examines the polycyclic aromatic hydrocarbon exposure during live fire training scenarios and the continued off gassing of bunker gear. Katherine Kirk and Michael Logan conducted this study with the help of fire instructors from the Queensland Fire and Emergency Services. The study examines the cumulative exposures of fire instructors' gear to toxic contaminants generated from live-fire training. Contaminants released from PPE and hoods after use included volatile organic compounds, carbonyl compounds, low molecular weight PAHs, and hydrogen cyanide. This study showed that PPE continues to off-gas well after the exposure occurred. However, air samples collected in a similar manner after laundering of ensembles according to manufacturer specifications indicated that laundering returns off-gassing concentrations of the investigated compounds to pre-exposure levels (Kirk &Logan, 2015).

This research changes the focus to include limiting exposure from off gassing of PAHs from contaminated bunker gear. This adds the element of totally removing PPE along with the firefighter's hood during rehab at training or on the fire ground. A hood exchange program will need to be included in the policy to protect firefighters from exposures.

The training scenarios demonstrated in the Queensland Combined Emergency Services Academy in Brisbane, Australia is comparative to how PBCFR conducts training. In the Australian study, exposures were measured during training evolutions in which students learned fire behavior in an enclosed space. PBCFR utilizes a cargo container in the same manner to teach flashover training. Other evolutions referenced in the Kirk and Logan study was teaching recruits how to make entry into a residential structure and conduct fire extinguishment along with search and rescue techniques. These training scenarios are very similar to how PBCFR utilizes the burn building to teach recruits. Kirk and Logan's research has moved this action oriented research project into yet another direction. A section of the new policy must also address the need for cleaning and maintaining students and fire instructor's hoods.

To understand the standards set by the NFPA for care and maintenance of firefighting hoods, the researcher examined NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2014 edition. NFPA 1851 provides the needed criteria for the fire service to be able to inspect, maintain, and care for structural firefighting clothing, which includes hoods. The first section of this standard, entitled Origin and Development of NFPA 1851, expresses that the fire service organization must ensure that policies, training, and administration of protective clothing programs be developed to provide for the overall safety of firefighters. Cleaning, repair, and decontamination are part of the structural firefighting program (NFPA, 2014).

NFPA 1851, section 6.2.2.2, provides a list of firefighter hood elements that must be included in routine inspections. This inspection should be conducted by the firefighter after each use and is comprised of checking for soiling, contamination, physical damage, thermal damage, loss of face opening adjustment, and loss of seam integrity and broken or missing stitches. The second type of inspection is called the advanced inspection and must be done by the hood manufacturer, a member of the department that is trained by the hood manufacturer, or a verified independent service provider. In the advanced type of inspection, everything in the routine inspection is done as well as shrinkage, elasticity, and label integrity (NFPA, 2014).

The reason a comprehensive maintenance policy to maintain firefighters' hoods should be established was gleaned from Lasky's 2006 book: *Pride & Ownership: A Firefighter's Love of the Job.* This book raises several questions about turnout gear. Is there an inspection program in place? Before crews enter a fire scene, do they inspect their partners? Does everyone have a hood on? PBCFR has this popular book in all forty-nine fire stations, and it has opened up needed dialog on firefighter safety. These questions were raised in chapter six, which was appropriately titled *Sweating the Small Stuff*; this fits with the APR subject matter pertaining strictly to firefighter hoods.

The warning and user information guide provided by Majestic Fire Apparel, Inc. with every hood has a section on care, maintenance, cleaning, and storage instructions. The information states:

> It is important that you keep your protective hood clean, free of contamination, properly maintained and stored at all times. Protective hoods that are dirty or contaminated pose significant hazards. The wearing of soiled or contaminated protective hoods can cause acute or long-term health hazards. Many contaminants can be absorbed through the skin and some contaminants are carcinogenic (Majestic, 2015).

The book “Fire Department Incident Safety Officer”, by David W. Dodson, published in 2007, contains the overall concept concerning operational safety in the fire service. Dodson connects the safety triangle with three pictures showing a firefighter with a nozzle, fire engine, and book identified as a fire department standard operational guideline. The caption below reads, "Operational safety relies on a combination of procedures, equipment, and personnel" (Dodson, 2007). The book suggests that fire departments have important procedures put into written policies or guidelines. The text recommends that fire departments that do not already have written policies should start with safety concerns. At the very top of suggested topics for operational policies is the care and maintenance of PPE (Dodson, 2007). A key component that is lightly touched on in chapter two is the need for a training component to implement certain guidelines or policies. This will be essential to successfully bring the firefighter’s hood maintenance policy to fruition for PBCFR.

Because PPE is issued to individual members, the care is also often delegated to them. However, because this equipment is specialized, the department has an obligation to provide a process or the facilities for cleaning and conducting minor repairs (Angle, 2005). PBCFR has two washer extractors for forty-nine stations, but currently uses a service agreement with a commercial bunker gear cleaning company. The text explains that standard operating procedures should state the care and maintenance needed to keep gear safe. This will be included into the policy, along with the hood exchange program.

Procedures

The action research method was employed to acquire pertinent information concerning firefighting hoods. The body of this ARP is framed on answering the initial five questions: a) What is the potential benefit for implementing a comprehensive firefighting hood maintenance

policy? b) What is the National Fire Protection Association standard for firefighting hoods? c) What are the manufacturers' recommendations for cleaning and maintaining hoods? d) What are neighboring fire departments doing to maintain and clean their firefighting hoods? e) What are the budgetary impacts of implementing a firefighting hood maintenance policy? The key for discovering pragmatic answers to these questions begins in the process of converting raw data into informed decisions. Data was first collected through an extensive literature review. Next, responses to the survey and interviews were interpreted. After months of analysis this data was transformed into valuable information. The information garnered from the action-oriented method was used to solve the stated problem. The information obtained from the research was then incorporated into creating a comprehensive structural firefighting hood policy for PBCFR, found in (Appendix A). This policy provides clear direction for firefighters on cleaning and maintaining their structural firefighting hoods and establishes a hood exchange program.

The procedures for this ARP were deliberately written to provide sufficient information to permit replication. These procedures are also appropriate to achieve the stated purpose. The literature review started at the Learning Resource Center (LRC) at the National Fire Academy to gather research concerning structural firefighting hoods for this ARP. A myriad of professional journals, fire science textbooks, and assorted publications provided a plethora of ideas and concepts for conducting research on personal protective equipment (PPE); however, there was relatively little information concerning just the care and maintenance of fire fighter hoods. The internet was used to find current information on NFPA standards, medical research on carcinogen exposures, and current scientific reports on cancer rates among firefighters. To help permit replication by other researchers, Bing (www.bing.com) was used as a search engine. Key terms used during this exhaustive internet research were "Cancer Firefighter Support

Network” ,“Minerva”, “Gloves, Inc.”, “NFPA 1851”, “OSHA firefighting”, “NIOSH”, “Majestic fire hoods”, “Ed M. Feld”, and “white papers firefighters and cancer”, were used. Only a small percentage of the overall research material was harvested for this ARP. Some written information was gleaned directly from the manufacturing company, Majestic, that designs, tests, and produces firefighting hoods. A survey was developed with a defined population provided, and the process for selecting the sample described in detail. The section concludes with a note on limitations and the paper itself is written to meet the 6th edition of the American Psychological Association Publication Manual.

To answer the first question concerning a potential benefit for implementing a comprehensive firefighting hood maintenance policy, a literary review started at the Learning Resource Center (LRC) at the National Fire Academy to gather research concerning structural firefighting hoods. Professional journals, fire science textbooks, and assorted publications covering medical studies, and scientific reports were analyzed. An extensive internet search using Bing (www.bing.com) for key terms like: “cancer firefighter support network”, “Minerva”, “Gloves Inc.”, “OSHA firefighting”, “Majestic fire hoods”, “NIOSH”, and “firefighters cancer studies”, were used. A short interview over the phone was conducted with Keith Tyson, the Director for the Firefighter Cancer Support Network on November 2, 2015.

To answer the second question concerning NFPA 1851, research was conducted at PBCFR headquarters located in WPB, Florida. The Bureau of Safety Services for PBCFR maintains a yearly subscription to the NFPA website. This allowed the researcher to print the entire NFPA 1851 standard on *Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting* from the 2014 Edition. This provided the appropriate information to answer question two within the literature section alone.

To answer the third question, about the manufacturers' recommendations for cleaning and maintaining hoods, the instructional guide provided with every Majestic hood as well as searching Bing (www.bing.com) was beneficial. Majestic's website produced detailed information on designs, warranty, and fabrics of the hoods, along with cleaning instructions. A phone interview with Majestic confirmed their written instructions on maintenance and cleaning procedures. Another phone interview was conducted with Ed M. Feld Equipment, a company that has specialized in firefighting and safety equipment for over sixty years. Because this company sells several different brands of structural firefighting hoods it may provide a different point of view then Majestic. The initial interview questions were hand-written, but later transcribed and presented in Appendix F. The interviews and information gleaned from manufacturer's websites were used to help write the firefighter hood policy. Majestic was selected because they are the hood manufacturing company where PBCFR currently purchases hoods.

A face-to-face interview with the manager of Gloves, Inc., located in Miami, was performed during the site visit at the branch store located in Miami. Gloves, Inc. is a certified Independent Service Provider (ISP) that cleans and maintains PPE for over twenty-five different fire departments in Florida. This face-to-face interview provided insight into cleaning requirements that follow NFPA 1851. Gloves, Inc. was selected for a site visit and interview because they are the ISP that PBCFR uses to clean, inspect, and make repairs to structural PPE including hoods. The complete transcribed survey can be found in Appendix H.

To find out what neighboring fire departments are doing to maintain and clean their firefighting hoods, a six-question survey was conducted. There are eleven fire departments working in Palm Beach County; they include career, volunteer, and some combination of both.

The demographics of all the departments are considered suburban and urban. The total number of possible completed surveys was eleven and full compliance was obtained. The majority of these surveys were completed in person to reduce the possibility of redundancy, or harvesting corrupt data often associated with electronic surveys. The fire chiefs of PBC gather once a month to discuss regional issues, as well as operations and training needs. It is in this setting that the majority of the surveys were completed. However, three departments did not attend the October meetings, and so two surveys had to be conducted over the phone and one department sent back the survey via email. The names of the departments and the six survey questions are found in Appendix B. The process of distributing and collecting surveys was completed in October 2015. The exact dates and location of events are documented on the survey questions.

The final question regarding the budgetary impacts of implementing a firefighting hood maintenance policy contained in the literature review was too broad in nature. Articles often associated the cost of maintaining PPE to the cost of a firefighter's life. This over dramatization did not provide the empirical data required to properly answer the research question. However, a defined cost for actual service provided for cleaning hoods was provided through a written contract established between Gloves, Inc. and PBCFR. This investigative work raised another question; approximately how many working structure fires and training burns occur in one year? The Planning and Training Division of PBCFR will need to provide answers to those two questions. Personal communication with PBCFR's inventory manager provided valuable insight into formulating a fiscally sustainable plan to create a comprehensive hood maintenance program. Department purchase orders for extra hoods to implement the hood exchange program is found in Appendix E.

The limitations for this ARP started with the literature review; the relatively minute amount of written information regarding just the care and maintenance of fire fighter hoods presented a significant limitation for this applied research project. Obtaining surrounding fire department policies on maintaining hoods was also limited; only one department actually had a written policy for cleaning and caring for PPE, but it did not directly address firefighter hoods. The information gleaned from the interviews was limited due to the very nature of the research topic. The recommendations were all in line with established NFPA standards and manufacturers recommendations. The interview with Keith Tyson, Director for the Firefighter Cancer Support Network was limited only to the specific nature of the research questions pertaining to hoods. Mr. Tyson was a wellspring of knowledge concerning firefighter cancer studies and statistics coming from several published reports noted in this ARP, but was only able to provide limited information on policies or programs related to structural firefighting hoods.

Results

Research Question 1: *What is the potential benefit for implementing a comprehensive firefighting hood maintenance policy*?

One of the ways to accomplish a comprehensive firefighting hood maintenance policy is by implementing a hood exchange program. This program allows for fast replacement of contaminated, ripped, or damaged hoods on the fire ground. The structural firefighting hoods are fabricated with flame-resistant materials to protect firefighters from the extreme heat that is produced by fire. Firefighters are less likely to receive first and second degree burns to the neck and face when properly wearing firefighting hoods (Corbett, 2009). By simply wearing a hood, there is some filtering of these “harmful elements” from the skin. This goes not only for firefighting on the job, but also during training with live fire (Majestic, 2015).

Contaminates present on a dirty hoods may reduce the fire protection. The exchange of clean NFPA compliant hoods could avoid heat burns around the neck and face. The review of this first question provided answers to the benefits of creating a hood maintenance policy as it regards to thermal burns, now the answer transverses into the topic of preventing exposure from carcinogens.

A 2006 meta-analysis that was to review 32 studies on firefighters and to quantitatively and qualitatively determine the cancer risk found that firefighters had a probable cancer risk for multiple myeloma, and a probable association with non-Hodgkin's lymphoma, prostate cancer, and testicular cancer (LeMasters et al., 2006). However, this study is not current and does not provide enough evidence that these exposures were due to dermal absorption.

A 2010 study by Underwriters Laboratories, Inc., with the help of the Chicago Fire Department, conducted tests to determine whether gaseous effluents, which leave an oily residue or film on exposed skin, were absorbed and pose a threat to firefighters' health.

Over a four-month period, Chicago Fire Department collected data and had their gloves and hoods analyzed for inorganic elements and organic compounds to identify the chemical composition of accumulated smoke residue. This study used CarbonX brand hoods and distributed them to eight firefighters. Every two weeks two sets of gloves and hoods were collected for testing. The chemical composition of accumulated smoke and soot on the firefighter gloves and hoods was virtually the same. However, the concentration on the gloves was one hundred times greater than that of the hoods. The greater concentrations found in the gloves was expected due to the transfer from direct handling of charred remains.

After all the procedures were performed, the samples of exposed gloves and hoods were sent to the University of Cincinnati for final analysis. The health implications found in this

report indicate that some carcinogenic chemicals might be absorbed through the skin from contaminated gear (Fabian et al., 2010). This study clearly indicates that contaminants can be absorbed into the fabric of firefighting hoods.

The report titled, *Evaluation of Dermal Exposure to Polycyclic Aromatic Hydrocarbons in Fire Fighters,* was released in December 2013. This study was aimed at determining if airborne polycyclic aromatic hydrocarbons (PAHs) and other possible cancer causing products that are created during live fire training do, in fact, pass through the skin of firefighters.

The tests consisted of three, controlled structural burns utilizing five firefighters for each burn. Three days of samples from the fifteen firefighters were gathered. One year later, another set of three controlled burns was conducted and similar data was collected.

A concluding recommendation was to provide fire fighters with long hoods less likely to come un-tucked. It was found that PAHs had entered firefighter's bodies during these controlled training burns. These exposures were considered low. However, it was recommended that firefighters wear full protective ensembles during all stages of firefighting, including a structural hood (Fent et al., 2013).

Both the NIOSH and the UL study established enough raw facts and circumstantial evidence to derive the need for implementing a comprehensive firefighting hood maintenance policy for PBCFR.

The second half of this question asks why it is important to have the hood exchange program placed into a written policy. Fire departments have an obligation to provide a process, or the facilities, for cleaning and conducting minor repairs to PPE. Standard operating procedures should state the care and maintenance needed to keep gear safe (Angle, 2005). The concerns for operational safety in the fire service are better met when important procedures are

put into written policies; departments that do not already have written policies should start with safety concerns (Dodson, 2007). The first section of NFPA 1851 expresses that the fire service organization must ensure that policies, training, and administration of protective clothing programs be developed to provide for the overall safety of firefighters (NFPA1851, 2014).

The possible benefit of PBCFR creating a comprehensive cleaning and maintenance policy for firefighters' hoods was discussed with Keith Tyson, a retired Miami Dade firefighter and cancer survivor. Tyson is the Director for the Firefighter Cancer Support Network and meets with PBCFR's FACE team several times a year. During a short interview conducted over the phone on November 2, 2015, Tyson was asked about his previous statement, "The idea that having the dirtiest, most worn gear in the station makes a firefighter look seasoned or macho is long past". Tyson still holds that sentiment and is starting to see a change in attitude with the troops, but feels the changes needed by administration are slower. He explained that thyroid cancer is very high in firefighters in Florida and felt this could be a result of exposures from dirty hoods. He believes protective hoods are a potential catch-all for contaminates and carcinogens and firefighters should be given two hoods. Every fire department should comply with NFPA 1851 according to Tyson. A policy should be in place, which would provide grounds, to enforce the cleaning and maintenance of all PPE. With the release of the various NIOSH reports, White Papers, and the Australian study, cleaning PPE is gaining traction. A hood exchange program could help reduce exposure to carcinogens, and "anything is better than nothing", stated Tyson. This information is provided in Appendix B.

Research Question 2: *What is the National Fire Protection Association's (NFPA) standard for firefighting hoods?*

Standards from the NFPA set forth requirements for both the purchase and care and maintenance of firefighting PPE. Specifically, NFPA 1971 includes the requirements for the various components of structural firefighting PPE, while NFPA 1851 describes the requirements of a PPE care and maintenance program (Angle 2005).

NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2014 edition provided the needed criteria for the fire service to be able to inspect, maintain, and care for structural firefighting clothing, which includes hoods. In NFPA 1851, chapter four section 4.2.2 states that organizations shall develop written standard operating procedures that shall identify and define the various parts of the program. Cleaning, repair, and decontamination are mentioned as part of the structural firefighting program. The structural firefighting protective hood is defined as the interface element of the protective ensemble that provides limited protection to the coat/helmet/SCBA facepiece interface area in section 3.3.99 (NFPA 1851). Later in chapter six, section 6.2.2.2 it provides a list of firefighter hood elements that must be included in routine inspections. This routine inspection is conducted by the firefighter after each use and is comprised of checking for soiling, contamination, physical damage, thermal damage, loss of face opening adjustment, and loss of seam integrity and broken or missing stitches. The second type of inspection is the advanced inspections; the hood manufacturer, a verified department, or a verified independent service provider must do this. During the advanced inspection, everything in the routine is completed along with examining the shrinkage, elasticity, and label integrity of the hood.

Research Question 3: *What are the manufacturers' recommendations for cleaning and maintaining hoods?*

The warning and user information guide provided by Majestic Fire Apparel, Inc. states:

It is important that you keep your protective hood clean, free of contamination, properly maintained and stored at all times. Improper cleaning can severely damage the protective hoods.

Cleaning Preventive Measures / Precautions:

- Do not use chlorine bleach or detergents containing chlorine.
- Do not use fabric softeners or detergents containing fabric softeners.
- Do not wash your protective hood with personal items.
- Do not commercially dry clean.
- Use regular mild detergent.
- Water temperature not to exceed 130° F (warm water recommended).
- Tumble dry heat not to exceed 130° F (low-heat recommended).
- Do not line-dry in direct sunlight.
- Do not store in direct sunlight.

Routine cleaning of protective hood should be done after each use or whenever your hood becomes soiled. Store your hood only when it is clean, dry, and free of contamination. Do your hood in the pocket of your protective coat or pants as this may lead to contamination and or damage (Majestic, 2015).

A phone interview with Doreen Glasso, manager for Majestic, confirmed their written instructions on maintenance and cleaning procedures. The researcher conducted a phone interview with Majestic, the hood manufacturing company that provides hoods for PBCFR. The company's manager states that issuing multiple hoods, or at least a second hood, would help ensure that firefighters have a spare hood while one is being cleaned. Majestic believes that wearing a hood that is inspected after each use and properly laundered, weekly if not more often, is the first line of defense in reducing exposure to the "harmful elements" of a fire. Their certified fire hoods are manufactured from inherently fire retardant knits, meaning that protective qualities of the materials cannot be "washed out" no matter how many times they are washed. According to the results of UL testing to the specifications of NFPA 1971 their materials are even more protective after washing, as proper washing tends to "tighten" knit materials. Majestic did not have a preference to in-house washing vs. using the services of a certified cleaning service. Majestic would not give a preference to either Gloves, Inc. or Minerva, and stated that by

following the guidelines of NFPA 1851 and choosing a certified industrial cleaning service, Palm Beach County is taking the necessary steps to help ensure PPE safety. The manager agreed that a policy to clean and maintain hoods should be created. Tracking the cleaning process would be a benefit to complying with NFPA 1851. A general question about the three different colors of Majestic's hoods makes was discussed. The hoods come in three different colors, white, black, and gold; the difference in color signifies changes in the blend of fabrics. A white hood is 100% Nomex, but the gold and black hoods are a different blend of Kevlar and Lenzing. However, the washing instructions for all three hoods are the same. For complete interview, see Appendix E.

Another phone interview was conducted with Ed M. Feld Equipment, a company that has specialized in firefighting and safety equipment for over sixty years. While most fire fighting hoods are similar in style, they do vary slightly. Some of the options include length (extra-long to cover your shoulders, blades, and chest or regular length to cover just below the neck), facial coverage (many hoods leave an opening only for the eyes and nose, while some have a big enough stretch to uncover the mouth as well), and material (hoods are mostly made with nylon blend, Nomex/Lenzing blend, or a Carbon based tri-blend rib knit). The purchasing manager states that firefighters should have two hoods assigned to them, and hoods should be washed monthly. The interviewee strongly recommended following the manufacturers' instructions on how to wash hoods. The manager states that Majestic's hoods are well made, but declined to give his preference to any specific PPE manufacturer and stated ED. M. Feld only sells NFPA compliant PPE. The manager did state that, in his opinion, every firefighter should have two hoods assigned to them. He did not have a preference as to in-house washing vs. using the services of a certified ISP. For complete interview, see Appendix F.

Gloves, Inc. is a certified, independent service provider to clean and maintain PPE. The store has service contracts with twenty-five different fire departments and is located in Miami. PBCFR has utilized Gloves, Inc. for cleaning and repairing PPE for several years. A face-to-face interview with Elya Alexander, the manager of Gloves, Inc., was conducted during an onsite visit. The interviewee provided their professional advice, but stated this was not necessarily Gloves, Inc.'s legal position. Mrs. Alexander states that firefighters should be issued two hoods. It was also recommended that hoods be washed after every significant exposure to smoke and soot. This would include training burns and motor vehicle fires. The manager believes that using an ISP to clean hoods is much better than a department using their own washers and extractors. In her experience from working with fire departments, she states they usually do not have the correct temperature settings for the washing machines and either uses too much or not enough laundry detergent to clean the PPE properly. The interviewee confirms that washing hoods does not reduce the protective qualities of the hoods, but actually makes them last longer. This coincides with the information from both Majestic and ED. M. Feld. It is in the best interest of the fire department to track, clean, and maintain hoods. Globe, Inc., charges PBCFR two dollars per hood for cleaning. After cleaning, workers look for physical damage like tears, rips, cuts, or other damage. Label integrity is to assure the label is attached and the manufacture date is present. If the label is missing or unreadable, the hood is past its life expectancy. Due to the relative low cost of purchasing a new hood, PBCFR always declines making any repairs. For complete interview, see Appendix H.

Research Question 4: *What are neighboring fire departments doing to maintain and clean their firefighting hoods?*

1. *Which one of the following titles best describes your rank?*

Answers	Response Percentage	Response Count
Fire Chief	16.66%	2
Deputy Chief	41.66%	5
Division Chief	33.33%	4
Battalion Chief	0.00%	0
Other	8.33%	1

Of the 12 questionnaires filled out, the majority were Deputy Chiefs, accounting for 41.66% of the responses, followed by Division Chiefs 33.33%, Fire Chiefs 16.66%, and other ranks 8.33%.

2. *What is the residential population your department serves?*

Answers	Response Percentage	Response Count
less than 10,000	25.00%	3
10.001- 25,000	8.33%	1
25,001-50,000	16.66%	2
50,001-100,000	33.33%	4
100,001-250,000	8.33%	1
Greater than 250,000	8.33%	1

Of the 12 questionnaires filled out the majority of the population was 50,001-100,000 with 33.33% of the votes. Next was less than 10,000, who had 25.00% of the votes, and 25,001-50,000 at 16.66%. The last three categories ranging from a population of 10,001-25,000; 100,001-250,000; and greater than 250,000, all tied at 8.33%.

3. *Does your department have a written policy for maintaining firefighter hoods?*

Answers	Response Percentage	Response Count
Yes	16.66%	2
No	83.33%	10

Of the 12 questionnaires filled out, the overwhelming majority surveyed advised they have no such policy. However, two departments 16.66% admitted that hoods were incorporated into their

overall PPE maintenance policy. PBCFR was among the 83.33% that do not have a written policy for maintaining hoods.

4. Does your department send hoods out to be cleaned?

Answers	Response Percentage	Response Count
Yes	41.66%	5
No	58.33%	7

Of the 12 questionnaires filled out, departments choosing to have their hoods go out to be cleaned came in at 58.33% compared to 43.66% of those cleaning hoods at their stations.

5. How often does your department clean their hoods?

Answers	Response Percentage	Response Count
After every exposure	8.33%	1
Twice a year or more	16.66%	2
Once a year or less	41.66%	5
As needed	33.33%	4

Of the 12 questionnaires filled out, the majority cleaned their hoods “Once a year or less” 41.66%. “As needed” was 33.33% of departments. Finally, “Twice a year or more” at 16.66%, and “After every exposure” at 8.33% were the remaining departments.

6. How many firefighting hoods is each firefighter assigned?

Answers	Response Percentage	Response Count
One	58.33%	7
Two	41.66%	5
Three	0.00%	0

Of the 12 respondents, 58.33% reported that their department issues only one hood. 41.66% advised that two hoods were issued to their firefighters. No fire department that resides in Palm Beach County issues their firefighters three hoods. Appendix I contains pie charts with data.

Research Question 5: *What are the budgetary impacts of implementing a firefighting hood maintenance policy?*

Components of safety and health programs cost money. However, the cost of not having a comprehensive program outweighs the cost associated with program operations. There are some popular methods for funding a program. The first and most common is to use funds from the organization's annual budget (Angle 2005). Don Howard is the manager of Inventory and Stores for PBCFR; he relayed in an email that in the fiscal year 2015-2016, fire rescue allocated $900,000 dollars in the safety equipment line of the budget, of which 600,000 was earmarked for bunker gear.

PBCFR purchases Majestic firefighting hoods through Municipal Equipment Company. The contract allows for the purchase of PAC III PBI Gold, for $34.80 each, and the ventilation style Gold hoods for $18.70. The White PAC III P-84 NOMEX hood costs $17.70. The gold and white hoods are specified in the contract, allowing procurement through direct order. The black hoods are not listed in the contract; they are the Ultra C6 CARBON PAC III and cost $30.80. Because they are not listed in the contract, a decentralized purchase order (DPO) must be processed for every order. Part of the comprehensive firefighting hood maintenance policy is to establish a Hood Exchange Program.

The initial budgetary impacts for creating a hood exchange program will involve purchasing the spare hoods that can replace contaminated hoods on the fire ground. This researcher, along with members of the FACE team, decided to utilize battalion chiefs to carry the extra hoods. They are the highest-ranking officer on shift and respond to all fires in their response zones. PBCFR has seven, on-duty battalion chiefs at all times; they are normally the incident commander on all structure fires. These single unit resources are assigned on 24-hour

shifts. The collective agreement is to provide 25 spare hoods to each of the seven battalion chiefs. The decision was made to buy 20 regular White PAC III P-84 NOMEX hoods at a cost of $17.70; 3 PBI PAC III Gold for $34.80 each; and 2 Ultra C6 CARBON PAC III at a cost of $30.80. The total purchase price for each battalion would be $519.34 and to outfit all seven battalion chiefs with 25 hoods each would be $3,635.38.

PBCFR has approximately 1300 sets of bunker gear. Over the last two years, PBCFR has started the process of sending all bunker gear, including hoods, to be cleaned and repaired by Gloves, Inc. This is a necessary step; it starts by making sure every firefighter is working and training with a clean hood. The service agreement with Gloves, Inc., for cleaning contaminated hoods, is two dollars per hood. The fail rate for hoods has been averaging about 5%. Approximately 90% of the hoods worn by firefighters are the White PAC III P-84 NOMEX, at a cost of $17.70. PBCFR expects to spend roughly $88.50 to $100.00 yearly replacing hoods due to advanced inspections.

The warning and user information guide provided by Majestic Fire Apparel, Inc. states:

> The life of a protective hood is generally less than 10 years. Regardless of when the hood was originally purchased, it should be routinely inspected and replaced when damage occurs, when the hood is no longer compliant with NFPA standard, or is ten years old (Majestic, 2015).

During the course of a year, hoods are damaged from normal operational use and must be replaced. These types of hood replacement requests constitute a low frequency; in 2014-2015, only 16 hoods were reported damaged and replaced. The PBCFR shop is starting to see a sharp rise in request for cleaning hoods after exposure to structure fires. These added request are so new that there is not enough historical data to make a financial prediction as to what the cost may be (Wayne P. Chambers, personal communication, November 10, 2015). Orders for extra hoods

to start the hood exchange program is shown in Appendix D and E. Both contracted orders and decentralized purchase orders (DPO) are provided.

The Palm Beach County Cause & Origin Analysis of 2014 reports on structure fires found within Palm Beach County. During Fiscal Year 2014, there were 225 structure fire incidents, 49 less than in 2013. Structure fires accounted for less than one percent [.18%] of PBCFR's total call volume (123,648) in 2014 (Gregory, 2015). However, the Training Division has conducted approximately 250 structure burns, 20 car fire burns, and 40 acquired structure burns in 2014-2015. Three times a year, PBCFR conducts an eight-week recruit class and nearly 50 training burns are completed to teach fire behavior to new employees. PBCFR expects to run at least three classes a year for the next five years (James R. Schaffner, personal communication, November 4, 2015).

Discussion

In an ever-changing world, that often brings new obstacles and challenges, the fire service must be like the sentinel on the hill who continues to look at the horizon, continually scanning for enemy threats. It is imperative that a paradigm shift occurs if today's fire service is to continue to survive and thrive as a service provider. Research shows that technology is doubling every five years; the fire service must be willing to let go of many of the old ideas and customs set in tradition and become their own architects of change. The research indicates the key to future success is for fire departments to evolve into more nimble and agile organizations. There is strong evidence to support the need for a hood maintenance policy at PBCFR.

This research project was action oriented with the goal of creating a policy to clean and maintain firefighter hoods. The problem was that PBCFR did not have a policy in place or a plan to exchange hoods after they were contaminated from a fire. Several well-vetted reports

investigating the possible link between firefighting and increased cancer rates help bring clarity to this topic. The controlled observations from these correlated works corroborate, if only circumstantially, each other's findings. Researchers explain that these studies strengthen the evidence of a relationship between firefighting and certain cancers. Some of the reports and commentaries suggest that firefighters have a slightly elevated risk of contracting cancer as compared to the general population (Fent et al., 2013; Kirk et al., 2010; Laitinen et al., 2012).

If the protected respiratory system is not the major route of entry, then it is reasonable to suggest the most significant route of entry for these contaminants may be the skin. Carcinogenic chemicals present on PPE may become absorbed through the skin (Fabian et al., 2010). The most permeable piece of personal protective equipment is the hood (Minerva, 2015). Firefighters are exposed to high levels of DEHP, a probable human carcinogen. The hoods that firefighters wear are easily contaminated and they protect areas of the human body that have the highest permeability, such as the neck, scalp, and forehead (Alexander & Baxter, 2014). However, The National League of Cities 2009 report states, "There is concern that conclusive evidence is lacking to demonstrate a causal relationship between firefighting and cancer" (NLC, 2009). This study also suggests that cancer rates among firefighters are not significantly higher than the general population. The NLC response is that more study is needed, especially about the effect of non-employment related risk factors, before any conclusions can be drawn that are sufficiently robust to support a change in public policy (Reiss, 2013).

Proponents for firefighters raise concerns as to why the NLC continues to dispute the scientific studies linking cancer rates to firefighting activities. The underlining sentiment is that perhaps the NLC has a financial stake in opposing these studies. The NLC is opposed to cancer presumption legislation. Presumption means there is a probability that an injury or disease is

work-related. Currently 28 states and 7 Canadian provinces have enacted presumption legislation for firefighters who get cancer. Perhaps the NLC feels that these recent medical studies will invoke more state presumption legislation for firefighters making it difficult to project the short and long-term costs.

Cause and effect is difficult to prove in the medical studies; cancer is a collection of various different diseases and subtypes, and performing a study researching cancer for a single group across the country is technically difficult (Basri & Bergman, 2010).

Scientists do not define cancer as a single disease, but as a broad term encompassing 200 diseases found in distinct body sites. A recent study in the Journal of Occupational and Environmental Medicine confirmed that a firefighter's risk of specific types of cancers is higher than the public (Daniels et al. 2013). The NIOSH study titled *Evaluation of Dermal Exposure to Polycyclic Aromatic Hydrocarbons in Fire Fighters*, recommends that firefighters wear full protective ensembles during all stages of firefighting, including a structural hood (Fent et al., 2013).

The ingrained traditions within PBCFR have instilled a symbiotic mindset that is difficult to change. The idea that having the dirtiest, most worn gear in the station makes a firefighter look tested and courageous is starting to wane. Leaders in the fire service are now speaking out, and calling for a new norm when it comes to cleaning and maintaining PPE. This paradigm shift in attitudes is valuable for successful implementation of a policy for washing contaminated hoods.

The IAFF is the driving force behind nearly every advance in the fire and emergency services in the 21st century. With headquarters in Washington, DC, the IAFF represents more than 300,000 full-time professional fire fighters and paramedics in more than 3,100 affiliates.

IAFF members protect more than 85 percent of the population in communities throughout the United States and Canada. The IAFF is also one of the most active lobbying organizations in Washington, DC. The IAFF Political Action Committee, FIREPAC, is among the top 25 federal PACs among the more than 4,000 in the country (IAFF, 2015).

In the IAFF (2013) report *What You Should Know About Fire Fighters and Cancer,* states that Firefighters have:

- 2 times the incidence for brain cancer
- 2 times the incidence for liver cancer
- 2.8 times the incidence for colon and rectal cancer
- 2.5 - 3 times the incidence for bladder cancer
- a higher incidence for non-Hodgkin's lymphoma
- a higher incidence for urinary cancer

Plausible evidence suggest Firefighters are at increased risk for:

- stomach cancer
- prostate cancer
- skin cancer

Contaminants, such as hydrocarbons, grease, and even carcinogens, such as asbestos found in smoke, can penetrate the PPE and must be removed from gear to ensure it is safe to wear (Corbett, 2009). Air samples collected in a similar manner after laundering of ensembles according to manufacturer specifications indicated that laundering returns off-gassing concentrations of most of the investigated compounds to pre-exposure levels (Kirk & Logan, 2015). However, because bunker gear washers and extractors are specialized equipment, the fire department has an obligation to provide a process, or the facilities, for cleaning and conducting minor repairs (Angle, 2005).

The cleaning instructions provided from Majestic Fire Apparel for their hoods aligned completely with the routine inspection and washing guidelines of NFPA 1851. This information also concurred with interviews conducted for this ARP.

There does not appear to be one unequivocal unifying pattern that reveals a causation between firefighting activities and increased cancer rates. The examination of current medical studies and scientific reports distinguish possible exposure theories. The body of work cited in this ARP weaves an elusive backdrop of singularity that infers dermal absorption from products of combustion.

The survey conducted with neighboring fire departments located in Palm Beach County indicated that the overwhelming majority did not have a written policy for maintaining hoods. PBCFR was included in the 83.33% not having a written policy, and the 16.66% that did, admitted their hood maintenance was actually incorporated into their overall PPE policy. The second question pertaining to firefighter hoods either going out to be cleaned by an ISP or washed in the station was a more even discussion. Departments choosing to have their hoods go out to be cleaned came in at 58.33% compared to 43.66% cleaning hoods at their stations. These two survey questions shed light on how fire departments will implement a program, create a line item in their budget for a service, secure a contract, but still not have a written policy in place for the employees to follow.

The next question in the survey asked how often fire departments cleaned their hoods. “Once a year or less” at 41.66% and “As needed” at 33.33%; this may appear to be a healthy response, but if the department does not have a written policy, who is determining when the hood needs to be cleaned. Third was “Twice a year or more” at 16.66%, and last place was “after every exposure” at 8.33%. The last statistic, “after every exposure”, is a realistic indicator that at least 58% of the departments working inside Palm Beach County are not following manufacturers guidelines or NFPA 1851. There is still a possibility that the other 42% of the

departments, those who answered that every firefighter is assigned two hoods, are complying. However, without a policy or a tracking system in place this data is impossible to prove.

The answers collected from the fire department surveys indicate that cleaning and maintenance of structural firefighting hoods, in many cases are not meeting the recommendations of NFPA 1851.

The face-to-face interview with the manager of Gloves, Inc. recommended that hoods be washed after every significant exposure to smoke and soot. This would include training burns and motor vehicle fires. The manager believes that using an ISP to clean hoods is much better than a department using their own washers and extractors. She believes that fire departments are not diligent with keeping the correct temperature settings for the washing machines and may use too much or too little detergent to clean hoods properly. ED. M. Feld and Majestic would not support this claim, but only referred to the manufacturer's instructions and NFPA 1851. Both companies also agreed that fire departments should have a policy to track, clean, and maintain PPE, including hoods. Gloves, Inc. stated that washing hoods does not reduce the protective qualities of the hoods, but actually makes them last longer. This coincides with the information from both Majestic and ED. M. Feld.

Interviews conducted with Majestic, Gloves, Inc., and ED. M. Feld all state that hoods should be washed to manufacturers' recommendations and PBCFR should comply with NFPA 1851. All three companies also agreed that fire departments should have policies in place to track, maintain, and clean hoods. Currently PBCFR does not have a policy in place and does not track the cleaning of hoods.

The theories and concepts offered in this action research illuminate the benefits of creating a comprehensive firefighting hood maintenance policy. The answers disseminated from

the cited works built a cohesive framework of facts that will create a data driven policy. The research conducted revealed strong evidence to support these bullet points:

- Firefighters are exposed to smoke, soot, and toxic chemicals.
- Some of these toxic chemicals are carcinogenic.
- Some chemicals are dermally absorbed into the body.
- Firefighters have a slightly elevated risk of contracting cancer as compared to the general population.
- The most permeable piece of personal protective equipment is the hood.
- Hoods should be washed to manufactures recommendations and comply with NFPA 1851.
- Operational safety relies on a combination of procedures, equipment, and personnel.
- Fire departments should have policies in place to track, maintain, and clean hoods.

Recommendations

The information gleaned from the in-depth literature review, survey, site visit, and several interviews assisted in creating Palm Beach County Fire Rescue's comprehensive firefighting hood policy, something previously lacking at the Department. The recommendation came from the answers to the research questions. The research questions were as follows: what is the potential benefit for implementing a comprehensive firefighting hood maintenance policy? What is the National Fire Protection Association's (NFPA) standard for firefighting hoods? What are the manufactures' recommendations for cleaning and maintaining hoods? What are neighboring fire departments doing to maintain and clean their firefighting hoods? What are the budgetary impacts of implementing a firefighting hood maintenance policy?

The comprehensive firefighting hood policy is divided into the three categories: Training, a hood exchange program, and a written policy.

Training Recommendation:

- Create a video on how the hood exchange program works.
- Create handout material outlining the IAFF 2013 report
- Start practicing this procedure with the new recruits.
- Provide the hood exchange program in written form as well as incorporate it into the computer based learning modules from Target Solutions.
- Have a Chief Officer explain the new policy at several officer's forum.
- Provide information explaining why PBCFR has initiated this program and policy.
- Place updated information of the Training's internal website.
- Make sure training officers are setting a good example and "practicing what they preach."

The recommendations for the training portion of this project were assigned to the Division of Training in November 2015.

Recommendations for the Hood Exchange Program:

- Track hoods in PPE software.
- Battalion chief vehicles will store 25 clean hoods. The extra hoods will be purchased from each battalion's safety gear accounts. They will order 20 regular white hoods, 3 gold hoods, and 2 black hoods to account for possible allergies.
- On all incidents where smoke exposure has occurred, the incident commander will exchange hoods as crews are released from the scene. This will be a one for one exchange to take place at the command post. Crews that have been exposed

to products of combustion will not receive their unit accountability passport until hood exchanges have taken place.

- The dirty hoods will be placed in a plastic bucket and kept in the battalion chief's vehicles.
- The battalion chief will contact Gloves, Inc., who will pick up the hoods for cleaning.
- Gloves, Inc. will wash, dry, and inspect hoods according to NFPA 1851.
- The returned, clean hoods will go back into general circulation.
- Personnel should be instructed not to mark or personalize hoods.

The recommendations for the hood exchange program were implemented at PBCFR in July 2015, and will be updated in January 2016.

Recommendation for Written Policy:

Clear direction for firefighters on cleaning and maintaining their structural firefighting hoods has been accomplished and can be seen in the new policy titled " Firefighting Hood Maintenance Policy", provided below in appendix A.

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Appendix A

Firefighting Hood Maintenance Policy

SCOPE: This policy applies to all employees and reservists of Palm Beach County Fire Rescue.

PURPOSE: The purpose of this policy is to develop and maintain standard operating procedures that address the cleaning and maintenance of structural fire fighting hood.

AUTHORITY: Fire Rescue Administrator
Occupational Safety and Health Administration (29CFR 1910.134)
NFPA 1971 &1851

POLICY: Palm Beach County Fire Rescue will adopt and maintain a hood maintenance program that addresses the proper care, inspections, donning, doffing, and hood exchange program.

PROCEDURE: All members of Fire Rescue shall, in the performance of their duty, keep their protective hoods clean and properly maintained. Each and every Firefighter is responsible for his/her safety and the safety of others.

Structural Fire Fighting Hoods

1. Personnel may only wear protective hoods that are issued to them individually by the Department.

2. All firefighters issued personal protective equipment are responsible for inspecting their protective hoods at the beginning of each shift and after each use.

3. Do not attempt to repair your hood. If damaged, immediately report the damage to your supervisor and the department will replace it.

4. To comply with NFPA 1851, *Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, anytime protective hoods are contaminated they will be sent out to a certified industrial cleaning service.

5. Protective hoods shall be replaced when it is no longer compliant with NFPA standard, or is 10 years old.

6. Store your hood only when it is clean, dry, and free of contamination in a dry, clean, and ventilated area, away from direct sunlight.

Hood Inspections

Before First Use Inspection- Prior to using the hood for the first time, ensue that the hood does not have any construction flaws or was damaged when being put into service.

Routine Inspections- Following every use, inspect your protective hood for:

- Soiling and /or contamination,
- Physical damage such as, but not limited to, rips, holes, tears, frays, or cuts,
- Thermal damage such as, but not limited to, charring, burn holes, melting stitches
- Elastic face opening- assess whether the face opening is still elastic and has not become overextended. The face opening of your protective hood much fit securely around your SCBA facepiece each time you wear it,
- Label legibility- labels should not be removed, and information/markings should be legible

Upon inspection, if any of the above conditions exits, without delay alert your supervisor and the department will replace it.

Advanced Inspections- Your protective hood must be subject to a more thorough inspection at least every 12 months, after every advanced cleaning, or whenever there is a concern about its condition for continued service. This inspection will be carried out by a certified industrial cleaning service trained in advanced inspections.

Wearing Instructions

Donning- Use the following steps for putting on your hood:

1. Place your protective hood over your head with the face opening over your face. Push your head through the face opening of the hood so that the hood is around your neck with the face opening forward.

2. Ensure that the bib portion of your protective hood lies on your upper body and is positioned so that it will remain under your protective garment when the collar is properly secured.

3. Put on the SCBA facepiece and adjust the straps for correct wearing.

4. Pull the hood up and over the back of your protective hood so that it covers all areas of your head and face not covered by the SCBA facepiece.

5. Position the facepiece opening of your protective hood so that it covers all areas of your head and face not covered by the SCBA facepiece.

6. Put on and adjust your helmet ensuring that positioning the helmet does not create openings in the protective hood's coverage of your face and head.

Interface Issues and Adjustments for Fit – Your protective hood must fit properly and not interfere with other ensemble elements to ensure your proper protection. The hood should overlap all portions of your SCBA facepiece, but it should not obscure your vision through the SCBA facepiece visor. Your protective hood should not interfere with the SCBA facepiece to face seal. The bib portion of your protective hood must be tucked in underneath the collar and top of your protective garment so that the bib does not pull out during use.

Doffing- Removing your hood procedure varies depending on whether or not your protective hood is contaminated.

No contamination- use the following steps:

1. Remove your helmet first.

2. Pull the face opening area of your protective hood away from your SCBA facepiece and down onto your neck, such that your head protrudes from the protective hood face opening.

3. Remove your SCBA facepiece.

4. Remove your protective hood from your head by gently pulling your hood over your head and out from under your protective garment.

5. Inspect your hood as indicated in the instructions above.

Contaminated- If your protective hood has become contaminated with blood, body fluids, toxins, chemicals, or other hazardous substances, use extreme caution in removing your hood. DO NOT contact the surface of your hood with your bare hands. Remove your hood by grasping the hood with both hands below your chin, lifting the hood up and over your head to the rear, avoiding bringing the contaminated hood in front of your face. You may seek assistance in removing your hood and other parts of your ensemble to minimize your exposure to any contaminants. Avoid spreading contaminates and follow the hood exchange program.

Hood exchange Program-

- Battalion chief vehicles will store 25 clean hoods. The extra hoods will be purchased from each battalion's safety gear accounts. They will order 20 regular white hoods, 3 gold hoods, and 2 black hoods.
- On all incidents, where smoke exposure has occurred the incident commander will exchange hoods as crews are released from the scene. This will be a one for one exchange to take place at the command post. Crews that have been exposed to products of combustion will not receive their unit accountability passport until hood exchanges have taken place.
- The dirty hoods will be placed in a plastic bucket and kept in the battalion chief's vehicles.
- The battalion chief will contact Gloves Inc. to be picked up for cleaning.
- Gloves Inc. will wash, dry, and inspect hoods according to NFPA 1851 standard.
- The returned clean hoods will go back into general circulation.
- Personnel should be instructed to not mark or personalize hoods.

Appendix B

Survey

Department: _____

Date: _____

Which one of the following titles best describes your rank?

A. Fire Chief 2

B. Deputy Chief 5

C. Division Chief 4

D. Battalion Chief 0

E. Other 1

What is the resident population your department serves?

a. Less than 10,000 3

b. 10,001-25,000 1

c. 25,001-50,000 2

d. 50,001-100,000 4

e. 100,001-250,000 1

f. Greater than 250,000 1

Does your department have a written policy for maintaining firefighter hoods?

a. Yes 2

b. No 10

Does your department send PPE & hoods out to be cleaned?

a. Yes 5

b. No 7

Approximately, how often does your department clean their PPE & hoods?

a) After any exposure 1

b) Once a year or less 5

c) Twice a year or more 2

d) As needed 4

How many hoods is each firefighter assigned?

a) One 7

b) Two 5

c) Three 0

Note: On October 15, 2015, Delray Beach, Boca Raton, Riviera Beach, North Palm Beach, Boynton Beach, Town of Palm Beach, Palm Beach County, and West Palm Beach fire departments were present at the Chief's Monthly Meeting at station five, West Palm Beach, in the EOC room, at 1330. These surveys were done face to face at that time. Tequesta, Palm Beach Gardens, and the Palm Beach Shores were done over the phone on October 16 and 19, 2015. Greenacres's fire department was sent the survey via email and the data was received in the month of October.

Appendix C

Name: Keith Tyson

Date: November 2, 2015

Previous Fire Department: Miami Dade

Current position: Director of the Firefighter Cancer Support Network for Florida

Q1: *How many times do you meet with PBCFR's FACE team?*

Several times a year, I think they are doing a good job and cannot wait to see what happens with the University of Miami research.

Q2*: Do you stand by your previous comment: "The idea that having the dirtiest, most worn gear in the station makes a firefighter look seasoned or macho is long past"?*

Yes, I am starting to see a change in attitudes towards soot-laden bunker gear being a badge of honor with the troops, but the changes needed by administration are slow in coming.

Q3: *Do you think a hood replacement program will reduce carcinogens?*

Thyroid cancer is very high with firefighters in Florida; this could be a result from exposures from dirty hoods.

Q4: *How many hoods should be assigned to a firefighter?*

I think two hoods, and they should be long, past the shoulders. I believe that is what Miami Dade still does. They are cheap, less than fifty dollars, and with the size of your department you could probably get a good deal.

Q5*: What do you think about our new hood exchange program?*

I think a hood exchange program could help reduce exposure to carcinogens; any action is better than doing nothing. I still think two hoods and an extra set of PPE is the way to

go. I do not really understand the logistics of how you are going to swap out every hood. But if you guys can make it happen you will be ahead of most departments.

Q5*: What ISP do you recommend, Gloves, Inc. or Minerva?*

I think testing needs to be done to see if the PPE is actually clean when they send it back. You should have UM test the cleaned hoods from both companies. Getting fire departments to comply with NFPA 1851 is the first step.

Q6: *What is the potential benefit for implementing a comprehensive firefighting hood maintenance policy*?

Every fire department should have a PPE policy in place; it gives teeth to enforce the cleaning and maintenance for all PPE. I think your topic should be broadened to incorporate all PPE and you need a standard operating guideline for fire ground operations. Look into rehab area and add a fourth engine to your response just for overhaul. In addition, where is your bunker gear located, in the bay floors? Well, that needs to change because you do not have sole-source capture exhaust systems. With the release of the NIOSH reports, White Papers, and the latest Australian study, cleaning PPE is gaining traction.

This interview provided insight on the benefits of having a hood exchange program, and reasons to have written policy on maintaining PPE.

Appendix D

CENTRAL DELIVERY ORDER

BOARD OF COUNTY COMMISSIONERS
www.pbcgov.com

DO 440 10051500000000000331

IMPORTANT

THE ABOVE NUMBER MUST APPEAR ON ALL SHIPPING LABELS, PACKING SLIPS, TRANSPORT DOCUMENTS, INVOICES AND CORRESPONDENCE.

SHIP TO
FIRE-RESCUE (561) 233-0900
VEHICLE MAINTENANCE FACILITY-FIRE RESCUE
2601 VISTA PARKWAY
WEST PALM BEACH FL 33411
ATTN TIM CALHOUN

ISSUED TO
Municipal Equipment Company LLC
2049 West Central Blvd
Orlando FL 32805
Dale West 800-228-8448

ORDER DATE	DELIVERY DATE	F.O.B.
10-07-2015	10-21-2015	Destination

VENDOR NUMBER	VENDOR ADDRESS	VENDOR CONTACT
VC0000142337	AD001	PC001

BID/QUOTE/RFP NO	AGREEMENT NUMBER
	CMA 680 950542

BILL TO

BOARD OF COUNTY COMMISSIONERS
PALM BEACH COUNTY FINANCE DEPT.
P.O. BOX 4036
WEST PALM BEACH, FL 33402-4036
TELEPHONE: 561-355-2912

ITEM	QUANTITY	UNIT	COMMODITY CODE	ITEM DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	50.0000	EA	34034	HOOD, FIRE, MAJESTIC FIRE, PAC III PBI GOLD HOOD PBI GOLD MSDS: Not Required	34.800000	1,740.00
2	400.0000	EA	34034	HOOD, FIRE, MAJESTIC FIRE, PAC III NOMEX HOOD VENTILATION NOMEX MSDS: Not Required	18.700000	7,480.00

TAX EXEMPTION INFORMATION
STATE TAX EXEMPTION NUMBER 85-8012622286C-8
FEDERAL EXCISE TAX EXEMPTION NUMBER 59-74-0344K
EXEMPTION CERTIFICATES WILL BE MAILED UPON REQUEST

NOTE TO VENDOR
UNLESS AGREED TO OTHERWISE, PALM BEACH COUNTY'S STANDARD TERMS AND CONDITIONS ARE INCORPORATED IN THIS ORDER BY REFERENCE AT WEB ADDRESS:WWW.PBCGOV.COM/PURCHASING. ADDITIONAL TERMS & CONDITIONS WILL BE NOTED IN THIS ORDER WHEN APPLICABLE.

NOTE: Vendors may now choose to receive payment from Palm Beach County by Credit Card! If you are interested, please contact the Palm Beach Clerk & Comptroller at pbcpaymentmgr@mypalmbeachclerk.com or 561-355-3295.

PRINT DATE: 10/07/15 RESP. DEPT: 440 UNIT: 4211

VENDOR E-MAIL: DaleWest@mecofire.com

ISSUER
MICHELE VOGT
EMAIL: MVogt@pbcgov.org

TELEPHONE
561-233-0878 EXT:

ORDER TOTAL
9,220.00

P.B.C. PURCHASING DEPARTMENT
50 S. MILITARY TRAIL, SUITE 110
WEST PALM BEACH, FL 33415-3199
PHONE: 561 616-6800
FAX: 561 616-6811
www.pbcgov.com/purchasing

PAGE NUMBER: 1 OF 1

AUTHORIZED BY
PALM BEACH COUNTY BOARD OF COUNTY COMMISSIONERS

Appendix E

SHIP TO
FIRE-RESCUE (561) 233-0900
VEHICLE MAINTENANCE FACILITY-FIRE RESCUE
2601 VISTA PARKWAY
WEST PALM BEACH FL 33411
ATTN: TIM CALHOUN

DECENTRALIZED PURCHASE ORDER

BOARD OF COUNTY COMMISSIONERS
www.pbcgov.com

DPO 440 1FR102015000000049

IMPORTANT

THE ABOVE NUMBER MUST APPEAR ON ALL SHIPPING LABELS, PACKING SLIPS, TRANSPORT DOCUMENTS, INVOICES AND CORRESPONDENCE.

ISSUED TO
Municipal Equipment Company LLC
2049 West Central Blvd.
Orlando FL 32805
TO Dale West
800-228-8448

ORDER DATE	DELIVERY DATE	F.O.B.
10-21-2015	11-04-2015	Destination
VENDOR NUMBER	VENDOR ADDRESS	VENDOR CONTACT
VC0000142337	AD001	PC001
BID/QUOTE/REF NO	AGREEMENT NUMBER	

BILL TO

BOARD OF COUNTY COMMISSIONERS
PALM BEACH COUNTY FINANCE DEPT.
P.O. BOX 4036
WEST PALM BEACH, FL 33402-4036
TELEPHONE: 561-355-2912

ITEM	QUANTITY	UNIT	COMMODITY CODE	ITEM DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	48.0000	EA	34034	HOOD MAJESTIC ULTRA C6 CARBON PACIII Quote #073640 MSDS: Not Required	30.800000	1,478.40

TAX EXEMPTION INFORMATION

STATE TAX EXEMPTION NUMBER 85-8012622286C-8
FEDERAL EXCISE TAX EXEMPTION NUMBER 59-74-0344K
EXEMPTION CERTIFICATES WILL BE MAILED UPON REQUEST

NOTE TO VENDOR

UNLESS AGREED TO OTHERWISE, PALM BEACH COUNTY'S STANDARD TERMS AND CONDITIONS ARE INCORPORATED IN THIS ORDER BY REFERENCE AT WEB ADDRESS: WWW.PBCGOV.COM/PURCHASING. ADDITIONAL TERMS & CONDITIONS WILL BE NOTED IN THIS ORDER WHEN APPLICABLE.

NOTE: Vendors may now choose to receive payment from Palm Beach County by Credit Card! If you are interested, please contact the Palm Beach Clerk & Comptroller at pbcpaymentmgr@mypalmbeachclerk.com or 561-355-3295.

ISSUER
MICHELE VOGT
EMAIL: MVogt@pbcgov.org
TELEPHONE
561-233-0878 EXT:

ORDER TOTAL
1,478.40

PAGE NUMBER: 1 OF 1

PRINT DATE: 10/21/15 RESP. DEPT: 440 UNIT: 4211
VENDOR E-MAIL: DaleWest@mecofire.com

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PALM BEACH COUNTY BOARD OF COUNTY COMMISSIONERS

Appendix F

Name: Doreen Glasso

Date: September 2015

Phone interview

Current position: Division Manager of Sales for Majestic Hoods

Q1: *Are the written instructions provided with every hood compliant with the 2014 NFPA 1851 standard?*

Majestic strongly recommends following the cleaning instructions provided with every hood. Majestic confirmed their written instructions on maintenance and cleaning procedures.

Q2: *How many hoods should be assigned to a firefighter?*

You should issue multiple hoods, or at least a second hood, this will help insure that firefighters have a spare hood while one is being cleaned.

Q3: *How often should hoods get washed?*

After each use and properly laundered, weekly if not more often, is the first line of defense in reducing exposure to the "harmful elements" of a fire.

Q4: *Does washing hoods reduce their protective qualities?*

No, because our certified hoods are manufactured from inherently fire retardant knits, meaning that protective qualities of the materials cannot be "washed out" no matter how many times they are washed. According to the results of UL testing to the specifications of NFPA 1971 their materials are even more protective after washing, as proper washing tends to "tighten" knit materials.

Q5: *Do you think in-house washing is better than using an ISP?*

I cannot possibly answer that question, all I can say is if your department washes it, or a cleaning service, they need to be certified.

Q6: *Does Majestic have a preference to either Gloves Inc. or Minerva for cleaning hoods?*

I cannot give a preference to either Gloves Inc. or Minerva, as long as they maintain their ISP certification they should be equally qualified to perform cleaning and repairs to Majestic hoods.

Q7: *Do you think fire departments should have a written policy in place to clean hoods?*

Yes, I definitely think your department should have a policy to clean and maintain hoods. I think if you read NFPA 1851, it has a section about tracking the cleaning, maintenance, and modifications or repairs to PPE.

Q8: *What is the difference with the colors in Majestic hoods?*

The hoods we sell you come in three different colors, white, black, and gold; the difference in color signifies changes in the blend of fabrics. A white hood is 100% Nomex, but the golden and black hoods are a different blend of Kevlar and Lenzing. I am not sure of the exact percent of the blends but you can find it on our website.

Appendix G

Name: John Feld

Date: September 2015

Phone interview

Current position: Ed M. Feld Manager/Owner

Q1: *How long have you been in business?*

Ed M. Feld has been selling safety equipment for over sixty years.

Q2: *How many hoods should be assigned to a firefighter?*

I think at least two hoods, that way you can have a clean hood while you are washing the dirty hood.

Q3: *How often should hoods be washed?*

I know some departments are doing a Sunday wash your hood day, but I think it definitely needs to be washed once a month.

Q4: *Does washing hoods reduce their protective qualities?*

No, because the hoods we sell are fabricated with flame-resistant materials, washing them does not lessen their fire retardant protection. In fact washing hoods correctly will prolong the serviceability of the hood not lesson it. However, you need to follow the cleaning instructions provided with every hood.

Q5: *Do you think Majestic hoods are well made?*

Yes, Majestic's hoods are well made; we never get any complaints about them.

Q6: *Do you think in-house washing is better than using a service provider?*

I do not have a preference; I guess as long as you or the company is following the manufactures recommendations is should be equal.

Appendix H

Name: Elya Alexander

Date: September 2015

Phone interview

Current position: Store Manager located in Miami

Q1: *Is Gloves, Inc. a certified service provider to clean and maintain PPE?*

Yes

Q2: *How many departments do you serve?*

The store has service contracts with twenty-five different fire departments for cleaning and repairing PPE.

Q3*: How many hoods should firefighters be issued?*

I think your firefighters should be issued two hoods.

Q4: *How often should hoods be washed?*

I think hoods should be washed after every significant exposure to smoke and soot. This would include training burns and motor vehicle fires.

Q5: *Do you think in-house washing is better than using a service provider?*

Well of course, I think we can clean your hoods better than firefighters can at their station. In my experience, the washer extractors are never set correctly and the firefighters usually do not use the right amount of laundry detergent to clean PPE properly.

Q6: *Does washing hoods reduce their protective qualities?*

No, washing hoods does not reduce the protective qualities of the hoods, but actually makes them last longer.

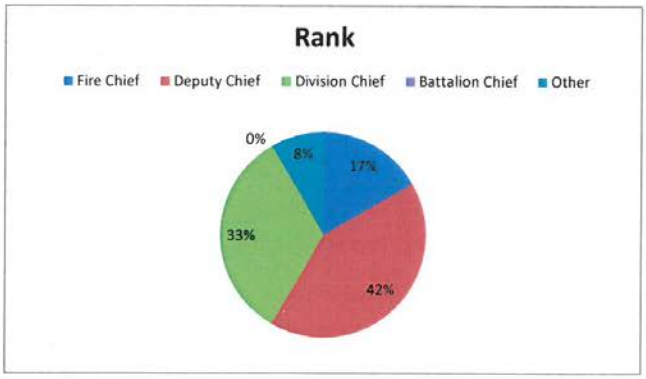
Q7 *How much do you charge to wash a protective hoods?*

Gloves, Inc. charges PBCFR two dollars per hood. After cleaning, my workers look for physical damage like tears, rips, cuts, or other damage. We also look for label integrity is to assure the label is attached and the manufacture date is present. If the label is missing or unreadable, the hood is past its life expectancy. Due to the relative low cost of purchasing a new hood, PBCFR always declines making any repairs and ops to purchase a new hood.

Appendix I

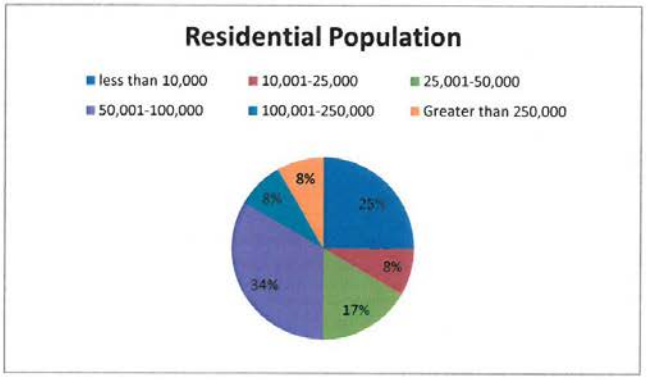
Which one of the following titles best desribes your rank?

Answers	Response %	Response Count
Fire Chief	16.66%	2
Deputy Chief	41.66%	5
Division Chief	33.33%	4
Battalion Chief	0.00%	0
Other	8.33%	1



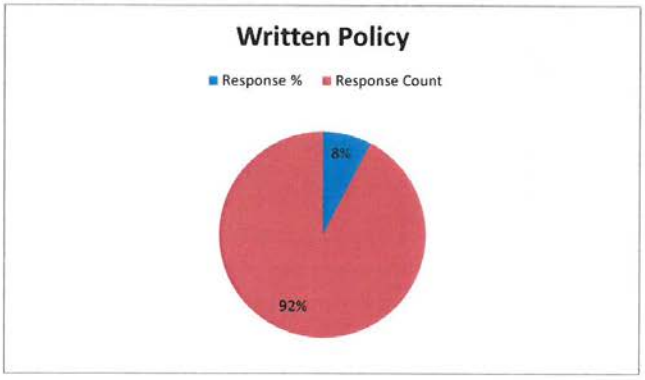
What is the residential population your department serves?

Answers	Response %	Response Count
less than 10,000	25.00%	3
10,001-25,000	8.33%	1
25,001-50,000	16.66%	2
50,001-100,000	33.33%	4
100,001-250,000	8.33%	1
Greater than 250,(	8.33%	1



Does your department have a written policy for maintaining firefighter hoods?

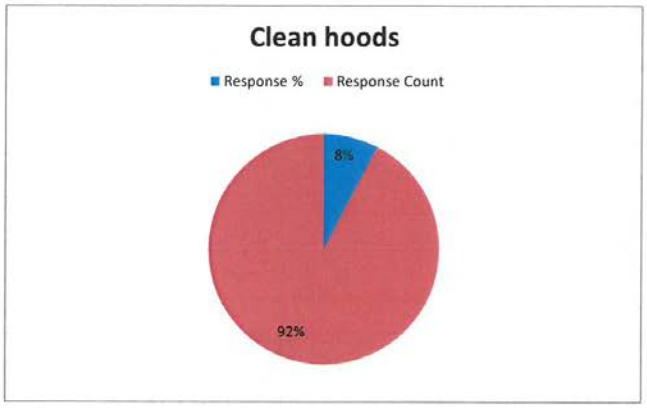
Answers	Response %	Response Count
Yes	16.66%	2
No	83.33%	10



Appendix I

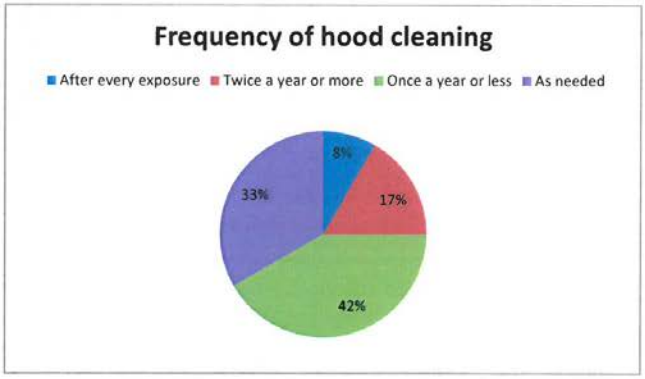
Does your department send hoods out to be cleaned?

Answers	Response %	Response Count
Yes	41.66%	5
No	58.33%	7



How oftern does your department clean their hoods?

Answers	Response %	Response Count
After every expos	8.33%	1
Twice a year or m	16.66%	2
Once a year or les	41.66%	5
As needed	33.33%	4



How many firefighter hoods is each firefighter assigned?

Answers	Response %	Response Count
One	58.33%	7
Two	41.66%	5
Three	0.00%	0