# FIREFIGHTERS' PERCEPTIONS OF THEIR HEALTH RISKS

By

Patricia Matthews

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ABSTRACT

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Since the tragic events of September 11, 2001, significant research has been conducted regarding the risks which firefighters take while working in their profession and the consequences of ill-health which they can experience. The purpose of this qualitative study was to investigate the reasons why firefighters do not wear appropriate respiratory protection when they are involved in overhaul at residential fire scenes. For this research, I made observation at twenty-one residential fire scenes and interviewed eight fire chiefs and eight firefighters. I discussed formal, informal, and non-formal adult learning opportunities and the Health Belief Model as frameworks within which I situated the activities, behaviors, and health choices of firefighters. The collective data of my research was situated within an extensive review of current literature and a review of the current research on firefighters. Based upon my interviews and fire ground observations, I developed suggestions for fire service personnel in an effort for them to align their academy training and other adult learning opportunities with their fire ground behaviors. This was done in an effort to improve the respiratory health risks of firefighters as they engage in overhaul activities at residential fire scenes.

This dissertation is dedicated in memory of my parents, Stanley and Margaret Johnston, especially to my Mother who wanted me to become a doctor . . . in medicine.
This dissertation is also dedicated in memory of my friend William Rosel, who told me there would never be a female firefighter on his fire department, unless she was the Dalmatian.
And finally, this dissertation is dedicated to the firefighters who have left this Earth before me.
Rest in Peace, My Brothers and Sisters.

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# CHAPTER 1: INTRODUCTION

Volunteer firefighters are found in all states, especially in the small cities, towns, and rural areas of our country. As their main source of income, they are employed in a variety of non-firefighter related professions. They have very diverse backgrounds for such variables as social economic status, age, family involvement, religion, political views, educational level, and medical knowledge. Their one commonality is a desire to serve, protect, and save lives and property by serving as volunteer firefighters.

While working, these individuals must undertake a variety of tasks that, according to Scott (2003), are designed within a closed-rational organizational system with the intent to achieve preset goals attached to the concept of saving lives and property. Many activities have certain established protocols, also called standard operating procedures or guidelines (SOPs or SOGs). These protocols are based on various National Fire Protection Association's (NFPA) standards (2018 and 2019), and they have been adopted and adapted by local fire service agencies to suit the specific needs of a fire department. The purpose of these standards is to maximize the efforts of firefighters and to minimize the potentiality for firefighter injury or death. Many of these standards are very specific, but other standards are less specific, and there are some situations that are not addressed in any departmental protocols.

During the active phases of residential firefighting, when various products of combustion are liberated from burning materials, various NFPA Standards specify that a self-contained breathing apparatus (SCBA) should be worn by all firefighters who could possibly breathe in harmful or toxic air. This point is supported by various articles and by the goals of some national firefighter specific organizations (Duncan et al., 2014; Dunn, 2009; Firefighter Cancer Support Network, 2013; Litzenberg, 2014).

After fire extinguishment at a residential dwelling, firefighters undertake an operational phase of firefighting called overhaul, post-extinguishment, post-control, or post-fire. During this phase of fire ground activity, firefighters generally remove their SCBAs and do not utilize any other form of respiratory protection, a point discussed in over one hundred published articles, from agencies such as Everyone Goes Home (2010), the Firefighter Cancer Support Network (2013), and the National Volunteer Fire Council (2015). This fact is also mentioned in past and current research literature (Burgess et al., 2001; Duncan, et al., 2014; Fabian et al., 2014; Farkas, 2015; Guidotti, 2014; Jahnke et al., 2012; Maglio et al., 2016). In addition, I have personally observed, during my nearly 40 years of community service as a firefighter paramedic on three rural, volunteer fire departments, that it is quite common for firefighters to remove their SCBAs during overhaul operations at residential fire scenes.

It is from these observations that my interest in overhaul activities on fire grounds, the need for respiratory protection, the potential for the ill health of firefighters, and the various concepts of adult learning intersected into this research. Since firefighters had formal academy training regarding the importance of wearing SCBA equipment during overhaul operations, why do these individuals choose not to follow the guidelines that were provided to them during training?

## Background and Rationale

During overhaul activities, various studies have concluded that the environment, contained within buildings, is still potentially hazardous to the health of firefighters. Many recent articles have discussed the negative health effects evident on the cardiovascular, respiratory, and digestive systems of firefighters (Firefighter Cancer Support Network, 2013 and 2015; Greven et al., 2011; Guidotti, 2014; Hvenegaard, 2012; National Institute for Occupational Safety and Health, 2013; Tsai et al., 2015). As a result, many authors strongly encourage the use of SCBAs

during overhaul activities at residential fire grounds (Bailey, 2016; Burgess et al., 2001; Duncan et al., 2014; Fabian et al., 2014; Farkas, 2015; Guidotti, 2014; Lindsey, 2015; Moore, 2015; Rine, 2015; Taylor, 2016). From personal interactions around various fire department stations, I have noted and asked about research studies and concluded that firefighters generally do not read these research studies, nor are they exposed to the content of these articles. As a result, many volunteer firefighters do not know about the significant impact that their decisions not to wear SCBAs may have upon their future health status.

Even though most volunteer firefighters are not reading research studies or related literature on teaching, leadership, or organization, they still make up a unique community of adult learners who engage in a variety of formal and informal learning opportunities throughout their careers within the fire service (Merriam et al., 2007; Schugurensky, 2000). For all state certified firefighters in Michigan, their training tends to begin formally in a State sponsored fire academy, which presents lectures and practical training sessions to the candidates. Training continues in non-formal and informal fashion through individual fire department activities, which can include specific training on equipment, new protocols, discussion of previous runs, observations of fire ground activities, and peer activities.

Formal training is conducted by fire officers who have been selected, trained, mentored, observed, and vetted by their predecessors to comply with the highly institutionalized, rule-oriented, and hierarchical system of the State fire academy program (Schugurensky, 2000). These academies teach candidates about the uniqueness of the profession by stressing the span of control, authority and leadership, and the delegation of responsibility, which are characteristics of structured organizations (Bolman & Deal, 2013).

Through mandatory academy classes, especially the practical training sessions, firefighters are exposed to a single-loop learning model. This form of learning, which does not

strive for deep-rooted behavioral changes, does allow firefighters to question the results of their fire ground activities and can, thus, be used to construct or correct previously erred assumptions, strategies, or actions (Ivergard and Hunt, 2004).

Although all candidates within the academy are adults, not all of these individuals reflect the characteristics of adult learning represented in the key principles of andragogy. According to Knowles (1970), andragogy is the art and science of helping adults learn. Although this theory focuses on the role of the teacher, the learning process itself involves key features of the firefighter's intellectual, emotional, and psychological states. Most students within the fire academy are self-directed, understand the role which experience plays in their learning, and are properly oriented toward their problem-centered learning process. However, some students, due to life circumstances or personal conflicts, are not ready to learn or do not have the motivation to learn the required material at this time (Chinnasamy, 2013; Holmes & Abington-Cooper, 2000). If the former three qualities can overcome the latter two, the adult learners who enter a fire academy should be adequately prepared to learn the required materials, prepared to take the State certifying written and practical examinations, and able to continue learning through their activities as firefighters.

All successful fire academy graduates have attended the required lecture classes, have participated in practical training sessions, and should have read the required training manual by the International Association of Fire Chiefs and National Fire Protection Association (2017), *Fundamentals of Fire Fighter Skills: Evidence-Based Practices*. During these various activities, the State certified instructors have informed all students about the risks which they will encounter during their firefighting activities. Included within the training units are the potential risks that could lead to future health problems if firefighters do not use their respiratory protective equipment during certain fire ground environmental conditions. The required training

manual (IAFC & NFPA, 2017) states, "During firefighting operations and immediately afterward, fire fighters should wear a full set of protective clothing and equipment, including SCBA. After the fire is out, the area must be ventilated, and the atmosphere tested and determined to be safe by the safety officer before fire fighters can work without SCBA" (p. 617) and "SCBA use is mandatory until the air is tested and found safe to breathe" (p. 633). Unfortunately, of the nine fire departments observed in my research, at least six do not have the ability to monitor air for safety and at least two departments do not have assigned safety officers, so the provisions of training cannot be met in the real world of volunteer fire ground activities. Although the required State training aligns with the Federal standards of the National Fire Protection Association 1001 (2019), these requirements, which necessitate that firefighters understand the hazards of smoke and other toxic environments and which explain why respiratory protection is needed at specific fire scenes, cannot be fulfilled if the equipment and personnel are not available.

Newly graduated firefighters, who wear respiratory protection during an active fire, as instructed by their teachings and required academy textbook readings, may not wear respiratory protection when undertaking overhaul activities, even though this time of fire ground activities is known to have toxic gases present (Bolstad-Johnson et al., 2000; Burneka, 2014ab; Evans, 2014; Farkas, 2015; Fabian et al., 2014; Herbert, 2008; Routley, 2009). Personnel from the Firefighter Cancer Support Network (2013) have reported that firefighters have SCBA packs on their backs, but they do not have masks on their faces when an unsafe environment is probably still present.

In 2000, one report stated that few studies had suggested the need for respiratory protection during overhaul (Bolstad-Johnson et al., 2000). However, studies conducted in the past decade suggest that until appropriate air monitoring shows that the environment is safe for SCBA removal, and firefighters can begin breathing room air after fire extinguishment,

appropriate respiratory protection should be worn (Bailey, 2016; Fabian et al., 2014; Horn et al., 2013; InterAgency Board, 2012; Rochford, 2009). Instructors of academy classes may stress the need for SCBA use during overhaul, when a toxic environment is potentially present, due to statements in the required textbook and in the presented lecture material, but if the required equipment and personnel are not available, this training is meaningless. Since the majority of rural volunteer fire departments do not have adequate air monitoring equipment, and some do not have safety officers, disconnect occurs between air monitoring, academy instructions, educational material presented, and SCBA use, because there is no way for firefighters to truly determine if the overhaul environment is safe or dangerously toxic.

From their State certified formal training, Michigan firefighters should understand the potential health risks that can occur if appropriate respiratory equipment is not used during overhaul, since information regarding appropriate respiratory protective equipment use was stated during educational modules of the fundamental firefighter skills textbook (IAFC & NFPA, 2017). Firefighters practiced donning their self-contained breathing apparatus (SCBA) and they listened to lectures stating that they needed to use this respiratory equipment. During their State certified testing, all academy candidates were required to don and use their protective respiratory equipment in the proper way, but this same training is void as to when the environment is deemed safe for room air breathing; and, according to the literature, most residential fires are still producing toxic gases during overhaul (Burgess et al., 2001; Fabian et al., 2014; Greven et al., 2011; Herbert, 2008; Peel, 2008; Tippett, 2009; Tsai et al., 2015).

After hours of respiratory protection training, generally with their SCBAs, most firefighters should have a good understanding regarding the need to use this protective equipment, and they should feel comfortable with their SCBAs use. The firefighters' training aligns with NFPA 1001, which states that firefighters will have access to personal protective

equipment, including SCBAs, and that they will have training on how to don and correctly wear and use this form of respiratory protective equipment (NFPA 1001, 2019).

With this being the case, and with my background as a firefighter, and as a collegiate professor who understands many aspects of adult learning, I have continually noted a dichotomy. This compares what firefighters learned during their formal training about the use of protective equipment during residential fire scene overhaul, and what these individuals do at these fire scenes. According to Anderson (1994), the firefighters' espoused theory regarding what activities will lead to a healthy outcome does not align with their theory-in-use, or what activities they engage in while undertaking overhaul activities at residential fires. Firefighters focus on immediate tasks, in a single loop fashion, oftentimes without regard to their health consequences. This allows them to achieve a purpose, control the environment, and use appropriate feedback to make some adjustments and adaptations in their work. This single loop model, however, discourages inquiry or the questioning of individuals' actions or behaviors, which does not allow an improvement in performance or standard of activity. As a result, while firefighters' training specifies that SCBAs should be worn when a potentially hazardous environment exists, their actual behavior does not conform to these training guidelines.

From their training and what peers have told them, firefighters should know that there is a serious potentiality that toxic gases are present during overhaul operations, so they should make certain that they are wearing appropriate respiratory protection. Regretfully, I continually see firefighters without their SCBAs being used on fire grounds during overhaul. This disconnect between their espoused theory, or how firefighters know they should act, and their theory-in-use, or the actual behavior of firefighters on fire scenes, has been noted by many authors, including Berger and Moulin (2016), Bolstad-Johnson and others (2000), Herzog (1994), Rochford (2009), Taylor (2016), and Tippett (2009).

From the articles I have read, the conferences I have attended, and the research literature I have studied, I know there is a serious potentiality that toxic gases will still be present during overhaul operations. This disconnect between the espoused theory and the theory-in-use of firefighters' behavior after fire extinguishment, regarding the lack of respiratory protective equipment, has been the impetus for my research.

During their State certified formal training and during informal fire department interactions, firefighters have been instructed, behavior has been modeled, and they have been reminded that potential health risks exist during overhaul operations at residential fires. As a result, the question arises as to why these individuals risk their current and future health status by not wearing appropriate respiratory protection, such as SCBAs, during overhaul. For many years, researchers have noted the lack of appropriate respiratory protective equipment during overhaul activities, but the reason for this negative behavior is not stated in the literature (Bailey, 2016; Burgess et al., 2001; Duncan et al., 2014; Dunn, 2009; Guidotti, 2014; Willing, 2012). From a personal perspective, based upon decades as an active member of the fire service, I have wondered what might account for this lack of congruence between what firefighters are trained to do and what behavior is observed. Possible reasons include a lack of appropriate training regarding overhaul activities or specific cultural factors within the fire service that might influence these individuals' behavior during post-fire extinguishment. Included within these aspects of the fire service are departmental organization, the influence of leadership, the learning environment, cultural aspects of the fire service, and the firefighters as student learners.

With regards to departmental organization, I investigated departmental governance, structure, membership, culture, influence of gender roles, and opportunities for learning. Since recent research by Khan, Davis, and Taylor (2017) discussed how the roles of gender affect safety behaviors in the fire service, I included as much information on this topic as I could

discern from each fire department within my research study. For leadership, I summarized what was observed about each of the chiefs' type of command, the influence of line officers upon command, the actions of the chiefs as they related to firefighters, knowledge acquisition and transmission, and how leadership influences individual firefighters to be productive members of the department. Most of this information was situated within the three basic types of public safety supervision or command. As discussed by Iannone, Iannone, and Bernstein (2013), these types of supervision are autocratic, democratic, and free rein or laissez-faire. With regards to learning environments, I compared the influence of culture upon formal, informal, and non-formal training, continuing education requirements, and mandatory or voluntary training options. In addition, I investigated the departmental environments for learning within apprenticeship, transmission, developmental, and transformative perspectives, and I attempted to determine if these learning options influence the behavior of firefighters. Lastly, I looked at the various departments' firefighters as students who interact with various learning environments. I compared how the fire departments' firefighters take responsibility for learning, how they best learn the skills and information transmitted, how their social interactions influence learning, and how much time is spent by firefighters on their learning. In addition, I attempted to discern what specific characteristics of firefighters facilitate or act as barriers to these students' learning. In essence, I used my personal observations, casual conversations, and interview information to discern as much information as I could about the nine fire departments' characteristics and the personal attributes of the nine firefighters with whom I personally interacted for this research.

## Statement of the Problem

From surveys that I constructed and administered to over 200 firefighters in rural West Michigan from six volunteer departments, and from my personal observations as a firefighter, approximately 40% of volunteer firefighters do not always wear respiratory protection during

conditions which they believe might be hazardous, and approximately 88% do not wear respiratory protection during overhaul activities at times when toxic environments may be present. Firefighters should be aware of the dangers that their behaviors during overhaul might cause to their current or future health. With this being the espoused theory, the question arises as to why these individuals make use of a theory-in-practice that increases risk-laden behavior.

There are several possible explanations regarding this dichotomy between what should occur and what actually occurs on fire grounds after residential fire extinguishment. Some firefighters might engage in risky health behaviors at fire scenes because they are truly not aware that they are exposed to health risks, since they have forgotten the content of their previous training regarding overhaul activities. Others, who are knowledgeable about their health risks, may choose to ignore and are not concerned with these potential health risks (Goldfeder, 2007). Another explanation could be that firefighters perceive that the level of risk to which they may be exposed is acceptable when compared to the benefits gained by their fire ground activities (Maglio et. al., 2016; Smith, 2014). Firefighters, as well as other professionals, are influenced by peer interactions and how peers interpret other's actions. Volunteer firefighters may ignore their health risk, since they are influenced by their perceptions of how they are expected to act by their leaders and peers (Avsec, 2014; Brondino et al., 2012; Burneka, 2014ab; Maglio et al., 2016; Willing, 2016). In addition, according to Dixon (2015) and Ballam (2015), having behavior which is more like one's peers, can lead to the normalization of deviance. Lastly, there are generally no immediate negative respiratory effects to firefighters' health when protective respiratory equipment is removed, so the high potential for respiratory disease, respiratory compromise, and even death may not be a concern while these individuals are working at residential fire scenes.

More than fifteen years ago, various authors began research, and specific training programs were suggested, on the use of respiratory protection during overhaul in an attempt to improve the future health status of firefighters (Berger & Moulin, 2016; Bolstad et al., 2000; Burgess et al., 2001; Burneka, 2014ab; Duncan et al., 2014; InterAgency Board, 2012; National Fallen Firefighters Foundation, 2015). As a result, I decided to conduct research that involved observations and interviews with a cohort of rural volunteer firefighters in western Michigan, who constitute unique adult learning communities. This research attempted to determine if the available formal and informal educational opportunities or other aspects of the fire service culture, including the departments' organization, leadership, and the diversity of firefighters who partake in training, help to determine why firefighters risk their health status by removing respiratory protection during overhaul activities at residential fire scenes.

## Purpose of the Research

The purpose of this study was to determine why, despite extensive opportunities for formal and informal learning, firefighters do not wear adequate respiratory protection during overhaul activities at residential fires. In efforts to fulfill this purpose, I explored three discrete areas of inquiry. The first area determined what firefighters' state their activities are during overhaul activities and what equipment, including SCBAs, are used at residential fire scenes. This information on the firefighters' theory-in-practice was gathered from interviews and personal observations. The second area investigated firefighters' perceptions regarding the risk-benefit ratio of their activities while on the fire ground, especially during overhaul activities. This area, which explored the congruence between formal certified training programs and fire ground behaviors, was determined through surveys, observations, and interviews which were based on fire ground activities. The third area determined how firefighters are influenced by their peers, their experiences, and various aspects of the culture of the fire service, with these three

items contributing to specific and unique adult lifelong learning communities within the fire service. This third area, which may encompass the first two, represents the overarching focus of this research study. With this as my central concentration, I am seeking to understand the varied learning experiences which firefighters have, that shape and inform their behaviors regarding the use of appropriate respiratory protection during residential overhaul activities.

## Need for the Research

In recent years, numerous articles were written for trade magazines, the medical profession, and ancillary health-related organizations, but little scholarly research has been written that specifically discusses firefighters' educational opportunities and residential fire ground overhaul activities as they relate to firefighter health. After the tragedy at the World Trade Center, the volume of literature has increased at an amazing rate, but the majority of research is centered on the events of September 11, 2001, in New York City, while only a few articles or research relate to the environmental health risks that firefighters encounter while engaged in fire ground activities at residential fire scenes during overhaul.

Over 25 years ago, the New England Research Institute conducted research that specifically addressed the health risks of firefighters. This project received support from the National Institute for Occupational Safety and Health (Berlin et al., 1989; New England Research Institute, 1989). In this research, firefighters were surveyed with ta goal to assess their health risks based upon their activities and behaviors. Another study, conducted in 2003 by the Rand Science and Technology Policy Institute, discussed the health risks that were incurred by firefighters who did not wear proper personal protective equipment, especially respiratory protective equipment, such as SCBAs, when their health status could be compromised due to fire ground activities (LaTourrette et al., 2003). Being somewhat limited in their scope, neither of these studies specifically addressed the need for respiratory protection during overhaul activities,

and neither addressed the dichotomy of espoused theory, or what had been taught and learned, as compared to theory in practice, or what actually occurs during overhaul activities at residential fire scenes.

In 2004, a conference sponsored by the National Fallen Firefighter Foundation specifically addressed the need for change within the fire service's culture, with a goal to reduce firefighters' injuries and deaths (Wilbur, 2004). Since then, the National Fallen Firefighters Foundation implemented the "16 Firefighter Life Safety Initiatives." This NFFF report and other publications have strongly encouraged, from various viewpoints, that additional research on the activities, behaviors, and health and safety status of firefighters be conducted.

Most of the current studies relate to compliance with the National Fire Protection Association's standard operating procedures or guidelines. These studies generally discuss the operational procedures or guidelines, present interpretations of policies, address how the guidelines might be implemented through formal educational programs, such as fire academy classes, and document the actual and potential health risks for firefighters (Fahy et al., 2015; Goldfeder, 2015; InterAgency Board, 2012; International Longevity Center, 2000). Other studies have discussed the effects of fire ground activities upon the current and future health status of firefighters (Fabian et al., 2014; FireRescue1, 2014; Higginbotham, 2015; Hvenegaard, 2012; Le Claire, 2015; Lindsey, 2015; Patterson et al., 2013; Roberts, 2011; Tyson, 2015). In addition, in 2014, Guidotti stated that "the occupational health problems of firefighters have been extensively studied, to the point that the world epidemiological literature on this topic is among the most complete and detailed available for any occupation (p. 6)." My review of the literature, however, found only three current studies that specifically address why a firefighter may choose not to wear appropriate respiratory protection during overhaul activities, but none of these studies relate

the lack of SCBA use to firefighter training, or the culture, organization, or leadership within the fire service (Jahnke, 2016; Jahnke et al., 2012; Maglio et al., 2016).

The fire services' culture is a tightly woven pattern of values, beliefs, traditions, practices, attitudes, customs, and artifacts that define its members, including who they are and how they undertake tasks. Since these well-defined concepts are deeply rooted in how firefighters perceive, think, and feel about their work, most authors believe that it will be difficult to bring about cultural change (Avsec, 2014; Basri & Bergman, 2009abc; Caspi, 2014; Salka, 2016; Sendelback, 2015ab). Even through this pessimism, there still needs to be the development of educational materials or training programs which can be implemented at informal and non-formal levels within the fire service, which address this organization and its leadership within its unique culture.

## Theoretical Framework

Health risk beliefs were incorporated into the theoretical framework within which the firefighters' perceptions regarding their activities and potential health risks were evaluated. For this study, the Health Belief Model (Janz & Becker, 1984) was used as a guide to determine the firefighters' behaviors, their perceived health risks, and the factors that influence discordance between these points. The basic construct of the Health Belief Model, its various influences, and applications are discussed more thoroughly in Chapter Two.

To enter the fire services' culture, the Health Belief Model became the framework which situated the research on SCBA use during residential overhaul activities. The Health Belief Model and other health risk belief models have been successfully used as a foundation for many studies, but only a few of these studies, beginning in 1989, have identified and placed the beliefs and activities of firefighters within a health behavior conceptual framework (Berlin et al., 1989; Mackin, 2016; New England Research Institute, 1989).

Although numerous authors have specifically discussed the effect of toxic environmental conditions on firefighters during residential overhaul conditions, research on why SCBAs are not appropriately used during overhaul is lacking, even though the lack of SCBA use has been mentioned as a cause of chronic respiratory impairment in articles since the 1990s. As a result, no conclusions have been drawn to determine if the lack of SCBA use during overhaul operations is due to a lack of appropriate formal or informal educational opportunities or if the lack of SCBA use is due to cultural elements within the fire service, including leadership, peer mentorship, societal stigmas, or a lack of behavioral understanding.

## Importance of the Study

Each year, thousands of firefighters are injured at active fire scenes, and thousands more experience life threatening or life altering medical problems many years later, since the afflictions of some firefighters have a latent period. This is especially true for cancer and respiratory illnesses, whose frequency can be exacerbated when appropriate respiratory protection is not used. The full potential of any exposure to toxic hazards may not be known or evident in the health of firefighters for many years. Due to this latent period before signs and symptoms of disease occur, it is important that a change in fire ground activities during overhaul be encouraged as soon as possible.

This study has importance because it may help to determine why firefighters do not appropriately use SCBAs during their overhaul activities. The reasons why this behavior lacks compliance may be due to many variables, which may stand alone or be interwoven within the fire service, such as department organization, leadership or peer influence, or learning opportunities for firefighters. Although firefighters should have gained an understanding about SCBA use during overhaul from their fire academy training, the lack of this information is evident in many firefighters' behaviors at this time. Lack of congruence between learning and

behavior needed to be investigated, since the firefighters' initial formal learning has not developed appropriate fire ground activities. It is, therefore, important to understand firefighter learning and ways to improve upon this learning which affects firefighters' behavior during overhaul at residential fire scenes.

The 16 discussion points from The Firefighter Life Safety Initiatives (Everyone Goes Home, 2017), especially the two points which relate to firefighters' culture and risk assessment for PPE use, have not been widely implemented into fire service operations, nor have they changed today's volunteer firefighters' behaviors. The reasons for the reluctance to implement these improvements in behavior have not been well established nor widely discussed in firefighter research. In an attempt to lessen firefighters' injuries and deaths, the attitudes of firefighters toward their fire ground risks need to be identified, and the reasons why firefighters ignore these risks at fire scenes need investigation.

A timely acquisition of this knowledge may help to prevent the development of illness or injury in firefighters who are currently working on fire grounds for the departments participating in the study. If appropriate conclusions are drawn, the information from this study may be the basis for additional research. In addition, firefighters from other fire departments, both now and in the future, may experience health benefits as new educational programs, organizational structure, leadership guidelines, and peer influences are altered and implemented. As firefighters' attitudes and the fire service culture changes about residential fire ground risks, this may act as the impetus for firefighters to modify their current fire ground behaviors.

## Definition of Key Terms

Fire ground (residential). The area in and around a non-commercial building within which members of a fire department engage in a variety of activities in order to evaluate, control, suppress, and investigate a fire.

National Fire Protection Association (NFPA). An association which publishes fire and building safety standards, including the National Electrical Code, NFPA 1500 (2007), *Standard on Fire Department Occupational Safety and Health Program*, and other NFPA publications which promote firefighter health and safety.

Overhaul. Activities that are conducted at a fire incident after the fire has been extinguished, in order to find any areas of potential hot spots, rekindling, extension, and to save additional property and belongings. (This time of fire ground activities is also referred to as post-extinguishment, post-control, or post-fire.)

Self-contained breathing apparatus (SCBA). An atmosphere-supplying respirator that supplies a respirable air atmosphere to the user from a breathing air source that is independent of the ambient environment and designed to be carried by the user (NFPA 1981, 2019).

Standard Operating Procedure or Guideline (SOP or SOG). An organizational directive that establishes a specific course of action for a given set of circumstances.

Township. A geographic area, established for administrative or governmental authority, that has defined boundaries. In Michigan, the typical township is generally in a rural area and is approximately 6 miles square. This area may include a small village or concentration of residences.

Volunteer firefighters. Individuals who are trained and state certified, and who belong to a governmental agency that is authorized to work at accidents and fire scenes. These individuals, who are not employed by their departments on a full-time basis, are generally employed in other professions, which are not related to the fire service, for their livelihood.

## Organization of the Study

Chapter One includes a background of the study, as well as a statement of the problem and the purpose of the study. The need for and the importance of the research is also discussed, and key terms that are used throughout the study are defined. Chapter Two summarizes a review of the literature pertinent to the study. Included in this review is a summary of the health behavioral risks of firefighters and a discussion of health belief models. An application of the Health Belief Model to firefighter behavior and the impact that firefighters' activities during overhaul after residential fire suppression may have upon their current and future health status are also explained. These points are situated with various components which affect learning, such as the organizational structure of the fire service, its leadership, and peer interactions. The research design and the methodology of the study are discussed in Chapter Three. Included within this chapter is detailed information regarding the selection of and access to the study's participants, the manner of data collection, the analysis procedures, and the limitations and delimitations of the study's validity and reliability. Results of my observations and interview data are contained in Chapter Four. Included within this data are summaries of some of the nine fire departments and their fire chiefs and the nine firefighters as they relate to their fire departments structure, culture, leadership, learning opportunities, and the individual firefighters as student learners. The findings, conclusions, recommendations, a summary of the study, suggestions for future research, and personal reflections are presented in Chapter Five.

# CHAPTER 2: REVIEW OF THE LITERATURE

For many decades, physicians, psychologists, sociologists, anthropologists, and others have questioned why individuals engage in activities that are known to be hazardous or potentially hazardous to human health. Many individuals in the public sector are cognizant of the fact that they, or their fellow citizens, engage in dangerous pastimes, are employed in dangerous occupations, and do not follow the recommendations of family, friends, or medical professionals that would lead to healthy lifestyle choices. Since information is available that could influence health risk choices, the question remains as to why many individuals still engage in hazardous life-style choices. In particular, I chose to investigate why firefighters do not wear respiratory protective equipment (SCBA) during overhaul at residential fire scenes when they have been appropriately trained to use this equipment.

## Introduction to the Theories

In the mid-1950s, several social psychologists, including Hochbaum and Rosenstock, developed a model that attempted to understand why people, who were given information regarding their health options, did not follow the given advice. The initial concepts of this model, which were based upon the theories of Karl Lewin, were introduced within the U.S. Public Health Service by psychologist Hochbaum and were further developed by Rosenstock, Leventhal, and Kegels (Brown, 1999; Todd, 1997). This model on health seeking behavior was initially used for tuberculosis screening in an attempt to determine why screening programs, which were offered to the public, were not successfully utilized (Hochbaum, 1958; Rosenstock, 1974). The originators of the Health Belief Model (HBM) used this theoretical framework of the model to determine why people, with access to medical care, choose not to seek that service. Rosenstock (1966) modified the major components for the Health Belief Model to include an individual's perceptions, modifying factors, and the likelihood for a person's change

in behavior. The initial studies focused upon the availability of tuberculosis prevention and immunizations services within a population, where individuals did not to use these medical services (Brown, 1999; National Institutes of Health, 2001; Rosenstock et al., 1988).

In the 1980s, Marmot, Kogevinas, and Elston (1987) conducted research to determine what might influence the risks that an individual will take in his life. This research specifically identified cultural, social, and psychological factors that influence unhealthy or risk-related behavior. Even when these factors were identified and explained to individuals who engaged in risk-related behavior, additional research determined that a person's behavioral choices are generally not altered to allow for less risky choices (Helman, 1995; Janz & Becker, (1984).

With an aim to understand why unhealthy choices are made by many individuals, and why their behavior is not modified when specific risks have been identified and explained, a number of theories have been developed. Many of these theories are based upon interrelated concepts, definitions, and propositions that present a systematic view for examining the variables that predict lifestyle choices (Glanz et al., 1997). Most of these theories have common elements that have guided risk-related behavior research, and yet many have unique qualities that attempt to explain human behaviors within various individual, interpersonal, community, and cultural situations.

## The Health Belief Model

A number of theories, including Lewin's Perception Theory (1951), Ajzen and Fishbien's Theory of Planned Behavior or Reasoned Action (1974), Prochaska and DiClemente's Stages of Change Model (1982), and Bandura's Self-Efficacy Model (1997), are conceptual frameworks which could be used for research on risk-related behavior and the potential for change. The model most commonly utilized to determine the effectiveness of health education on an individual's risk behavior modification is the Health Belief Model (Glanz et al., 2002; Janz &

Becker, 1984). The Health Belief Model is a value expectancy or humanistic theory which states that an individual's behavior is a function of the significance that person places upon a specific outcome and the behavior required to achieve that outcome (Champion & Skinner, 2008; Denison, 1996; Glanz et al., 1990; University of Kentucky, 2001).

In more recent years, the Health Belief Model (HBM) has been used as a theoretical framework to promote and maintain both short and long-term educational programs on life-style choices (Blalock, et al., 2000; Jamal, et al., 1999; Janz, 2002). These programs have encouraged behavioral change in many areas. Recent screening programs used the HBM to investigate genetic carrier status, and screenings for high blood pressure, high cholesterol, diabetes, osteoporosis, and cancer susceptibility (Family Health International, 2002; Hayden, 2009; Mackey, 2002; Todd & Mullan, 2011). Other studies have used the model to investigate a variety of conditions, such as disease transmission, smoking cessation, alcohol use, dietary choices and eating disorders, inoculations, sedentary lifestyles, cancer screening, seatbelt usage, and cardiac rehabilitation (Denison, et al., 2009; Gandelman & Freedman, 2002; Glanz et al., 2002; Norman & Brain, 2005).

When the Health Belief Model was first developed, it contained a number of constructs that have been altered as society changed. Their original points included an individual’s general motivation toward good health, the person's perceived susceptibility to becoming ill, the perceived seriousness of the potential illness, the perceived benefits that a person could obtain if health behavior improved, and the perceived barriers to the behavioral change (National Institutes of Health, 1995). In later years, a construct based upon an individual's cues to action, which addressed one's readiness for behavioral change, was added to the model (Hayden, 2009), and the construct addressing a person's general health motivational state was deleted by some researchers (Norman & Brain, 2005). In 1988, the concept of self-efficacy, based upon one's

confidence in that person's ability to successfully perform or, in some cases, not perform, the action required, was included in the model (Bishop et al., 2014; Family Health International, 2002; Umeh & Rogan-Gibson, 2001; Wallace, 2002).

Each of the Health Belief Model's current constructs, including the perceptions for susceptibility, seriousness, threat, benefits, and barriers, and the action of self-efficacy, can be expanded for clarity. The perceived susceptibility may be the most important point of awareness for an individual to initiate behavior change. If a person perceives that a risk is high in a given situation, this individual should have a greater chance for undertaking activities which will reduce this risk. Research, on a variety of topics, have been based on the individual's assessment of his risk for developing a specific health problem (Chen et al., 2011; Lamanna, 2004; Maes & Louis, 2003; Seo, 2005).

The perceived severity of the health problem assesses how seriously the person believes the development of the condition might be. This construct of the HBM, which determines how seriously a person believes a risk may be, is based upon medical signs, symptoms or information, social and employment consequences, and available media to which the person has access (Hayden, 2009; McCormick-Brown, 1999). A variety of social stipulations or outcomes could cause an individual to become more conscious regarding his actions or inactions toward the risk's severity.

When added together, the two constructs of susceptibility and severity form the perceived threat of the health problem. This perceived threat can be eminent or could occur at a later time. For any potential behavioral change to occur, in an attempt to prevent this threat, the individual must truly believe that a threat is present or he will not be interested in adopting any behavioral changes that might reduce the threat (Denison, 1996; Grove et. al., 2015; Mullens et al., 2003). If the threat is perceived to be real and deemed significant, this may cause an individual to evaluate

behavioral changes which would lower the perceived threat (Champion & Skinner, 2008; Communication Initiative Network, 2008).

Once an individual perceives a specific threat, the next two constructs can become the basis for action. The first of these is the perceived benefits of a specific action, which is the belief that an action will reduce, prevent, or cure a specific condition. These benefits can be medical, financial, social, or individually determined. If a person adopts a healthier lifestyle, he may believe this will lessen his chances of developing the condition which he had perceived to be the eminent threat (Hayden, 2009).

The next construct to reducing a threat is the perceived barriers that might exist if the potential action to improve the specific health condition is undertaken. As a person compares the potential benefits of the behavioral change against the potential barriers to the change, a cost-benefit ratio is established. This benefit to barrier relationship, which seems to be a strong predictor for change, will be the basis for any action that the individual chooses to take (Janz & Becker, 1984). Any cue to action is personally determined and can be based upon a person's self-determined view of his life or external cues, such as educational media, expense, medical side-effects, or personal medical information (Champion & Skinner, 2008; Rimer & Glanz, 2005).

Once the person believes that an action should be taken, the individual is prepared for a specific change. The confidence that the individual has regarding his potentiality to successfully modify his behavior is the HBM's construct of self-efficacy (Clark, 2003; Green & Murphy, 2014; Norman & Brain, 2005). Most people will change their behavior when they believe that they have the capacity for this change. If they lack the confidence for a behavioral change, they will probably not attempt the change or will only attempt the change for a short time before stopping the actions needed for change (Umeh & Rogan-Gibson, 2001). For any change to occur,

a person needs to have a positive attitude that he can successfully undertake the actions needed for the behavioral change to occur (Hayden, 2009)

Since the HBM attempts to predict a person's health-related behavior based upon specific belief patterns, the unique perceptions of the individual will have a direct influence upon how that person's behavior can be impacted. Included as perception modifying factors, which could influence an individual's behavioral change, are the person's age, sex, ethnicity, religion, personality, socioeconomic status, knowledge base, support systems, peer influences, previous personal experiences, and the individual's circumstance within which the change must occur (Clark, 2003; Green & Murphy, 2014; NIH, 2001; Rimer & Glanz, 2005). Many of these psychosocial factors can impact the person's ability to attempt the behavioral change. The individual must believe that the benefits of taking the preventative action will out-weigh the perceived barriers to that action. As a result, it has been noted that the HBM is more valuable in understanding the elimination of negative behaviors as opposed to the adoption of actions that will lead to positive behaviors (Janz & Becker, 1984)

According to some reports, a target population will, for various reasons, only implement, as a behavioral change, approximately one-half of all medical advice given to those in need (CPC Healthcare Communications, 2002; Mackey, 2002). Access to information alone does not lead to a motivation for change, compliance, or the development of desirable outcomes. When an educational program is shown to impart a factual gain in knowledge, the instructed individuals may show only a minimal or short-term change in their health behavior (National Occupational Research Agenda, 1998). When behavioral changes do occur, they are generally more effective when the preventative behavior is a short term or one-shot action, rather than one which requires a long-term modification of an established routine (Chaney, 2013; International Longevity Center, 2000).

In an attempt to moderate some of these limitations, a National Occupational Research Agenda report from 1998 stated that many models of health behavior are incorporating a more interdisciplinary viewpoint. This includes the various societal factors that influence an individual's health style choices. These social elements can include a culture's norms, values, assumptions, beliefs, roles, ways of thinking, and peer pressures (Bolman & Deal, 2013; Kouabenan, 1998; Morgan, 2006; Russell, 2001; Shepard, 1999). According to various authors, socioeconomic status and level of education are the two factors that will have the greatest influence upon health behavior (Flynn, et al., 1994; Institute of Medicine, 2001). Mackey (2002) believes that emphasis needs to be placed upon the individual when the HBM is used, since each person will interpret the influences upon his health in a unique manner. From personal interpretations, each individual will be actively involved in the decisions he makes regarding risk-related behavioral choices. Ory, Jordan, and Bazzarre (2002) have suggested that "future efforts must focus on understanding the vast range of factors affecting various lifestyle choices, (in an effort to find) better ways to implement strategies that encourage health promoting behaviors, and (which will reduce) health-impairing activities and environments" (p. 3). The key to this statement is the implementation of appropriate actions that will suit the individual's specific needs and lifestyle choices. To do this task, it is necessary to assess an individual's health risk and his belief that engaging in risk reduction interventions can lead to healthier outcomes (Mackey, 2002).

## Application of the Health Belief Model to Firefighter Behavior

Current events have identified firefighting as a profession with unique cultural elements, which needs some risk-related behavioral modifications. The specific occurrences which drew attention to these individuals and the risks that they take were the events of 11 September 2001, where, during rescue efforts, 343 firefighters died. In subsequent days, firefighters from

hundreds of departments took similar risks as they assisted in the search for entrapped victims. From their rescue efforts, many firefighters were exposed to environmental conditions that immediately or subsequently threatened their wellbeing (Lioy & Gochfeld, 2002; NYC air quality environmental alert, 2003; Szeinuk et al., 2002; Smith, 2002).

**Influences to Firefighters' Health Status**

In addition to the firefighters who died on September 11th, many of the rescuers experienced or are currently experiencing ill-health, and many health care professionals fear that hundreds of firefighters will eventually die as a direct result of their respiratory exposures at Ground Zero in New York City (Davis, 2002; Hill, 2002; Lioy & Gochfeld, 2002; Smith, 2002; Szeinuk et al., 2002). From these events and the subsequent research studies, other environmental contaminant exposures, from a large variety of sources, have been documented as the cause of firefighters' ill health (Booze et al., 2004; Fent & Evans, 2011; Lioy, 2002; Kinsella et al., 1991). When firefighters' duties and their potential for ill-health from their activities are coupled with other health factors, which affect many firefighters, such as excess weight, poor dietary choices, high blood pressure, elevated stress levels, and smoking, additional health risks can develop (Basri & Bergman, 2009abcd; Firefighter Cancer Support Network, 2013; Goldfeder, 2007; Haddock et al., 2012; Patterson et al., 2013).

For many years, researchers have been studying one aspect of firefighter health compromise, which is the inhalation of gases and particulate matter that are formed as the products of combustion. Numerous studies, some of which were conducted forty years ago, documented that the inhalation of these products has immediate or future impact upon respiratory health (Large et al., 1990; Musk et al., 1982; Peters et al., 1974; Sparrow et al., 1982). A report from the Fire and Emergency Service Administration (2002) stated that "exposure to smoke and hazardous gases go hand in hand with the job" (p. 2).

To limit such exposures, firefighters are required to wear personal protective equipment (PPE), which are continually updated or modified to specific standards by the National Fire Protection Association (NFPA 101, 2018; NFPA 1500, 2018; NFPA 1852, 2019; NFPA 1971, 2018; NFPA 1981, 2019). For respiratory protection, self-contained breathing apparatus (SCBA), which reduces firefighters' exposure to hazardous inhalation products are generally used (Baxter, 2014; Burgess et al., 2001; Fabian et al., 2014; Greven et al., 2011; Hvenegaard, 2012; Peel, 2008; Tsai, 2015).

Even though specific respiratory and other personal protection is required to lessen the risks of their professional activities, it is well documented that firefighting is associated with more hazardous working conditions or less healthy work environments than many other professions (Bailey, 2016; Forgue, 1992; Lioy & Gochfeld, 2002; Russell, 2001; Smith, 2002; Szeinuk et al., 2002). In addition, firefighters are two to three times more likely to develop certain cancers, specifically of the respiratory, digestive, and urinary systems, due to toxic smoke exposure (Giroday, 2009; Maruca, 2016; National Institute for Occupational Safety and Health, 2013).

These statistics and information are readily available to firefighters, from the first days of their training, at department meetings, in trade magazines, from commonly accessible public media, including news reports and television programs, during health examinations, and during conversations with colleagues. Various organizations, including Everyone Goes Home, Firefighter Cancer Support Network, National Fallen Firefighters Foundation, National Volunteer Fire Council, and the United States Fire Administration, present recommendations, hold conferences, discuss current events, and offer publications. In addition, various research projects are based upon firefighters' activities and the correlation to their health status, including

current research by Haddock, Jahnke, Poston, Jitnarin, Kaipust, Tuley, and Hyder (2012), Jahnke (2016), and Maglio, Scott, Davis, Allen, and Taylor (2016).

Although few firefighters are attuned to this or other research on their profession, I am in contact with some of these researchers and read as much about their work as I can. As a result, I know that I have a different perception regarding the severity of ill-health effects which can occur within my profession than do many of my peers. Within the various departments from which I interviewed firefighters and fire chiefs, I have noted that few fire chiefs discuss the content of current research, even though these leaders are knowledgeable about the current information. Contrarily, most firefighters do not seem knowledgeable about these topics, so any discussion can become a teachable moment. I have also noted, when firefighters initiate discussions, some fire chiefs are receptive to the discussion, while others listen to the topic mentioned and do not engage in further discussion.

**Perceived Susceptibility, Severity, and Threats**

As a result, from their fire ground activities and their experiences, firefighters should perceive that their activities will give them a susceptibility to ill-health conditions. Although each fire is different and presents unique health risk conditions, there are certain commonalities that do exist at fire scenes, particularly respiratory hazards, from which firefighters should perceive their susceptibility to potential health problems (Brand & Hsu, 2001). Of interest to me is the time of residential fires, after the fire has been extinguished, which is termed overhaul, since this is a time when many firefighters remove their SCBAs, their only form of respiratory protection. The reasons this form of respiratory protection is not utilized during overhaul operations vary, but can include weight of the equipment, limitation in mobility and visibility, fatigue, difficulties in ease of respiration, increased body heat, and problems communicating (Bolstad-Johnson et al., 2000; Horn, 2015; Peel, 2008; Routley, 2009; Stone 2005).

From experience, I know that my personal protection equipment (PPE) ensemble weighs over forty pounds, with my SCBA weighing approximately twenty-two pounds of that total. As a result, during overhaul, when firefighters are seeking hot spots, rekindling, and possible areas of fire extension, which may be a longer phase at a fire scene than active fire extinguishment (National Volunteer Fire Council, 2014ab; Peel, 2008), this activity can be more easily accomplished without SCBA equipment.

Since Federal regulations only mandate wearing SCBAs when going inside an actively burning structure, but not during overhaul (FireRescue1, 2014), most firefighters, when overhaul begins, merely remove their masks but continue to have the remaining equipment on their backs (Dunn, 2005; Firefighter Cancer Support Network, 2013; Routley, 2009; Wise, 2015). This action improves some movement capabilities, communication, and visibility, but the weight of the equipment, its unwieldiness, and the shift in the firefighters' center of gravity still exist. As a result, for minor advantages, firefighters are willing to increase the susceptibility to respiratory health risks.

The severity of any perceived ill-health event should be evident to all firefighters from the information which is continually available from various sources. Unfortunately, since volunteer firefighters respond to so few residential fires, they may not be concerned about respiratory hazards. As a result, volunteer firefighters may believe that their health risk severity is less than if they had more frequent exposures to the products of combustion. Even with fewer fires, during overhaul operations, the environmental hazards which can cause ill-health respiratory problems are still present. This severity can be increased during overhaul, due to the limited number of personnel on most volunteer fire departments, who have been documented to breathe more rapidly and deeper due to increased physical exertion (Bailey, 2016; Baxter, 2014).

After the extinguishment of a residential fire, when most of the smoke has dissipated, firefighters tend to remove their respiratory protective equipment (Berger & Moulin, 2016; Fire Rescue1, 2014; Firefighter Cancer Support Network, 2013; InterAgency Board, 2012; National Fallen Firefighters Foundation, 2015; National Volunteer Fire Council, 2015cdef). Once one firefighter removes his equipment, others who are working in the same environment tend to also remove their SCBAs, since it is easier to work without this equipment (Avsec, 2014; Burneka, 2014ab; Herbert, 2008; Taylor, 2016; Willing, 2016). This emulation of behavior may lessen the perceived severity of respiratory problems or risks involved, even though it has been documented that the use of respiratory protection, due to the level of hazards, needs to be worn throughout an entire fire, including the time of overhaul or post-extinguishment (Bolstad-Johnson et al., 2000; Burgess et al., 2001; Firefighters' Cancer Support Network, 2013; Forgue, 1992; Greven et al., 2011; Guidotti, 2014).

For over twenty-five years, numerous authors have stated that the time of post-fire extinguishment or overhaul, may present more respiratory hazards than during the free-burning time of a fire. During overhaul, when the environment has lower heat, lower intensity of burning, and lower oxygen level conditions, more cyanide and carbon monoxide are produced (Hall, 2009; Herbert, 2008; Hvenegaard, 2012; Rochford, 2009). During the free-burning stage of a fire, when flames and smoke are visible, firefighters wear their proper respiratory protection, but this same equipment is removed during overhaul. When fire and smoke are no longer visible, firefighters perceive that the severity of the fire environment is no longer present when, in actuality, this environment is more hazardous than firefighters may assume (Duncan et al., 2014; Guidotti, 2014; Hvenegaard, 2012; Kales et al., 2007; Patterson et al., 2013; Tsai et al., 2015).

When the perceived susceptibility is inter-related to the perceived severity, this will yield the perceived threat (Sheeran & Abraham, 1996). A threat, which is an indication of a probable

risk, should be something about which firefighters are concerned whenever they work. This would certainly be true about their activities during overhaul. Since most firefighter injuries occur during this time of fire ground activities (Karter & Molis, 2014; Smith, 2004), firefighters should be particularly aware of their activities and the associated health risks. The consistent use of SCBA during overhaul would reduce many of these respiratory risks (Duncan et al., 2014; Forgue, 1992; Hall, 2009; Willing, 2012). Since many fire departments do not have standard operating guidelines or procedures (SOGs or SOPs) for overhaul activities, and these activities are not specifically addressed in Federal standards, this may lead firefighters to perceive that, during overhaul, their health threat is low.

According to Herbert (2008), only 13.6% of firefighters reported always wearing their SCBAs during overhaul, 6.8% reported they never wear their SCBAs during overhaul, and 79.5% stated that they sometimes wear their SCBAs during overhaul. This data shows that firefighters are not taking their perceived threat of a health risk during overhaul seriously. With no respiratory protection, there can be changes in spirometric measurements, lung permeability, and blood serum pneumoproteins, which can lead to lung damage (Burgess et al., 2001; Herbert, 2008). The overhaul environment is known to contain toxic gases, some of which are known carcinogens (Bolstad-Johnson et. al., 2000; Burneka, 2014ab; Evans, 2009; Fabian et al., 2014; Putorti, 2016; Taylor, 2016).

From personal observations and experiences, I know that some firefighters do not wear their SCBAs at appropriate times. After fires, when the department's personnel have returned to the station, there are oftentimes discussions about who did what activities and what these activities gained. It is not uncommon for firefighters to compare their sooty faces, which they tend to wear, as stated by FireRescue1 (2014), as their badge of honor. These dirty faces are evidence that these firefighters were not wearing their SCBAs during their fire ground activities.

On some occasions, I have asked these same firefighters to check the color of their nasal mucus. When this mucus is also sooty, it is evident that these firefighters also breathed into their respiratory tracks the products of combustion, which could contain toxic and carcinogenic chemicals. Even when presented with this physical evidence, the perceived threat of respiratory illness does not appear to have any impact on these firefighters' activities, since they will exhibit their same sooty faces and nasal mucus after the next residential fire overhaul.

**Perceived Barriers and Benefits**

Since firefighting is a well-known risk-laden occupation, the question as to why so many individuals seek this profession, may be asked. It could be that society has constructed a romantic notion of firefighters acting in heroic fashion as they engage in their activities (Fire and Emergency Services Authority, 2002). If a person believes that firefighters are revered for their actions, the consequences of their risky behavior may not be sufficient to deter them from entering the profession. Newly recruited firefighters may join the profession because they wish to follow other family members into the service. From personal observations, at least one-half of all volunteers on the rural fire departments with whom I interacted for my research, have, or had in previous years, other family members in the fire service. These individuals may pursue firefighting because they have been told about or have witnessed the culture of the fire service through the stories or exaggerated imaginations of their relatives.

This culture of firefighting is unique because it is based upon a strong sense of family and tradition (Robeson, 1999; Russell, 2001; Shepard, 1999). Still others may join the fire service as a way to give service back to their community. With the increasing demands of today's busy society, some firefighters have stated that they joined the fire service because they enjoy the freedom, the companionship and structure, and prestige which their memberships within a department give to their lives (Nemko, 2007; Shepard, 1999).

According to Russell (2001), firefighting may be a calling or the fulfillment of a personal journey, which may attract a very specific type of personality. These individuals may be lured into a culture that allows risk-laden behavior in exchange for the benefits that the profession can bestow upon the community. Whatever may be the reason that caused an individual to pursue a risky profession, the individual generally must believe that the rewards and benefits of their employment outweigh the detrimental aspects, including the potentiality for injury, illness, or death (Tuler et al., 1992).

Although the reasons for becoming a firefighter, the perceived benefits, can be as different as the profession is diverse, a common thread of dedication seems to be evident in its members, which has caused a unique culture to be established. This culture has impact upon many behavioral and social aspects of firefighters. When groups are strongly bonded by culture, their degree of cohesiveness may hinder the development of wider contacts, other social interactions, and the health of the participants (London Health Commission, 2002). In their 1988 report, Vingerhoets and Marcelissen concluded that the culture in which people live or work, not only influences their belief, attitudes and social behavior, but also their disease patterns and health risk decisions which are exhibited through behavior (Cline, 2009; Crawford, 2007; Damschroder et al., 2009; Nicol, 2015b; Tuler et al., 1992).

The culture of the fire service has not changed to any degree in the past 40 years. The buildings, apparatus, and equipment have all changed, but the good old boys club attitude, where tradition and history are preserved, and an attitude toward being macho and revering heroism are very prevalent (Crawford, 2007; Farina, 2016; Houska, 2010; Nicol, 2015b; Sendelbach, 2016ab; Shepard, 1999). When I joined my first volunteer fire department in 1979, I soon discovered that this culture was very different from that of academia, where my career began in 1972. I discovered that shared values were well entrenched within the fire service. When I relocated to a

new area in West Michigan, and joined two other fire departments, I found these same aspects of the fire service culture.

I soon realized, even though some changes did occur, in such areas as record keeping and updating personnel data, the inclusion of physical exams and drug testing, and station cleaning, the culture was so stable that it was difficult to implement small changes which required minimal time or financial investment. The established routines, norms, beliefs, values, and attitudes of most volunteer department members' gives stability to the organization, but this constancy can become a barrier which also allows poor habits to remain (Morris, 2009; Salka, 2016; Shepard, 1999). Since many members learn their routines, skills, and attitudes from other members, this mentorship model brings the next generation into a department with many of the same thoughts and actions as the previous generation (Johnson, 2009). When change is needed within a department, the entrenched consistency becomes a perceived barrier which will make change difficult (Peterson, 2010) and, according to Wilmoth (2004), it may take generations to bring about cultural change.

For firefighters, particularly young recruits, if they do not conform to the decades old cultural standards, they may fear that they will not be able to participate in some fire ground activities (Avsec, 2014; Taylor, 2016). This can be particularly evident when safety equipment, such as SCBAs, are used during overhaul activities (Taylor, 2016). These young recruits feel pressure from veteran firefighters not to use proper respiratory protection, since the use of this equipment is not macho and will not yield sooty faces and blackened mucus. I have heard comments from veteran firefighters which are similar the one stated by Taylor (2016), "Come on, don't be a sissy, you don't need that," referencing the use of appropriate respiratory protection. These comments and similar actions all present perceived barriers to any changes which could reduce health risks and improve the health status of firefighters.

With a slowly changing culture, which is being initiated by fire organizations and articles in trade magazines, but generally not by active members of fire departments, the idea of going against the established group is slowly changing some aspects of the fire service. If there could be momentum for this movement, and young recruits pay more attention to their health, their training, and the fire services' safety movement, there may eventually be a positive change in fire departments' beliefs, norms, attitudes, and values (Stewart, 2015; Wilmoth, 2010). This change may give each person more individual accountability regarding his personal responsibility for his health (Jakubowski, 2004; Taylor, 2016). Rather than being called a sissy for not wearing appropriate respiratory protection during overhaul, a firefighter may have the courage to state that he does not care if he is being mocked by his peers for his behavioral change toward safety, if he believes his future health status will be protected (Taylor, 2016).

During the past few years, The National Volunteer Fire Council and other national fire service organizations have been discussing personal accountability. These organizations are attempting to understand why unsafe behaviors continue to occur at fire scenes, and why firefighters are not more receptive to any positive changes which could improve their health status. Behavioral changes need to be implemented by individual firefighters and by command officers who lead their departments (Jakubowski, 2004; National Volunteer Fire Council, 2015ab; Wilmoth, 2004). It has been suggested that small cultural changes should be implemented, such as the mandatory use of seat belts (Mueller, 2008; Wilmoth, 2016). Since the use of seat belts in motor vehicles has been mandatory for decades, it amazes me how many times I have listened to the pinging of the seat belt sensor as I rode with a fellow firefighter to a scene. According to Wilmoth (2017), three basic steps are needed for change to occur, which include engaging the individual who needs to be affected by the change, motivating the person whose behavior needs to change, and removing any obstacles which prevent the change.

For firefighters, the perception of barriers being present may prevent change. If departmental SOGs were well thought-out, properly written, explained, and enforced, all individuals would understand that an immediate change was needed in their behavior, and obstacles to change would be removed. If firefighters are rewarded by their leaders and accepted by their more experienced colleagues, respiratory protection during overhaul activities can be ingrained into the behavior of the firefighters (Sendelback, 2015ab).

Articles from trade magazines, fire service organizations, such as the National Fallen Firefighters Foundation, the Firefighters' Cancer Support Network, and the National Volunteers Firefighters' Council, and from fire service leaders are stressing that firefighters need to educate themselves on their health risks and that they need to learn how to minimize respiratory risks through the appropriate use of SCBAs, especially during overhaul operations. According to literature (Bailey, 2016; Burgess et al., 2001; Duncan et al., 2014; Fabian et al., 2014; Guidotti, 2014; Taylor, 2016), and from my personal observations, most rural volunteer firefighters are not complying with the use of any form of respiratory protection while working overhaul at residential fires.

## Adult Learning Concepts Applied to Firefighters

According to numerous textbooks, articles, classes, and personal interactions, I know that there are numerous concepts which can affect adult learning. Although most of these individual entities have not been directly researched or reported for firefighters, these concepts can certainly be applied to firefighters. These concepts might be divided into numerous categories within educational learning opportunities but, for volunteer firefighters, the most important areas are departmental organization, forms of leadership, learning opportunities, and firefighters as students.

## Organizational Culture of Some Volunteer Fire Departments

Most volunteer fire departments have a similar manner of organization, which includes, from the top down, a chief, potentially some administrative officers, line or field officers, sector officers, and firefighters, and the physical environment in which these individuals work. The chief for most volunteer fire departments can be elected by the departmental members or appointed by township or governmental officials. If administrative officers do exist within a department, they are usually appointed by the governmental officials. Line or field officers and sector officers can be appointed by the chief or elected by the departmental members, which may give more flexibility to the membership within this area of organization than the previous two. Depending upon the volunteer department, some sector officers may arise simply due to their areas of expertise, competence, and aggression (Crawford, 2017). When this occurs, these members will need to be supported, generally in an unofficial manner, by the chief and other supervising officers. The remaining firefighters of the department take on any tasks requested by the fire chief or any other officers. All these roles are defined positions with particular job expectations within the fire service (Merriam et al., 2007).

Due to this structure, which is common for volunteer fire departments, certain elements of the organizations' cultures, such as beliefs, goals, legends, missions, rituals, and values, give commonalities and internal structure to each department's employees (Schulman, 2008; Smith 2000). According to Daniels (2005), there are five dimensions of many cultures. Based upon membership, some members of the department will have independent beliefs and, due to their work, they will not feel that they are an integral part of the organization, while other members will work well together as they interact as a collective sub-group of the organization. Some members may understand the importance of the organization's hierarchical structure and power, while others may openly rebel when interacting with command members (Merriam et. al., 2007).

These interactions or feelings can influence the third category of culture, which is based upon how members react in structured or unstructured situations. These three dimensions influence the fourth and fifth concepts which include how the members of the department focus on the future, or hold on to past events (Losh, 2001), and how current members will accept new recruits and their roles within the department, especially when these new members are women, who may not want to adopt male norms (Olafsdottir, 1997). Although the number of women in volunteer fire departments is only around 5%, their impact is being felt as numerous elements of the fire service have adjusted to meet women's needs (Post, 2016).

Based upon these dimensions, volunteer firefighters compose a small, unique community of individuals who have stated roles and work in small groups within a rather precisely defined and often unchanging culture and physical environment. Regretfully, this resistance to change within most fire departments continues to contribute to a culture where injury is not a rarity and death may result (Schulman, 2008). According to Lamb (2002b), a study of firefighter behavior within the departments' culture concluded that the enemy of firefighters is the culture of firefighters which, they, themselves, created.

Firefighters have created a culture of injury and death, where firefighters learn how to take risks, be rewarded by injuries, and are glorified in death with well-prescribed, ritualistic ceremonies (Schulman, 2008). It is known that firefighters treat risks as a macho activity, court danger, and are influences by peer pressure, universal character, bonding, and hidden competitiveness (Lamb, 2001). As a result, most firefighters believe that their organizational culture builds loyalty through their actions, so there is no need to change their current beliefs and behaviors, a change which might lead to a more rational and less risk-laden actions (Siarnick & Gist, 2014; Smith, 2000).

Although many authors have written about changing the behaviors of firefighters, with an aim to improve their current and future health, linkages to the past are hindering the current organization and culture of the fire service (Russell, 2001). As a result, there needs to be meaningful change as personal safety gains importance. Fire department members need to transform themselves by promoting growth toward identifying risks and eliminating them as much as possible. Safety must be accepted as a culture within the organization and around the fire station from the first day of employment for its members (Lamb, 2001). Cultural change needs to bring about organizational, as well as personal, responsibility toward health and safety (Parow, 2011). Even though firefighting is known to be a hazardous profession, the evident risks can be lowered in many ways, such as the use of SCBAs during overhaul at residential fire scenes.

This area of concern has been continually discussed for many years, but the lack of SCBA use is still evident on fire grounds during overhaul. A change needs to come about within the organization through the education of all officers and members, by creating an environment of safety, through the writing and enforcement of SOPs, and through the actions of all fire personnel who bring about change in the current, risk-taking culture of each fire department.

**Leadership**

According to football coaching legend Vince Lombardi, "Leaders are made, they are not born" may be true for sports, but this may not be true for leadership within volunteer fire departments (FEMA, 2002; Lenning & Ebbers. 1999). It is not unusual for a son to replace a father, or a brother to replace a brother, as chief of a department. In many small, rural, volunteer fire departments, the inter-relationships which exist among members is quite familial, which oftentimes evolves into leadership positions being passed down within families. Due to this uniqueness, nepotism, be this a good or unfavorable outcome, does result. The one good thing

that does come about is that most leaders were, at one time, a follower within this same or another department (Griffin, 2017). As a result, as members become inducted within the fire department's culture, they learn how things are understood and accomplished (Carter, 2016). This form of structure which, unfortunately, can evolve into leadership roles, can inhibit decision-making, progress, and organizational change within a department.

Based upon those in leadership roles and others who assume leadership positions, each member has specific models or patterns of behavior which are taught to him as he joins a fire department. These individuals quickly learn that the chief's and other officers' decisions should be followed, generally without questions. For new members who come from other forms of employment, where managers work with facts and equipment, these individuals soon learn that fire department leaders work with people in very specific and, oftentimes, very stressful situations, whose directions need to be followed without hesitation (Hora, 2012).

If leaders have not demonstrated good decision making, have caused undue risks to others, do not have a good base upon which to make decisions, have not gained the respect of the other members, or have used coercion to achieve goals, this department may experience a breakdown in the command structure (Krueger & Paterson, 2011). To avoid this, department leaders must have good knowledge and skill bases, be able to communicate well, be able to make decisions in new situations, and understand the abilities of each unique firefighter. Leaders must guide and empower their members, develop and communicate a vision, and stress changes which will bring about improvements for the department (Crawford, 2017). In addition, the department's leaders must be role models, set and demand reasonable standards, make appropriate decisions, and be agents of change for unhealthy or risk-laden behaviors (Hora, 2012; King, 2009). If department leaders become exasperated by the behaviors of some firefighters, who may not agree with the direction in which the department is going, leaders will

need to work individually, as much as is possible, with these disgruntled members in an attempt to explain appropriate behavior, expectations, goals, and rewards (Krueger & Peterson, 2011).

If department leaders recognize, are educated about, or see activities which will cause harm, they should develop SOPs or SOGs which will minimize or eliminate unsafe behaviors (Huston, 2012; Lamb 2002a). If the leaders of a department do not have appropriate SOPs or SOGs to follow, this may lead to the questioning of fire department actions or behaviors or this inaction could lead to legal or liability issues. As a result, leadership, in concert with its members and governmental officials, should write, update, review, and revise SOGs or SOPs for the fire department. This will allow these individuals to review the values, beliefs, rituals, symbols, and behaviors of the fire culture with the goal to improve the current and future health status of firefighters working for the agency (Smith, 2000).

**Learning Environments**

In addition to fire department organization and its leadership, there are other concepts which can affect firefighters' behaviors and their health, including the environments in which adults learn. These educational situations can be formal, non-formal, or informal depending upon the setting in which this learning occurs (Merriam et al., 2007; Schugurensky, 2000). The context of this learning generally focuses upon improving the actions of firefighters and, potentially, changing specific aspects of their culture. Since the dominant culture of a fire department may not value the importance of learning, this can have a negative impact upon the learning opportunities offered to the personnel of any department (Belenky et al., 1986).

When leaders of a fire department wish to bring about change, especially changes which can improve the health and safety of their organizations, transformative learning may be employed. This type of learning encourages firefighters to view their work activities differently, which, with regards to safety, allows them to determine how specific actions and behaviors are

detrimental to their current and future health status (Mezirow, 1991). With this new cognition, changes in actions and behaviors may allow firefighters to alter future activities as they learn new material, which correlates to their health and safety.

This new learning should cultivate in firefighters, as students, a new set of working activities and social norms, which concentrate on lessening current and future injuries. Most firefighters learn either by watching their peers or by being instructed into how they are to do a specific activity. This type of apprenticeship learning helps firefighters to develop similar performance standards as demonstrated by other more knowledgeable firefighters. As apprentices, new recruits will develop, through informal learning, an understanding of the duties needed for the position of a firefighter. By creating this knowledge, these learners will affect their immediate environments through their actions and behaviors (Merriam et al., 2007; Pratt et al., 2001).

Since most firefighters learn by watching and doing, the dominant ways of their apprenticeship, so they generally only partake of formal learning while in their academy classes. This causes firefighters to be active, participating, learners, who must learn to be critical thinkers, due to the situations involved in firefighting (Grabinger & Dunlap, 1995). Recruits do not enter the fire academy with totally blank slates of knowledge, so learning is an individual activity, as each person evaluates what information needs to be developed. This self-directed learning sets individual goals, fosters transformational learning, and promotes emancipatory learning, all of which can lead to social action with a group of colleagues or within fire departments (Merriam et al., 2007).

As firefighters gain knowledge, they not only build on their previous experiences, but they learn from their new experiences. As these department members work with their peers, they share their experiences and use collaboration which develops a learning community (Merriam et

al., 2007). This situative or situational learning is based upon who participates in the process, since individuals' experiences will not be the same from one fire department to the next. As the opportunities for this learning are expanded, a community of practice develops through their introspective experiences.

Regrettably, these opportunities for collaborative learning within fire departments, may be stifled by the very fire departments which would benefit by these improvements. This unfortunate occurrence comes about due to the proud traditions, deeply held beliefs, honor of sacrifices, and valor for the culture of the fire service (Siarnicki & Gist, 2014). This culture strives for conformity of social norms, obedience to past instruction and order, and compliance to activities that have been done for decades. These past experiences become the obstacles to new learning for most adults, including firefighters, who are not inclined to engage in learning unless it is meaningful to them (Losh, 2001; Merriam et al., 2007). What must be learned by firefighters is that the basis of their culture needs to be changed to improve their health status, even if this change brings about alterations in some aspects of the fire service's culture.

**Volunteer Firefighters as Students**

Based upon the most recent statistics from the U.S. Fire Department Profile – 2015 (Haynes & Stein, 2017), there are currently over one million firefighters in America with slightly over 70% being volunteer firefighters, who work for 88% of the 29,727 fire departments in America. These firefighters generally have full-time employment in other professions than firefighting. These individuals volunteer their time to their communities in an attempt to save lives and property for those families who live and work in these communities. According to Losh (2001), volunteering as firefighters is the most time-demanding activity of all volunteer activities, so partaking in this volunteer work causes major time constraints on the lives of these volunteers.

Due to their time constraints, some firefighters may not be prepared to learn what is needed for their profession. According to andragogy, the adult learning theory developed by Malcom Knowles (Hartree, 1984), there must be specific characteristics so that adult learning can occur, including a mature person who exhibits a good self-concept, is problem centered, accumulates a reservoir of knowledge, and is ready to learn new information (Merriam et al., 2007). These characteristics certainly define aspects of firefighters, especially if learning can be accomplished in informal and non-formal settings.

From personal interactions with numerous firefighters, I know that formal learning, especially time spent in the fire academy, did not benefit firefighters as much as time spent learning from their peers. Most firefighters have not undertaken any coursework past their high school classes, with less than 20% enrolling in college coursework. During their academy classes, recruits did spend time learning the required curriculum so they could acquire information which would allow them to become State certified firefighters, but this information was gathered for details rather than an understanding of its significance (Menges et al., 1996). This single-loop learning, such as how to run the pump on a fire engine, rather than double-loop learning, which would have an individual understand the internal valves, pumps, and hosing, is generally what firefighters need to know.

This knowledge base regarding how to run the engine's pump would not need to be changed until the fire department received a new fire engine ten or more years in the future. The firefighters have found a level of knowledge that they do not wish to change. If a new fire engine arrives at a fire station, many volunteers express complaints, create problems, and complain about a lack of expertise, as they need to relearn specific tasks (Losh, 2001). Since firefighters in America are not required by the State to participate in continuing coursework, once recruits graduate from the academy, they only need to satisfy the qualifications required by their

departments or department leaders. There is no formal continuing education requirement to maintain, expand, or improve upon the knowledge which was gained during the initial formal classroom training (Cervero & Wilson, 2001).

Firefighters need to learn how to make decisions, in a rapid fashion, based on prior experiences, need to self-evaluate their individual needs, incorporate comments by others, and act as a group with informal knowledge, and social needs and controls (Hora, 2012). The social, educational base, personal attributes, demographic information or status, which individuals bring to the fire service, as in some other organizations, have little impact upon their acceptance into the experiences of this culture (Nunes & de Barros, 2014). Each person needs to show motivation, be willing to incorporate new information and skills, understand the need to fit into the culture of the organization, and show a willingness to learn the trade of the fire service (Menges et al. 1996).

This willingness to fit into the male-dominated culture of the fire service has been a detriment for women, who wish to become firefighters, but who do not want to join a masculinized profession (Belenky et al., 1986). According to Olafsdottir (1997), having equality, in many aspects of life, including employment, which is based on male norms, is not necessarily what women are attempting to achieve. Women in the fire service are not striving to change most aspects of their employment, but they do desire equity, equality, and the potential for promotion without harassment.

Firefighters respond to change, including the need to operate a new pump system on a fire engine or having squad members who are women, in a variety of ways. Some choose not to change their attitudes, social standing, or learning mode, so they leave the fire service. Other members rebel against any change, establish obstacles to change, counter new learning, and cause unrest before they finally leave the organization. Some firefighters refuse to change their

attitudes, and stay within the organization, while they build barriers to change which causes further problems within the department. Others rebel about learning new concepts and refuse to bring about change, but they are more silent as they remain within the fire service. To the advantage of most fire departments, there are those members who embrace changes, foster new educational opportunities, and understand that changes take time and must involve numerous phases before accepting new ideas, personnel, or equipment. (Losh, 2001)

Although change can be uncomfortable, most firefighters take pride in their memberships within their agencies. As a result, they do not want other fire departments' members to think detrimentally about their department, so they will undertake self-improvement, which is generally driven from within the membership (Huston, 2012). Identified deficits, in behaviors, knowledge, and abilities, tend to be quickly addressed, so that appropriate social or educational actions can be taken. Members of a fire department seek changes designed to improve their organization's objectives, perceptions, and function toward community service.

In an attempt to improve all aspects of a fire department, specific written standard operating procedures or guidelines (SOPs or SOGs) should be written. When firefighters work to establish these guidelines, the department will function more effectively and efficiently, and the members of the department will know what is expected of them. This leads to more informal and non-formal experiences as firefighters want to prove to themselves, their line officers, or their peer mentors that they want to be the best members of the department as they can be. This will include becoming students, as life-long learners, in a variety of situations for the fire service. As students are supported, they will perform at higher levels and retain learned information for a longer time (Knight & Sutton, 2004).

## The Effect of Their Culture on Firefighters

Many individuals both in the profession and those not affiliated with firefighting argue that appropriate measures that would eliminate or lower risk-laden behaviors within the fire service should be developed (Cole, 2001; Crawford, 2007; Herzog, 1994; Lioy & Gochfeld, 2002). These measures could be implemented in specific programs that will lower the current risk-related behaviors of today's firefighters (National Volunteer Fire Council, 2015cdef; Peterson, 2002; Russell, 2001; Sendelbach, 2015ab).

In past years, educational programs, which were developed to improve one's health through the lowering of risky behaviors, would not have been considered within the fire service. Newly recruited firefighters were merely expected to adopt, without ever questioning, the behaviors of their predecessors. The officers of the fire service, functioning within a hierarchical, top-down administrative structure, taught new recruits what they had been taught in previous years (Morgan, 2006). Oftentimes, these recruits were taught the habits, which the previous generation had learned (Ballam, 2015; Dixon, 2015). This form of educational activity merely perpetuated many unsafe and unhealthy practices.

Risk-taking activities by valued colleagues were oftentimes rewarded and the accompanying inappropriate behavior was passed down to the rookies from one generation of firefighters to the next (Shepard, 1999). A recruit developed a misplaced belief about the rightness of an action merely by emulating his superiors or peers (Chikerotis, 2006; Russell, 2001; Sendelback, 2015ab; Taylor, 2016).

Times, however, have begun to change, even if it is at a slow pace. As stated in a report by the Federal Emergency Management Agency (2002), "'It ain't like it used to be!' The old cliché certainly is appropriate for today's fire service compared to yesterday's." Today's firefighters are beginning to change in many ways but most of these changes are not occurring

for rural volunteers. The mission of the fire service has changed to a community service that strives to prevent future harm to the public, from a variety of sources, and to the firefighters who join these community organizations (Baldwin, 2015; DeStefano, 2015; Sendelbach, 2015ab; Wilmoth, 2007ab). To accomplish this endeavor, new programs need to be developed and effective leaders need to bring about appropriate change (Butterworth et al., 2007; Hong et al., 2013; International Longevity Center, 2000; Rhoades, 2016; Sendelback, 2015ab).

In 1990, Risdon stated that the culture of the fire service needed to change. He described this culture as a "Red Badge of Courage" philosophy, which considered injury and death to be a normal consequence of employment. By actively working to change this cultural philosophy, in the future, firefighters should be able to assess risks and learn the difference between risk acceptability and risk tolerability (Avsec, 2014; Cline, 2009; Eastin, 2005; Jakubowski, 2004; National Volunteer Fire Council, 2015abcdef).

As the culture of the fire service changes, there may be an influence upon who joins the service, who remains employed, and what aspects of the society will be assimilated into the behaviors of its members (Robeson, 1999). Although risk-taking behavior may be expected in some circumstances, this generally occurs only when clearly defined benefits are perceived to outweigh any potential situational risks. New members to the service need to be instructed about "the correct way to perceive, think and feel in relation to the external and internal problems encountered by the organization" (Tuler et al., 1992, p. 9).

The shared history of the fire services' members and the stability of this profession have contributed to the internalization and institutionalization of attitudes and beliefs within its members, as occurs in other established organizations. The various cultural elements helped to develop limits within which the service's members are expected to perform and helped to foster a willingness to partake in risky professional behaviors (Robeson, 1999). The values of loyalty and

professionalism combine to form an expectation that one must undertake risk-laden activities as a requirement of employment or to be an accepted member of the fire service (Avsec, 2014; Burneka, 2014ab; Herbert, 2008; Taylor, 2016; Triandis, 1995).

The perception that the fire service is a calling with inherent risks, a "Red Badge of Courage" occupation, must be changed (Risdon, 1990). Firefighters, according to self-reported personality traits, have elevated needs for stimulation and are risk takers, which are characteristics that define the Rescue Personality (Salters-Pedneault et al., 2010). Some individuals, who base this conclusion on brain chemistry, believe there is a genetic basis, potentially the DRD4 gene, for the thrill-seeking traits of the Rescue Personality (Crawford, 2007; Wagner et al., 2009; Frazier et al., 2009). Whatever may be the basis for employment as firefighters, this profession must employ skilled practitioners who utilize safe procedures and appropriately assess risky behaviors (Russell, 2001). According to Shepard (1999), firefighters "must embrace the strengths of (their) culture [and there are many], but be willing to give up the weaknesses in favor of improvement and change" (p. 1).

To lower risk-related behaviors of firefighters, Shepard (1999) stated that the culture of the fire service must be changed from one that is based upon heroism and risk-taking to one that is educated to understand the values of safety and health. To do this, the values and beliefs that, for many years, have glorified heroism and risky behaviors must be changed to encompass the values and beliefs that reflect safe firefighting behaviors. A new foundation for the fire service must be constructed that is based upon new educational ideals. Although many believe that firefighting has expected and acceptable risks because of the inherently hazardous activities, the assumption that accidents will happen when people take certain risks should be treated as a myth. According to Robeson (1999), accidents occur when people take a non-calculated risk, while

accidents are nearly eliminated when a correct assessment, or a calculated risk, of the actual situation is done.

According to Dixon (2015), when deviant behavior is repeated, without catastrophic results, this behavior may eventually become the accepted social norm for an organization, and the normalization of deviance has occurred. Unless a negative outcome occurs, due to this normalization process, the behavior will gradually become the acceptable practice or standard activity for firefighters and some may come to believe that no risk exists (Chikerotis, 2006; Firefighter Cancer Support Network, 2013; Kahn, 2014; National Fallen Firefighters Foundation, 2016; Nicol, 2015ab; Zigmont, 2010). This incorporation of deviant behavior can lead to risks within the department's culture (Ballam, 2015).

Cultural elements, which may be inappropriately assessed or valued by some fire service members may be well-rooted in the organization and may inhibit any attempts to eliminate some behaviors. Included among these established attitudes and beliefs may be those that, if changed, would help to improve or eliminate the current risk-taking behaviors of firefighters (Cole, 2001; Goodrich, 2011; Kline, 2015; Nicol, 2015ab; Smith, 2014). Since cultural change takes time, the elimination of risk-taking behavior will not be incorporated into the culture as a quick-fix solution. Many factors, which influence the social and cultural aspects of a person's profession, may ultimately influence personal decisions toward risk-taking behaviors (Ballam, 2015; Dixon, 2015; Fishbein, 1995).

Although risk-laden behavior is common in the fire service, the degree of risk that an individual may be willing to take has been inversely linked to income, degree of education, situational awareness, professional status, and socio-economic status (Dixon, 2015; Litzenberg, 2014; Marmot, 1999; National Fallen Firefighters Foundation, 2016). The degree of control that a person perceives that he has over life circumstances, and his ability to act during these

circumstances, may also have a direct influence on an individual's behavioral risks (Beck, 1989; Butterworth et al., 2007; London Health Commission, 2002; Smith, 2014; Turrell & Mathers, 2000). If an individual believes that he will be different from his peers and, as a result, may not be considered a valued member of his professional cohort, the individual may not want to change his risky behaviors (Avsec, 2014; Clark, 2003; Damschroder et al., 2009; Russell, 2001; Taylor, 2016; Willing 2015). Those individuals who perceive themselves to be passive learners, who do not have the opportunity to discuss their feelings and abilities toward meeting their health goals, may not believe that they are as able to change their health-related risks as others (International Longevity Center, 2000; Mackey, 2002). Any of these actual or personally perceived barriers may have the ultimate influence upon the adoption of safe behaviors (Seo, 2005; Taylor, 2016).

## The Need for Additional Research on Firefighter Behavior

With a goal to improve safer behavior within the fire service, I undertook a qualitative study, which is based upon the conceptual framework of the Health Belief Model and grounded in adult learning theory. This study investigated the potential relationship that exists between health risk factors in the fire service and the development of an adult educational program. According to Mackey (2002), the associations discovered through such a study may not lead to direct cause and effect associations, but the information may lead to a possible correlation between the constructs of the Health Belief Model and the elimination of risk-laden behavior within the fire service.

This type of study may yield data on the relative risk of specific behaviors, but such a study can have disadvantages, including the time-frame of the study, those interviewed, or the lack of correlation between risky behavior and the development of disease (Loscar, 2015; McKenzie et al., 2002; National Volunteer Fire Council, 2015cd). The use of the Health Belief Model in a prospective case study has some limitations, but it was hoped that the research design

and analysis eliminated some of these difficulties. Influences on the study, such as trust and an understanding of the culture, may have been eliminated since I, as a member of the fire service, conducted the research. I developed the survey questions, introduced the study, conducted the interviews, and analyzed the data. It was hoped that the firefighters who participated in the study would realize the importance of the study and would value the information that was gathered about risky health behaviors of firefighters.

According to Helman (1995), identified risk factors will only have a limited predictive value when attempting to link a behavior to the development of a specific disease or health risk. The elimination of a negative behavior or the adoption of a positive behavior, which is known to affect future health status, can and should be assimilated into the activities of the fire service (Butterworth et al., 2007; Cole, 2001; Kline, 2015; Nicol, 2015ab). White males, who comprise the majority of firefighters, have lower perceptions and attitudes about risk-taking behaviors than other males and all females (Courtenay, 2000; Flynn et al., 1994; Frazier et al., 2009; Holmgren, 2014). This fact could mitigate risk-related behavioral changes in the fire service's culture. Although a direct, causal relationship between the change in risky behavior and the future health of firefighters has not been proven, the concepts of the Health Belief Model and adult learning can still be utilized as a conceptual framework within which to evaluate and potentially alter risky behavior.

To accomplish this goal, surveys which elicited some in-depth information about the study's subjects were given to approximately 200 rural, volunteer firefighters in West Michigan. The questions requested information on personal demographics, fire service employment and duties, and the individual's attitudes regarding perceived risks during various firefighting duties and while undertaking fire ground activities. Once this information was organized and analyzed, additional in-depth, open-ended questions were written. These interview questions were asked of

individuals who engage in overhaul activities after a residential fire. During these activities, most firefighters do not wear respiratory protection, even though it has been known since the 1990s that a potentially hazardous environment exists (Bolstal-Johnson et al., 2000; Evans, 2014; Farkas, 2015; Forgue, 1992; Lioy & Gochfeld, 2002; Taylor, 2016).

Some firefighters who remove their respiratory protection during residential overhaul operations may believe that, since the equipment is not mandated by Federal regulations or most fire departments' standard operating guidelines, the need for this equipment is not essential (Duncan et al., 2014; Dunn, 2009; Firefighter Cancer Support Network, 2013; FireRescue1, 2014; National Volunteer Fire Council, 2015cdef). Numerous air quality tests do show that a hazardous environment exists during overhaul activities, so some form of respiratory protection should be required by departmental policy (Bailey, 2016; Bolstad-Johnson et al., 2000; Duncan, et al., 2014; Fabian et al., 2014; Greven et al., 2011; Guidotti, 2014).

Due to the complications of using an SCBA, an alternative respiratory protective device, such as an air purifying respirator, which is lighter and allows for better vision and communication, could be used as an acceptable replacement during overhaul activities, if the environment has been monitored for toxic gases and the area has been well ventilated (Bailey, 2016; Burneka, 2014ab; Duncan et al., 2014; Fabian et al., 2014; Herbert, 2008). During nearly forty years of observations on various fire grounds during residential overhaul operations, I have seldom seen a four-sensor air monitoring device used. This device, which monitors oxygen, carbon monoxide, hydrogen sulfide, and combustible gases, has limited usefulness, since other poisonous and potentially lethal gases and combustion products can be present during overhaul. These chemicals include acetaldehyde, acrolein, arsenic, benzene, formaldehyde, formic acid, and hydrogen cyanide, which are all known to cause serious health consequences if inhaled Bolstad-Johnson et al., 2000; Burneka, 2014ab; FireRescue1, 2014; Herbert, 2008; Rush, 2009).

## Firefighter Education Programs Based Upon Adult Learning

In an effort to convince a specific cohort of firefighters that the need for respiratory protection exists, and that they can eliminate some risk-laden behaviors, adult learning theories were situated within the constructs of the Health Belief Model. According to Holmgren (2014), few individuals have researched firefighters in relationship to adult learning. Although research has not generally included firefighters as the adult learners, the basic theories can be utilized for this unique cohort of adult, lifelong learners.

Adult education is a diverse field of study, which can include generalized theories on learning, including social constructionism and andragogy. Although these are referenced as adult learning theories, they are not based solely on age, but on life experiences and informal and noncompulsory learning activities (Carman, 2005; Holmes & Abington-Cooper, 2000; Kim et al., 2004). When most individuals reference the how, where, what, and why of adult education, the five learning principles of andragogy are generally considered, which include self-direction, the role of experience, a readiness to learn, being problem-centered, and having a motivation to learn (Bryan et al., 2009; Chinnasamy, 2013; Hansman, 2001; Holmes & Abington-Cooper, 2000; Kerka, 2002; Marquez-Leccio, 2016). To appropriately engage these principles, the historical, sociocultural, and a holistic view of the learner needs to be considered from a social constructivist base, otherwise there can be personal blocks to the learning process (Merriam, 2001 and 2008; Simons, 2000; Tovar, 2008).

When firefighters begin their mandated, State training program, there is no individualization to the learning process. The homogeneity of the class curriculum may not accommodate the learning styles of all students (Gilakjani, 2012; Kilgore, 2001). Fortunately, the repetitive nature of the curriculum, the alternation between classroom lecture and hands-on activities, and the social aspects of the learners' interactions generally allow most students to

gain a good foundation on the basic principles of firefighting. This single step of formal education is only the beginning in the acquisition of their needed expertise (Jolemore & Taber, 2007).

As a result, when firefighters graduate from an academy, their book knowledge and most practical skills are proficient, since these students have been taught the correct way to practice their trade. As the years pass, their level of formal knowledge decreases, as their practical experiences increase and firefighters learn, through their informal learning, to take short-cuts and generally decrease safer activities for those that will be faster, less expensive, and require fewer resources (Prielipp et al., 2010). The informal learning of firefighters, which has not been well researched, is centered on department socialization and allows for the internalization of values, attitudes, behaviors, and skills, that can be individually self-directed or incidental in nature (Bennett, 2012; Marsick & Watkins, 2001; Merriam et al., 2007; Schugurensky, 2000). According to Livingstone (2001), informal training and untaught learning are "the submerged part of the iceberg of adult learning activities" (p. 22). These informal, unintended, unstructured, opportunistic, and implicit learning opportunities are the hallmark of the fire service (Eraut, 2004), which generally involves mentoring by veteran colleagues or fire officers in the workplace (Beckett & Hager, 2002; Berg & Chyung, 2008; Colley et al., 2002). In this way, firefighters, like other adult learners, through their real-life experiences, learn competencies, undertake challenging tasks, and develop problem solving skills (Dirkx, 2001; Paloniemi, 2006).

Most of this gained knowledge is single-loop, since it only involves limited or superficial changes to the current problem-solving or learning process (Crain, 2008; Sun & Scott, 2003). If the learning were double loop, it would also involve changes to the underlying assumptions, strategies, and values which bring about changes to the learning process or the organization

(Argyris, 2002; Corbett & Kenny, 2001). If double loop learning occurs, this may bring about a better alignment between espoused theory and the theory-in-practice of firefighters.

Most individuals, including firefighters, possess certain values which they believe guide their behaviors and what they say they do in certain situations. Theory-in-use are the values reflected in the behaviors of what individuals do or how they behave (Corbett & Kenny, 2001; Savaya & Gardner, 2012). For most individuals, there are disconnects between what they believe they do and what their behavior exhibits in given situations, with the latter point not truly being known by the individuals (Anderson, 1994; Savay & Gardner, 2012). If there can be more double loop learning and more alignment between espoused theory and theory-in-use, this can bring about incremental or paradigm changes in firefighters' behavior, which can cause transformative learning for the individuals involved (Baumgartner, 2001; Collin & Tynjala, 2003; Imel, 2000; Ivergard & Hunt, 2004). For firefighters to undergo double-loop or transformative learning, there will need to be changes to the fire service's organization.

Numerous authors have discussed how structure can affect an organization's interactions with its members and other agencies (Bolman & Deal, 2013; Morgan, 2006; Reeves et al., 2007; Bunderson et al., 2016; Senge, 2006). Although many organizational models exist, the hierarchical bureaucracy, which is similar to a paramilitary structure, exemplifies the fire service (Baldridge et al., 2000; Diefenback & Sillince, 2011; Lucas & Kline, 2008; White, 2001). The incident command structure of the fire service requires that decision making, both preplanning and incident analysis, be determined by the fire chief and the organization's frontline officers (Scott & Davis, 2007; White, 2001). In such a highly structured bureaucracy, effective leaders must have certain characteristics, which include interpersonal relationship skills, technical knowledge, an understanding of the organization's or department's culture, the ability to manage stress and change, and a vision for the future (Diefenback & Sillince, 2011; Etzioni, 2000; Lucas

& Kline, 2008; Moynihan & Pandey, 2007; Senge, 2006). Leaders need to understand that change is an integral feature of organizations and they must be able to effectively evaluate and implement specific modifications (Lucas & Kline, 2008; Reeves et al., 2007; Bunderson et al., 2016).

The leaders within an organization, including the fire service, help to establish a climate and develop a culture, as they interact with the organization's members, that helps to determine how well the organization will function and how it will progress in changing times (Leonard, 2002; Morgan, 2006; Triandis, 1995). Throughout the past 40 years, numerous authors have researched and discussed how the climate and culture of organizations is framed and how these characteristics influence the development of its members (Bronfenbrenner, 1979; Erikson, 1985; Jones & McEwen, 2000; Kohlberg, 1975; Renn & Arnold, 2003). These features, in turn, can further affect the direction determined by the organization. For the fire service, it is important that the department's leaders develop a climate and culture that fosters positive attitudes toward wellbeing, safety, and the reduction of health risks.

In order to implement new knowledge for the benefit of its members, it is important that leaders understand the culture, goals, and students of the organization, as they develop a unique learning community (Cincinnato et al., 2016; Compton, 2005; Kasl & Yorks, 2016; Lattuca & Stark, 2009; Morgan, 2006). Effective leaders should have knowledge about the information that needs to be conveyed and should understand how the students will incorporate this information into their lives, with this aspect of education being particularly important for the fire service (Avsec, 2014; Burke et al., 2011; Gardner, 2008; Harms, 2004; Rebok, 2014).

If the preceding elements of an organization, including its structure, climate and culture, its leadership, and appropriate learning opportunities and instructional techniques, are well chosen and implemented, a teachable moment may be created (Chinnasamy, 2013; Collin &

Tynjala, 2003; Goldman et al., 2009; Marquez-Leccio, 2016; Merriam, 2001). If this occurs, members of the organization may develop new management strategies. These ideas may bring about the implementation of new policies and educational opportunities for the betterment of the organization and its members (Calas & Smircich, 2000; Lattuca & Stark, 2009; Morgan, 2006). For firefighters, the development and enforcement of new policies through educational theories and standard operating guidelines could lead to actions that alter behavior and attitudes. These changes could then lead to decreased health and safety risks at residential fire incidents, since firefighters would wear appropriate respiratory protection, not only during suppression efforts, but also during overhaul operations.

## The Development of a Risk Reduction Program for Firefighters

According to a report described by Shepard (1999), fire service policy can be developed by initially interviewing firefighters, analyzing the culture of the department, and providing strategies that will lead to realistic solutions to actual or perceived problems. These improvements can be implemented in two manners, with a bottom-up or with a top-down theory (McAfee, 2015; Willing, 2012), but Shepard (1999) recommended a blending of both concepts to achieve the necessary cultural change. In addition, with a goal toward institutionalize change, it has been recommended that both group and individual interactions be undertaken (Elliot et al., 1999). According to Gandelman and Freedman (2002), if a group can identify and discuss problems, solutions to these problems can be proposed for implementation by the members of the organization. If these ideas for cultural change are implemented, members of the fire service may begin to institutionalize safety as a core value through the elimination of risk-related behaviors during overhaul operations, as well as during other fire operations.

According to Grove, Gray, and Burns (2015), future research can be grounded in current theory and that, as a foundation for new research, a review of the current literature should be

undertaken. In addition, to appropriately conduct such a study, the researcher, such as myself, should have a background in the principles of teaching and learning, should know the academic setting and the content area of the research, and should know the culture of the society being studied (Siegrist & Cvetkovich, 2001). I, as the researcher, should also present and represent all study material in a manner that does not exhibit biases and which maintains appropriate ethical standards and academic integrity (Erickson, 2012; Grove et al., 2015; Mackey, 2002).

The primary goal of this research was to gain a better understanding as to why firefighters do not wear appropriate respiratory protection during residential overhaul activities and to have a better understanding regarding the impact that adult learning plays on the development of these risk-laden behaviors. In addition, it is hoped that this research study will have the potential to advance the existing literature on health-related risk behaviors for firefighters during their overhaul activities (Ory et al., 2002). Although a single case study may not meet these goals and may not be widely applicable to other fire departments' policies, this research should provide a foundation for general conclusions and may be an information source for future generalizations or specific studies (Creswell, 2003; Grove et al., 2015).

# CHAPTER 3: RESEARCH METHODOLOGY

The purpose of this study was prompted by decades of personal interactions with firefighters. From my observations, as well as numerous publications, there is disconnect between what firefighters know should be their activities at residential fire scenes and what activities they undertake during this time. This lack of congruence between the firefighters' espoused theory and their theory-in-use, between what firefighters have been trained to do and what behaviors they exhibit, prompted my interests and my research question (Anderson, 1994; Crain, 2008; Savaya & Gardner, 2012). At residential fire scenes, during overhaul operations, I wanted to understand why firefighters remove their self-contained breathing apparatus when a hazardous environment, which has negative health effects, continues to exist.

In an attempt to understand this question, I have been observing and interacting with firefighters, as my peers, for many years. Additionally, I have been reading extensive fire service literature which relates to the topic of overhaul operations at residential fire scenes. These readings have allowed me to examine some of my assumptions about fire ground observations, given me a better knowledge base, and identified gaps in the current research on the topic of overhaul, all points which have been identified as important to qualitative research (Marshall & Rossman, 1999). My observations and the literature gave substance to my ideas, so a qualitative research study was conducted with a goal to further explore my ideas regarding specific firefighters' activities.

In this chapter, I will discuss the overall design of my study, including recruitment of my sixteen study participants and the nine study sites, how my interviews were conducted, and how the information gathered from these interviews was interpreted. I also discuss the approval process for this qualitative study and the difficulties I encountered during the timeframe of my

study. I will conclude this chapter with a discussion on my position as the researcher and the interpreter of the data collected.

## Research Design

According to Grove, Gray, and Burns (2015), qualitative research "is a systematic approach used to describe experiences and situations from the perspective of the person in the situation" (p. 67). For this reason, I decided to utilize a qualitative approach, employing observations and an interview protocol to gain information from the study's participants. According to Creswell (1998, 2003, 2009), qualitative approaches can be used in combination with case studies, which focus on a specific event that is placed within the setting of the participants' lives, actions, feelings, and thoughts.

For my research, I compared the information obtained from my observations during overhaul operations with the information solicited from the semi-structured questions of my interviews (King, 1994; Turner, 2010). This was done so that I could compare what some volunteer firefighters stated they did during overhaul activities and what I observed them doing. I utilized a localist approach which, according to Qu and Duman (2011), applies a "perspective to gain insights into the interview method, the eventual aim is for interviewers and interviewees to become equals, with both of them being involved in the production of situated accounts through complex interpersonal interaction" (p. 14). Even though I related well to the interviewees, due to our common experiences and work environments, I wanted to gain a better understanding of how these firefighters viewed their experiences, their espoused theory, in the fire service. Through our face-to-face interview interactions, I was also able to gain an understanding regarding the comfort or anxiety level, other social cues, and the interpretation of reality and meaning-making from each interview participant (DiCicco-Bloom & Crabtree, 2006; King, 1994; Maxwell, 2004; Opdenakker, 2006). Being able to ask specific questions, upon which only firefighters could base

their experiences, contributed to the trustworthiness of my interviews (Creswell, 1998; Morse et al., 2002).

I used semi-structured interviews, observations, and a review of the pertinent literature to study nine sites to determine the commonalities and differences which exist between these sites and the participants who work within these geographical areas (Khan & VanWynsberghe, 2008). By using numerous sites, I hoped to contribute to the trustworthiness of my data due to points of homogeneity (Grove et al., 2015). Due to my perspective as the researcher, as well as a firefighter, there is the potential that my investigation had some unintended bias, since I brought my individual values to this study (Creswell, 2003). I chose the fire departments for this study due to their locations. This selection naturally led to the inclusion of specific fire chiefs in my research since they are the leaders of the departments chosen. The firefighters who were interviewed were selected by their fire chiefs, so any bias would be based upon these chiefs' selection and not mine.

Although these selections may have produced some bias, I believe that my familiarity with the fire departments involved may have added truthfulness to the responses of the fire chiefs and their respective firefighters (Golafshani, 2003). Since all interviewees seemed to be generally comfortable interacting with me, as someone they have known casually from fire ground interactions, I believe that their responses were credible. In addition, since I believe that ethics is the foundation upon which research should be conducted, I approached the various aspects of my qualitative research project from a stance that I did not want to cause harm, in any form, to the participants of my study. This is a tenant of the Nuremberg Code (1949) and the Belmont Report (1979) upon which I based my research. My goal in the final analysis of this qualitative research was to accurately report the perspectives of my subjects and to draw

appropriate conclusions, as I gave power to my interviewees and removed myself, as much as possible, from this project (Erickson, 2012).

## Case Study Design

This qualitative research project was a descriptive analysis of observations of nine fire departments and their fire ground activities during residential overhaul activities, as well as interviews with eight fire chiefs and eight firefighters. The goal of these observations and interviews was to answer the question as to why firefighters do not wear appropriate respiratory protection during residential overhaul operations, despite what they were supposed to have learned during training about what safety precautions should be taken during specific fire ground activities. By focusing on a situation or event, this allowed me to gain a better understanding as to why firefighters act as they do during a specific activity (Creswell, 1998, 2003, 2009; Merriam, 1998).

Although firefighters have a common base for their initial knowledge, based upon their fire academy classes, firefighters, due to their departmental, environmental, and cultural interactions, have different activities as they work during overhaul. Through the interview process, before I asked any questions which related to my research inquiry, I was able to obtain some initial self-reported demographics for each of the sixteen participants. The firefighters all have common tools available to them, but how they approach and complete their tasks can vary. In addition, the input of the firefighters' fire chiefs will have an impact upon how tasks are completed. As a result, when the same questions were asked of firefighters regarding their tool use and their activities during overhaul activities, these individuals were expected to have similarities, but also some differences. Additionally, the input regarding overhaul activities by the respective fire chiefs has an impact upon what occurs on fire grounds. Again, by asking the

same semi-structured questions of the fire chiefs, a comparison of answers through qualitative analysis was made.

Since I, as the researcher, asked the same open-ended questions of the eight fire chiefs and eight firefighters, I had no control over, and did not direct, the flow of the answers given to me during the interview process. If allowed, I recorded these answers, in addition to taking copious notes as the responses were given. Although I was not fortunate to audio record all the interviewees, I believe that the reluctance of these individuals was due to personal reasons as opposed to the interview process. From additional interactions, I believe that being a subject in educational research and having their voices recorded was a discomforting thought, as opposed to just conversing on the topic of fire ground activities with a peer. I still believe that I was able to report an accurate record as to what was stated, but not recorded, for these individuals as they answered each question. This allowed me to separate each fire chief's or firefighter's responses as separate entities, rather than as collective data, which allowed me to compare, via qualitative analysis, these individual responses. According to Yin (2009), "multiple-case studies provide more convincing data and also can permit the investigation of broader topics than single-case studies" (p. 260). As a somewhat negative result, according to my consent forms, I was not permitted to allow the responses of any fire chief or firefighters to be correlated to specific individuals. As the primary researcher, I was committed to insuring confidentiality for the information which these individuals told me during the interview process.

## Sites and Selection of Participants

The research participants were chosen from nine contiguous West Michigan fire departments, which are in three counties. Eight of these departments each cover one township, while the remaining department covers two townships. All these departments employ paid-on call, who are also referred to as volunteer, firefighters. Four of these departments have fire chiefs

whose primary employment is as the townships' chief officer, one department has a half-time chief who works the other half of his employment doing other township tasks, and the remaining four departments employ their chiefs on a yearly basic, which allows these fire chiefs to have other employment provided that they complete their township and fire department duties as needed.

As a firefighter-paramedic, I know each of these chiefs on a professional basis, when we interact at fire scenes and meetings, but I do not socialize with them. Due to our level of interactions, I contacted each of these chiefs via phone to ask if I might converse with them on a particular date at a specified time. When we met, I introduced my proposed research study, gave them a copy of the chiefs' consent form, and asked if they would like to become a study participant. Originally, I had wanted to recruit ten chiefs but, due to scheduling difficulties, I was only able to interview eight of the ten proposed fire chiefs. After these eight chiefs gave me permission to interview them, we arranged a time to meet at their respective fire stations. I believed that meeting at the fire station of each of the chiefs would allow them to feel more at ease with the interview process.

From the ten fire chiefs I contacted, each of them identified a firefighter who engaged in overhaul activities at residential fire scenes. Since most firefighters have rather specific tasks at fire scenes, among these being safety overview, water supply, engine operator, interior attack, or ventilation, it was necessary to have each chief identify those individuals who specifically engage in overhaul activities, so I could interview them due to their fire scene assignments. I contacted the ten firefighters who were suggested by their chiefs but, again, due to scheduling difficulties, I was only able to enlist eight of these men to participate in my research. For one department, I was able to interview a chief but not a firefighter and, for another department, I was able to interview a firefighter who engaged in overhaul activities, but not the chief of this

individual's department. For the eight firefighters who agreed to meet with me, we scheduled a mutually agreeable time when I could meet individually with them at their home fire stations. I gave each firefighter a copy of the consent form, asked them to read it, asked if they had any questions, and then requested that they sign the form. For these eight firefighters, there were no expressed questions or concerns about my research project.

For the interviews, I assured the fire chiefs and the firefighters that the answers given to me would be reported in either a collective format or individually, but all responses would be anonymous. As a result, each fire department, the fire chiefs, and the firefighters were assigned pseudonyms and any information which could identify a specific city, village, town, or township was eliminated from the report. To give adequate depth to my research, I reported some demographic information by department, but other data was stated in a collective fashion.

## Data Collection

I joined my first fire department in 1979 and, after moving to a different area in the region, joined two other volunteer fire departments in 1988 and 1990. As a result, for many years, I have had the opportunity to observe the behaviors of numerous firefighters during overhaul activities. Since overhaul activities involve risk-laden behaviors, I wanted to investigate why firefighters do not appropriately wear their respiratory protection when the environment is probably hazardous. These firefighters learned about these risks during their academy training and they were informed about what actions should be taken to protect themselves. To accomplish this research, via case studies, I made observations at residential fire scenes, conducted interviews with fire chiefs and firefighters, and reviewed the textbook and the State of Michigan approved teaching content for the use of self-contained breathing apparatus, which is presented to fire academy students.

Since case studies are quite fluid, rather than being narrowly defined, I utilized an interview protocol that consisted of semi-structured questions (Creswell, 2003). I developed my interview questions based upon my years of fire ground observations and the extensive literature from fire service resources. Although biases could have arisen during my research, I believe that my academic background, years of interacting with students, and my fire service experiences, gave me a unique perspective which allowed as much neutrality as might be possible. As the data from my interview questions aligned with my observations and concerns regarding the espoused theory and the theory-in-use, I noted disconnect. This lack of congruence between what firefighters should do during overhaul operations and what actually occurred gave verification to the foundation of my research (Morse, 2007).

My initial intent was to complete all data collection within a maximum of two years. Due to personal, academic, and research-based complications, most of which were unanticipated and uncontrollable, the collection of data took additional time. As a result, six of the fire chiefs were contacted again to see if there were any changes or updates to their department protocols or guidelines regarding overhaul activities at residential fires. Since this updated information did not affect the outcome of the data analysis, the original data was still deemed valid; and I, as the researcher, was amazed that very few changes to the previously gathered data were noted.

**Interview Protocol**

The data collected from qualitative research projects contain the ideas, perceptions, and thoughts of the participants, which are gathered through semi-structured, open-ended interview questions (Grove et al., 2015). According to Creswell (2003), this is the basis for social constructivism, which seeks to understand the venue in which the participants work and "develop subjective meanings of their experiences" (p. 8). To gather information for my research, I developed two interview protocols, which consisted of thirteen questions which were answered

by fire chiefs and nineteen questions which were answered by firefighters. I also wrote consent forms for the fire chiefs and firefighters to sign once they agreed to participate in my interview process. Copies of the questions asked in the interview protocol of the fire chiefs and the firefighters, as well as the consent forms for each group's participants, are found in the Appendices A and B of this document.

**Interview Process**

The interview process for the fire chiefs and the firefighters were quite similar. I contacted these men via telephone and arranged a time to meet individually with them at their respective fire stations. After arrival at the fire station, a quiet room was chosen, where interruptions would be minimal, so that the approximate 60 minute face-to-face interviews were conducted in private (DiCicco-Bloom & Crabtree, 2006; King, 1994; Opdenakker, 2006; Turner, 2010). After the reason for the research was again stated, the participants were given two copies of the consent form and asked to sign one of them for my records. I asked the participants if they were comfortable, had any initial questions or concerns, before I asked any questions. I explained that I would audio record the interview, if they agreed to this action. Only nine participants agreed to the recording and initialed the consent form on the appropriate line, while the remaining seven men chose not to have our interview audio recorded. None of these latter individuals stated why they preferred not to have a recording made and, with my aim to create a comfortable atmosphere, I did not inquire into their reservations for negating this process. For all participants, I explained that I would be taking notes during the interview process, so that I would document what each person had stated. In this way, there would be minimal errors regarding what was stated, transcribed, and interpreted.

Since the goal of each interview was to determine the thoughts of the fire chiefs and firefighters through their stated answers to the questions, I allowed the subjects to answer the

questions without prompting. For most of the participants, their answers tended to be rather brief and on topic, but there were times when some individuals stated additional information or deviated the course of the conversation from the initial question.

**Observations**

My personal observations, which were conducted at residential fire scenes, involved incidents to which one of the departments responded. I was granted permission from the fire chiefs in my geographic area of study to attend any residential fire scenes which were convenient for me. As a result, I was able to make twenty-one observations of overhaul for my study when I responded to or was dispatched to residential fire alarms in my research area. Each of these observations, which occurred during overhaul at residential fire scenes, lasted between two and four hours depending upon the degree of fire involvement within the residence and the needed actions on each fire ground during overhaul.

The procedural process which I used to make my fire ground observations was followed, in basically the same order, at all fire scenes. Upon reporting to the fire ground, I would notify the fire chief, or the incident commander, of my arrival. Since this time of fire ground activities is very chaotic, I merely asked what task I needed to complete at that time. As fire extinguishment activities progressed, I remained cognizant of the approximate time when overhaul activities would begin at the fire scene. Once these activities began, I noted who was engaged in overhaul, what equipment was being used, with emphasis on the use of appropriate respiratory protection, and how safely or risk-free, from my perspective, these activities were occurring. I was especially aware of the environmental conditions which existed during the initial overhaul operations, which included the presence of smoke verses steam, the amount of ventilation undertaken, and if any air quality monitoring, via approved equipment, was occurring.

Due to this option of viewing fire ground activities, I became a participant-observer or a researcher-participant within my project (Grove et al., 2015). This is a form of qualitative research, which was originally utilized in ethnographic studies, but is now also used in educational research (Kawulich, 2005). According to DeWalt and DeWalt (2002), participant observation enables a researcher to view specific activities of certain individuals, as they go about their tasks in their natural setting. For my research, this meant making observations of individuals engaged in overhaul activities at residential fire scenes. Since all activities were done either by the choice of the firefighter or through directions of the fire chief or line officer, and I do not undertake overhaul activities at any fire scene, I did not have any impact upon these overhaul activities, the tools used, or the personal respiratory protective equipment worn by the participants. On these scenes, I was able to make observations of the residential fire scenes during overhaul, but I was not actively involved in any overhaul operations.

In addition, Kawulich (2005) states that the researcher should limit any potential bias in the observations being made, especially those which might show the participants in a negative way. Unfortunately, the overhaul activities which I did observe could be interpreted as the negative aspects of a healthy outcome, so I had to make certain that I interpreted and reported my observations appropriately.

Observational data have been acknowledged as a reliable mechanism though which to understand what occurs at a workplace and, for firefighters, a residential fire scene is their workplace. According to Eraut (2007), observation information can be added to other data, such as interviews, to give a richer, and potentially more appropriate, view of what occurs in the work environment. When participants know that observations have been previously made of their work activities, as noted by Eraut (2007), these individuals may give more truthful statements

during the interview process, as opposed to giving a more idealized view of what occurs on the fire ground.

### Document Analysis

Prior to the start of my interview process, I assumed that I would have Standard Operating Guidelines or Procedures to review from the various fire departments involved in my research's geographic area. No fire chief or firefighter reported having a specific SOG or SOP which addressed the activities, the required equipment, or the potential health risks of firefighters during overhaul at residential fire scenes. Based upon the progressive level of technology employed, and the new equipment which five of the fire departments have, I had assumed that these departments would be more advanced in their activities toward safety. For the nine fire departments, who participated in my research, none had any form of guidelines regarding what personal protective respiratory equipment should be worn or what risk reduction activities should be done during overhaul operations. As a result, the only additional information which could be located are those stated in the textbook, *Fundamentals of Fire Fighter Skills: Evidence-Based Practices* (IAFC & NFPA, 2017) and the material presented during fire academy classes which pertains to respiratory protective equipment.

## Data Analysis

The use of qualitative analysis can yield detailed descriptions of the sites and the populations investigated during a research study. From this analysis, major themes or categories of commonalities or disparities can be discovered. According to Creswell (2009), a six-step process of data analysis should be employed to organize the themes.

All interview data, personal observations at fire scenes, and the examination of relevant printed material were collected prior to beginning the analysis of this information. Through qualitative analysis, the collected information was used to construct general ideas about the

views of the participants. From these views, specific themes and areas of commonalities, rather than disparities, developed. These themes aligned with the literature I had been reading for many years, but definite gaps in congruence between these readings and my research project became evident. These major themes are reported as research conclusions in the next chapter.

## Positionality Statement

When undertaking qualitative analysis, according to Merriam (1998), the researcher is an instrument of the research, since each individual brings her own educational experiences, ideas, and social interactions into the research process. In some ways, this interaction could cause different interpretations or biases to be brought into the analysis process for the conclusions of the research (Creswell, 2003). Positionality, which explains the relationship that exists between the researcher and her research project, should include concepts of qualitative research.

Since I have been a member of volunteer fire departments for nearly 40 years, and have worked at many residential fire scenes, I understand the experiences, culture, and educational processes which firefighters go through during their fire service activities. My previous years' observations regarding the lack of congruence between firefighters' education and their known health risks and the behavior of firefighters during overhaul activities prompted my research interests. Since I care about the individuals who have become my "brothers in the fire service," I would like to ensure that these individuals will not experience ill-health due to their fire ground activities. I am hopeful that my research yielded some information to improve firefighters' health status and that the findings of my research have a positive influence on firefighter training and may bring about a change in fire service policy.

Based upon my experiences, I believe that the questions asked of the fire chiefs and the firefighters were appropriate. These questions and their respective consent forms for the interview participants were sent to the Michigan State University Human Research Protection

Program for approval. The questions to be asked for the fire chiefs and firefighters were approved without any major changes. The initial consent forms needed to be altered before the interview protocol was approved. These required changes were made, as suggested, and approval of the documents was granted. As required, the consent forms were altered every year and approval was granted for the continual administration of the interview instruments.

I know that I have accumulated experiences and knowledge which could bias my qualitative research on firefighters' activities during overhaul operations. One of these biases, which is evident during some fire incidents, is that male firefighters tend to view their fire ground activities differently than do women. Even though there are far fewer women in the fire service, it has been noted by some researchers that men construct different views of their fire service health behaviors and learning opportunities than do women (Courtenay, 2000; Hayes, 2001). According to Courtenay (2000), men tend to disregard risks, view themselves as being invulnerable to risks, have little concern for their safety, and adopt less healthy behaviors than women. In addition, research by Khan, Davis, and Taylor (2017) concluded that gender does affect safety behaviors and positive outcomes for health in the fire service. Since there are very few women who work as volunteer firefighters in West Michigan, and none were recruited as participants in this research study, I was not able to verify any differences between the two genders. However, my own observations do confirm that I have considered some activities to be risky when most of my male peers did not.

Since I was acquainted with many of my research subjects on a casual basis, I attempted to eliminate any bias during the interview process by striving to stay within the scripted, open-ended questions. During fire ground observations, I merely noted what was occurring and, purposefully, did not attempt to identify the firefighters who were or who were not wearing their

respiratory protection during overhaul operations. I believe that my actions within the research process did not present any biases which would influence the outcomes of the research.

I do, however, feel that being a firefighter and a participant-observer had a positive influence upon the interview process and my observations during overhaul. As the participants answered the interview questions, I understood their responses, since the terms used in the given answers were familiar to me. I did not need to interpret the casual phrases or lexicon used by the firefighters to describe their activities. During the observations of overhaul activities, as someone who has in previous years done overhaul, I knew what tools were being used, why they were being used, and what the effect of their use should be on the prevention of fire extension. I also had the knowledge to understand the environment and the activities being done during the free-burning phase of fire extinguishment as opposed to the time of overhaul.

For most aspects of my research, I found that being an insider in the fire service culture was advantageous. I was able to formulate a qualitative research project based upon disconnect which I noted between what should be done verses what occurred during fire ground operations. I was able to make observations during a specific time of fire extinguishment when I believe risk-laden behavior is occurring. I constructed questions which built a foundation for interviews that added data to the separately made observations. I accessed and read a large volume of literature which allowed me to understand what research was being done by others and where there were gaps in the reported investigations. I was able to easily interact with firefighters and fire chiefs, since I was viewed as a peer within the service, as opposed to someone who needed to gain access via a gatekeeper. Each of these occurrences proved to be an advantage, even though some might view this listing as points upon which bias was built.

## Trustworthiness

Since I formulated the research question, constructed the interview questions, made the fire ground observations, conducted the interviews, and did the analysis, I was involved in all aspects of this qualitative research investigation. According to Greenbank (2003), a researcher, such as myself, needs to be aware of how educational experiences, social values, ethical foundation, and interpersonal involvements could have affected my research. I also needed to be aware that I should appropriately assess how these points of involvement affected the final outcomes of any research conclusions.

In addition, I needed to be aware of the trustworthiness of my qualitative research which, according to LaBanca (2010), is increased if research is done in a highly credible fashion and with appropriate objectivity. This latter point assumed that my research was based on reality and truthfulness. This means that I, as the researcher, needed to remove my own biases, based upon my personal traits, beliefs, and values, from as much of the research as was possible. Based upon the various aspects of my qualitative research, I believe I was as objective as possible and that my degree of truthfulness was at an acceptable level. These points, in their totality, should allow others to investigate similar situations and potentially draw similar conclusions on future research.

## Summary

In this chapter, I discussed the qualitative methodology which I utilized for my research on firefighters during overhaul operations. To accomplish this research, I conducted interviews using semi-structured questions, did observations during overhaul activities at residential fire scenes, and read and analyzed the limited number of documents available which related to this research. The following chapter reports the results of the analysis of the data and the specific themes that were identified from the research data.

# CHAPTER 4: FINDINGS

The purpose of my research was to determine why firefighters, who wear their respiratory protection during active fire extinguishment, remove this protective equipment during overhaul operations at residential fire scenes. The foundation for this determination is based upon the various components of adult learning, which can include formal, informal, and non-formal practices. To gather data for this research, I did observations at residential fire scenes for nine West Michigan volunteer fire departments. In addition, I personally interviewed eight fire chiefs and eight firefighters from the departments where I conducted fire ground observations. In an effort to either support or refute my research findings, I kept current with the information in trade magazines, research studies, and scholarly writings. In addition to the influence of this literature, which is reviewed in Chapter Two, my interview questions and the responses of fire service personnel and my fire ground observations are stated in this chapter.

This chapter begins with information on the study participants. I have reported how I recruited the subjects for my interviews. I explain the process for gaining informed consent, the location of the interviews and how they were conducted, and the process for reporting the interview responses. From the responses of the eight fire chiefs and the eight firefighters, who consented to my interviews, I reported generalized demographic data. I stated responses, which were collected from the fire chiefs and firefighters, to my interview questions. The data collected through the interviews have been reported as collective, yet selected, responses from the fire chiefs and firefighters. In this way, I have attempted to not provide any identifying information which could link the responses of either a fire chief or a firefighter to a particular fire department.

After this information is reported, I transition into the observations which I reported from twenty-one residential fires in my research area that occurred during the time frame of data

collection. I describe these fire scenes through general information, since I have promised all of the research participants that I would not disclose any specific characteristics which could identify their departments, townships, villages, or cities.

This chapter concludes with a discussion of the results obtained from this qualitative study. The interview responses, which are reported in Appendices C and D, and fire ground observations which were made during overhaul were analyzed for common themes within the activities of the fire service, which relate to adult learning and the Health Belief Model.

## The Study Participants

My initial goal was to interview the fire chief and one firefighter from ten fire departments which are contiguously located in three counties in West Michigan. Due to a number of intervening problems, I was only able to interview eight fire chiefs and eight firefighters from a total of nine fire departments. Unfortunately, my interviews involved one fire chief from a township where I was not able to interview a corresponding firefighter and one firefighter was interviewed from a department where I was not able to interview the corresponding fire chief.

The geographic area of study was chosen for my convenience and also for access potential. One fire chief asked me about the selection criteria for my study area for observations and my interview participants. As I stated during our interview, “I’m keeping it in the general area. I haven’t gone too far out. Part of it is because, if I go too far out, I’m going to get people who don’t know who I am and they’re going to start questioning what I’m doing. Where, if the guys know me, or know me by word of mouth, they know that I’m not a total idiot. That I’m dedicated to the service.” Since I did not want to utilize a gatekeeper or spend a great deal of time attempting to explain who I was, what I was doing, what I planned to do, and why I needed

their participation, I decided to stay within a defined local area and work with the personnel from fire departments with whom I had some form of appropriate fire service history.

The fire chiefs were selected since they were the leaders of their respective fire departments when I was able to schedule their interviews. Since the time of my interviews with the fire chiefs, two fire chiefs have retired and two other fire chiefs were asked to relinquish their positions. At the time of the interview scheduling, the seated fire chiefs each identified one firefighter who regularly engaged in overhaul activities at residential fire scenes. For eight of the nine represented fire departments, I was able to interview a well-seasoned firefighter who, when we met, did confirm that he engaged in overhaul activities.

In order to schedule the interviews with the fire chiefs and the firefighters, I called them by phone. During these conversations, I explained my research, why I was conducting it, why I wanted to involve them, and asked if they would be willing to cooperate with me. Other than the one fire chief and the one firefighter whose schedules were not compatible with mine, I was able to schedule sixteen interviews, eight with fire chiefs and eight with firefighters. I arranged to meet with each of these individuals at their respective fire stations.

Upon my arrival at a fire station, either the fire chief or firefighter and I chose a quiet area within the station where we could converse without interruption. I explained that I had some questions, which I wanted to ask them, that would guide the interview process. I gave each participant two copies of my consent form, asked him to read it, asked if he had any questions about its content, and then requested that he sign the form. If he consented to having the interview audio recorded, I also asked him to initial the form where indicated.

Of the sixteen participants who were asked to allow an audio recording, nine consented. Although I did not ask the other seven participants why they would not allow the recording to occur, I believe that they may have been uncomfortable with this process. Being asked to engage

in academic research is not an activity in which many fire service personnel engage. Since I wanted the environment of our interviews to be as non-threatening as possible, I did not ask for an explanation as to why they negated this request.

Once the consent form was completed, I continued to explain the interview process. I explained that I had an interview protocol, which contained thirteen questions for the fire chiefs or nineteen questions for the firefighters. I showed the participants that I had placed one question on each page of a paper tablet, so that I could take notes during the interview. In this way, I would have a written record of what we had discussed, as well as the audio recording when permitted. Since I do not trust the function of recording devices, I wanted to transcribe, to my best ability, what was stated during the interview process. When finished with these processes, I asked each of the fire chiefs and firefighters if they were comfortable with this information. Since there were no stated problems, I began the interview protocol.

**Fire Chiefs' Demographic Information**

As I had promised the participants, all of the information which was gathered during the interviews would be reported as collective data, with no identifiers being reported for any one person. The fire chiefs have been leaders of their respective departments from six to twenty years. They all started as new recruits, took fire academy classes, became firefighters, worked their way up through the department's ranks, and eventually became fire chiefs of their departments. For six of these chiefs, with respective fire departments assigned the letters of D, F, H, M, R, and T, the department in which they originally started is the same one in which they became the fire chief. *Figure 1* shows the relationship of these township areas, and the letter designations for these townships that were used throughout the data interpretation.

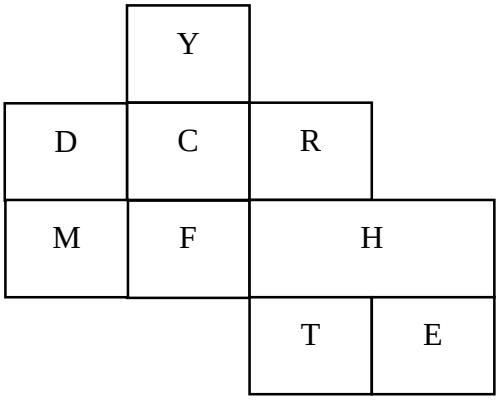


*Figure 1*. The Geographical Relationship of the Fire Departments Involved in the Research.

All of these eight fire chiefs are graduates of a State of Michigan sponsored fire academy, where they received their initial formal fire service education. Some of these men have taken additional course work, including medical first responder training, fire officer classes, and other courses, in such specialties as hazardous materials, incident command, and bioterrorism, all of which would be forms of formal education. Five fire chiefs (D, E, H, R, and Y) have also attended national conferences, which would include formal education sessions, informal activities, and non-formal peer interactions. Six fire chiefs (C, D, E, H, R, and Y) mentioned that they read trade magazines, engage with peers informally, attend governmental meetings in their respective counties, and attend regular fire department meetings as required by their district or township boards. Five fire chiefs (C, D, E, R, and Y) work full-time for their departments and the other three fire chiefs (F, H, and M) are employed as paid volunteers who work part-time as needed for their departments. Four of these fire chiefs (E, H, R, and Y) have some form of formal, collegiate education, usually without a terminal degree, while the others have trade school or practical skills' education.

Although the demographics of these leaders, as chiefs of their departments, show varied backgrounds, each has a specific type of leadership style. I deduced which of the three types of leaders each fire chief exhibited, autocratic, democratic, or free rein (Iannone et al., 2013),

through the interviews I conducted and my fire ground observations. Fire chiefs C, E, F, H, R, and Y exhibited a democratic style, fire chiefs M and T acted as free rein leaders, and fire chief D displayed autocratic behavior.

Due to these varied styles, there was an impact upon the firefighters of the respective departments. Regarding fire chief D, a fire fighter stated that, "You do what the chief tells you to do. That's our SOP. What the chief tells us to do," which shows this fire chief's control over his firefighters' behavior. Fire chiefs M and T do not have a great deal of influence over their department members, as is illustrated when a firefighter stated, "Maybe going off on overhaul by myself. Maybe trying to do something on my own." This lack of positive control by these two fire chiefs may have contributed to their removal from their leadership positions by township officials. The remaining six fire chiefs (C, E, F, H, R, and Y) allowed a good level of participation and decision making by their respective firefighters. For fire chief F, all department officers have meetings four times a year to discuss staffing issues, equipment and training needs and a calendar for these items, issues regarding medical responses, continuing education opportunities, and any other topics which any department officer feels is important to discuss.

**Firefighters' Demographic Information**

The firefighters, who had been identified by their respective chiefs as engaging in overhaul at residential fire scenes, have been in the fire service for ten to more than twenty-five years. Most are still with their original fire departments, where they joined as new recruits, but two (D and Y) were on other fire departments prior to joining the one where they now volunteer. Five of the eight firefighters (C, E, H, R, and Y) had completed both sections of the basic fire service education, which are levels I and II, while three (D, F, and M) have only completed the first half of this training program. Completing and passing only one half of the basic program, will still certify a person as a State of Michigan firefighter.

The interviewed firefighters are employed by their township fire departments as volunteers, in paid on-call positions. Depending upon their positions within their departments, some of these men are only paid when they respond to a call while others sign-up for specific shifts, for which they receive extra pay. Most firefighters, although they do receive some pay, are still considered volunteers due to the hours they work and their average pay. As an example, I volunteer approximately 150 hours per month, for specific medical shifts, duty work, meetings, and emergency responses within the fire service, and my average pay is less than $3000 per year. Volunteer, paid on call firefighters do not work on a department for the pay they receive but, rather, for the community service, internal gratification, and the fellowship of the fire service. Only three of the firefighters (D, F, and R) interviewed have any formal, collegiate education, with two of these individuals having a terminal or advanced degree (D and F). The remaining five firefighters have passed apprentice programs or have experience in skilled trades.

**Fire Chiefs' and Firefighters' Responses to the Interview Questions**

Thirteen questions were asked of the eight fire chiefs and nineteen questions were asked of the eight firefighters. As previously stated, to maintain confidentiality, due to the specific geographic area where these men are employed within the fire service, I will be reporting the interview data as pooled responses. Occasionally, the conversation deviated from the originally asked questions. If this occurred and the information stated was important to this research project, this information was reported in the selection of interview responses stated by either the fire chiefs or the firefighters (Appendices C and D).

For the eight fire chiefs, I have divided their responses into two categories, one for the full-time fire chiefs (C, D, E, R, and Y) and one for the part-time fire chiefs (F, H, and M). This was done since the full-time fire chiefs have more time for department work, meeting attendance, and colleague interactions at meetings and conferences. Since the three part-time fire chiefs are

employed in professions other than with their fire departments, these chiefs do not have the same time allotments, especially for community and non-fire department related activities which the full-time fire chiefs attend during their work weeks.

The interviews were conducted at the fire chiefs' home departments in an area of the station which allowed privacy and eliminated the potential for interruption. In this environment, I hoped to establish an atmosphere where the interviewee would feel comfortable. Based upon each of the fire chief's responses to the questions asked, the manner in which the responses were stated, and the over-all body language of each participant, I believe that each interviewee did feel at ease throughout the entire interview process.

Selected responses from the eight fire chiefs to the 13 questions asked of them are provided in Appendix C. These responses from the eight fire chiefs are divided into two categories within each question, which separate the responses for the full-time fire chiefs from those who work part-time time for their departments.

All of the firefighters, who were interviewed for my research, work as part-time volunteers for their respective departments and spend more time employed in their professional jobs, rather than at the fire department's station or engaged in fire service activities. Selective responses made by the eight firefighters to the nineteen open-ended questions are provided in Appendix D. For these firefighters, the questions were asked at their respective home department stations in an area which allowed privacy and eliminated the potential for interruption. This seemed to create an environment where the interviewee was comfortable. From the firefighters' responses to the interview questions, how the responses were stated, and our interactions during the interview process, I believe that each interviewee felt comfortable during our interview exchange.

## Observation Settings

During the course of this research project, I was able to attend twenty-one residential fires, so that I could observe the overhaul operations which occurred at these scenes. Although there were many more fires to which the fire departments who participated in my research were dispatched, I could only attend those fires which were convenient for my daily activities. Since I do not work in the district of my research and take holidays away from home, there were numerous residential fires which I could not attend. Observations are only reported which include those fire scenes to which I personally responded. All of these residential fires were located within the boundaries of the fire departments that participated in my research.

The collective responses of my fire ground observations during overhaul at residential fires are based on specific incidents, with the number of residential fires identified by the letter assigned to each township in the geographic area. These observations are reported as collective data, so the confidentiality of each fire department could be maintained. Although all of the departments involved in my research had additional residential fires, I did not use any information which was communicated to me about these other fire scenes.

The majority of the geographic area, which includes five of my participating fire departments (C, D, F, M, and T) is rural farmland, with populations, according to the 2010 census, ranging from approximately 2300 to 4200 residents. There are also three areas (H, R, and Y), two of which contain one township each and one fire area which covers two townships, where these defined fire service areas are primarily rural farmlands, but also contain small subdivisions and small businesses, which have been built on former agricultural land. The populations within these three fire districts are estimated to be between 10,000 and 13,000 individuals, according to the 2010 census. The final fire district of the nine (E), which still has some rural farms, contains numerous subdivisions, many small businesses, and a large

governmental institution. This fire district has, according to the 2010 census, an approximated population of 20,000.

Of the twenty-one fires I attended, thirteen were found in rural areas (C: two fires, D: one fire, F: one fire, H: two fires, M: three fires, R: two fires, T: one fire, and Y: one fire). The structures in these areas are older homes, with construction done 75 years ago or more, and some homes constructed with more modern techniques and materials. The remaining eight residential fires were in homes which were in subdivisions or in larger residential areas and were similarly constructed to the newer homes in the rural areas (C: three fires, D: two fires, E: one fire, R: one fire, and Y: one fire). Eighteen of these fires were contained to or involved only one to three rooms, while the remaining three fires involved a significant portion of the structures (C: two fires and M: one fire). For the eighteen fires, which had small involvement, the time on scene lasted between two and four hours, while the three fires with larger involvement, required between four and six hours of activity. For all of these fires, overhaul occurred once the fires were primarily extinguished.

For all twenty-one fire scenes, due to the level of involvement, the fire departments were able to save the structures, so overhaul operations were undertaken. There were other residential fire scenes to which I responded that resulted in a declared total loss to the dwelling. As a result, the tactics for fire extinguishment were defensive toward these dwellings and did not involve any overhaul activities. These residential fire scenes are not included in the research data.

Overhaul operations were undertaken in twenty-one structures. For these structure fires, except for one in fire district E, I observed two or more firefighters who were not wearing proper respiratory protective equipment during these fire ground operations. Appropriate respiratory protective equipment, in the form of self-contained breathing apparatus (SCBA), was being used by all firefighters during the phase of active fire extinguishment. Some of these same personnel

transitioned to overhaul operations and removed their SCBAs during this latter time of fire ground activities.

I noted overhaul activities during post-fire extinguishment when seven out of nine fire chiefs entered structures without SCBAs. At these same or other fires, during overhaul, I also noted that all eight of the firefighters, who I interviewed for my research, exited structures without SCBAs or other respiratory protective equipment. When conversations were easily heard and understood during overhaul activities, it was obvious that respiratory protective equipment had been removed. Similar observations, by various researchers, have been made during overhaul at fire scenes across the country, and these references are included in Chapter Two, the Literature Review.

## Summary of Research Findings

According to interview comments, which were made by the eight fire chiefs and the eight firefighters who participated in this research, and the observations which were made at various fire scenes for nine fire departments, three fire department themes emerged. When adult learning was situated within the components of the Health Belief Model, six themes were noted for their importance.

### Themes Related to the Fire Service

The themes which merged from this research show importance to personnel within the fire service. The first theme is that the fire departments' personnel, the fire chiefs and the firefighters who participated in this research project, reported that any firefighter who wished or needed to partake in overhaul activities at a residential fire scene had appropriate respiratory protection available to him. Although the type of respiratory protective equipment varied within the departments, and the availability to a personal mask was inconsistent, all fire service

personnel stated that their respective departments had some form of SCBA available for their use during overhaul, as well as during active fire extinguishment.

The second theme that emerged from the interviews is that both the fire chiefs and firefighters, who participated in this research, are aware that it would be advantageous to wear self-contained breathing apparatus during overhaul. Ironically, it was stated during the interview process, as well as during my fire scene observations during overhaul that, for most fire scenes, at least one member of the department did not wear appropriate respiratory protection during overhaul.

The third theme drawn from the responses of the research participants is that these fire departments need to have a standard operating guideline or procedure (SOG or SOP) for overhaul. Since it is difficult to practice overhaul during a training session, due to the lack of an available structure, informal learning activities must be discussed both before a fire develops and as a post-extinguishment debriefing. In this way, firefighters would have a well-stated, written guideline, as well as practical application ideas which have been gleaned from members at all levels of the department.

**Adult Learning Themes Related to the Health Belief Model**

The responses given by the eight fire chiefs and eight firefighters, who work for nine volunteer fire departments in rural West Michigan, give clues to the three main areas of adult learning. These areas are formal, informal, and non-formal learning opportunities. When these areas are situated within the Health Belief Model, a relationship can be drawn between health risk factors in the fire service and the elements of adult learning. The five perceived areas within the Health Belief Model, which can affect health, are susceptibility, severity, threat, benefits, and barriers, with the last area of this Model being self-efficacy.

**Perceived susceptibility.** Based upon their perceptions about risk susceptibility, or the fact that a risk is high in a given situation, some of the full-time and part-time fire chiefs, as well as some firefighters, mentioned comments which suggest a lack of perceived susceptibility. For example, some of the firefighters stated that:

> "SCBA. Well, they don't always wear their SCBA but they should. Sometimes it is a pretty smoky and hot job – they should have some kind of SCBA, but they don't always."
>
> "I can go in. I don't see anything that's going to kill me and no one else is coughing their lungs out, dying. I can do this."
>
> "So I think, as far as my health is concerned, it is a risk to my health that I am willing to take, that is, to be in the fire service because of the experiences that I have had and how those experiences have made me feel."

When a person perceives that a risk to his health is high in a given situation, this individual should have a greater chance for undertaking fire ground activities which will reduce these risks, such as wearing appropriate respiratory protective equipment.

From the fire chiefs' and the firefighters' responses, they do not recognize the risk susceptibility that exists during overhaul, which could negatively alter their health status. The concept that a hazardous environment exists during overhaul operations at residential fires was taught to all fire firefighters during their formal adult education within their fire academy classes. Based on fire academy curriculum, firefighters must wear full PPE during overhaul, since appropriate respiratory protection is mandatory until the air is tested and found to be safe to breathe. From observations of overhaul operations at residential fire scenes, and from the associated comments from interviewed fire chiefs and firefighters, the aspect of perceived

susceptibility, which was learned during these individuals' formal training, is not having an impact upon their life actions within the fire service.

This is especially true since most volunteer fire departments have only a single gas air monitor for carbon monoxide or a meter which monitors four or five environmental conditions, including oxygen, carbon monoxide, hydrogen sulfide, and sulfur dioxide, and a lower level for explosive limits. There are currently no gas monitors which measure all toxic chemicals and carcinogens which are released from residential fires. As a result, it is nearly impossible to determine when a post-extinguished residential fire scene is no longer a hazardous environment.

**Perceived severity.** The perceived severity of a risk, according to the Health Belief Model, deals with how seriously people believe the development of a health risk might be. During the activities which I observed at twenty-one residential fire scenes, I noted a lack of SCBA use during overhaul operations at residential fire scenes for eight of the nine fire departments involved in my research. These observations are summarized in Figure 2.

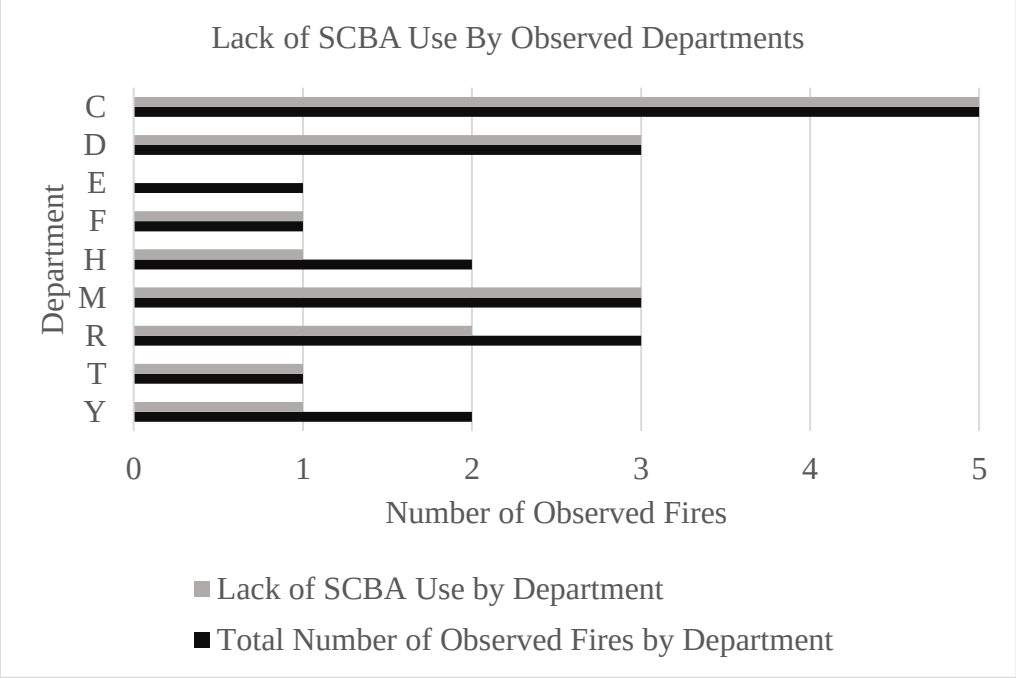


*Figure 2.* Lack of SCBA Use by the Number of Observed Fires per Department.

This yielded a rate of a lack of appropriate respiratory protection at seventeen out of twenty-one fires, or over 80% of observed residential fires during overhaul operations. The rate of 80% for a lack of SCBA use during overhaul operations at residential operations is similar to the surveyed rate of 88%, which was the self-reported information from over 200 firefighters who stated that they did not always wear respiratory protection during overhaul when a toxic environment may still be present. This stated data, which was not published but which I can make available, was obtained from surveys I administered to firefighters in my research area from 2004 through 2010.

The lack of concern or laissez-faire attitude, which is evident during overhaul operations, does not agree with comments regarding the perceived severity made by some of the fire chiefs and firefighters. During my interviews, both fire chiefs and firefighters stated that there is a potential health risk if SCBAs are not appropriately used during the time of post-extinguishment. Reported among these comments are quotes from two fire chiefs and firefighters which stated:

> "Probably respiratory, I don't know. I don't have any problems, and I don't know of anybody who is."

> "Our firefighters and some of our leadership want to remove the SCBA and start breathing standard air in the atmosphere – which, as you know, may be an endangerment to our human selves."

> "I am a little bit from the old school that says, well, if I am wearing breathing protection or if I've got positive ventilation going, and the top of the roof is burned open anyways, then the likeliness of our firefighters ingesting, if you will, or breathing in a lot of debris, even though we know when we go outside and grab a tissue and blow our nose, we say "oh, my goodness look at all the debris', yeah, gook."

"Even if it isn't hot, it's not a real safe scene to go in there and investigate it, even the next day. And how many days after a fire can you still smell stuff? What have you released in that fire, you know, besides smoke? Yeah, there's chemicals you release."

"There's a potential of lung problems, I guess. You really don't know what has burned sometimes and depending upon the concentration of gases or smoke in the residence that are left over, you might, it may seem fine at that time and yet there may be residual effects that come up later on that are unforeseen difficulties."

"Inhalation. I think you could run in to some stuff that you aren't even aware of – maybe absorb it through your skin. Somewhere, later, you could develop something and possibly they could say, well back to . . . back to sometime along the line you picked up something you didn't even know you had."

These comments illustrate the view that fire chiefs and firefighters are aware of the severity of their fire overhaul environments and, yet, these individuals do their assigned tasks at residential fire scenes without appropriate SCBA equipment. It is obvious that firefighters, as well as fire chiefs, disregard the importance of appropriate respiratory protection to their present and, more importantly, their future health status.

During their formal adult education at their fire academies, all state certified firefighters were taught about the importance of wearing their SCBAs when the environment is known to be contaminated, suspected of being contaminated, or could possibly become contaminated. The textbook materials and curriculum presented by the instructors of the fire academies did not seem to affect the firefighters' behaviors during subsequent fire ground activities. The information

presented during the firefighters' formal adult learning classes is not practiced on the fire ground, establishing a dichotomy between what is their espoused theory and the theory-in-use regarding respiratory protection.

**Perceived threat.** The concept of perceived threat to good health is reflected in the Health Belief Model when the susceptibility and the severity of health risks are combined. This threat can be one that occurs at the time of an incident or may develop years later. The concept of threat was mentioned in comments which were made by both the interviewed fire chiefs and firefighters:

> "The biggest thing that I would worry about would be some sort of lung problem from whatever smoke or chemicals, houses, cars, cars are terrible."
>
> "I think there's the possibility you could pick up something maybe 15 to 20 years later that might affect your health."
>
> "It's like if something happened 20 years ago and now all of a sudden it's showing up on health issues."
>
> "Well, there is always the chance of breathing something that, God knows, is going to just tear your lungs apart."
>
> "Fear is always in my mind. It is in mine, but don't know about others. That fear of breathing something and being overcome by toxic gas."
>
> "When they go through fire school it definitely is something that is talked about. It definitely is something that we could add."

The responses by these fire chiefs and firefighters mirror those written in the approved textbook for the fire academies which state that SCBA should continue to be worn during overhaul until the air has been tested and proven to be safe.

Unfortunately, the fire departments in my research area, where I made fire ground observations, may have a single gas, carbon monoxide meter, or a meter which measures four or five environmental conditions, but none of these fire departments had a multi-gas meter, which may be utilized to more appropriately determine when an atmosphere was safe to remove respiratory protective equipment. Regretfully, even these multi-gas meters, which are the only available and affordable portable units, do not measure all chemicals which could be released at a residential fire scene and which can be a hazard to firefighters' health, especially those that are carcinogenic.

**Perceived benefits.** According to the Health Belief Model, the concept of perceived benefits means how an individual's advised action will bring about reduced risk or help to lower the seriousness of a risk's impact. This, in turn, helps to define or clarify what actions need to be taken for positive health affects to occur (National Institutes of Health, 1995; The Communication Initiative, 2008). In addition, this can allow an individual to weigh the perceived benefits of a changed action against the potential costs, risks, or inconveniences which the individual may experience (Tatman, 2010; Vance, 2018). If firefighters believe that a change in their actions or behavior will improve their current or future health status, their changed actions or behavior would be viewed as being beneficial.

According to Hayden (2009), if a specific action or behavior is deemed beneficial by the individuals involved, they may be more inclined to partake in the change process. Based on the responses from some of the interviewed fire chiefs and firefighters, what these individuals perceive as benefits may not be classified as benefits by others. The research participants suggested that appropriate resources and equipment contribute to the perception of benefits regarding the use of appropriate respiratory protective gear:

"Generally, we have everything to do overhaul safely. It's there. If we can fight a fire, we can do overhaul and do it safely."

"Light weight, high-pressure tanks; fatigue-wise, they are better yet than the new ones we've got."

They also mentioned the importance of training in contributing to the perception of benefit:

"We have people that we've trained and are good at it (overhaul), and go in and once it's out, you know, go in and they'll kind of show me what started and what transpired."

"I'm going to go and rely on the training that I've had and the people that are there backing me up to make sure that we all come out of there without any injuries or without anything that will be debilitating or a hindrance to us in our future."

Perceived benefit is also derived by firefighters from personnel they view in authority or leadership positions which emphasize:

'I think I can just take it off because I can. If I was ordered to leave it on, I would leave it on."

"If my IC (incident commander) would say, 'don't take your mask off,' I wouldn't take it off."

"We may check it by, you know, some guy just smelling or some of the old guys, some of the older-timers who have been around, and if we're not sure, we'll say, 'Get your mask on. Get your tanks on'."

One participant summed it by saying,

"We've got a pretty good system in place and we have good people and we have good equipment and that's two huge factors when it comes to

your own safety. Believing in your equipment and believing in the people that you're with."

For the first time in this research analysis, the fire chiefs and firefighters are referencing informal and non-formal educational processes in their responses about the perceived benefits for health risks. Through on the job training of firefighters, a form of informal adult education is occurring, and by following the orders of the incident commander, non-formal adult learning experiences occur as firefighters interact with their co-workers.

**Perceived barriers.** Barriers are defined as conditions that do not allow the firefighters to take actions to improve health risks and do not allow positive changes. The involved individual will need to overcome these negative aspects if they are to improve their potential health status.

A variety of conditions were mentioned which present barriers to the use of SCBA during overhaul. For example, firefighters mentioned the equipment itself was a possible barrier:

"SCBAs are heavy, they limit visibility . . . there is some opposition to your breathing though the SCBA because of the exhalation valves . . . weight and the bulkiness . . . poor communication capabilities"

Other individuals perceived that a lack of training or experience contributed to a lessened knowledge and skills' base which is necessary to effectively use appropriate respiratory equipment during the required environmental conditions:

"We're not really taught, we're not disciplined enough to say – some departments are. They actually do readings before they say OK."

"Possibly the lack of practice of overhaul because we are just not able to do that anymore . . . How can you become experienced in overhaul? And you probably wouldn't other than on the scene. Maybe four structure

fires a year. You don't get good at fighting fires when you only do four biggies in a year, where you've got one room involved with flame."

Some firefighters regard overhaul as an activity which has a much lower priority than fire extinguishment or search and rescue. Overhaul is a time of *mop-up* or *grunt work*, which requires a great deal of physical exertion, to make certain that the residential fire has been fully extinguished:

"Overhaul is basically the stepchild of the fire service, an orphan. It's something we do, you know you've got to do it, but you don't look at it as a hazard; you've got the fire out. But the gases are still there."

Finally, the influence of others on whether to use the equipment was clearly evident in some of the responses, such as:

"It is based upon how much smoke you can see? . . . And between us, kinda like, what the other guys are doing, a little . . .Well, I mean if they are in there overhauling too, and you know, I got my air pack on and they don't . . . It's kinda like, he's not dead yet, it must be okay. . . I guess I'm following the herd a little bit with regards to wearing SCBA."

Again, informal education of firefighters is mentioned as a perceived barrier, since firefighters are not taught, within their departments, to utilize appropriate respiratory protection during overhaul operations, even though their formal education stressed this point. The form of leadership exhibited by the departments' fire chiefs may influence various aspects of the departments' learning opportunities, including the type, amount, quality, and continuance of appropriate training (Iannone et al., 2013). If a fire chief does not stress the importance of appropriate use of their SCBAs and does not have his firefighters train in specific activities which use this equipment, these firefighters may not adopt preferred behaviors.

In addition, since very few volunteer fire departments have enough residential fires to practice overhaul, veteran firefighters cannot model overhaul activities in an informal manner for others within the department who need this training. As one firefighter stated, "Possibly the lack of practice of overhaul because we are just not able to do that anymore . . . How can you become experienced in overhaul?" Without proper training for overhaul activities, good mentoring, and the inability to practice this activity, overhaul does not become a valued activity. The end result is that there is not the drive to find ways to engage in training activities for this time of post-fire extinguishment, even though it is known that adults tend to learn when they are actively engaged in practice activities (Jahn, 2011; Jolemore & Taber, 2007; Vaillancourt, 2009).

**The concept of self-efficacy.** A sense of self-efficacy is developed if perceived threats can be acknowledged, benefits maximized, and barriers minimized (Eraut, 2004; Vance, 2018). This concept can be achieved when an individual has the ability to take a positive action, by providing training or guidance in learning an objective (National Institute of Health, 1995). This will allow fire chiefs and firefighters to undertake changes which will improve these individuals' behaviors toward their current and future health risks. When individuals develop confidence that change can positively modify health risks, they will develop more positive activities (Clark, 2003; Green & Murphy, 2014; Norman & Brain, 2005). Most individuals will change their behavior when they believe that they have the capabilities for this change. If individuals lack the confidence for a behavioral change, they will not attempt the required change or will attempt the change for only a short time before ending the actions needed for the change (Umeh & Rogan-Gibson, 2001).

The change which is required to develop this sense of self-efficacy was evident in a number of the participants' responses, which largely reflect a reinforcement, in different ways, regarding what is already known about respiratory protective equipment use:

"Knowledge is important."

"Probably develop a policy, the obvious thing. Then make certain that the policy is adhered to. Probably something that needs to go into the policy is the continued use of SCBA or air monitoring."

"The magazines say that years later there could be a problem, causing cancer."

"We do emphasize that you continue to wear SCBA even after the fire has been extinguished."

"What drives it the most could be . . . MI-OSHA (says) 'I don't see protective breathing apparatus on that firefighter.' So that drives you toward safety."

"I think it's just a comment, it is very good that somebody like this is doing this, just to wake you up on, yeah, overhaul."

"The officers need to step up more and say 'hey, get your pack back on if you're going back in there. It's not clear yet. We haven't ventilated, it is not all out. Packs on'."

"A lot of times, I don't. I think about it later and I think, as, shouldn't have did what I did. It's just one of those things you do."

From these comments from both the fire chiefs and the firefighters, it is obvious that change needs to come about within all levels of the fire service. The development of a sense of self-efficacy from firefighters, through line officers, and to the chiefs may bring about the changes needed within the fire service to improve the health of its members.

## Chapter Summary

In this chapter, I described the geographical areas where this research study was conducted. I also used selective information for the collective responses of the fire chiefs and the collective responses of the firefighters. General information regarding the residential fire scenes where I conducted observations were reported in this project's data.

Based upon the observations of twenty-one residential fire scenes and the interview responses from the sixteen participants, I have drawn three conclusions regarding themes for the fire service. I have also developed six conclusions about adult learning themes as they relate to the Health Belief Model and the fire service. These conclusions regarding adult learning interface well with the six components of the Health Belief Model dealing with the perceptions of susceptibility, severity, threats, benefits, and barriers, as well as the development for self-efficacy.

In Chapter Five, I present a discussion of my research findings, as they relate to the fire service and adult learning practices. I summarize my research conclusions regarding the current behaviors of firefighters during overhaul at residential fire scenes and discuss how principles of adult learning could modify these behaviors. I also include some implications for practice and policy. In addition, I state some limitations which were involved in this study, which could influence its future implementation. Lastly, due to the importance of this research topic, I make some recommendations for future investigations, which have the potentiality to improve the health of today's and future firefighters.

# CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

In this chapter, I summarize the information gained from my multiple qualitative analysis regarding the activities of firefighters during overhaul at residential fire scenes and their choices not to wear respiratory protective equipment when it should be worn. This information supports my research question as to why firefighters do not wear appropriate respiratory protection during overhaul at residential fire scenes. I investigate adult learning themes for fire service personnel and discuss six components of the Health Belief Model as they relate to the behavior of firefighters during overhaul activities. I overview formal, informal, and non-formal learning opportunities which impact the choice to wear respiratory protective equipment. I also state implications for fire ground practices and policies and discuss the limitations of this study. I conclude my research by making recommendations for active interventions which, with some efforts by many fire service personnel and organizations, could lead to the improvement of firefighters' respiratory health as a result of their activities during residential overhaul.

## Study Summary

My research examined overhaul activities at residential fire scenes and the choices made by firefighters who decide not to wear their available respiratory protective equipment at this time of fire extinguishment. I formulated the research project, wrote interview questions, conducted interviews with eight fire chiefs and eight firefighters, did fire ground observations at twenty-one residential fire scenes during overhaul, and attempted to examine policy documents. The primary question which drove this project is why firefighters, who have been appropriately educated about hazardous environments during their initial fire academy training, and who have respiratory protective equipment available to them, choose not to utilize this equipment when the environment during overhaul is potentially hazardous to their present and future health status.

My choice of a qualitative analysis was appropriate for this research, since my varied forms of investigation allowed me to find specific themes within the collected data (Grove et al., 2015). From my observations of nine fire departments during their overhaul activities at residential fires and from my interviews of eight fire chiefs and eight firefighters, I was able to gain perspective on why firefighters negate the use of their available respiratory protection when the use of this equipment could have a positive impact upon these firefighters' health status.

## Study Participants and Observations

I selected the nine fire departments due to their contiguous location within three West Michigan counties. The fire chiefs were selected because they were the leaders of their respective departments at the time of my interview research, and the firefighters were selected by their respective fire chiefs. Although I initially chose the fire departments, I did not choose the fire departments in an effort to interact with any specific fire chiefs or firefighters. The fire ground observations which I made during overhaul operations were random events, since fires at residential buildings are not planned occurrences. In addition, I was not available to attend all fire scenes to which I was dispatched or which occurred within my research area during the time of my investigations.

The qualitative methodology I utilized (Kennedy & Lingard, 2006), allowed me to gain a better understanding as to why firefighters generally remove their respiratory protective equipment during overhaul, even though this equipment was available to them during the time of active fire extinguishment (Charmaz, 2014). Since my observations were conducted at a specific time on the fire ground, I found that many consistent actions occurred in the firefighters' behavior. When firefighters initially arrive at a fire scene, there is a time of apparatus placement, personnel and equipment assessment, and other concerns which need to be made quickly by the fire chiefs and the line officers. Within a short time, firefighters are working on the tactics

needed to complete their assigned tasks. This is a time when quick decisions and some confusion may arise. However, during overhaul, very specific tactics are undertaken to achieve a specific goal. As a result, my observations were done during a time on the fire ground when activities can be planned, well thought-out, and there is little concern for immediate time restraints. This latter situation allowed for more precise observations to be made, in a naturally occurring setting, which positively contributed to my data analysis.

Unlike the time of fire ground observations, the data collected from the face-to-face, one-on-one interviews were compiled in a calm, private building setting. The interviewee and I talked casually, drank coffee, and interacted as colleagues who had similar backgrounds. Although I did not gain as much information as I had wanted, due to some very brief answers by some of the study participants, I was still able to note similarities between the fire chiefs' responses and the firefighters' answers. This congruence allowed me to investigate themes on adult learning from the fire chiefs' and the firefighters' responses, which are applicable for the fire service and six themes which can be situated within the Health Belief Model as they also relate to adult learning within the fire service. Due to the lack of available policy documentation, I was not able to include substantive data analysis of this material.

## Discussion of the Findings

The fact that firefighters experience formal, informal, and non-formal learning opportunities is well understood, but the amount of research on how, why, and when firefighters learn has not been well researched (Holmgren, 2014). For my research participants, formal learning occurred within the first year of these men joining a fire department. Since firefighters need to complete an academy class so that they can take the State of Michigan test for certification, their respective fire departments required this formal training to occur as soon as possible. Without this training and certification, the activities which these individuals could have

participated in while on the department were quite limited, so their fire department leaders or governmental agencies required training to occur when a local academy class became available.

These formal adult educational opportunities of the academy classes were well structured, had common curriculum, trained facilitators, and a classroom setting, which was augmented with hands-on training and demonstrations. For many firefighters and fire chiefs, the formal educational opportunities of their fire academy classes were the only learning that was placed in a formal setting. Six of the fire chiefs and four of the firefighters have attended other fire related educational opportunities, such as incident command, bioterrorism, hazardous materials, and heavy-duty rescue training, but only four of these chiefs and two of these firefighters attended all of these stated classes. After their initial academy classes, which gave them certification, most fire service personnel have not participated in additional formal adult educational opportunities, for which learning is tested. Seminars or conferences, which are presented to fire personnel, generally by fire officers or authorities in a particular field of study, may issue a certificate merely for attendance rather than the extent of learning which is achieved by the participants.

Informal learning occurs throughout the firefighters' time in the fire service. Since equipment, apparatus, protocols, and personnel change, there is a continual need to engage in learning activities. Informal learning results from the normal activities of work, is generally not intentional, not structured, and is often an opportunistic way to bring about a specific learning objective (Colley et al., 2002; Eraut, 2004). For the firefighters in this study, informal learning was generally more casual and tended to occur between colleagues, mentors, or line officers. This training can still be additive and transformative, with this latter point potentially bringing about changes to existing knowledge and assumptions of the fire service personnel (Schugurensky, 2000). Although this can cause double-loop learning to occur, which is deeper, more meaningful, and can change values related to theory-in-use (Ivergard & Hunt, 2004), I did

not observe these changes. Firefighters who did not wear the appropriate respiratory protective equipment at the beginning of my research were still not wearing this equipment at the end of my observations, even though my interview subjects knew that I was investigating the topic of SCBA use during overhaul at residential fire scenes.

Most of the informal learning opportunities occurred during department training, with most departments offering four to five hours of training each month. Unfortunately, this informal training was not mandatory, although attendance was taken, and was not offered as much as it could have been to be beneficial. In fact, one firefighter, who was from a fire department in my research area, began attending training sessions with another fire department, which was also in my research area. This firefighter was concerned because he felt that his home department was not offering training which he determined was necessary and advantageous to him for his position within the fire service.

Non-formal learning is more difficult to quantify, since much of it is self-directed or self-selected, non-sequential and short-termed, may occur in isolation, and is not an evaluated event (Colley et al., 2002; Eraut, 2007; Schugurensky, 2000). It can occur through training from mentors or peers, be directed by training officers or line officers, or be obtained from various media. For the individuals who engage in non-formal learning, their decision to participate is voluntary and may be based on personal demographics or knowledge gaps (Colley et al., 2002; Goldman et al., 2009; Merriam et al., 2007; Rogers, 2005). Five of the fire chiefs and three firefighters, who I interviewed, stated that they read magazines and reviewed on-line materials which are posted by various individuals as blogs or training materials. Included in this selection were magazines and on-line list serves, such as EMS World, Firehouse, FireRescue1, articles from the National Volunteer Fire Council, and The Secret List, which are available daily, weekly, or monthly.

**Formal Learning**

From my interviews and observations, I have noted learning, which involve formal, informal, and practical experiences. Formal learning is based upon learning environments which are generally classified as occurring in a formal setting (Colley et al., 2002; Kim et al., 2004; Tynjala, 2008). The first formal learning environment, which my interview respondents encountered, was their fire academy classes. In Michigan, these classes generally meet one or two times per week, for approximately four hours each, during approximately twenty weeks. These academy classes are taught by fire instructors who have been trained and vetted by other fire instructors, with many of these individuals being members of the Michigan Fire Fighter Training Council.

During this formal coursework, all sixteen of my interview participants were recruits exposed to the academics of firefighting, the culture of the fire service, practicalities of working as a fire fighter, and specific content which would allow most recruits to pass both the State of Michigan written and practical aspects of the qualifying exam (Jolemore & Taber, 2007; Taber et al., 2008). These points are similar in many ways to the aspects of formal learning which have been stated for other professional careers in public safety (Iannone et al., 2013). With the successful completion of both parts of this qualifying exam, these individuals became Michigan certified firefighters. Based upon limited comments by the interviewed firefighters, since no questions in my protocol specifically asked about aspects of their academy training, these individuals did give positive comments. One firefighter stated, "Knowledge is important." while another stated, "I went through firefighter I and MFR (medical first responder) training. On scenes, I like to feel that I can do pretty much whatever is required. I can fit in."

This formal education is based upon the required academics, which included prepared Power Point presentations and the use of the textbook, *Fundamentals of Fire Fighter Skills:*

*Evidence-Based Practices* (IAFC & NFPA, 2017). Of particular interest to my research is Chapter 3 of this textbook, "Personal Protective Equipment and Self-Contained Breathing Apparatus" which discusses, the use of self-contained breathing apparatus (SCBA), including personal protective equipment choice, respiratory protection, the use, inspection, and maintenance of this equipment, and special safety considerations regarding this equipment. Since the individuals interviewed for my research have been affiliated with the fire service for many years, they used other editions of this textbook. The wording regarding SCBA use, in previous editions of the text, might be different from the current text, but the discussion regarding respiratory protection during overhaul is still stressed to some degree in these previous texts' editions.

During the academies' course content on SCBA use, there is limited information regarding what defines a hazardous environment. In the conclusion to Chapter Three, there is reference to the fact that firefighters have the potential to be exposed to dangerous environments in which the use of personal protection equipment is necessary to maintain health and safety. This necessity arises since respiratory protective equipment shields firefighters from toxic gases, particulate matter, and other threats to their health. In later chapters of various editions of the academy textbook, it is written that fire departments may utilize gas meters, which monitor the environment for low oxygen, elevated carbon monoxide levels, or the presence of toxic gases, to determine if the environment is safe. Unfortunately, there is no information which explains how to precisely determine if or when an environment is truly hazardous or has been deemed safe to breathe natural air (Baxter et al., 2010; Burgess, et al., 2001; Fabian et al., 2014; Greven et al., 2011). This disconnect between theoretical application and practical environments comes about since many research articles have been written that list numerous toxic gases or combustion substances which cannot be measured by the current meters available to firefighters.

Of the nine fire departments whose personnel participated in my research, only one department has a simple one gas meter, while three others have meters which monitor four gases. The most simplistic meter only measures carbon monoxide levels, while a four-gas meter monitors the levels of oxygen, carbon monoxide, hydrogen sulfide, and combustible gases. As reported by my research respondents,

> "CO (carbon monoxide) detector is the only air monitor."
>
> "Only a CO, carbon monoxide meter, but not one of the combination gas readers."
>
> "We've got that gas detector, but I think – when it's completely out, and I don't know, I guess we use mainly our nose to smell. If we feel – and I think some of it we look and see what's in there."
>
> "I think you could still end up going in, and I mean the air smelled good, nothing's measured, and everything smelled good, but I think there's the possibility you could pick up something maybe 15 to 20 years later that might affect your health."

If a fire department has one of these meters, the department's firefighters learn to use the gas meter during informal, in-house training, usually during department meetings. These meters are used to determine if a potentially hazardous environment exists, for a limited number of gases, during any fire conditions, but the use of these meters is flawed, which creates the disconnect between learning and practical application. The measurement of one to four gases is a very limited list compared to the dozens of hazardous combustion products which are known to be found at residential fire scenes during overhaul. These compiled lists have been widely discussed in published research literature (Bailey, 2016; Bolstad-Johnson et al, 2000; Fabian et al., 2014;

Guidotti, 2014; Hvenegaard, 2012; Washington State Council of Fire Fighters, 2017; Taylor, 2016).

The various editions of the academy textbooks also state that any inhalation of smoke and other products of combustion can pose short-term or long-term health risks, or can result in fatalities, which can infer that hazards only exist when smoke or combustion products are evident. This is a false assumption, since during overhaul, when minimal or no smoke is present, a hazardous environment potentially exists. Various comments by firefighters, who contributed to my research, seem to understand this health risk during overhaul when they stated:

> "Exposure to the gases that are still in the structure, if they don't have an SCBA on. It could be – definitely would be a health risk down the road – we don't know when."
>
> "Just that gut feeling that it wasn't right. Yep. Well, I could smell it."
>
> "You go in there and you're digging around or whatever and you get into, who knows, lead based paint, dust, fiberglass insulation, some asbestos. You get that in your mouth, your nose, your eyes."
>
> "I think lungs could be something that might be affected."
>
> "There's a potential for lung problems, I guess. You really don't know what has burned sometimes and depending upon the concentration of gases or smoke in the residence that are left over, you might, it may seem fine at that time and yet there may be residual effects that come up later on that are unforeseen difficulties that, rather than lugging an air pack around while you're trying to pick through piles of burned out stuff, you don't."
>
> "Well, there is always the chance of breathing something that, God knows, is going to just tear your lungs apart."

"Getting into your lungs. Deteriorating your lungs. Some of that stuff can cause brain problems too, can't it?"

There is a disconnect between what the firefighters are taught during their academy experiences, what they seem to know are the risks for their behavior, and what behaviors exist on fire grounds during overhaul activities. This dichotomy between the facts of health risks and the behavior of the firefighters, who choose to remove their respiratory protective equipment during overhaul at residential fire scenes, may occur when minimal or no smoke was noted or when simplistic portable gas meters reported that no hazardous gas conditions exist.

With this minimal reference in the fire academy textbooks to overhaul, firefighters, including those who participated in my research, may not have learned from their formal academy teaching, or they may not remember, that during post-fire extinguishment, respiratory protective equipment must be worn to eliminate health risks. All interviewed firefighters had similar comments regarding SCBA use during overhaul, such as:

"During overhaul, there isn't a whole lot of fire, there is some smoke and we don't have packs on. No SCBAs."

"SCBA. Well, they don't always wear their SCBA but they should. Sometimes it is a pretty smokey and hot job – they should have some kinds of SCBA, but they don't always."

"You know, I can't think of anything that I've ever done that's not been safe. No, that's not 100% true! I've gone in without my air pack, pulling ceilings down and stuff. You breathe in some insulation."

"I think the biggest thing in overhaul – you know, we never used to wear masks. You wasn't a big boy if you didn't go in there without a mask, but today you don't have – today you've almost got to do it because of the

toxic, all the materials in houses today, the toxic chemicals, and all that stuff when it burns."

As a result, when overhaul is discussed during academy classes, it should be mandatory that instructors stress the use of respiratory protective equipment, generally SCBA use, during the entire process of fire extinguishment, and especially during overhaul. Although the use of SCBA is taught in the academy, this learning has had little impact upon the behavior of the firefighters I observed during my study.

**Informal learning**

After fire recruits graduate from an academy, they will learn most of the needed skills for firefighting while associating with other firefighters (Careless, 2008; Goldman et al., 2009). As one fire chief stated when he congratulated a new graduate from a fire academy, "Forget everything you learned in the academy. We'll teach you what you need to know and do." This informal learning, as to what new recruits should do, is generally accomplished through training on meeting nights, through mentoring activities by experienced firefighters within the department, and by peer modeling at fire scenes (Chinnasamy, 2013). In each of these cases, when the trainers, mentors, and peers do not appropriately wear their respiratory protection during overhaul, as I have observed, the new department members model the behavior of others and learn not to wear their SCBAs during overhaul. I made this observation during numerous fire scenes and this point was stated by firefighters during our interviews, when it was stated,

"It is based upon how much smoke you can see? For the most part, yeah. And between us, kinda like, what the other guys are doing, a little."

"Three or four guys or people go in, and say, 'Yeah, we don't need a mask'."

> "Well, I mean if they are in there overhauling too, and, you know, I got my air pack on and they don't, am I going to go out when my bottle's empty? Maybe not, you know. It's kinda like, he's not dead yet, it must be OK."
>
> "I guess I'm following the herd a little bit with regards to wearing SCBA."
>
> "I think that you probably, you know, the old days of, heck, I can go in. I don't see anything that's going to kill me and no one else is coughing their lungs out, dying. I can do this."

According to Dixon (2015), Ballam (2015), and Bashoor (2018), this modeling of a deviant or unsafe activity becomes the norm for fire ground activities, including overhaul operations. As firefighters seek the end goal of their tactics, they do not minimize the potential health risks which could occur.

Even though I have seldom heard first-hand evidence of firefighters experiencing ill health at a fire scene during overhaul, I have read numerous trade journal and research articles which state the correlation between the lack of SCBA use and respiratory system illnesses. Regretfully, some firefighters have admitted to coughing after smoke exposure and to noticing soot in their nasal mucus. However, since most firefighters have not experienced ill-health effects after working during overhaul, without first-hand experience, these men tend to negate their potential health risks. As one firefighter stated "You blow your nose and that black icky goo stuff that comes out with the mucus . . .You blow your nose and there's black in it. Yeah. And that's, I guess the way it is." From the fire scenes I have observed in over thirty years of fire service experience, only one firefighter, who was undertaking overhaul operations, was required to seek medical aid at an emergency care facility due to smoke inhalation. Until some adverse

event occurs which necessitates a change, the normalization of deviance results in a behavior which does not require SCBAs to be worn during overhaul. This has the potential to bring about health risks to the firefighters who engage in overhaul tactics.

In addition to the lack of appropriate behavioral changes which should occur during overhaul, it is very difficult to practice overhaul operations. Firefighters can practice extrication, search and rescue, roof and fan ventilation, water stream placement, and engine and tanker operations, but it is nearly impossible to effectively practice overhaul activities. If home owners wish to have their property cleared of any buildings, firefighters can use these buildings for most of the exercises stated above. When one of these structures is burned at an owner's request, the goal is to leave as little unburned material as possible. As a result, firefighters do not stop the incinerating process to practice overhaul, since this would delay the total burning process or could cause difficulties in burning the entire structure. This point was included in a number of comments made during my interview process, when it was noted that,

> "How can you become experienced in overhaul? And you probably wouldn't, other than on the scene. Maybe four structure fires a year. You don't get good at fighting fires when you only do 4 biggies in a year, where you've got one room involved with flame."
>
> "Possibly the lack of practice of overhaul because we are just not able to do that anymore."
>
> "Newbies lack overhaul training. I like to double check what is going on."
>
> "We haven't had that many fires. Some people talk about hundreds; I don't think we have had a hundred fires for real."

"With sprinkler heads, only a little bit of overhaul – but literally the fire is out when we arrive."

During the time of my research, I attended nearly a dozen residential fires where home owners requested their buildings be removed through incineration. In all of these cases, no firefighter entered the structure immediately after the active burning stage in any effort to undertake overhaul. Without practice and a lack of appropriate modeling during actual residential fires, firefighters can negate the use of their respiratory equipment when it should be used. Since adults tend to learn best by doing or participating in activities (Hayden, 2009; Vaillancourt, 2009), the lack of overhaul activities does not foster appropriate opportunities to learn.

The ability to engage in overhaul practice is not possible in live-fire training facilities. One of these buildings is owned by a fire department whose personnel participated in my research. This structure is made of commercial, metal shipping containers that are stacked and partitioned to simulate rooms in a two story house. Firefighters can train in this building without damaging the structure. Although this facility is a good training tool, since it produces fire, heat, and smoke conditions, there is no possibility to practice overhaul, since the steel walls and ceilings cannot be opened in an effort to expose trapped fire, as would occur after residential fires during overhaul.

These informal education opportunities generally yield only single-loop learning, where a change in an action is the net result (Crain, 2008). Firefighters do not have appropriate learning options for overhaul, which could be offered by their leaders, mentors, and peers, that would bring about double-loop learning and behavioral changes (Argyris, 2002). In addition, due to the limited number of structures to burn, there are not adequate opportunities to practice the skills needed to develop behaviors which are safe and effective for overhaul activities.

To develop knowledge which fosters safe activities and behavior, individuals need to engage in effective training. Without effective or appropriate learning and training opportunities, there is the potential for unsafe activities or the development of unsafe behaviors, which can lead to higher health risks (Burke et al., 2011). If a fire department engages in safe tactics, due to the positive attitudes and activities of leaders, mentors, and peers, safer behaviors should develop within the fire department personnel (Bryan et al., 2009).

**Non-Formal Learning**

When individuals engage in voluntary, short-term, non-sequential, self-selected learning opportunities, these activities are termed non-formal learning (Merriam et al., 2007; Rogers, 2005; Schugurensky, 2000). This form of learning is intentionally structured, may be socially constructed, is generally not evaluated, and may contain a variety of media (Colley et al., 2002; Goldman et al., 2009). Informal learning allows students to engage in activities of their choice, which are offered at times and in locations that the students prefer (Dib, 1988).

Based on the data from the participants in this study, a number of non-formal learning experiences were noted, which were available to personnel during fire department interactions. One is the use of internet sources, which can include, but is not limited to, videos, pictures and diagrams, blogs and list-serves, and emails. Some on-line videos were used for training purposes, as the techniques of other fire department personnel were viewed, reviewed, and critiqued. This can also include the reading of trade magazines and access to on-line resources available from various fire departments. Non-formal learning, was not stressed but was noted by fire chiefs and firefighters, when they stated,

> "The media. Here's that firefighter, hundreds of other firefighters judging that picture to say, 'Gosh, they don't have SCBA on.' or 'the tank is on, but he's not wearing the face piece' so, therefore, he is getting no

protection on his lungs and his breathing facilities. That's sad, but true, you know."

"The magazines say that years later these (the lack of proper equipment) could be a problem, causing cancer."

"You know, I get all the magazines. In one, a few years ago, some guys had gotten sick that were firemen, you know, and I just couldn't --- you kind of think, well, it will never happen."

"I am concerned about his well-being as a person, as a firefighter, but what drives it the most could be that or if MI-OSHA on a Monday morning, 'I don't see protective breathing apparatus on that firefighter.' So that drives you toward safety."

"Firemen tend to watch out for each other."

Although periodicals are generally available on tables in most fire department meeting rooms, I have seldom observed anyone reading one of these magazines before, during, or after a meeting, but these magazines can be borrowed by any firefighter. Discussion of articles from these magazines are rarely initiated at meetings or during peer conversations. If department members are reading on-line content, this information has not been widely discussed, to any extent, during fire service interactions.

**The Health Belief Model**

Based upon the Health Belief Model (Janz & Becker, 1984), I was able to infer the following points which related firefighters' activities to the Health Belief Model. For some fire personnel, there may not be a perceived susceptibility to any health risk, although numerous firefighters did mention health risks during their research interviews, but the significance of these risks were not emphasized by any fire personnel. If there is no perceived health risk, based upon

their espoused actions, firefighters will not have any impetus to change activities in their theory of practice. For other firefighters, who may understand that a health risk exists due to their activities during overhaul, they may still choose to ignore any health threats in favor of implementing tactics which will eliminate a fire rekindle. Since overhaul is one of the last activities at residential fire scenes, firefighters are generally tired and want to complete their final tasks so they can leave the scene. This could lead the firefighters to develop a goal-oriented attitude as they negate thoughts of health risks.

**Perceived Susceptibility, Severity, and Threat.** By analyzing the six points within the Health Belief Model (Janz & Becker, 1984), it becomes evident that if firefighters do not acknowledge there is a susceptibility to a health risk, it is difficult for them to determine the severity of the risk. The severity can only be determined if there is susceptibility. If firefighters do perceive that a health risk exists, as some of my interviewed firefighters stated, but choose to undertake activities which could still bring about susceptibility to a risk, they will probably not acknowledge the severity of the ignored risk.

This situation of risk susceptibility and severity can be improved if firefighters are educated about what could occur with regards to their future health status. The literature on these topics are certainly available and is rather voluminous, if one seeks out the appropriate sources. Firefighters should be encouraged to gain knowledge about their health as it relates to their fire ground activities. This can come about by reading research conclusions, available literature from fire service organizations, and trade magazines.

If an educational process for and by firefighters is added to a change of attitude toward the health risk susceptibility and severity, it could bring about an acknowledgment of perceived threat to the health of firefighters. This health threat could be immediate, or it could, more likely, occur in future years. If a group of firefighters know a current or past firefighter who has

compromised health, due to his activities as a firefighter, it should lead to an acknowledgment of potential threat. From my research, no currently active firefighter or fire chief stated that they knew any former or current fire service personnel who had directly experienced health risks from his fire service activities. If susceptibility and severity are not evident or acknowledged, the threat may not be obvious. If this occurs, firefighters may be driven by the strategy to fully extinguish the fire and the need to successfully complete the tactics of overhaul to accomplish this goal rather than determining any health risk.

The perceived health threat can be eminent or could occur later. For a potential behavioral change to occur to prevent this threat, the individual must understand that without a personal or known historical ill-health event in another firefighter, the actualization of a thought regarding a threat may not exist. Even though the threat truly exists, he will not be interested in adopting any behavioral changes that might reduce the specific threat. The lack of perceived susceptibility and a lack of the perceived severity oftentimes do not allow a threat to become evident. This was noted numerous times during the firefighter interviews, when they stated,

> "Depends. It will depend on whether I believe it is safe to go in without an SCBA. It varies."
>
> "You've got your tank on, but you've got your mask hanging down – you're not wearing it, you're not utilizing the air."
>
> "We tend to get false messages, get carried along by saying, well, I don't see the smoke, my visibility is better, I'm going to take my – it's easier to breathe with my face piece off and my SCBA disengaged, so I'm going to remove it."
>
> "OK, we've got the fire out, there's no more contamination, we're just going to overhaul."

"I've snuck, I ducked in a couple houses. I could taste it for like a week or two."

"That leads back to my statement of sometimes the pack doesn't always go with you on overhaul. Should it, probably. And I am reminded of it from time to time, absolutely. It just doesn't always go with you."

Short and long-term health-risk affects need to be realized as a threat to firefighters' health, even if it is just through the literature or a past oral historical reference. Appropriate respiratory protective actions should be taken. Since many fire department do not have SOGs / SOPs which would mandate SCBA use during overhaul operations, appropriate SOGs need to be written, so that the correct actions will be required at each residential fire. The appropriate SOG, when supported by the fire chief, line officers, and all other department personnel, would give more impetus to the need for respiratory protection during overhaul at residential fire scenes.

**Perceived Benefits.** Again, without awareness of any risks of susceptibility and severity, which could lead to the threat of ill-health, it will be difficult to determine what benefits can occur. Without knowledge about or acknowledgment of a threat, it is difficult to seek benefits which would improve health status. Since many fire department members become involved in actions to complete post-extinguishment activities as effectively and efficiently as possible, and seem to be centered exclusively on these tactics, it may be difficult for other firefighters to change their activities as they attempt to improve non-obvious health benefits.

**Perceived Barriers.** For many years, since the work of Janz and Becker (1984), perceived barriers to change have been stated as the strongest predictors for implementing a behavioral modification. This is also true in the fire service. When a new recruit joins a department, there is a time when the individual probably feels that he is not an integrated member of this group of volunteers. As time progresses, the recruit learns acceptable tasks, the

fire service language, and how to fit in at the fire station and response scenes. The individual learns to become a member of a tightly bonded culture. Although this may take some time, most new members learn what they need to do appropriately, so that they will think, work, and act as others on the department. This cohesive working environment may lead to additional barriers for change. Ballam (2015) states that this is what Dixon has called "the drift into failure." Firefighters learn to mimic their peers, adopting behaviors which others model, leading to the normalization of what can be stated as the departments' norms, even if these actions reinforce deviant behavior (Ballam, 2015; Bashoor, 2018; Dixon, 2015).

To undertake safer actions on a fire scene, the individual will need to alter his behaviors from what others have done to complete specific tasks. This change may bring about some negative feelings toward, or barriers for, the person who is attempting to improve his health status, as he becomes an outlier to what is normally done by his fire department peers. He could be perceived as not being daring or not blending into the macho culture which many in the fire service revere (Crawford, 2007; Farina, 2016; Houska, 2010; Nicol, 2015b; Sendelbach, 2016a; Shepard, 1999). Since most individuals do not want to become outliers from a group, they will do what they perceive is important to become an embedded member of the fire department.

**Cue to Self-Efficacy.** Once any barriers for conformity are acknowledged, it may be difficult for the individual who wants to change his behavior to undertake this change. For an individual who has a desire for change, his self-efficacy, he needs to judge how successful he will be to bring about his goal of behavioral change. If the person believes he will not fit into the fire service culture when he attempts a specific behavior modification, he may choose not to initiate this change. For most members of the fire service, it is very important to be included in this well-established culture of prescribed norms and behaviors.

However, the need to lower health risks should be a significant motivator for change. If an individual improves the accountability for his actions, he may protect his future health status, even though his peers may not be undertaking this behavioral change. For most firefighters, who generally think altruistically, they may choose to ignore any actions which could improve their own health status, as they work for the benefit of others. They, however, do need to think about their future health status, since their medical conditions will not only affect them but may also affect their family members and friends. It is for this latter group that firefighters need to consider their actions. If firefighters choose to take risks, they need to acknowledge how any change in their health status can, ultimately, negatively affect others who are a part of their lives.

In previous years, firefighters were taught to put others before themselves and to remain quiet if something inappropriate occurred (Caspi, 2014). In an effort to break the stigma of nonconformance, a few firefighters, writers of trade magazine articles, and researchers are now discussing what cultural changes need to occur so that appropriate behavioral modifications can occur (Avsec, 2014). With the challenging of cultural norms, it is hoped that a safer fire ground will evolve, which will include the appropriate use of respiratory protection during overhaul at residential fire scenes (Nicol, 2015a; Taylor, 2016). Unfortunately, there is still some push-back from firefighters who want to maintain what has always been done in the past (Willing, 2012).

## Implication for Practice and Policy

To improve the use of respiratory protective equipment during overhaul operations at residential fire scenes, a series of inter-related activities within the fire service need to change. This succinct list would include:

1. Firefighters are trained about SCBA use in the academy. This must be stressed, and the use of gas meters needs to be explained within the actual environmental hazards of overhaul activities.

2. Firefighters are goal driven and SCBA equipment can be a hindrance to their tactics during overhaul. Firefighters need to understand the threat to their health status that can occur without SCBA use, so that the environment's susceptibility and severity during overhaul is equated into a realized threat to firefighters' health for today or in the future.
3. Fire chiefs and line officers need to insist upon SCBA use when any hazardous environment could exist. The benefit of the input, regarding SCBA use during overhaul, from these individuals within the chain of command needs to be emphasized so that there is no deviance from the written guidelines regarding hazardous environments.
4. There needs to be consistent modeling by experienced firefighters and other peers regarding SCBA use during overhaul. The current barrier, which exists when deviant behavior becomes the hazardous norm of behavior for firefighters, needs to be eliminated as all firefighters learn appropriate behaviors which their peers will model.
5. As cues to self-efficacy, firefighters need to take it upon themselves to demand that appropriate SOGs / SOPs regarding overhaul activities be written and enforced. Any fire service personnel deviating from this new standard needs to be appropriately and equitably reprimanded for their inappropriate behaviors which do not meet the standards of the department.

The first two of these items are training practices. They can be implemented via formal learning activities. The currently used textbook, *Fundamentals of Fire Fighter Skills: Evidence-Based Practices* (IAFC & NFPA, 2017), needs to be edited so there is more emphasis on the need for respiratory protective equipment, especially SCBA use, from the beginning of fire extinguishment through all phases of overhaul. A lack of smoke, ventilation efforts, and a

personal evaluation of the environment by sight or smell, or with the use of an air monitor, are not adequate measures to determine if the air quality during overhaul is clear so that SCBA use can be discontinued on the fire ground.

If an air monitoring meter is used, this device, which generally only measures one or four gases for toxic conditions, is not an adequate instrument to determine if the atmosphere is free of contaminants. According to numerous scientific studies related to fire ground environments, dozens of harmful chemicals can be present during overhaul at residential fire scenes, which are not qualifiable or quantifiable by current instrumentation available to the fire service. For this reason, firefighters must wear adequate respiratory protection during overhaul, even if the fire department's air monitoring meter indicates that conditions are acceptable. When the removal of SCBA equipment is based on only one or four contaminants' readings, respiratory protective equipment should not be removed.

In addition to having the textbook edited so that more emphasis is placed on adequate respiratory protection during overhaul operations, informal learning needs to occur within the fire service for each department. The fire chiefs and line officers should be approached so that my concerns regarding the lack of respiratory protection equipment during overhaul operations can be appropriately evaluated and adequate action taken. There should be precise behavioral guidelines which are implemented. Since research regarding overhaul activities state that the environment at this time of post-extinguishment is hazardous, with chemicals that cannot be seen, smelled, or measured with a portable gas meter, precise behaviors must be demanded of all fire personnel who are working overhaul activities after a residential fire has been extinguished.

If the leaders of the fire service, even within one area of the State, understand my concerns and take action to improve the content of the fire academy coursework, this would give support when attempting to bring changes to other fire departments. Since this order of change

may become too cumbersome, if my research is shown to have validity, I plan to initially approach the individual fire chiefs who participated in my research. In this way, I can inform them of my conclusions and how they, as leaders within their fire departments, can institute changes during overhaul operations which will improve the health status of their current or future firefighters.

Since the impact of these changes are to alter the behavior of firefighters, with adequate supervision by the fire chiefs and line officers, any fire personnel who engage in overhaul operations at fire scenes should be reminded to wear, and reprimanded if they do not wear, their appropriate respiratory protection. This single change, which could be rather simple to implement, should have a positive impact upon the health of the fire department's members. This change, since it would be mandated, would result in singe-loop learning rather than the more advantageous double-loop learning. However, any change which would bring about a behavioral modification, resulting in improved health status, would have a beneficial outcome.

There needs to be consistent modeling and enforcement of behavior by individuals who are engaged in or who supervise overhaul operations at residential fire scenes. This will reinforce positive behaviors, show new recruits the behaviors accepted and expected by the fire department, and will help to eliminate any normalization of behaviors which are not acceptable to the fire personnel on a department.

As firefighters become integrated members of their departments, since deviant behaviors are no longer tolerated, there should be more cohesion, consistency, and acceptance within the fire service personnel. This should help to eliminate feelings of being outliers, since these firefighters have learned the normative activities, know what is expected of them, and choose appropriate behavioral pathways. With the paramilitary hierarchical structure of the fire service,

this cohesion and consistency should lead to more stability and appropriate expectations within fire departments.

In an effort to assist with this change to scene operations during overhaul, I have prepared a sample Standard Operating Guideline or Procedure, which I will share with the fire chiefs who participated in my research project (Appendix E). If they find this SOG or SOP appropriate, I will gladly allow them to use the document which I prepared for my dissertation in its entirety or with modifications, which can be specific for their departments. If this document is accepted by the fire chiefs, even if specific modifications are made, this will allow the fire departments who participated in my research to have a document available to them in a short time. Since firefighters generally understand the need for SOGs or SOPs, the adoption of one more document, regarding fire ground operations, added to the fire department's binder on SOGs or SOPs, should not be problematic to any fire personnel.

Unfortunately, as early as 2002, Lamb discussed some of the same points which I have concluded from my research, but compliance to appropriate fire ground behaviors regarding overhaul operations is still lacking by many volunteer fire departments. In an effort to increase compliance and to reduce potential respiratory health risks for firefighters, I will gladly discuss my research findings. If any fire chief, especially one from the fire departments who participated in this research, requests, I will certainly do a short presentation on my research to this chief or the members of his fire department. In this way, these firefighters may better understand the rationale for the new SOG or SOP and may realize why a change in their behavior is needed during overhaul operations. As a fellow firefighter, I understand the limitations which compliance to SCBA use can cause to a firefighter, who has already worked, sometimes to near exhaustion, during fire extinguishment. These physiological problems relate to the equipment's

weight, limited visibility, resulting clumsiness, stress, and limitations on movement. However, I also understand the need for firefighters to change their behaviors during overhaul activities.

If any firefighter would like additional information on the hazardous environment which can be present during the time of overhaul, I will share any of my research documents with this individual. Fortunately, the data regarding the toxic environment which is present during residential fire scene overhaul operations is very impactful. Even an individual, who does not understand human physiology or chemical contaminants, should understand the meaning of cancer, respiratory problems, sudden cardiac death, and the potential for a permanent disability.

## Limitations of the Study

The one area for which I cannot deduce a suggestion deals with the lack of practice for overhaul activities. From my fire ground experiences, especially during overhaul, I do not know what activities could be used to simulate the actions which occur during this specific time of post-fire extinguishment. From my extensive review of pertinent fire service literature and trade service publications, I have not encountered any suggestions or equipment which could be used as a substitute for actual overhaul activities, other than the informal training, which can occur during a residential fire. There are fire personnel training towers and rooms, simulation computer programs, and articles to read on overhaul activities, but these are poor substitutes compared to the actual work of overhaul. None of these activities give firefighters or fire chiefs real-world experiences, hands-on activities, which are needed to better understand and practice overhaul (Jahn, 2011; Jolemore & Taber, 2007; Vaillancourt, 2009).

Additional limitations for this research study deal with the mechanics of the research project. As the sole researcher for this qualitative study, the observations, interview questions, their presentation, their final interpretation and analysis, and the review of the current literature were all done by one person. As a result, there may have been an unconscious bias in this

research. However, since I was an informed, participant-observer, who is competent in fire service operations, and who understands the lexicon and tactics employed by firefighters, this allowed me to have a better and potentially more appropriate understanding and perspective about these activities.

Based upon my knowledge of the fire service and my academic background, I do not believe that there were any compromises which would affect my positionality or trustworthiness regarding this research project. In addition, since I continually had approval from The Michigan State University Human Research Protection Program, my research was deemed appropriate and should not have caused any harm or complications to the individuals who participated in my project.

The eight fire chiefs and eight firefighters who participated in the interview process of my research were fewer than I had initially anticipated. Due to the limited size of my participant pool and the defined geographic area from which these participants were selected, the research implications and conclusions may not be transferable to all fire departments. However, the research conclusions may be more easily transferred to rural volunteer fire departments than to other types of departments.

Although my original research question was centered on the reason why firefighters do not comply with the fire service standard regarding the appropriate use of respiratory protection during overhaul, my conclusions were not specific to this *why* question for any individual's personal behavior choices. My research data yielded more information about the educational process of firefighters, their informal acceptance into the fire service, and their activities during overhaul. As a result, I could not thoroughly situate the *why* of their behavior choice in the Health Belief Model as I had expected.

## Recommendations for Future Research

I am hopeful that this research, which uses elements from adult learning, will add to the literature on formal, informal, and non-formal educational practices for firefighters. Although the recommendations for overhaul at residential fire operations are based on single-loop learning, with appropriate integration into the behaviors of firefighters, double-loop learning could be accomplished by fire agency personnel. Since this latter form of learning needs to be embedded in the culture, it may take time to bring about this change, but the exposure to other research, literature, and trade magazine articles could become the basis for these modifications. The idea of disconnect between the espoused theory and the theory-in-use could also be a theme which allows change in the deeper rooted cultural elements within the fire service.

Although this research did not include as many participants as was anticipated, the sample size of eight fire chiefs and eight firefighters yielded adequate data, so that conclusions were drawn and specific areas of concern were noted. A larger sample size may have been more appropriate or may have shown different connections within the research. Since the quality of the information gained in a study may be more important than the number of subjects included, the size of this project seemed to give transferability to the conclusions (Grove et al., 2015). Additional studies based upon this research could be undertaken by other individuals, which would lead to more substance on this topic, as well as potentially more conclusions.

Since conclusions have better validity in research which is repeatable and verifiable, I would suggest that other projects be conducted which use this format. Any additional research could replicate this project, could use some of the criteria as a basis for another study, or could use minor facets of this research as the foundation for a more extensive study.

A great deal of time, energy, and thought went into this research, so I hope the findings and conclusions of this dissertation will be used for additional projects. I know that I will

continue to work toward firefighter safety on fire scenes during overhaul. My immediate goals are to educate local firefighters, their line officers, fire chiefs and, potentially, township and fire board officials on the need for appropriate policies on overhaul activities. This would involve the implementation of Standard Operating Guidelines or Procedures for the fire departments who participated in this research study. My ultimate goal would be to present my research conclusions at a state or national conference. Since the conclusions which came from this research are applicable to most volunteer firefighters, this goal may certainly be obtainable.

## Conclusions

In this final chapter of my research, I summarized the study and discussed my findings, with emphasis on formal, informal, and non-formal learning. I gave suggestions for needed changes in fire ground practices and for fire department policies. I stated the limitations which developed from this study and placed some of these components within the Health Belief Model. This chapter concluded with recommendations for the possibilities of future research. I also stated my final goals for the distribution of the conclusions from this research.

APPENDICES

APPENDIX A: Consent Form: Fire Chief Interview Questions

As the fire chief for your department, you are being asked to answer a few questions about your department's personnel, equipment, and standard protocols or guidelines. The intent of this research is to determine the activities of firefighters at residential fire scenes, especially during salvage and overhaul activities and to determine how firefighters view the potential risks that could accompany such activities. To accomplish these goals, personal interviews will be conducted with firefighters who engage in salvage and overhaul activities at residential fire scenes and with the respective chiefs of the departments to which the firefighters belong.

1. Any information obtained during the interview process will be reported in the final research document so the identity of the respondent and his/her department will not be disclosed.
    A. The confidentiality of each respondent will also be protected to the maximum extent allowable by law.
    B. In addition, all interview notes and tape recordings, if applicable, will be kept by the researcher in a location that is securely locked and accessible by the researcher during the analysis of data. Any tape recordings, if applicable, will be destroyed within one month of the interview after the audio tape has been transcribed by the researcher.
    C. All data collected from this research, including the transcribed notes and consent forms but excluding the audio tapes, must be retained for a minimum of three years following closure of this project.
    D. During this three year time of retention, all research data will be transferred to the Primary Investigator for this project, Dr. John Dirkx at Michigan State University.

E. During this retention time, only the research team and the IRB (a group of people who assure that appropriate steps are taken to protect the rights and welfare of humans participating in research) will have access to the research data.

2. You are being asked to voluntarily participate in this research with me, your interviewer.
    A. If at any time, you do not feel comfortable answering a specific question or do not wish to continue with the interview, you may stop the interview in its entirety or you may ask that the flow of the interview be altered.
    B. You may also ask for clarification about the interview process or for clarification of the questions being asked.
    C. After the interview is completed, you may request that you not be directly quoted in the final report.
    D. You may also ask that any or all of your responses, even in paraphrased format, not be included in the final report.
3. Since participation in this project involves your voluntary cooperation, I do not believe that there will be any risks associated with your participation in the research interview, which should take approximately one hour of your time.
    A. I must also inform you that you will not receive any immediate or personal benefits from your participation in this research.
    B. It is hoped, however, that this individual interview and the resultant research will contribute to my better understanding of firefighters' behavior at residential fire scenes during salvage and overhaul activities.

4. To facilitate the interview process, you are being asked if your responses can be audio recorded. If you agree to this, you may still request that the terms outlined in the previous paragraphs be followed. If you agree to an audio recording, please initial at the right. _____
5. It is my hope that you will feel at ease during all phases of this interview process, so you should feel free, at any time, to ask questions about this project or the final report.
    A. If you have any concerns or questions about this study, such as scientific issues, how to do any part of it, or to report an injury (i.e. physical, psychological, social, financial, or otherwise), please contact me, Patricia Matthews, the researcher for this project. You may contact me at 2545 15 Mile Road NW in Sparta MI 49345, by calling 616-887-9291, or via email at matthewp@gvsu.edu.
    B. If you have additional questions or concerns about this research, you may contact Dr. John Dirkx, the Primary Investigator for this research project. He can be contacted by calling 517-353-8927, via email at dirkx@msu.edu, or by writing him at 419 Erickson Hall in East Lansing MI 48824.
    C. If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or email irb@msu.edu or regular mail at 207 Olds Hall, MSU, East Lansing, MI 48824.

If you agree to participate in this research and if you agree to these terms, please sign and date this consent form in the area indicated below.

I, _____ voluntarily agree to participate in this research study.
(Please print your name)

_____ Date _____

_____ Date _____
(Project Researcher)

APPENDIX B: Consent Form: Firefighter Interview Questions

As a result of the activities that you engage in during residential fire ground operations, your fire chief has identified you as an individual who participates in salvage and overhaul activities. If you believe that this is an activity that you engage in while working on the fire ground, you are being asked to participate in a brief one-to-one personal interview for a project that is being conducted through Michigan State University's College of Education. The intent of this research is to determine the activities of firefighters at residential fire scenes, especially during salvage and overhaul activities and to determine how firefighters view the potential risks that could accompany such activities.

1. To accomplish these goals, personal interviews will be conducted with firefighters who engage in salvage and overhaul activities at residential fire scenes and with the respective chiefs of the departments to which the firefighters belong.
    A. The answers given to the questions and any other information gathered during the interview process will be reported in the results of the research, but the identity of the respondent and his/her department will not be disclosed.
    B. Any information obtained during the interview process will be reported so the identity of the respondent and his/her department will not be identifiable.
    C. The confidentiality of each respondent will also be protected to the maximum extent allowable by law.
    D. In addition, all interview notes and tape recordings, if applicable, will be kept by the researcher in a location that is securely locked and accessible by the researcher during the analysis of data.
    E. Any tape recordings, if applicable, will be destroyed within one month of the interview after the audio tape has been transcribed by the researcher.

2. All data collected from this research, including the transcribed notes and consent forms but excluding the audio tapes, must be retained for a minimum of three years following closure of this project.
    A. During this three year time of retention, all research data will be transferred to the Primary Investigator for this project, Dr. John Dirkx at Michigan State University.
    B. During this retention time, only the research team and the IRB (a group of people who assure that appropriate steps are taken to protect the rights and welfare of humans participating in research) will have access to the research data.
3. You are being asked to voluntarily participate in this research with me, your interviewer.
    A. If at any time, you do not feel comfortable answering a specific question or do not wish to continue in the dialogue, you may stop the interview in its entirety or you may ask that the flow of the interview be altered.
    B. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled and you may discontinue your participation at any time.
    C. You may also ask for clarification about the interview process or for clarification of the questions being asked.
    D. After the interview is completed, you may request that you not be directly quoted in the final report.
    E. You may also ask that any or all of your responses, even in a paraphrased format, not be included in the final report.

4. Since participation in this project involves your voluntary cooperation, I do not believe that there will be any risks associated with your participation in the research interview, which should take approximately one hour of your time.
    A. I must also inform you that you will not receive any immediate or personal benefits from your participation in this research.
    B. It is hoped, however, that this individual interview and the resultant research will contribute to my better understanding of firefighters' behavior at residential fire scenes during salvage and overhaul activities.
5. To facilitate the interview process, you are being asked if your responses can be audio recorded. If you agree to this, you may still request that the terms outlined in the paragraphs above be followed. If you agree to an audio recording, please initial at the right. _____
6. It is my hope that you will feel at ease during all phases of this interview process, so you are free, at any time, to ask questions about this project or the final report.
    A. If you have any concerns or questions about this study, such as scientific issues, how to do any part of it, or to report an injury (i.e. physical, psychological, social, financial, or otherwise), please contact me, Patricia Matthews, the researcher for this project. You may contact me at 2545 15 Mile Road NW in Sparta MI 49345, by calling 616-887-9291, or via email at matthewp@gvsu.edu
    B. You may also contact Dr. John Dirkx, the Primary Investigator for this research project. He can be contacted by calling 517-353-8927, via email at dirkx@msu.edu, or by writing him at 419 Erickson Hall in East Lansing MI 48824.

7. If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or email irb@msu.edu or regular mail at 207 Olds Hall, MSU, East Lansing, MI 48824.

If you agree to participate in this research and if you agree to these terms, please sign and date this consent form in the area indicated below.

I, _____ voluntarily agree to participate in this research study.
(Please print your name)

_____ Date _____

_____ Date _____
(Project Researcher)

APPENDIX C: Fire Chiefs' Responses to the Research Questions

This is a selection of the collective responses made by the eight fire chiefs, which have been divided into two categories, for full-time fire chiefs (C, D, E, R, and Y) and for part-time fire chiefs (F, H, and M), as they answered the thirteen open-ended questions which were a portion of my research protocol. The questions were asked at the fire chiefs' home departments in an area of the station which allowed privacy and eliminated the potential for interruption. In this environment, I hoped to establish an atmosphere where the interviewee would feel comfortable. Based upon each fire chief's responses to the questions, the manner in which the responses were stated, and the over-all body language of each participant, I believe that each interviewee did feel at ease throughout the entire interview.

***Research Question #1***: Please explain to me what your department's firefighters do during overhaul activities at residential fire scenes.

All of the fire chiefs gave similar answers, in that overhaul is a "search for extension of fire, hot spots, to extinguish those."

*Responses from five full-time fire chiefs.*

"It is a time when the firefighters assume that the fire has been extinguished, but there is a need to 'open walls and ceilings, check for structural integrity'."

"The worst thing that can possibly happen to any department is to go back on a rekindle."

"Firefighters will use a variety of tools to open things up, including 'hand tools, closet hooks, axes, pick axe, pike poles, halligan tool'."

"SCBA. Well, they don't always wear their SCBA but they should.

Sometimes it is a pretty smoky and hot job – they should have some kind of SCBA, but they don't always."

"We have people that we've trained and are good at it, and go in and once it's out, you know, go in, and they'll kind of show me what started and what transpired."

*Responses from three part-time fire chiefs.*

"We use many tools, 'hand tools, pike poles, axes, pick axe, halligan tool'."

"Just to keep going, to continuously going back through, which I know sometimes it seems like, why do we have to do this again?"

"We haven't had that many fires. Some people talk about hundreds; I don't think we have had a hundred fires for real."

***Research Question #2***: As the incident commander at a residential fire scene, do you generally enter the structure during overhaul activities? If so, what is your role at this time of fire ground operations?

*Responses from five full-time fire chiefs.*

"We started a ventilation process, anxious to put our feet onto the . . . within the structure itself to get a little gander to say OK, exactly where is the problems; initiating the salvage and overhaul process."

"Yes, to see what has gone on – either wrong or right, to make sure the job is being done well; important with new firefighters who have not done this (overhaul) before. Newbies lack overhaul training. I like to double check what is going on. I also take pictures."

"I normally do, yes. It's not that I do not trust the people or I do not

second guess the decisions they have made, but I feel that one more set of eyes, to get back to the rekindle phase, you know. It's just one more set of eyes."

"Well, the overhaul person at that point unless it is a given what the cause, you know, the origin was, you know, I am looking for things like that; or possibly if I've already interviewed the property owner or occupant of the dwelling. It's not that I don't trust people but, you have to have some level of trust but, it's always in the back of my mind, I don't care, are they trying to blow sunshine up my butt. You know, I guess I've become a little calloused to people."

"I try to remain outside where I can watch everything, and do the command job."

*Responses from three part-time fire chiefs.*

"I would say probably not at the very first part of overhaul. Probably, every one that I do, eventually get in it."

"Look through a picture window, walk in through the front door; get a knockdown, fire 90% - plus under control."

"Making sure that things are going on that are supposed to be going on, and there are people doing their jobs inside and out."

***Research Question #3***: What personal protective equipment (PPE) is generally used by the firefighters of your department at residential fire scenes? In your opinion, what PPE do you believe may be underutilized at residential fire scenes?

*Responses from five full-time fire chiefs.*

"We use bunkers, coats, all turnout gear. SCBA. Standard turnout gear, boots, gloves. SCBAs."

"We just paid $3875 each. We bought a spare tank with each one."

"Probably air packs. Well, I think sometimes we tend to take them off too early and we get into the smoke or not put them on. There are people working on the outside who go in and out in the smoke cloud at the fire ground who don't have them on."

"Probably lack of a feeling of a need for them. Kind of a mindset that we have. Basically, if you can see across a room, it's probably not that bad."

"Safe is determined . . . when the smoke is gone, use fans to ventilate the room or structure."

"Probably have enough turnout SCBA and breathing protection (26 sets of full SCBA) for those who are going to be directly, actively involved with the fire suppression task."

"Where we tend to want to remove the SCBA once the ventilation is underway. Our firefighters and some of our leadership want to remove the SCBA and start breathing standard air in the atmosphere – which, as we know, may be an endangerment to our human selves."

"We have light tanks, I don't think the weight is an issue on any of the firefighters. It fits very comfortably on your back; and, yeah, after 25 minutes, if it is me, with a lightweight run, I'm ready to take the thing off again."

"I would definitely say the SCBA because they most generally have

their full turnout gear as far as their jacket and pants and boots and helmet. Everything is on, except the SCBA."

*Responses from three part-time fire chiefs.*

"Turnout gear. SCBA."

"I think that probably, you know, the old days of, heck, I can go in. I don't see anything that's going to kill me and no one else is coughing their lungs out, dying. I can do this."

"There's a light haze in there. It's probably more critical now-a-days to put on proper protection than anything, any days. I think the SCBAs is probably the most, the most . . ."

"The attire: pants, coats, boots, gloves, helmets, hoods, full PPE."

"SCBAs are heavy, they limit visibility. The guys are already tired, so they want to take them off. The guys may remove it as soon as it is safe."

"Doing more of a physical type work, so your breathing rate is faster. There is some opposition to your breathing through SCBA because of exhalation valves. I want to get more air in so, therefore, I am going to release that face piece and I am just going to breathe the outside air. Since it doesn't smell bad, I don't immediately cough from it, and I know my fans are pushing fresh air in, I am under the belief that this is an OK thing to do. This has been kind of tradition, not only with our department, but I'm sure with many, many departments."

"An approved SCBA unit; they have full turnout gear."

"Weight and the bulkiness of an SCBA; able to function a lot easier

without getting so tired."

***Research Question #4***. What equipment do your department's firefighters generally really use during overhaul operations?

*Responses from five full-time fire chiefs.*

"Closet hooks, pikes, axes, halligan."

"Positive pressure (ventilation), PPV, is very predominant."

"Getting ventilation started up so that we can get those products of combustion blasted out of that structure by the use of forcible air."

"Ventilation fans, closet hooks, pike poles, hoses, camera (thermal imaging), and digital for pictures."

"Only a CO, carbon monoxide, meter, but not one of the combination gas readers."

"Generally, they are completely in all of their PPE, except for possibly their air packs."

*Responses from three part-time fire chiefs.*

"Pike pole, pick axe, or axe, halligan."

"Visibility. And if they do take the air pack off a little early, that gives them at least a little better shot of what we call fresh air from the outside. I'm not saying that it's right or wrong, we are just saying that's the way it is."

"Fans, hand tools, pike poles, closet hooks, stuff like that."

"Pike poles, shovel, pitch fork, depending upon the situation, sometimes shovels, thermal imaging camera and, of course, nozzle, water, tarps."

***Research Question #5***. What current or future health risks do you believe might exist for you or your department's firefighters because of their activities at residential fire scenes during overhaul operations?

*Responses from five full-time fire chiefs.*

"Normal strains and sprains. Respiratory is my biggest concern. Yeah."

"Well, I suppose that they could be exposed to some toxic chemicals that may be a carcinogen or create respiratory or lung problems at some point in the future. Whatever other things, I suppose, heart disease or something attributed to exposure to chemicals and such."

"My heart attack is the only thing I can think of"

"Fractures, sprains, strains, burns, temperature burns."

"I think the firefighters and incident commanders, we get that false sense to say, well, the fire is knocked down, we've got windows opened up, we've got air shoving in here, yeah, we've got water dripping all over the place, but it's probably safe enough for me as an incident commander to take the 20 foot walk and go into that structure and take a little peek, and turn around and walk back."

"You've got your tank on, but you've got your mask hanging down – you're not wearing it, you're not utilizing the air."

"You get that false feeling that you are breathing good air and, you know, well, what's 2 to 3 minutes of bad air."

"There still may be toxic materials that we are ingesting, breathing in our systems."

"Exposure to the gases that are still in the structure, if they don't have an SCBA on. It could be – definitely would be a health risk down the road – but we don't know when. Heart attack. You think of a heart attack during the fighting of the fire, but it can happen pretty easily during overhaul. That's a little more strenuous sometimes than fighting the fire."

*Responses from three part-time fire chiefs.*

"Probably respiratory. I don't know. I don't have any problems, and I don't know of anybody who is. That's probably the worse, to me. That's the biggest concern."

"We've been fairly injury free."

"We tend to get false messages, get carried along by saying, well, I don't see the smoke, my visibility is better, I'm going to take my . . . it's easier to breathe with my face piece off and my SCBA disengaged, so I'm going to remove that."

"It's there, and most firefighters, we're not really taught, we're not disciplined enough to say – some departments are. They actually do readings before they say OK, you can take the air pack off."

"Let's get this SCBA off and get this off my back."

"Fall down through a floor; partial building collapse."

"The risk of injury from stepping on a nail, broken glass, minor injuries, the roof could collapse, a hole in the floor that they would fall through."

"Some of the older ones – would maybe go work the overhaul. They are probably going to be going in to see what's going on. Maybe not overhaul, but to see what's going on."

***Research Question #6.*** What, if any, are your priorities for acquiring new or different personal protective equipment (PPE) now or in the future for your department's firefighters?

*Responses from five full-time fire chiefs.*

"I would like to see our SCBAs, with the new mask with the new safety pack – integrated PASS. So I would say that for SCBAs, would be to keep those updated to the best that we can afford. Money is the big thing. The pack is $900 apiece (used), were like a $2800 setup, isn't the cheapest one, er, isn't the best one you can buy. Those high pressure with the little tank, they are probably $3500."

"Has a built in PASS system. They actually have received their own face piece. Some have the special optical accessory or option made specifically to fit within that face piece."

"Most everybody has fit tested to the medium or large size, and that's what we carry pretty much on all the pumper trucks. Some are not fit testing because they have the optical lens specialty inside (their masks). We are very cognizant that the units, after they're used, need to go through a cleansing / cleaning process, and we do that quite faithfully."

"We've got the SCBAs, we've got to utilize using them. $4500 to $5000 for SCBA, one tank, harness, mask. The carbon fiber bottles they're like $1200 to $1300 a bottle; much lighter."

"Yeah, communication; we've got speaker mics. Still it sucks, excuse my language. It sounds like you are speaking in a tin can."

"Most of the fire chiefs have been there, come up through the ranks, so they pretty know what is going on."

"New air packs; 24 on the department and 20 sets of bunker gear, new helmets; a nice grant! $130,000 and we had to put in 10% with it."

*Responses from three part-time fire chiefs.*

"We now have 13 packs, so everyone that is qualified to enter the fire should have one. Everyone will have their own face mask. Fit testing, it was $25 a head, I'm going to say $600 to $800 for everyone."

"Our budget is limited, but the community is generous. $1500 to $2000 per man for gear. Keep buying and replacing our SCBAs. We need lighter weight models and more bottles with better volume."

"It's like the old days, before they did the nomex, knew that it was time to get out (due to the heat). Nowadays, with the nomex hoods, I think that you can stay in too long. Carbon fiber tanks, where is the fatigue? You know, the aluminum tanks that we have, a couple of tanks, you know, and you're tired. You're wooped, which maybe isn't so bad. Carbon tanks are that much lighter weight; allowing you to, maybe, do too much."

"The standard tank, 20 to 30 minutes. The weight. Some people can put one on and not be influenced by it at all."

***Research Question #7***. In your opinion, what are the currently available or emerging innovations that would be most beneficial for increasing the protection of your department's firefighters' current or future health status?

*Responses from five full-time fire chiefs.*

"Buddy breathers on them, RIT. In the RIT bags we bought $2600, so that's a lot of money"

"I think seatbelt use. We really been hammering on this past year. It's been tough. They've been used to not wearing a seatbelt in a firetruck. We're not going to kill a firefighter over the few seconds you save putting that air pack on."

"Probably the cameras, thermal imaging."

"Turnouts, on average, maybe $1500 a set, plus $100 helmet, a couple hundred dollars for boots, and $40, $50 for gloves. They are making the equipment too good."

"Thermal imaging camera, accountability tracking, education about structures, proper ventilation techniques."

"Knowledge is important."

"The thermal imagers are smaller and lighter, fans are cordless and more portable."

"Eye protection, goggles."

"Survivair, heads-up display"

"The infrared camera. It's a marvelous tool, finding those hotspots in overhaul."

"Definitely could be some issues there with health hazards; played a factor on my hearing."

*Responses from three part-time fire chiefs.*

"We don't run a lot of structure fires."

"It's all geared around firefighter safety."

"A better form of communication with the people that are in the fire."

"A set of big glasses, or whatever, the frames in their shield."

"Lighter weight, high-pressure tanks; fatigue-wise, they are better yet than the new ones that we've got."

***Research Question #8.*** If your fire department has a policy or a standard operating procedure or guideline (SOP or SOG), which addresses salvage and overhaul operations at a residential fire scene, would you tell me what it recommends?

*Responses from five full-time fire chiefs.*

"We have one, yeah. It's in our book, but I guess I would have to . . we would have to look at it and see what it says. It probably says wear your SCBA. There's something to investigate someday."

"The department does not have one, not one that is specific for S/O (salvage and overhaul). The SOGs need to be updated, nearly continually. Some are older than they should be. For the township and the lawyers, we should keep them updated. A cooperative effort within the department and its officers and through cooperation to see what others are doing."

"Proper ventilation. When it is smoky, fans need to be used to clear the air and bring in new, cleaner air."

"You're supposed to have your turnout gear on, unless you're in anyway in any type of harm at all, I don't know if it's necessary to, that they have their coats on."

"It probably would be an excellent idea to have one. It's something to do someday."

*Responses from three part-time fire chiefs.*

"I guess I can't comment on that. I don't know exactly what it says."

"Nothing in writing. Usually 2 (bottles) on one person as a max. We don't have a lot of that in writing."

"We need to watch for hazardous environments."

***Research Question #9.*** If your fire department has a policy or guideline (SOP or SOG) that addresses what equipment can or should be utilized during overhaul operations at a residential fire scene, would you tell me what it recommends?

*Responses from five full-time fire chiefs.*

"I don't think that we have anything."

"I guess I can't comment on that. I don't know exactly what it says. We have one."

"Yeah. It's in our book, but I guess I would have to . . . we would have to look at it and see what it says. It probably says wear your SCBA."

"I have no idea."

"I might be in the office or somewhere in the station. I'm not aware."

*Responses from three part-time fire chiefs.*

"I don't think that we have a policy. No written policy. Yeah, use whatever, you know . . what the IC directs."

"No SOG specific for this."

"There's something to investigate someday."

***Research Question #10.*** (To be asked if the answer to Question #8 was negative.) If your department does not have a policy or guideline (SOP or SOG) that addresses overhaul activities and, as you previously stated, you believe that there are inherent risks during this time of fire ground activities, what might you suggest to improve this situation?

*Responses from five full-time fire chiefs.*

"Most departments need to work on ventilation earlier; makes it easier to see; with better visibility, the environment is safer."

"Probably develop a policy, the obvious thing. Then make certain that the policy is adhered to. Probably something that needs to go into the policy is the continued use of SCBA or air monitoring."

"A lot of SOPs. Yeah, we cover quite a lot of stuff, but not everything."

*Responses from three part-time fire chiefs.*

"CO detector is the only air monitor"

***Research Question #11.*** Does your department currently have a training program that addresses the health risks that could be incurred while working at a residential fire scene during overhaul activities?

*Responses from five full-time fire chiefs.*

"No, we haven't."

"Nothing specific for S/O particularly."

"The magazines say that years later these could be a problem, causing cancer."

"Being sure that when you go in, your PPE, your coat is all buttoned, your collars on, SCBAs on, your helmets on; it's all put together correctly."

"We do emphasize that you continue to wear SCBA even after the fire had been extinguished."

"I am concerned about his well-being as a person, as a firefighter, but what drives it the most could be that or if MI-OSHA on a Monday morning, 'I don't see protective breathing apparatus on that firefighter'. So that drives you toward safety."

"When I seldom put on SCBA because I am more off into a distance. If you are near that fire, if you are near the flames and smoke, you'd better have SCBA on."

"The media. Here's that firefighter, hundreds of other firefighters judging that picture to say, "Gosh, they don't have SCBA on," or "the tank is on, but he's not wearing the face piece, so, therefore, he is getting no protect-tion on his lungs and his breathing facilities. That's sad, but true, you know."

"We won't get the 6 or 10 officers there to oversee an overhaul operation. I don't have that experienced captain or lieutenant looking over the new firefighter with an axe in his hand to say, 'open this wall up, I think we have fire extending in this wall'. And it's based on experience and judg-ment. But you're right also from the fact that we're not."

"With sprinkler heads, only a little bit of overhaul – but literally the fire is out when we arrive."

"Sometimes my answer to bad overhaul is to put the whirlybird sprinkler on the top of the rook line and just let it slowly penetrate water through the whole thing, and then come back in 24 hours and shut the water off."

"I don't think we've ever addressed that in our in-house training. When they go through fire school it definitely is something that is talked about. It definitely is something that we could add."

*Responses from three part-time fire chiefs.*

"We train on pump practice, extrication, search and rescue, CEUs, and medical training. Training is not always well attended, as it should be. The department needs to train regularly."

"Getting lost inside is the first thing we're going to deal with."

"Because I guess I look at SOG function. I am a little bit from the old school that says, well, if I am wearing breathing protection or if I've got positive ventilation going, and the top of the roof is burned open anyways, then the likeliness of our firefighters ingesting, if you will, or breathing in a lot of debris, even though we know when we go outside and grab a tissue and blow our nose, we say, 'Oh, my goodness, look at all the debris; yeah, gook'."

"Yep, the air piece is dangling or they are not wearing it."

"20 years ago we did it that way."

"Possibly the lack of practice of overhaul because we are just not able to do that anymore."

"How can you become experienced in overhaul? And you probably wouldn't, other than on the scene. Maybe 4 structure fires a year. You don't get good at fighting fires when you only do 4 biggies in a year, where you've got one room involved with flame."

***Research Question #12.*** Do you have any concerns or comments that have not been discussed during this interview process that you would like to mention at this time?

*Responses from five full-time fire chiefs.*

"A baseline blood test, have your blood drawn and checked, and you could see if you basically have anything in your blood that shouldn't be there now. They said there were basically no hazardous chemicals in that building, but there were."

"That's the hardest part, is the command, to stand outside. If you've got good people and they can feed the right information."

*Responses from three part-time fire chiefs.*

"I think it's just a comment, it is very good that somebody like this is doing this, just to wake you up on, yeah, overhaul. Overhaul is basically a stepchild of the fire service, an orphan. It's something we do, you know you've got to do it, but you don't look at it as a hazard; you've got the fire out. But the gases are still there."

***Research Question #13.*** Is there any other information or particular subject that you would like to discuss or any question that you would like to ask? If so, please feel free to ask any questions or to make any comments that you feel appropriate.

*Responses from five full-time fire chiefs.*

"Will you let me know the outcome of your study?"

"Generally we have everything to do overhaul safely. It's there. If we can fight a fire, we can do overhaul and do it safely. And yeah . . . we do, we definitely . . and not just overhaul but investigation too. If you are going to go in there when it's – even if it isn't hot, it's not a real safe scene to go in there and investigate it, even the next day. And how many days after a fire can you still smell stuff? What have you released in that fire, you know, besides

smoke? Yeah, there's chemicals you release. So, yeah. I don't have anything more."

*Responses from three part-time fire chiefs.*

"I think it is excellent, you know. Something is needed in fire service, definitely. Anything that can help us be safer."

APPENDIX D: Firefighters' Responses to the Research Questions

This is a selection of the collective responses made by the eight firefighters as they answered the nineteen open-ended questions which were a portion of my research protocol. The questions were asked at the firefighters' home departments in an area of the station which allowed privacy and eliminated the potential for interruption. In this environment, I hoped to establish an atmosphere where the interviewee would feel comfortable. Based upon each firefighter's responses to the questions, the manner in which the responses were stated, and the over-all body language of each participant, I believe that each interviewee did feel at ease throughout the entire interview.

***Research Question #1.*** Would you please tell me a little about your family, where you grew up, where you went to school, where you currently work, etc.?

"Grew up locally. Married and have three children. Volunteer employee, paid on-call fireman for current fire department for 11 years, and 2.5 years with another department."

"OK. I am married, I have three kids, six grandchildren – two greats. I grew up locally, lived here all my life."

"I grew up in another area, lived elsewhere until ----, when I moved to Michigan."

"I was in the Marine Corps in ----. Got my GED through the Marine Corps. Joined when I was seventeen years old. I was going into eleventh grade in high school. That's pretty much it for education."

"I am the third of four children. I grew up locally and have been here all my life. I have three boys."

"I was born and educated in Michigan. I lived in a number of

communities, one in a mid-Michigan resort area. I lived out of state for a while and moved back to Michigan. I am married have three children, and one grandchild."

***Research Question #2.*** Can you tell me about your history within the fire service: You may wish to discuss such topics as, but the list is not limited to, when and why you joined the fire department, when and how you were trained to be a firefighter, and your primary tasks at fire scenes?

"I have been with the department for ten years. I joined to have something in common with my older brother. It would bring us closer together as brothers."

"I went through firefighter I and through MFR training. On scenes, I like to feel that I can do pretty much whatever is required. I can fit in."

"It was probably within a year that I went through the firefighter school."

"I joined in ----, under a lot of thought and consideration. I probably took about three to four months before I ever made the decision."

"I had an ex-brother-in-law on the department at the time I joined."

"I took my firefighter I class and then I took firefighter II class four or five years ago. Then my first responder."

"I guess I wouldn't be here if I didn't enjoy it."

"Sometimes I think I'd just as soon go back and play, you know."

"I wanted to give back to the community."

"I do like the comradery."

"We had some people that were engineers, some older guys,

and I got hooked up with a couple of them."

"I try to leave with an engine, size up for an attack, my primary task is performing an interior attack."

"I got in when I was 21. My boss at the time was on the department and they were looking for people and I thought, well, I'll try it. It sounded, something, interesting. As the years went on, I just got more into it and really enjoyed it. I really do."

"I've got probably pretty close to 40 years. Then we had to go to training which was only 66 hours. We had practical and we did have an exam, the majority of it was more practical. One to two nights a week plus Saturday."

"I've been a lieutenant and I've been a captain."

"I did my share of grunt work. And I'm not scared to do it now. I mean, if I have to, I will."

"I've been through three of four chiefs now."

"If you've got a good group it makes it a little easier."

"I shouldn't say drawbacks, but there's a lot of issues. The biggest thing that I say if you're going to be a firefighter, if you're married, the biggest thing you've got to do is make sure your wife, or your spouse if you're a gal, vice versa, that they are behind you and understand. There's going to be times you're going to have to leave, whether you want to or not. I've got called away from birthday parties and all that, you know."

"I always wanted to be on a volunteer fire department. It took me five years to finally get on. I took firefighter I and II."

"Entry level fireman. I love going inside. I like to be in the action. I

like to be in the heat of the battle. I'm not a watcher, I'm a doer."

***Research Question #3.*** Would you also tell me if any other member of your immediate family is or has been a member of the fire service? If so, who is/was the individual and when, where, and for how long was he/she in the fire service?

"My ex-brother-in-law, but not someone close."

"My father. I thought it was pretty cool. He had a little red light in his glove box of his truck."

"My older brother for twelve years and my little brother for three years."

"My son was on the same department as I for a short time, before he moved out of the area."

***Research Question #4.*** Your fire department chief mentioned that you participate in overhaul activities after a residential fire has been extinguished. Can you tell me what you do during these activities?

"Overhaul, in my mind, is the dangerous part of the fire; it's over"

"Overhaul – checking for extensions."

"Overhaul, I like to look for a cause, do a little bit of investigating. Look, investigate."

"Help throw stuff out or go in."

"Kind of oversee the whole project. Overseer of the overhaul and stuff like that."

"We have people that we've trained and are good at it, and go in and

once it's out, you know, go in and they'll kind of show me what started and what transpired."

"Overhaul is to go in, extinguish the hot spots."

"You know, they ask me if it's OK before we leave because I haven't been wrong yet, you know, on whether or not the fire have been extinguished. I know the difference between steam and smoke."

"Just that gut feeling that it wasn't right. Yep. Well, I could smell it."

"It's smell, feeling, smelling."

***Research Question #5.*** During this stage of fire ground activity (overhaul), what equipment do you utilize and why is it used?

"Tarps. Overhaul. Flashlights, halligan bars, saws and hooks, pike poles, hose. Little foam pack. Use a K-12 to cut a hole in the wall."

"Tarps, picks, axes, and stuff, pike poles."

"Pile poles, Thermal imager."

"Pike poles, axes, shovels, sometimes depending, pitch forks, yard rake, a variety of hand tools."

"A small hand line, ventilation fans if there is a lot of smoke in the room or in the house or in the whatever to get the smoke out."

***Research Question #6.*** Have you or anyone who you directly know ever been injured while doing overhaul activities at a residential fire scene? If so, in what way did the injury or injuries occur?

"No."

"I cannot say that I know of anyone, that I can think of, who has

been injured during overhaul."

"Maybe burnt on the back of the neck."

"We have guys who listen, fortunately. Your officers are probably the worst (to do unsafe things)."

"They've got cut. Really have never had anybody, any major, you know – maybe somebody is overcome by smoke or something like that. A couple of guys fall through the floor."

"I'm thinking, I'm thinking hard, so the answer must be no."

***Research Question #7.*** In your view, what are the activities and/or situations that the firefighters in your department engage in when they are at the greatest risk for injury or illness? Why do you believe that these are risky situations?

"Obviously, firefighting isn't a safe business to be in, you know."

"I don't think that overhaul is that risky."

"One of the risks is not to go in."

"Two guys went to the top of the stairs and they had one of that, I don't know what you call it . . . backdraft explosion?"

"Interior attack."

"Interior attacks, or an interior search and rescue, you can't see a thing and you don't know where the fire's at."

"Ventilation could be pretty tricky on a snowy roof."

"To sum it all up, really, the initial probably ten to fifteen minutes on a scene would be the potential for the most injury or illness is probably right there."

"When I said the old school, and the hero, if you wore a mask you,

you know, basically . . . we didn't have, I don't think, near the toxic. We had some, but today it is just unreal."

"So I think, as far as my health is concerned, it is a risk to my health that I am willing to take, that is, to be in the fire service because of the experiences that I have had and how those experiences have made me feel."

"Anything could happen. Do I like to think about, if I go into this burning building . . . no! I'm not going to think about that. I'm going to go and rely on the training that I've had and the people that are there backing me up to make sure that we all come out of there without any injuries or without anything that will be debilitating or a hindrance to us in our future."

"Again, it kinda depends on what's in the house. How much smoke is in the house. If the windows are all out and there's a nice breeze blowing through, then maybe not."

"If it's still on your back, and it gets a little smoky in there or what-ever, then yeah."

"It is based upon how much smoke you can see? For the most part, yeah. And between us, kinda like, what the other guys are doing, a little."

"Well, I mean if they are in there overhauling too, and, you know, I got my air pack on and they don't, am I going to go out when my bottle's empty? Maybe not, you know. It's kinda like, he's not dead yet, it must be OK."

"I guess I'm following the herd a little bit with regards to wearing SCBA."

"What it comes down to, probably, the biggest thing, is the smoke.

If the smoke's gone, nah."

***Research Question #8.*** In your everyday life, do you engage in any activities that you would consider to be risky behaviors? If so, please explain.

"Other risky behaviors, I don't think so. I'm pretty mellow."

"I hunt and fish. I cannot think of too many risk factors in that."

"No risky behaviors."

"Risky behaviors? I do electrical work."

"Run into a burning building. It's an adrenalin rush."

"I don't even drive my car too fast, unless I am responding to a call. Then, I guess I can be a little risky."

***Research Question #9.*** In general, what risks to your current or future health do you believe might exist during overhaul activities at a residential fire scene?

"There is so much of this stuff in the houses today that's toxic."

"I've snuck. I ducked in a couple houses. I could taste it for like a week or two."

"There's a potential of lung problems, I guess. You really don't know what has burned sometimes and depending upon the concentration of gases or smoke in the residence that are left over, you might, it may seem fine at that time and yet there may be residual effects that come up later on that are unforeseen difficulties that, rather than lugging an air pack around while you're trying to pick through piles of burned out stuff, you don't."

"The biggest thing that I would worry about would be some sort of lung problem from whatever smoke or chemicals, houses, cars, cars are terrible."

"Breathing in some of the smoke that you breathe in."

"I think the biggest thing in overhaul – you know, we never used to wear masks. You wasn't a big boy if you didn't go in there without a mask, but today you don't have – today, you've almost got to do it because of the toxic, all the materials in houses today, the toxic chemicals, and all that stuff when it burns."

"I think not wearing my SCBA. We feel that the danger is over. I think we get complacent and if we don't get a little smoky or breathe a little smoke we're not firemen."

"During overhaul, there isn't a whole lot of fire, there is some smoke and we don't have packs on. No SCBAs."

"You don't know if they have asbestos lining their pipes or asbestos in the glue that holds their tile on the floor."

"I think you could still end up going in, and I mean the air smelled good and everything smelled good, but I think there's the possibility you could pick up something maybe 15 to 20 years later that might affect your health."

"Very different than what it was years and years ago. Yeah, yeah."

"To be cool. Overhaul, if there is any, any type of smoke, I think we still should have our SCBAs on."

"Even if we're tired and it's uncomfortable, and we're wore out, I still think we should have them on."

"There are too many toxins in these homes today."

"My back gets a little achy, so it's uncomfortable. I think I can just

take it off because I can. If I was ordered to leave it on, I would leave it on. It's that plain and simple."

"If my IC (incident commander) would say, 'don't take your mask off,' I wouldn't take it off."

"I think we are a little lax in areas when it comes to overhaul."

"The officers need to step up more and say 'hey, get your pack back on if you're going back in there. It's not clear yet. We haven't ventilated, it is not all out. Packs on'."

***Research Question #10.*** Would you elaborate upon the activities that you personally engage in during overhaul operations at a residential fire scene that you believe might be unsafe?

"Maybe going off on overhaul by myself. Maybe trying to do something on my own. It's a good question."

"Basically, it's a risky business, but my own safety comes first."

"By the time you are doing overhaul, you're usually pretty tired. Might slip and fall."

"I'm from the old school. And it's not because I'm a hero, because I don't wear the mask. I have did it a few times without a mask – to either go in and look or maybe they partly got it knocked down. I'd go in there, and I shouldn't be in there, but I am. I think that's a risk that I just gotta work myself not to do."

"Has their SCBA on, that's basically what we require, until we feel comfortable that everything is fine."

"We've got that gas detector, but I think – when it's completely out,

and I don't know, I guess we use mainly our nose to smell. If we feel – and I think some of it we look and see what's in there."

"More or less our eyes and nose, I guess, it's basically how we feel."

"They haven't had the SCBAs, we felt it was safe, and all of a sudden somebody said, 'God, I don't think it's safe! Let's get our masks back on'."

"You know, I can't think of anything that I've ever done that's not been safe. No, that's not 100% true! I've gone in without my air pack, pulling ceilings down and stuff. You breathe in some insulation."

"I honestly can't think about a whole lot more aside from probably the air pack stuff."

"The biggest danger part, like I said right at the beginning, is over with when you're at overhaul, you're just trying to clean up a little bit and make sure everything's out so you can go home."

***Research Question #11.*** In what ways do you believe that working as a firefighter can affect your current or your future health status?

"Inhalation. I think you could run in to some stuff that you aren't even aware of – maybe absorb it through your skin. Somewhere, later, you could develop something and possibly they could say, well back to . . . back to sometime along the line you picked up something you didn't even know you had."

"The biggest thing is plastic. And I mean, it's unreal how much stuff is plastic."

"You know, I get all the magazines. In one, a few years ago, some

guys had gotten sick that were firemen, you know, and I just couldn't . . . you kind of think, well it will never happen."

"It's like if something happened 20 years ago and now all of a sudden it's showing up on health issues. A possibility to. . . "

"Some of that you wouldn't smell."

"Just the smoke that we sometimes breathe. That would be about it."

"Getting into your lungs. Deteriorating your lung. Some of that stuff can cause brain problems too, can't it?"

"I think lungs could be something that might be affected."

"Well, there is always the chance of breathing something that, God knows, is going to just tear your lungs apart."

"Fear is always in my mind. It is in mine, but don't know about others. That fear of breathing something and being overcome by toxic gas."

"Been working for a while, might be getting tired. You don't put on your air pack."

"You go in there and you're digging around or whatever and you get into, who knows, lead based paint, dust, fiberglass insulation, some asbestos. You get that in your mouth, your nose, your eyes."

"You blow your nose and that black icky goo stuff that comes out with the mucus."

"My face is charcoal black, just cause I've had a runny nose and rubbed my face with my gloved hand."

"That leads back to my statement of sometimes the pack doesn't

always go with you on an overhaul. Should it, probably. And I am reminded of it from time to time, absolutely. It just doesn't always go with you."

"It's bulky, it's more difficult to work in than working without it. They're considerably lighter than they used to be, but they're still 20, 30 added pounds hanging on your back."

"You don't have the peripheral vision, it limits your vision a little bit. It's difficult to communicate. Cause you've got this big thing on your face, your nose and your chin are packed inside of it so you can't more your mouth that well and, again, it's better than the ones; the newer packs are way better than the old packs as far as being able to talk and understand through them, but it still garbles your voice up. And if the straps aren't, you are in a big hurry when you put it on and you might have a buckle twisted and that digs into your head and after a while, it gives you a headache. I'm starting to sound like a little woozy fireman over here but just things that I've noticed."

***Research Question #12.*** Do you have an SCBA (self-contained breathing apparatus) available to you during residential fire ground activities? If so, when do you use this form of respiratory protection?

"Fire wants me, first take might be a better way to say it."

"85 to 90% of the time that I want one, I've got one. Any time I go inside, with the exception sometimes of overhaul."

"If I'm exterior on the downwind side, I'll have one on."

"Make sure I stay out of the smoke."

"I usually have it on until I feel personally that I'm exhausted and

need rest myself. Our SOP is two bottles, we rest."

"Personally, I don't have one, but I could get one off a truck. I don't have my own mask."

"When do you use this form of respiratory protection? To tell you the truth, I haven't."

"Initial entry; gone through two bottles."

"At a structure fire, I want to go in, man. I'm coming. I'm coming fast."

***Research Question #13.*** If you have used an SCBA during active fire extinguishment activities at a residential fire scene, do you still use an SCBA during overhaul operations at the same fire scene? If you do not use an SCBA at this time of fire ground operations, can you explain the reason(s) why this equipment is not used?

"I would say normally no, because I've already gone through two bottles and can't put on another one."

"If I haven't gone through my entire second bottle, I'll have a pack on."

"Personally, I don't."

"And for the guys? The guys wear it."

"We may check it by, you know, some guy just smelling or some of the old guys, some of the older-timers who have been around, and if we're not sure, we'll say, "Get your mask on. Get your tanks on'."

"Some on them don't put it on, I think some of it is they feel it is safe."

"OK, we've got the fire out, there's no more contamination, we're

just going to overhaul"

"Three or four guys or people go in, and say, 'Yeah, we don't need a mask'."

"Hey, go get your mask on. You need a mask. And they've hollered at me for that."

"OK, I want to see what is going on. That's the hardest part, is the command, to stand outside. If you've got good people and they can feed the right information."

"I had gear, it looked like brand new, and when they got new I'd say 'Give it to someone else'. I never really got new gear for a long time."

"Depends. It will depend on whether I believe it is safe to go in without an SCBA. It varies"

"Ventilation. We use positive ventilation. We will vent and now . . . positive ventilation is the biggest key factor now."

***Research Question #14.*** Do you currently do anything that could lessen your current or future health?

"Not that I'm aware of. I'm pretty boring."

"Probably, uh, standing in the smoke, or entering or going in when I shouldn't."

"I've stuck my head in some and a week or two later and still taste it."

"I do probably that would later have a possibility – could do some health risk."

"You blow your nose and there's black in it. Yeah. And that's, I

guess the way it is."

"No. I use some smokeless tobacco once in a while, so I'm working on getting rid of that though."

"I don't drink that much and I don't do any drugs. I never have."

"Yep. Smoking. I'm not a heavy smoker."

"Overweight. I could stand to lose a few pounds, and exercise a little more to get myself back in shape."

***Research Question #15.*** Would you discuss any steps or procedures that you would like to take to protect yourself from injury or illness while you engage in overhaul activities at residential fire scenes?

"I don't really see anything, but you know, like I say, I don't do things that are unsafe."

"Firemen tend to watch out for each other."

"Good communication is the key. Yeah, write that one down."

"Probably one of the things I should do is probably have turnout gear on when I go in there."

"A lot of times, I don't. I think about it later and I think, aw, I shouldn't have did what I did. It's just one of those things you do."

"We've got a pretty good system in place and we have good people and we have good equipment and that's two huge factors when it comes to your own safety. Believing in your equipment and believing in the people that you're with."

"Blasting stuff in my face without my air pack on, so I can go home

with lung cancer."

"Yep. I like the fire service in general."

***Research Question #16.*** If your fire department has a policy, or a standard operating procedure or guideline (SOP or SOG), that specifically addresses overhaul activities, would you tell me what it recommends?

"It's been a while since I've looked at our SOP on overhaul, I could not tell you. We have one though. It's in that one book that we have. I'd hate to see what is on the overhaul for our department. I know it's made me really wonder what our's does say about overhaul. It's a very good point. I'll have to look that up." [According to the chief of this department, there is no SOP to cover overhaul!]

"Full turnout."

"Not sure about one for s/o (salvage and overhaul), but there are SOPs for fire scenes."

"There is an assumption that an individual will wear all PPE."

"I've never seen any standard operating procedure on this department for anything."

"You do what the chief tells you to do. That's our SOP. What the chief tells us to do."

"I don't know if we've got an exact policy. I don't think we've got one in writing."

"Sometimes I think the more you get on paper, the worse it gets."

***Research Question #17.*** If your fire department has a policy or guideline (SOP or SOG) that specifically addresses the use of equipment for respiratory protection, would you tell me

when the policy recommends that respiratory protection be used at a residential fire scene?

No responses.

***Research Questions #18.*** Do you have any concerns or comments that have not been addressed during this interview that you would like to mention at this time?

No responses.

***Research Question #19.*** Is there any other information or particular subject that you would like to discuss or any question that you would like to ask? If so, please feel free.

"No. You're happy. I'm happy."

"I don't think so."

## APPENDIX E: STANDARD OPERATING PROCEDURES / GUIDELINES

### Overhaul Operations

This document establishes procedures or guidelines for conducting overhaul operations at residential fire scenes. The goal of overhaul is to reduce the possibility of secondary fires, control property loss, and stabilize the fire scene while providing for the safety of all fire personnel. Additional objectives may include:

- Preserving evidence and securing the fire scene for further investigations
- Protecting all personnel engaged at or on the fire scene

When undertaking overhaul operations, the Incident Commander and Line Officers need to:

- Insure overhaul is conducted safely. All firefighters must wear appropriate respiratory protection, generally SCBAs, throughout the entire overhaul operation.
- Positive pressure ventilation must be started or continued throughout overhaul, in an effort to maintain an acceptable working environment and to reduce further building loss. Fire personnel must evaluate and monitor environmental and building conditions when operating fans, but fire personnel should not use measured gases as an indication that a fire scene is safe to remove respiratory protective equipment.
- Ensure that adjunct equipment, such as a thermal imaging camera, portable foam applicator, and appropriate hand tools, are utilized when necessary. The use of a multi-gas meter is recommended, but this meter, or any other atmospheric measuring device should not be used to determine if the environment is safe, so that SCBA could be removed. SCBA must be used by all personnel engaged in overhaul activities.
- During overhaul operations, at least two firefighters, in full personal protective attire, including SCBA, and with a charged line should remain in the immediate fire area, so any hidden fire and re-ignition can be detected as soon as possible.
- Ensure that periodic post-incident observations are conducted by fire personnel in an effort to detect, as soon as possible, any potential re-ignitions.
- Closely coordinate overhaul with fire investigators and other public safety personnel, who might need to have extensive documentation regarding the particulars of the fire.
- Discuss the completed and anticipated fire ground operations, including overhaul, with the property owner or current occupant of the residential dwelling.

Health Risk and Life Safety Awareness:

Overhaul is a leading cause of respiratory problems, even years after a firefighter leaves the fire service. These conditions, as well as immediate injuries, especially to the extremities, can be reduced or eliminated with proper equipment use and scene awareness.

Adapted from M.P. 202.12b 03/09-r Page 1 of 3, which was found in Duncan et al., 2014, by P. Matthews (2018), as part of her research, for use by fire service personnel.

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