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# Occupational Risks and Hazards Associated with Firefighting

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# Occupational Risks and Hazards Associated with Firefighting

by  
Laura Walker

A report submitted in partial fulfillment of the  
requirements for the degree of

Master of Science  
Industrial Hygiene Distance Learning / Professional Track

Montana Tech of the University of Montana  
2016

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## **Abstract**

Annually about 100 firefighters die in the line duty, in the United States. Firefighters know it is a hazardous occupation. Firefighters know the only way to reduce the number of deaths is to change the way the firefighter (FF) operates. Changing the way a firefighter operates starts by utilizing traditional industrial hygiene tactics, anticipating, recognizing, evaluating and controlling the hazard. Basic information and history of the fire service is necessary to evaluate FF hazards. An electronic survey was distributed to FFs. The first question was, “What are the health and safety risks of a firefighter?” Hypothetically heart attacks and new style construction would rise to the top of the survey data. Review of the survey and existing line of duty death data revealed “job stress” and “health and wellness” as the top hazards for FFs. Thus the hypothesis was not completely correct. Standard Operating Guidelines/Standard Operating Procedures can be implemented, updated or revised to reflect hazard reduction. Additional ways to address reducing “job stress” and “health and wellness” include implementing National Fire Protection Agency recommendations, educating FFs with existing national campaigns and utilizing ideal fire instructors.

**Keywords: Firefighter Hazards, Firefighter Management, Standard Operating Procedures**

## **Dedication**

As a FF, emergency medical technician, volunteer, paid part-time rescue employee, and first responder, one has a dedicated obligation to know and recognize the hazards of firefighting. As a FF instructor, emergency medical services instructor, and more than a decade on the job, one has a dedicated obligation to teach others the hazards of firefighting. As a wife, mother, daughter, granddaughter, and sister one feels the dedication to reduce the hazards of firefighting. When one realizes their many positions of possible influence, one recognizes the dedication to determine, “What are the hazards of firefighting? What can I do to anticipate, recognize, eliminate and/or reduce FF hazards?” Looking at FF’s across Midwest Ohio, it can be hypothesized poor health and fitness are top hazards.

## **Traditional Dedication**

Thank you to my mother for always being worried about her FF. Thank you to my dad for understanding we train and reduce risk.

Thank you to Matthew, Adrian, William and Wyatt Walker, my husband and children, for always supporting me and my endeavors.

## **Acknowledgements**

Thank you to Sinclair Community College and all FFs who responded to the survey questions. Thank you to Brad French, Molly Moorman and Meredith Briski for their expertise and time.

Thank you to Dr. Julie Hart, Dr. Terry Spear and Dr. Theresa Stack for their time and dedication to completion of the report.

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# **1. Introduction/Background**

## **1.1. Firefighter Deaths**

In the United States, we lose roughly 100 FF each year to deaths in the line of duty. We know firefighting is a hazardous occupation. We know many of those hazards. We know the only way to reduce the number of deaths is to change the way the FF operates. Changing the way a FF operates starts with the firefighter anticipating and recognizing the hazard. To varying degrees the FF must evaluate the hazard and decide when, if and how the hazard will be controlled. Firefighter operation, to reduce FF death, begins by implementing the tactics of anticipation, recognition, evaluation and control of hazards (AREC).

The list of firefighting hazards includes many items. The list needs to be narrowed and prioritized by FFs, prior to attempting implementation of AREC. The objective of the report is to determine what FFs think is the top health and safety hazard associated with their occupation. Firefighters were given the opportunity to respond to a survey. Once the survey was complete, a list of the top health and safety hazards for FF's was compiled.

The second step in reducing FF death is to review standard operating procedures/guidelines (SOP/SOG) FFs follow at their occupation. A section of the report covers who writes SOP/SOG and where SOP/SOG originate. The last step covered in the report is suggestions for fire departments to begin AREC by addressing the top of the prioritized health and safety hazards list.

## **1.2. Firefighter Defined**

Multiple pages are utilized to define a FF in a FF certification textbook. By textbook definition, a FF is trained in "fire suppression, search and rescue, extrication, ventilation,

salvage, overhaul and emergency medical services” (Stowell, 2015). Textbook definition also fits the general definition of “structural firefighter.” The focus of the report surveys FFs about their actions and related opinions. Many FFs are responsible for the textbook definition and additional tasks. The additional tasks are performed by specialty FFs when incidents and staffing are abundant. For example: in western United States during wildfire season, many wildlife FF positions are filled. In Ohio, if there is a field or woods fire, the local structural FFs put out the fires. Positions which do not fit the report are strictly: airport FFs, wildland FFs, hazardous material (haz-mat) technicians and emergency medical personnel. To reiterate, often FF positions begin with the traditional structural FF tasks and add tasks as needed. Further definition of firefighter tasks changes per call and responding fire department.

### **1.3. Occupational Tasks of the FF**

New York City describes the activities of a FF as: “control and extinguish fires, perform search and rescue at fire emergencies, provide pre-hospital emergency medical care, and perform fire safety education activities, enforce laws, ordinances, rules and regulations regarding the prevention, control and extinguishment of fires, non-fire emergencies including terrorist activity, hazardous materials incidents, vehicle accidents, water main breaks and utility emergencies” (New York City, 2016).

This New York City FF duty explanation continues, explaining the opportunities firefighters will have as experience is earned. These additional duties include marine unit, an elite rescue squad, a specialized collapse unit or a highly trained fire marshal (New York City, 2016). The concluding paragraph states, “But this is just the beginning -- part of the excitement of being a New York City FF is that you never know what to expect” (New York City, 2016).

A Greenville, Ohio, FF job description is as follows: “employee to work under the direction of the Chief of the Greenville Fire Department; respond to fire alarms; assist with controlling and extinguishing fires; operate numerous pieces of equipment; operate hand tools; respond to life-threatening situations and provide emergency medical treatment, as necessary and all other functions necessary to ensure the safety of the public as required by the Chief of the Greenville Fire Department” (Fire Chief Mark Wolfe, 2016). While the description seems similar to the description from New York City, the job can change at the whim of the Fire Chief.

Not described in the frequently asked questions or specific job descriptions is the discrepancy between the fire department daily operations. Dayton, Ohio, is a city between the size of Greenville and New York. Dayton has multiple stations throughout the city, several hundred FFs; on the roster and close mutual aid stations in the adjacent suburbs. Dayton Fire department divides FF work into assignments. Assignments have different names: house, company, truck, engine, ladder, quint, rescue, aerial, team, operator, driver, garage, administrative and more. Each assignment typically completes only a specific type of FF work. Truck companies complete only truck work. Truck work includes searching buildings and removing victims. Hose or engine companies pull lines and fight fires. Rescue obtains victims through extrication, search and rescue. In some departments rescue includes taking patients on the ambulance, while in other departments rescue does not leave the scene. A house includes an engine and other apparatus. A quint is an apparatus capable of multiple assignments ranging from pumping to aerial work. The garage may only work on hydrants, not even respond to emergency calls. When blessed with personnel power and expertise, the described assignment tactic for accomplishing FF tasks is optimal. When the fire department does not have a surplus of personnel or well-rounded expertise, the operation of the department changes (Walker, 2016).

In a department of 25 employees (volunteers are considered employees), everyone is required to do everything. Seats may be assigned at the beginning of the shift or call, but eventually the firefighter will rotate through each seat. If the seat is open in the apparatus, the firefighter jumps in and does the task at hand. The task may change according to the type of call response needed by the apparatus. A *Fire House* article, Grace (2006), states, “I was a volunteer chief in a small department, also in upstate New York and I figured that if it (seat assignments) could work in Lake Carmel, it could work in my department too. It was especially useful in my department because we didn't go to very many fires so experience and repetition weren't factors on which we could rely” (Fire House, 2016).

Grace continues, “This concept of course, is not rocket science....Pre-determined seat assignments makes the division of labor at an incident much easier and in most cases, it makes the basic emergency scene functions "automatic"” (Fire House, 2016). Seat assignments must be “flexible and dynamic” according to Grace. Found in Appendix A, “Seating Assignments” is a model standard operating procedure (SOP) from *Firehouse*. “Seating Assignments” provides the setup for seating assignments and example assignments.

At the Montezuma Fire Department (MFD), in Ohio, seating assignments are similar to the example provided in Appendix A. For all apparatus, at MFD, the initial seat logic is the same. Five seats are expected to be filled prior to the apparatus leaving the volunteer fire department (Walker, 2016).

The term “driver’s seat” refers to the apparatus operator. Operating the apparatus is not simply driving the vehicle. Operating the apparatus includes tasks specific to the call. In general, the operator will always be responsible for turning on the power takeoff (PTO) and setting up scene lighting. The operator is also ultimately responsible for the vehicle. Ultimate responsibility

ranges from returning to the station with a full tank of fuel to not running over anything or anyone (Walker, 2016).

The front passenger seat is known as the “Officer Seat” at MFD. This seat is reserved for the individual who holds the highest rank at the time the apparatus is leaving the station. If the highest ranking FF is the only person qualified to operate the vehicle, the officer seat will be filled by the second ranking FF. The general tasks of the officer seat do not change. Running warning lights, operating the air horn, watching for traffic, talking on the radio, establishing incident command, completing a 360 degree walk around of the scene, and general scene management are some of the general tasks of the officer seat. Other tasks are specific to incident command of a particular scene or call (Walker, 2016).

Rear seats assignments at MFD vary according to the call, capabilities of the FFs and guidance from the ranking FF sitting in the officer seat. In general, rear seat will be assigned to tasks relating to their side of the apparatus. The person sitting on the side of the apparatus where the axe is stored is responsible for the axe. After grabbing the axe, the FF will set out to accomplish any axe-related tasks. Rear seats should be assigned to crews by the ranking officer, prior to disembarking the apparatus. Each crew should complete the assignment and return to the ranking officer for the next task (Walker, 2016).

As a firefighter gains tenure at MFD, the firefighter’s knowledge will grow and expand to be capable of completing all the tasks of each seat on the apparatus. Montezuma requires probationary firefighters to complete an Ohio fire certification within one year of the department voting to accept the volunteer. Montezuma does not have a required timeline for continuing education progression. Other departments may require level 1 FF with a pro-board certification within one year, pump operator within two years, or other requirements according to the standard

operating procedures or standard operating guidelines. Fulltime departments typically have requirements starting at entry level and progressing to a maximum hourly pay at the FF level. Further certifications may lead a firefighter to the opportunity to apply for an officer's position. The track to obtaining an officer position varies per department. MFD positions are by popular vote and the Chief appoints line officers. Other departments may hold a written test for the officer position, host a combination written, practical and oral trial before a board, or other types of ability and aptitude testing (Walker, 2016).

To enter a burning building, a certification is required, but the level of certification required to be a member of the department may be different. Volunteer fire departments in Mercer County, Ohio, have an 84 hour difference in certification requirements. Montezuma Fire Department requires volunteers to obtain a 36 hour certification within one year. Coldwater Village Fire Department requires members to obtain a 120 hour certification (Walker, 2016).

A FF's job responsibility ranges from completing the tasks of the apparatus seat (as mentioned above and in Appendix A) to maintaining the fire house to completing run records to much more. Additionally FFs educate the public, pre-school to geriatric; put out fires, search for victims, lay water supply and many more tasks related to the fire service (Walker, 2016).

#### **1.4. Evolution of Firefighter Occupation**

A typical textbook for FFs notes, "Traditions and culture can also be a barrier to change, although these barriers are lifting" (Stowell, 2015). Historically, fires leveled cities, homes, and more, "slowing economic growth and the progress of society" (Stowell, 2015). Unofficial groups of men patrolled the streets watching for fire. Benjamin Franklin created the fire volunteer fire company in 1735. New York was quick to follow in 1737. Early departments were bucket



brigades, small ladders and hooks. Soon hand-operated pumps, hoses and nozzles replaced or worked with buckets (Stowell, 2015). A bucket brigade is literally a group of people with buckets. One person stood at the water source, filled a bucket and passed the bucket down the line of people to the fire. Bucket brigades were effective on small fires, but completely ineffective on large structure fires. Small ladders provided FFs access to the roof or a second story window. The first ladders were wooden, which ran the risk of catching fire. Many fire service ladders are currently made of aluminum, but wooden small ladders are still in service today. The term ladder also refers to modern fire apparatus which contains a tall telescoping ladder on the main body of the apparatus and additional ladders in the apparatus compartments.

A hook is typically used to pull apart a structure and look for fire extension. Hooks may also refer to a metal hook on the end of a rope. The hook can be thrown into a window where it catches on the window ledge and the firefighter can climb up or a person can climb down. Today, “hooks” is typically a reference to rescue and truck tasks. Hand operated pumps improved FF efficiency, but the Industrial Revolution changed the fire service.

The Industrial Revolution brought steam pumpers, some which remain in service. A typical FF certification book, maintains the previous note. In mid-west Ohio, the only steam pumpers in service are those utilized in parades. Steam pumpers are not a realistic option compared to modern fire apparatus. Building construction also changed during this time from wooden timbers to metal products. The National Fire Protection Association (NFPA) began in 1896, with the sprinkler code. Historical fires have changed FF’s procedures, guidelines and tasks; ultimately changing the building codes related to fire. National Fire Protection Association continues to evolve and adapt to the needs of the community and firefighters (Stowell, 2015).

## 1.5. Application of Industrial Hygiene Concepts to Firefighter Tasks

Following completion of the FF's prioritized list of health and safety hazards, concepts of industrial hygiene (IH) were utilized to offer options for mitigating the top health and safety hazards. Industrial Hygiene is a very broad field of study, ranging from specific noise studies to general safety surveys. The field covers: physical (noise, radiation, thermal stress) as well as chemical and biological hazards. Mitigation of hazards follows a basic approach of anticipation, recognition, evaluation and control of the hazard. Control fits into the following chronological process, further defining IH throughout the report:

- Anticipation of hazards includes expectation and prediction. (Anna, 2011)
  - Firefighters know hazards exist in every minute a FF is on the job.
  - Rookie or probationary FF's gain experience from listening to, reading about and watching video on FF close calls. A close call is when a FF came close to dying or being injured.
  - Observation, also known as situational awareness in the fire service, is ongoing while the FF is on duty. Observation, situational awareness, is an acquired skill, which takes time and practice to master.
  - Fire Engineering website and magazine, National Institute for Occupational Safety and Health (NIOSH) reports, National Institute of Standards and Technology (NIST), company product research and other routine testing are included in a dedicated FF's "homework."
  - Management expects FF's to perform certain tasks and FF's expect management to provide space for the FF to do so.
  - Union stewards, in the fire service, often know the trends in safety and risk. Union stewards are often able to predict hazards prior to FF's awareness of the hazard.
  - Each call, every FF attempts to predict the magnitude of the hazard, ranging from a patient who is about to go into cardiac arrest to structural collapse due to fire burning through new construction.
  - FF's are taught from the first day of class to avoid, prevent, communicate and manage hazards. FF's, as all workers, have a wide range of skill level when it comes to anticipating hazards.
  - Being proactive is a trait the fire service, finds difficult to grasp. FF's are steeped in tradition, which has potential to hamper forward progress (Walker, 2016).

- Recognition of hazards includes identification, realization and acknowledgement (Anna, 2011).
  - At the scene of a residential structure fire, two story, one family dwelling, FF's must be able to recognize the following hazards (and more):
    - New style construction which burns hotter and faster, leaving weak structure and weaker flooring.
    - Structural collapse, roof collapse, stair collapse, ceiling, wall and any other possible collapse which could pin a FF under debris.
    - Becoming disoriented while inside the structure. If a FF is to survive disorientation, the FF must recognize the need for help and call a "May Day." A May Day is when a FF can no longer help themselves and a crew is sent to retrieve the FF in need.
    - Running out of water is a hazard no FF should ever encounter. There are no excuses for running out of water, but it continues to happen. Recognizing the need for additional water supply is key to successful scene control.
    - Traffic, responding to the scene and working around apparatus parked on the street; FF's must be aware and recognize rubber-neckers, gawkers, texting drivers, and otherwise distracted drivers.
    - Arsonists strike every day, everywhere, FF's must recognize arson potential and scenes prior to investigators arriving on scene. If FF's do not recognize the fire as arson, FF's will destroy evidence for investigation and often succumb to arsonists' booby traps.
    - FF are responsible for wearing proper personal protective equipment (PPE) at all times. FF's must recognize what PPE is needed during which hazardous situation. For example; during overhaul (opening up the walls and ceiling looking for hot spots) FF's must wear self-contained breathing apparatus (SCBA) to avoid inhaling cancer causing agents.
    - FF's must be cognizant of continuously changing fire conditions. FF's must know how to recognize deadly fire conditions, including flashover and backdraft.
      - Flashover is, as defined by Essential's textbook, "stage of fire at which all surfaces and objects within a space have been heated to their ignition temperature and flame breaks out almost at once over the surface of all objects in the space" (Stowell, 2015).
      - Backdraft, as defined by Essential's textbook, "very rapid, often explosive burning of hot gases that occurs when oxygen is introduced into an oxygen-depleted confined

space. It may occur because of inadequate or improper ventilation procedures” (Stowell, 2015).

- FF’s also benefit from learning the art of reading smoke and continuing education (Walker, 2016).
- Evaluation of hazards includes measuring and/or rating and/or interpreting.
  - Every run FF’s must “ascertain the value or worth of...” (Anna, 2011). A typical tactic to accomplish evaluation is the saying, “Risk a little, save a little, risk a lot, save a lot.”
    - For example:
      - If someone calls 911 stating a person is trapped, firefighters arrive, scene size-up shows potential for victim survival, then firefighters will immediately begin searching for the victim.
      - If the same call comes in, scene size-up shows a fully engulfed structure, in which no one can survive, firefighters are not going to enter the building to immediately search for victims. FF’s are going to put out the fire and perform recovery of victims when the scene is safe (Walker, 2016).
  - All FF’s must select personal limits on which evaluation of hazards will be measured. FF’s are known for being “type A” personalities, which leads to aggressive rescue attempts and limited exterior firefighting. FF’s often work on their own accord, out of immediate supervision, leaving the FF’s PPE to themselves. FF’s need to evaluate situations measuring, interpreting and controlling the hazard on their own accord.
  - Incident commanders (IC) measure hazards routinely throughout an incident. The IC is looking for structural integrity; how long will the structure remain standing? Is the roof strong enough for a FF to climb on and cut a ventilation hole? When structural integrity deteriorates, the IC must be cognizant to clear everyone out of the structure.
  - FF’s may have a three gas meter or other evaluation devices on the apparatus. FF’s must know how to use the meter and interpret the results to control the hazard or wear the proper PPE (Walker, 2016).
- Control of hazards includes restraint, restrain, regulate, contain, check, curb, moderate and more (Anna, 2011).
  - Additional description of controlling hazards includes: lessening the intensity of, temper, moderate, hold or keep within limits, eliminating or decreasing the hazard, protective measures and more.
  - Stepping away from the predominate focus of the report, FF’s face many additional hazards beyond structural firefighting.
    - FF’s face combative patients, which must be restrained.

- FF's must exercise restraint when handling combative patients and when speaking to the public in general. Most FF's are public employees and must present a positive image at all times.
- Routine home, business and club inspections can curb hazards.
- Surprise business inspections keep owners in check and keep owners following the rules to reduce hazards.
- Suppression and detection systems can control fire hazards prior to the arrival of the fire department. Systems do not replace the need for FF's or eliminate the hazards. Systems are known to reduce or eliminate the hazard in commercial and residential settings. (Walker, 2016)

Implementation of AREC depends on FF's actions in conjunction with standard operating guidelines and procedures (SOP/SOG). Firefighters make decisions based on their training and their SOP/SOG. SOP/SOG must be written clearly with detail and direction for the FFs to make on scene decisions. The person(s) writing SOP/SOG needs field experience and excellent writing skills.

## **2. Standard Operating Procedures/Standard Operating Guidelines (SOP/SOG) for FF Health and Safety Hazard Control**

Standard Operating Procedures/Standard Operating Guidelines (SOP/SOG) for the fire service are written by many different people and organizations. Procedures are typically written in a handbook so that all FFs can become familiar with them. These are also known as Operating Instructions, Predetermined Procedures or Standard Operating Guidelines” (Stowell, 2015).

While the textbook lumps SOP/SOG together, fire departments often separate SOP and SOG by further definition. In general, an SOP is a rule not to be broken and an SOG is to provide guidance for decision making. The text offers the following definition for standard, “A set of principles, protocols or procedures that explain how to do something or provide a set minimum

standards to be followed. Adhering to a standard is not required by law, although standards may be incorporated in codes, which are legally enforceable” (Stowell, 2015).

The text also defines procedure, “step-by-step written plan that is closely related to policy. Procedures help an organization to ensure that it consistently approaches a task in the correct way, in order to accomplish a specific objective” (Stowell, 2015).

Montezuma FD has a set of SOP’s which are to be followed, no questions asked. MFD also has an SOG document. The MFD SOGs are predominately utilized by new FF’s, at scenes which are not typically encountered and when fire officials are displeased with the response FF have provided. The SOGs are updated, changed and sections added on a regular basis. Fire departments often follow the text book definitions of SOP/SOG. As MFD does, fire departments exercise different options to communicate recommendations to their FFs. (Walker, 2016)

Overall, FFs follow recommendations from the National Fire Protection Association (NFPA). The authority having jurisdiction (AHJ) may choose to put NFPA recommendations into rule or law. An AHJ may select portions of a recommendation or the entire recommendation to implement. Often the AHJ references NFPA to create SOP/SOG specific to needs of the jurisdiction (Walker, 2016).

## **2.1. National Fire Protection Association creates codes and standards.**

The NFPA began with the mission to “reduce the burden of fire and related hazards on the quality of life” (NFPA, 2016). The mission has evolved to include over 6,000 volunteers with more than 68,000 members. National Fire Protection Association creates and advocates for “scientifically-based consensus codes and standards, research and education for fire and related

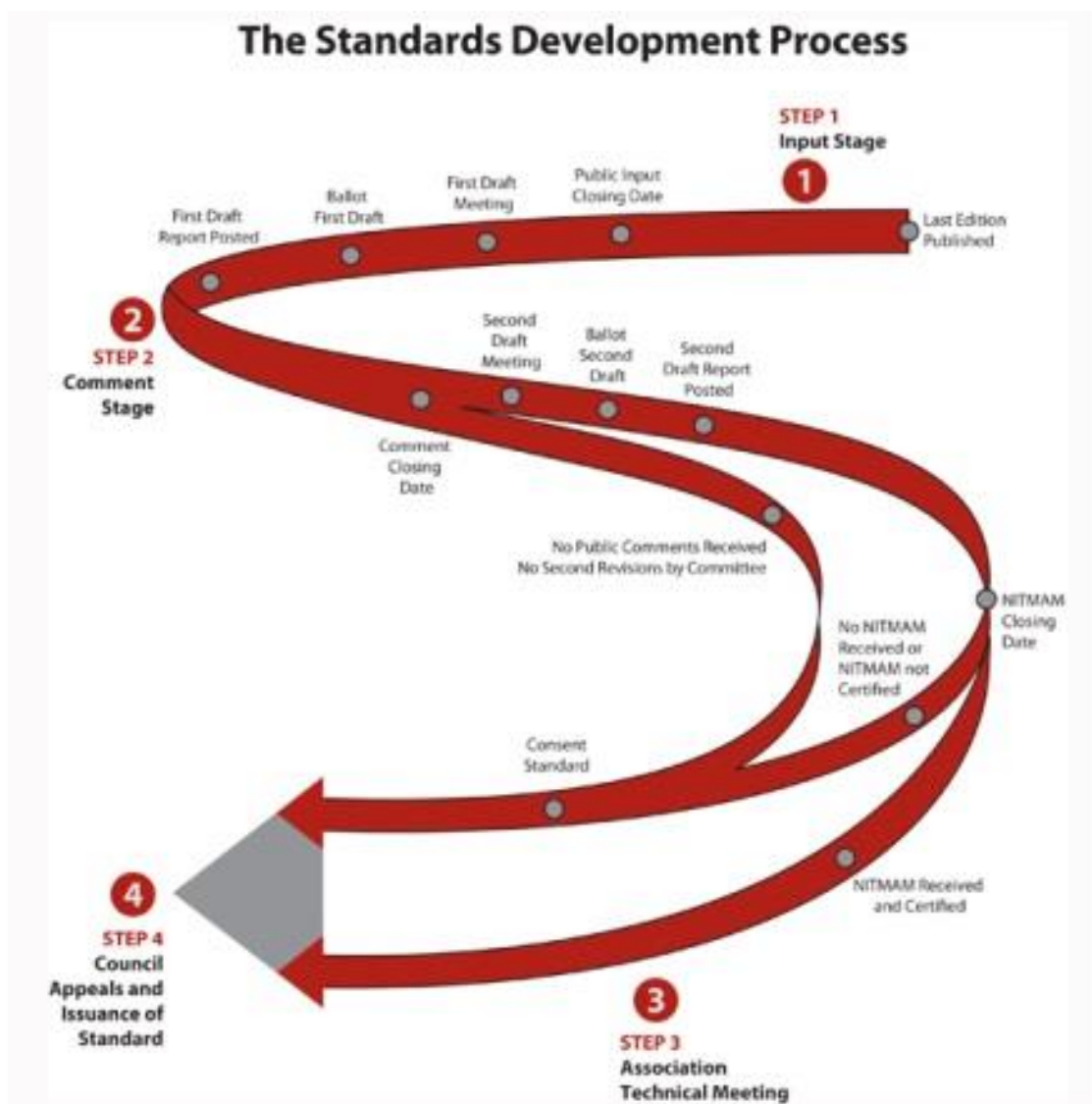
safety issues.” Codes and standards are the recommendation, which AHJ (authority having jurisdiction) can choose to implement.

Many of the codes and standards overlap, work alongside or intertwine with Underwriter’s Laboratory and Factory Mutual standards. These codes and standards are specifically related to equipment. Other codes and standards of interest to firefighters are those related to life safety, education, operations at the fire house and operations on the fire ground. All actions of a FF fall under SOPs and SOGs. SOPs and SOGs should all follow NFPA. Under specific, and many additional, circumstances, “If your AHJ has adopted the applicable NFPA standards as law, your employer is required to meet them as well” (Stowell, 2015).

### **2.1.1. National Fire Protection Association Process**

National Fire Protection Association has a process each code and standard completes. Revision to the codes and standards also complete a rigorous process. National Fire Protection Association’s codes and standards brochure begins by stating, “Safety is Everybody’s Business” (NFPA, 2016). The intentions of NFPA are similar to the IH concept of AREC. In 2012, at the time of printing the current standards and codes brochure, NFPA included prevention at the top of reasons to provide codes and standards. “Codes and standards are to there to provide us with ways to prevent their (disasters) occurrence, manage their (disasters) impact and protect us.” (NFPA, 2016) NFPA utilizes a “full, open, consensus-based process. Full consensus means that anybody can participate and expect fair and equal treatment” (NFPA, 2016). Throughout the code and standard creation process, NFPA emphasizes, “Safety is everybody’s business.” For further information, see online, “*An Introduction to the NFPA Standards Development Process.*”

The process is described in the following figure: “The Standards Development Process” (NFPA, 2016).



**Figure 1. NFPA process for developing firefighting standards for (NFPA, 2016).**

The NFPA process includes volunteer participation throughout. It takes approximately 101 weeks for NFPA to certify amending motions. Following certification, the motion will undergo approximately 141 weeks for revisions. The timeline is summarized in the following table.



**Table I. NFPA Timeline to Create a Standard**

<b>Steps 1-4</b>	<b>Actions</b>	<b>Number of weeks to complete</b>
Step 1 – Input Stage	Input accepted from the public or other committees for consideration to develop the First Draft	Begin week one
Step 1 – Input Stage	Committee holds First Draft Meeting to revise Standard	23 weeks
Step 1 – Input Stage	Committee ballots on First Draft Committee(s) with Correlating Committee	12 weeks 11 weeks
Step 1 – Input Stage	Correlating Committee First Draft Meeting	9 weeks
Step 1 – Input Stage	Correlating Committee ballots on First Draft	5 weeks
Step 1 – Input Stage	First Draft Report Posted	Posted
Step 2 – Comment Stage	Public Comments accepted on First Draft	10 weeks
Step 2 – Comment Stage	If Standard does not receive Public Comments and the Committee does not wish to further revise the Standard, the Standard becomes a Consent Standard and is sent directly to the Standards Council for issuance.	Moving onto Step 4.
Step 2 – Comment Stage	Committee holds Second Draft Meeting Committee(s) with Correlating Committee	21 weeks 7 weeks
Step 2 – Comment Stage	Committee ballots on Second Draft Committee(s) with Correlating Committee	11 weeks 10 weeks
Step 2 – Comment Stage	Correlating Committee Second Draft Meeting	9 weeks
Step 2 – Comment Stage	Correlating Committee ballots on Second Draft	8 weeks
Step 2 – Comment Stage	Second Draft Report posted	Posted
Step 3 – NFPA Technical Meeting (Tech Session)	Notice of Intent to Make a Motion (NITMAM) accepted	5 weeks
Step 3 – NFPA Technical Meeting (Tech Session)	NITMAMs are reviewed and valid motions are certified for presentation at the NFPA Technical Meeting	

<b>Continued Table I. NFPA Timeline to Create a Standard</b>		
Step 3 – NFPA Technical Meeting (Tech Session)	Consent Standard bypasses NFPA Technical Meeting and proceeds directly to the Standards Council for issuance	
Step 3 – NFPA Technical Meeting (Tech Session)	NFPA membership meets each June at the NFPA Technical Meeting and acts on Standards with "Certified Amending Motions" (certified NITMAMs)	
Step 3 – NFPA Technical Meeting (Tech Session)	Committee(s) and Panel(s) vote on any successful amendments to the Technical Committee Reports made by the NFPA membership at the NFPA Technical Meeting.	
Step 4: Council Appeals and Issuance of Standard	Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Technical Meeting	20 days
Step 4: Council Appeals and Issuance of Standard	Standards Council decides, based on all evidence, whether or not to issue the Standard or to take other action.	

## **2.2. Department Officers Create Local Protocols**

LeBlanc (2010) reported in Fire Engineering, “There is more to standard operating procedures (SOPs) than just words. These documents form the backbone of our existence. They govern how we operate and they ensure that everyone is on the same page.” FD’s can implement NFPA codes and standards. Typically FD’s utilize the NFPA codes and standards as a goal when writing local SOGs/SOPs. FFs are stubborn, proud and knowledgeable about their territory. Thus being the case, FFs and officers typically write or rewrite SOGs/SOPs for their department. Rarely will a FD directly adopt NFPA or anyone else’s exact SOG/SOP. Many departments perform the exact same actions, but the words on the written SOG/SOP may vary considerably (Walker, 2016).

### **2.2.1. Defining Qualified Protocol Writers**

The term qualified person has different definitions within the FF field. In the fire service and other blue collar occupations, co-workers define qualified by experience and proof of ability to complete occupation tasks. A worker may appear to be qualified on paper or resume, which implies that they are qualified according to management. However, if the employee cannot prove themselves in the field, co-workers will not define the worker as qualified. Similar scenarios occur when writing SOPs. Management may feel paperwork leads to a specific SOP. Management feels viewing the paperwork qualifies themselves to write the SOP. If FFs do not see the same paperwork and agree with management's SOP, FFs may not see management as qualified to write SOPs. When FFs do not see management, those who write SOPs, as qualified, FFs tend to ignore the SOP. Management may or may not realize the new SOG/SOP was ignored. When upper level management realizes the new SOP/SOG is not implemented, management sees FFs as not qualified. A general lack of communication often occurs when a new SOP is not being implemented by FFs as management expects. Management is often compelled to write another SOP/SOG and the cycle repeats (Walker, 2016). All levels of employees should be included when an SOP/SOG is written and implemented (Anna, 2011). If all levels are not included, the boots/management cycle repeats. One might question, "What makes a FF qualified to write an SOP/SOG?" From a FF's perspective, it takes knowledge of existing (or lack of existing) SOP/SOG plus experience in the field. Textbook knowledge is not sufficient. Knowledge of rules and other departments is not sufficient. Experience in training or at other departments is not sufficient. NFPA includes many different types of expertise, no FF should be excluded from the process. The definition of qualified can be controversial and changes for every FD. A closer look at who approves SOPs is a concise and comparable exercise (Walker, 2016).

### **2.2.2. Accepting/Implementing Standard Operating Procedures/Standard Operating Guidelines**

There are various SOPs published from state to state. The site [www.firesops.com](http://www.firesops.com) was created by a Boston firefighter to facilitate, “Sharing and exchanging of Standard Operating Procedures for municipal fire departments. Our service allows firefighters to evaluate and implement the SOP’s of similarly sized communities” (Kendrick, 2012). As mentioned prior and continued later, many factors relate to a good SOP/SOG. Kendrick and his site recognize SOPs are different but may be molded to fit the FDs field. The site description concludes by saying, “Fire SOP’s firmly believes that through exchanging and sharing information we will create a more efficient and ultimately safer fire ground.” To prove he is qualified to discuss and review SOP/SOG, Kendrick includes a photo of him on duty in his rig. He is qualified to be in the field and qualified to transfer his field knowledge to SOP/SOG.

Every department has a different process for accepting/implementing SOP/SOGs. In Montezuma, the Chief may state an SOP/SOG is being changed and the SOP/SOG is changed. Other instances in Montezuma a FF suggests change in SOP/SOG, a committee is formed, the SOP/SOG is rewritten, voted on by the entire department and the SOP/SOG is changed. Fire departments run by a governing board or with different bureaus, the writing and approval process will be different. The table below provides examples from across North America. Different officials approve SOPs depending on the organization structure of the department.

**Table II. Officials who Approve SOPs**

<b>Fire Department</b>	<b>Location</b>	<b>Title/Position(s)</b>	<b>Year</b>	<b>Population</b>	<b>Type</b>	<b>Comments</b>
<b>Altoona</b>	Nevada	Chief	2012			Sole “Acknowledgement of Authority”
<b>Whitehall</b>	New York	Chief	2011			Front page disclaimer, “The SOP’s as set forth herein are for reference by the Officers and Members. An incident commander, fire officer or member may overlook any SOP that could interfere with the good order or command of the fireground. The references noted have not been endorsed or adopted by the Whitehall Volunteer Fire Company Inc. as policy or procedure.”
<b>Nantucket</b>	Massachusetts	Not noted	2011	10,000 (summer 50,000)	Combo	Aligns 911 center personnel and field personnel
<b>Jefferson County</b>	Pennsylvania	Director of Emergency Services, Commissioner	2009			
<b>City of Brandon</b>		Chief, Deputy Chief, Captain, Committee as assigned by Chief	2009 plus other years			Mayor has ultimate override of the Chief.
<b>Boston</b>	Massachusetts			618,000 (daytime 1.2million)	Career	

Full SOPs, referenced here, are located online or by request (Kendrick, 2012).

### **2.2.3. Traits of a Successful Standard Operating Procedure/Standard Operating Guideline**

A successful SOP is one which firefighters follow. SOP/SOGs must be easy to understand, comprehend and execute by all levels of FFs. FFs must be trained or expected to know SOP/SOGs. The last questions of the FF hazard survey, asked respondents to comment on any additional items related to IH and controlling hazards. One respondent stated, “Our biggest problem is the Fire Chief. He is not educated for the position. So, we are stuck at his level. We will not improve our outcome without a change in Leadership.” The chief writes, approves, requires implementation of and has complete influence over SOP/SOGs.

According to a respondent in a FF hazard survey, “Even though there is a push in the service towards better hazard mitigation, there is still an amazing level of complacency across the board. More education would help, but many FF need to be scared before they listen.” While SOP/SOG’s may be updated and adequate to control hazards, FF’s must be willing to implement and follow the standard for the hazard control to be successful (Walker, 2016).

### **3. Firefighter Health and Safety Hazard Survey**

The first step to determine “What health and safety hazards does a FF face?” is to review current lists of FF hazards. Three popular lists were revealed. National Institute of Occupational Safety and Health, National Fallen Firefighters Foundation and National Volunteer Fire Council all complete, on a continuous basis, reports related to FF hazards. Each organization is slightly different resulting in different lists, which led to the inclusion of each list on the survey. Firefighters were asked to provide rank for each item from each respective list. Firefighters were provided the website links, to follow if they were not familiar with the list.

Survey monkey was utilized due to a low cost, familiarity to the survey creator and ease of use. A FF can complete the survey on any electronic device taking them to the website:

[www.surveymonkey.com/r/FFhazards.com](http://www.surveymonkey.com/r/FFhazards.com) .

#### **3.1. Existing Lists of FF Hazards**

Three lists of occupational hazards for FF are commonly referenced. The Center for Disease Control (CDC) lists common areas of FF hazards. The CDC list includes: structural hazards, chemical exposures, diesel exhaust, emergency response hazards, fire-damaged floor and job stress. The National Fallen Firefighters Foundation (NFFF) hosts an initiative called,

“Everyone goes home.®”. The NFFF list focuses on line of duty death life safety initiatives. A typical FF certification course requires FFs to complete a 16 hour course related to these initiatives. The 16 Initiatives cover a wide range of topics from driving apparatus to eating healthy. National Volunteer Fire Council quotes NFPA statistics, “...64 firefighters died in 2014 while on duty in the U.S.... As in most years, sudden cardiac death accounted for the largest share of the on-duty deaths (36). In 2014, 63,350 firefighter injuries were reported. Of these, 27,015 were injuries at the fire ground” (NVFC, 2016). The national organization uses those and similar statistics to form various national safety campaigns, which includes lists of hazards.

A survey was created, including a separate section for each list of hazards. Each list is similar, yet different. As stated early in the report, FFs know the hazards of firefighting. Results of the survey were hypothesized to have heart attacks as a top occupational hazard and apparatus response a close second priority. Hypothetically, hazards focused on specific events or structures would rank lower on the priority list. FFs taking the survey were given two options, a short survey taking less than five minutes or a longer survey taking about 20 minutes.

Survey monkey and social media was used to collect responses. At 20:00 February 28, 2016, 132 responses were received with 39 completing the long option of the survey. (Many questions were lengthy and required significant participation.) A copy of the survey can be requested.

Prior to sending the survey, it was previewed by a reliable fulltime career FF and international fire instructor, a reliable volunteer fire officer and a survey building expert. After a few corrections and clarifications to the draft questions, the survey was posted to Facebook and emailed to the author’s contacts. Contacts were encouraged to share the survey and an electronic copy of the report is to be provided to those requesting it following participation in the survey.

Survey questions began with basic respondent data. The survey was specifically designed for two types of FF's, those who want to take a minute to answer a survey and those who want to take twenty minutes to answer a survey. The condensed minute survey collects basic respondent data and their opinions on FF hazards. The longer survey option expects the FF to enter their opinions on FF hazards, just as the minute survey, and allows FF's to use their own words for additional hazards and opinions. Survey Monkey collects and summarizes data in many different formats. These formats were used for reporting results.

### **3.1.1. Firefighter's opinion**

After requesting basic identification information, the first actual question of the survey is, "What do you think are the health and safety hazards associated with your occupation?" Responses varied, with only 1 non-productive response. All responses are to be considered FFs' opinion, because all responses belong to structural firefighters, retired FFs and officers. The first survey questions collected general data on the respondent. The first question, requiring their opinion was, "What do you think are the health and safety hazards associated with your occupation?" Responses are listed in Table III. FF Hazard Written Responses. No responses are edited, spelling and grammar errors are common throughout the responses; often text formatting and grammar transfer poorly from a handheld device to the computer generated report. The following table is a list of the highlights of the first question of the survey. Cardiac, diet, cancer and the unknown were common themes throughout.



**Table III. Firefighter Hazard Written Responses**

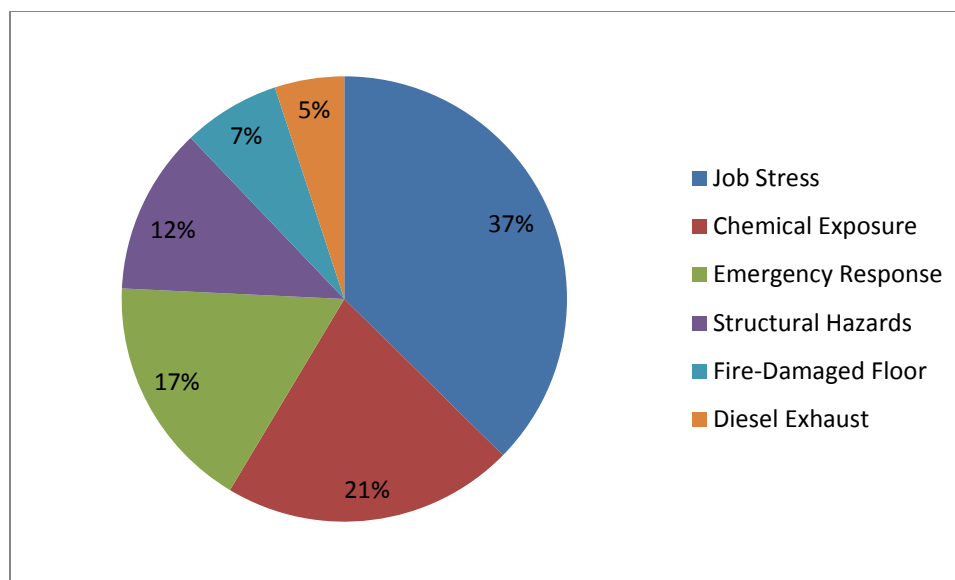
Diet, Respiratory, Sleep deprivation, Cardiac
IDLH Atmospheres, changing fire conditions, hazardous conditions on roadways to include drivers, violence associated with EMS calls, the list goes on and on.
2 things. (1)The unknown. The things we can't control (building collapse, rapid flashover, etc.) (2) The things we can control. (obesity, stress, overall physical fitness.)
Workplace violence Workplace injuries HAZMAT/WMD/Active shooter /Terrorism response Continued exposure to toxins on fire scenes and homemade chemical labs Lack of physicals and physical fitness programs Lack of training with increased response demands 24 hour shift fatigue No Mental health recognition, treatment, or assessment.
The list is long. Cancer, Respiratory, Heart Issues, Depression, Lower Back Concerns, Sleep Disorders would be the main concerns
PTSD associated with what we experience and see. Sleep patterns disrupted which spills over into our days off. Injuries. Carcinogens.
Unwashed gear leaching contaminants, diesel exhaust fumes, lack of conditioning for physical exertion
Mental health is generally a problem, but almost never spoken about. Also there is little being done to keep contaminants from exhaust away from living quarters in stations, even though we wash our gear every few months, in the interim the contaminants are being transmitted to our station gear everytime we put our structural gear on.
Traffic, contagious diseases, assault, stress, increased risk of cancer due to the chemicals produced from combusting furnishings and from diesel exhaust, lightweight construction combined with furnishings that burn hotter and faster which leads to increased risk of entrapment and getting caught in a flash over
It is the unexpected and having up to date equipment to keep my guys safe. Also, it is keeping my guys healthy.
Carcinogens in today's materials, structural hazards in new construction, safety on scenes (working in/near roadways, violent scenes). Poor staffing of firefighters to operate safely. Lack of extra gear to use during a 24 hour shift when current gear has been exposed to smoke/fire hazmat
Technology has provided some improvements (TIC, PASS, Nomex, etc.) but we have lost too many positions. Departments have too few firefighters on duty to proper stop fire before they flashover. Staffing still the most critical need in this line of work. Four person Engines, 4 or 5 person Ladders, with enough medic units in service to keep MA requests to a minimum. Dayton Staffs at least 12 fewer people a day than should be the minimum. We need more people.
You name it.... Carcinogens, Improper/lack of training (quality training that is not just checking the box), inexperienced "senior" members that feel that 20 years in the fire service equals experience and not just tenure, no on-going physical fitness requirements, no push locally for annual physicals, and fire companies of 2-3 people doing the same work that 4-5 people did a few years ago (doing the same or more with less people).
Inherent risks related to structural firefighting and technical rescue situations; short term issues include burns, smoke inhalation, sprains/strains, lacerations, etc. Long-term risks also continue to emerge as a threat to our profession, namely cancer. Both on the fireground (for obvious reasons), and around the fire station (diesel exhaust, dirty fire gear storage, etc.), firefighter are exposed to known carcinogens on a virtually constant basis. Poor lifestyle choices of many firefighters (i.e. tobacco use) further contribute to a higher incidence of cancer development in comparison to the general population.

#### **3.1.1.1.1. Hazard List from Center for Disease Control and Prevention Survey Results**

The beginning of the survey contained content questions that were lengthy and open-ended. The next three questions left room for comment, but focused on ranking lists of hazards. The first of these three content questions of the survey was to rank the hazards listed by the CDC. Firefighters ranked “Job stress” as the highest hazard. Job stress can include exposure to traumatic incidents, incident stressors, a conflict of network and social support, leadership intervention, psychosocial risk factors and more. The second and third highest items were separated by four percent of the ranking. Chemical exposure, as defined by the CDC, includes products of combustion and products of incomplete combustion. Simply put by the CDC, the “dirt on FF PPE which is being studied for cancer causing effects.” The CDC also includes other chemicals and traditional chemical calls such as spills and leaks. Emergency response, as defined by CDC, ranges from driving to work to responding to a large incident, such as Hurricane Katrina.

The bottom ranked items; fire damaged floor and diesel exhaust are often referenced in specific situations or locations. Situations and locations, such as fire damaged floor and diesel exhaust, are not as prevalent as general FF job stress. Fire damaged floor is specific to work on or below the fire damage. Fire damaged floor is not necessarily due to specific structural hazards. Structural hazards are defined as directly related to building materials, materials stored within the structure or fire conditions, such as temperature and oxygen availability.

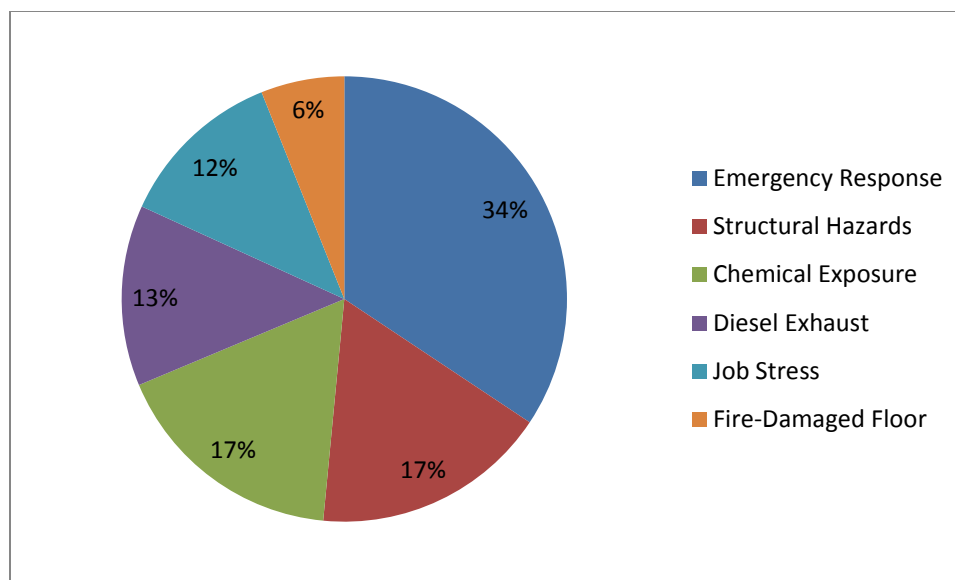
Additional rankings, as defined by the survey results, are illustrated in Figure 2.



**Figure 2. Top Hazard According to CDC List**

Often first responders, including FFs, consider emergency response to be the top hazard. Seat belt campaigns are always running and driving courses are required annually. However, the results of this survey indicate over one-third of the respondents felt emergency response was not the top hazard. Over one-third of FFs ranked emergency response as their second highest hazard. A pie chart showing the percentage of votes for the second highest hazards is next, Figure 3.

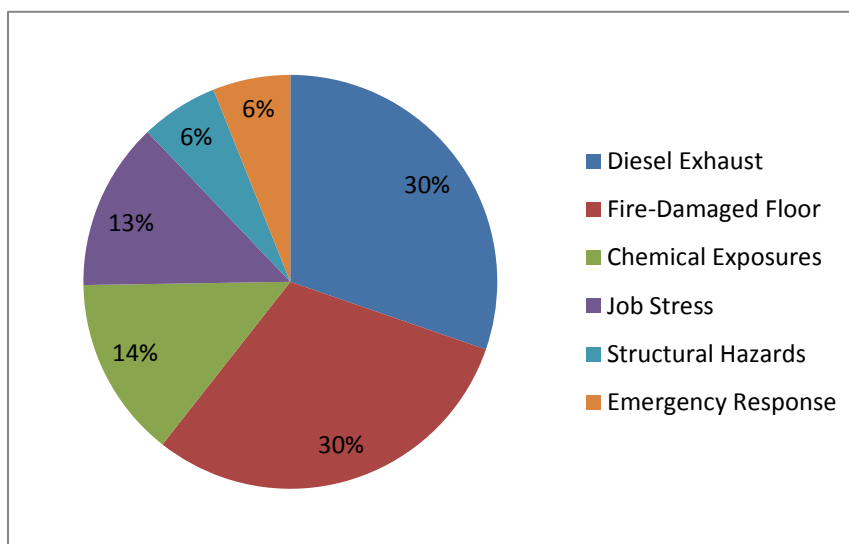
Second Highest Hazard According to Survey.



**Figure 3. Hazard #2, Second Priority Hazard**

Confirming FFs lack of concern for diesel exhaust and fire-damaged floor is the following pie chart. Firefighters listed the hazard of their least concern, resulting in a tie. Diesel exhaust and fire-damaged floors have contributed to LODD, in the past. At the current time, 60% of firefighters listed these as the hazard of least concern. Results can be seen below in Figure 4.

Hazard of Least Concern According to Survey.



**Figure 4. Over Half FFs Agree on Low Ranking Hazards**

### **3.1.1.2. Life Safety Initiatives from National Fallen Firefighters Foundation Survey Results**

The NFFF utilizes a curriculum of 16 Life Safety Initiatives throughout FF training programs. The initiatives are derived from common LODD causes. Since the inception of the 16 Life Safety Initiative training in 2004, NFFF reports, “The Initiatives have deeply informed the emerging safety culture in the US fire service, and become the bedrock foundation for thousands of fire departments and EMS organizations who have a desire to ensure that their firefighters and medics return home safely after every shift” (National Fallen Firefighters Foundation, 2016). The survey asked FFs to review the Life Safety Initiatives and rank their personal opinion of each initiative. Ranking began with the initiative is “Very important to reducing hazards” and included five options decreasing the importance of the hazard to “Not even relevant to reducing hazards.” Table IV: Importance of 16 Life Safety Initiatives reveals the percentage of FFs who selected each rank. For example: almost 72 percent of FFs said medical and physical fitness is very important to reduction hazards. Twenty-five percent of FFs selected medical and physical fitness as important to reducing hazards. Leaving less than three percent for the lower sixty percent of the ranking. The conclusion is made, medical and physical fitness are important to hazard reduction. Another noteworthy example: close to four percent of FFs think technology and cultural change are not even relevant to reducing hazards. The conclusion drawn from these two life safety initiative ranking results is four percent of the FF population are hampering cultural change, including utilizing technology to reduce hazards. Refer to Table IV: Ranking 16 Life Safety Initiatives to draw further conclusions and review the full list. A power point style review of survey results can be requested. Full survey results, by individual response, can also be requested.

Table IV. Ranking of 16 Life Safety Initiatives

	Very important to reducing hazards	Important to reducing hazards	Might be important to reducing hazards	Not at all important to reducing hazards	Not even relevant to reducing hazards	Total	Weighted Average
Cultural Change	47.73% 42	27.27% 24	14.77% 13	6.82% 6	3.41% 3	88	1.91
Accountability	55.68% 49	30.68% 27	12.50% 11	1.14% 1	0.00% 0	88	1.59
Risk Management	53.93% 48	35.96% 32	7.87% 7	2.25% 2	0.00% 0	89	1.58
Empowerment	26.14% 23	37.50% 33	28.41% 25	7.95% 7	0.00% 0	88	2.18
Training & Certification	58.43% 52	31.46% 28	8.99% 8	1.12% 1	0.00% 0	89	1.53
Medical & Physical Fitness	71.91% 64	25.84% 23	2.25% 2	0.00% 0	0.00% 0	89	1.30
Research Agenda	19.10% 17	33.71% 30	37.08% 33	8.99% 8	1.12% 1	89	2.39
Technology	25.84% 23	47.19% 42	20.22% 18	3.37% 3	3.37% 3	89	2.11
Fatality, Near-Miss Investigation	46.07% 41	32.58% 29	15.73% 14	4.49% 4	1.12% 1	89	1.82
Grant Support	26.97% 24	41.57% 37	23.60% 21	5.62% 5	2.25% 2	89	2.15
Response Policies	39.77% 35	44.32% 39	14.77% 13	1.14% 1	0.00% 0	88	1.77
Violent Incident Response	37.08% 33	34.83% 31	24.72% 22	2.25% 2	1.12% 1	89	1.96
Psychological Support	42.70% 38	39.33% 35	15.73% 14	1.12% 1	1.12% 1	89	1.79
Public Education	30.34% 27	39.33% 35	23.60% 21	4.49% 4	2.25% 2	89	2.09
Code Enforcement & Sprinklers	35.96% 32	38.20% 34	14.61% 13	7.87% 7	3.37% 3	89	2.04
Apparatus Design & Safety	39.77% 35	39.77% 35	17.05% 15	2.27% 2	1.14% 1	88	1.85

### **3.1.1.3. Volunteer Firefighter Health and Safety Priorities Survey Results**

The last content question was to rank the Volunteer Firefighter Health and Safety Priorities. The priorities are focused on the acronym “BEST.” Behavior (B) covers support of emotional, physical and mental wellbeing; operating emergency apparatus properly, including wearing a seatbelt; health and wellness; and fire ground accountability. Equipment (E) includes maintenance of existing equipment to safety standards and providing and requiring proper use of full PPE. Standards and Codes (S) encourages use of detectors as situation deems necessary, vigorously enforce all fire safety codes and obtain apparatus/equipment which meet or exceed current safety standards. Finishing the acronym is training (T), operate a safe training ground, establish, maintain and deliver fire safety to all ages without discrimination and utilize fire training programs which conform to high safety standards. Again all the priorities were listed with an option to select one being the “Very Important to Reducing Hazards” and the other end of the rank being “Not even relevant to reducing hazards.”

Weighting the results, FFs ranked the priorities as:

- 1) “Training” (72 of 88 selected “very important to reducing hazards”)
- 2) “Behavior” (54 of 88)
- 3) “Standards & Codes” (38 of 88)
- 4) “Equipment” (34 of 88).

Results show FFs take occupational and community training very important in the reduction of hazards. Sixty-one percent of FFs think behavior, which covers from driving apparatus to mental well-being, is important to reduction of hazards. Equipment ranked last in the weighted scale, but over one-third of FFs still selected equipment as very important to reducing hazards.

#### **3.1.1.4. Industrial Hygienist Role in the Fire Service**

The final question of the survey described the role of an IH and opened up the response box for any answers. The full file of 42 answers can be requested. The example in the question related to noise; therefore possibly generating some responses related to noise also. Others commented directly to IH in the fire service, “It (IH) definitely applies to us in the fire service. We can greatly reduce our chances of getting cancer by being more proactive in cleaning our gear/ equipment, keeping our SCBAs on longer during overhaul operations.” A common theme throughout results is the similarities of IH to firefighters, “Safety Officers, Industrial Hygienist, call them what you want...”

### **4. Existing Data Related to Firefighter Hazards**

#### **4.1. Line of Duty Death Causes**

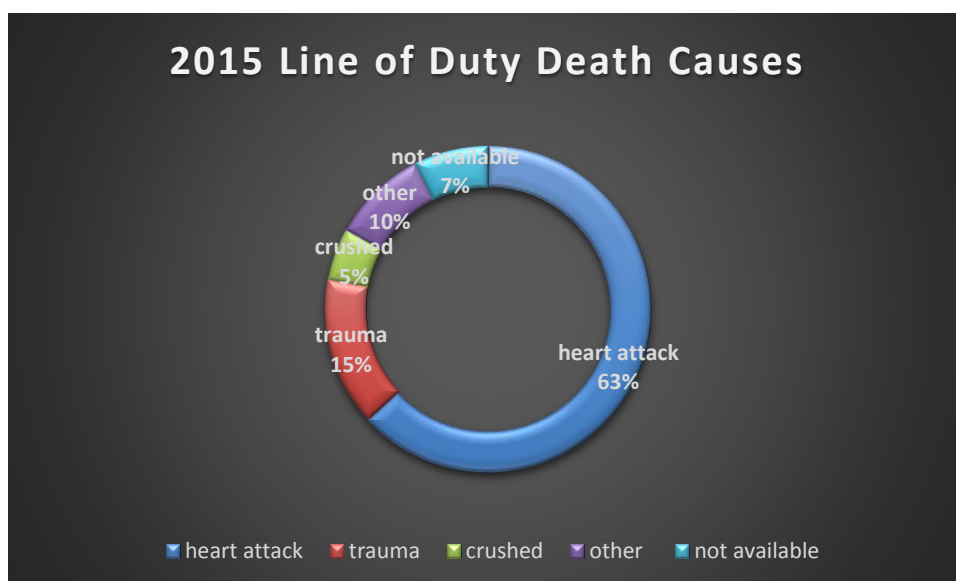
Direct causes of death are not located on the NFFF website with the LODD list, [www.firehero.org](http://www.firehero.org). The NFFF website focuses on family and department functions related to the LODD. The NFFF website includes an explanation of how LODD are selected. Not every FF death is considered LODD. Death may occur several days after an incident and be considered LODD. The criteria is very specific. Utilizing LODD causes to determine ways to reduce FF risk, is not a viable option.

#### **4.2. Existing Data – National Institute for Occupational Safety and Health Reports**

Annually NIOSH compiles a list of LODD for firefighters, the most recent list is in Appendix A, Table IV: LODD 2015 List. NIOSH also investigates every LODD. The average age for LODD is 50, with the vast majority of LODDs between the ages 30 and 70. Note: many



fire department insurance companies force retirement at 65 years old. The force is driven by insurance companies' refusal to insure FF above a certain age. The list reveals an overwhelming number of deaths due to heart attack with over 50 LODDs (sixty percent) caused by heart attacks as illustrated in Figure 5. Other causes include: asphyxiation, burns and stroke. The category "not available" can be listed for a number of reasons, typically the report is not finished or the results are not definitive.



**Figure 5: 2015 Line of Duty Death Causes (NIOSH, 2016)**

## 5. Existing Attempts at Firefighter Risk Reduction

National Fallen Firefighters Foundation (NFFF) hosts a website, with information related to firefighter line of duty deaths. NFFF has two focuses: handling LODD and reducing LODD. Specific training related to reducing risk and hazard is included. (National Fallen Firefighters Foundation, 2016) Classes have different focuses.

One class covers FF and the community, "Community Risk Reduction (CRR): Can We Use the 16 Life Initiative to Accomplish This?" The four-hour class addresses specifically the

14<sup>th</sup> and 15<sup>th</sup> Life Safety Initiatives. The 14<sup>th</sup> Initiative states, “Public education must receive more resources and be championed as a critical fire and life safety program.” The 15<sup>th</sup> Initiative states, “Advocacy must be strengthened for the enforcement of codes and the installation of home fire sprinklers.” Fire departments can request this class and others to be delivered locally. By utilizing the class FFs addressing one of the top priorities revealed in the survey (National Fallen Firefighters Foundation, 2016).

### **5.1. Close Calls Lead to Hazard Reduction**

Workers, including FFs may not implement a hazard reduction recommendation unless they know a person who was injured or killed due to the hazard. In attempts to bring FF close calls to mainstream education, Chief Billy Goldfeder created, “The Secret List.” “The Secret List” (TSL) was created in 1998 to “bring forward issues involving injury and death” to firefighters. (Goldfeder B. , 2016) “With the attitude that in order for us (firefighters) to survive the dangers of the job, they must learn how we have had “Close Calls” and even been injured or killed. The Secret List brings forward issues in an effort to enforce that philosophy-and get use to refocus on “What’s important”” (Goldfeder B. , 2016).

If FF take the time to visit and review TSL, FF may reconsider their direction and efforts in hazard reduction. The website is full of pages of information related to close calls and firefighter deaths. A FF or training officer or safety officer can utilize a page filled with printable posters for the fire service. A few are inside jokes for firefighters, but all focus on safety, evaluating hazards and risk. A FF may see a poster on the bathroom wall and think twice about skipping a workout or wearing their seatbelt (Goldfeder, 2016).

Another poster example is seen below in Figure 6. Nick Recommends Risk Reduction, Nick reminds firefighters to minimize their risk in a variety of ways.



Figure 6: Nick Recommends Risk Reduction (National Fallen Firefighters Foundation, 2016)

### **5.1.1. Hazard Reduction Due to Close Calls in Related Fields**

The fire service is not the only occupation reporting near misses. Aviation utilizes a website to report directly to the Federal Aviation Administration. One can report safety issues, low-flying aircraft, hazardous materials violations, unmanned aircraft system encounters and many more subjects related to safety. Reports can be made anonymously or with contact information for call back. The FAA does not hesitate to share information which falls under the freedom of information act (FAA, 2016).

A communications blackout occurred creating potential for mid-air collisions. Here the FAA was quoting stating the cause of the problem, “A required 30-day maintenance check on the primary radio and voice communications system was not performed,” the agency said. “This system turns off if this check is not performed” (Associated Press, 2016).

The field of nuclear power, weapons and medicine is always improving, including reducing close calls. History.com reviews different close calls during the Cold War. Several of these include drills, which opposing sides believed to be real. Several other close call incidents were related to computer glitches or monitoring equipment detecting false positives. Each required proper human intervention to prevent nuclear disasters. It makes sense for every occupation to have a way to report close calls, public or private. It isn't just FF's who need to prevent injury and accident from others mistakes. It is law enforcement, paramedics, nurses, doctors, teachers, factory workers, construction workers, chefs and anyone else who works in and around hazards. All occupations should be able to report and read about close calls.

## **6. Top Hazards and Recommended Controls**

Reviewing the report information for the top hazards, survey monkey results, the LODD data and the FF near miss information, revealed the top two hazards as job stress, and health and wellness within the 16 Life Safety Initiatives. Job stress ranges from worrying about running out of water at a fire scene to not being well prepared and trained to actual volatile incidents creating stress on the body. Job stress is included on the CDC list, within the NFFF Initiatives and within the priorities listed by the National Volunteer Fire Council. Other lists mention health and wellness, but NFFF designates an entire initiative. Health and Wellness is NFFF life safety initiative number six, “In this profession (firefighting), health and wellness are non-negotiable. Departments should establish and enforce SOPs which support wellness; individuals must embrace wellness as a strategy for successful fire service careers or seek employment elsewhere” (National Fallen Firefighters Foundation, 2016). Heart attacks, the killer of over half the LODD in 2015, combine these top two hazards, job stress and health and wellness.

### **6.1. Job Stress**

Job stress for the FF has a wide range of topics from office politics to manpower concerns to modern combustibles generating too much heat to common problems across the fire service. One product claims, “GelTech Solutions is committed to creating effective solutions to common problems” (FireIce, 2016). Job stress is a common problem across the fire service. A universal tool may prove useful in reducing job stress hazards.

GelTech Solutions is a company who created products which are added to water. Once added to water, specifically the FireIce® products, the water has increased firefighting abilities. Knowing one tank of water can extinguish a house fire, can eliminate one hazard for the FF.

Simply put, if FFs successfully utilize FireIce<sup>®</sup>, water will have super powers and FFs will be the super hero who destroys hazards. The characteristics of the water are enhanced by FireIce<sup>®</sup>. Water, treated with FireIce<sup>®</sup>, has increased cooling ability, increased ability to reduce rekindle, increased penetrability and more. FireIce<sup>®</sup> can be used when fire hazards are anticipated.

FireIce<sup>®</sup> can be used on electrical fires, a place where water is typically used very sparingly. FireIce<sup>®</sup> is successfully eliminating the hazard of electrocution. FireIce<sup>®</sup> can be used when the FF recognizes a fuel spill and controls the hazard of ignition.

During the evaluation step of AREC, FF's can utilize FireIce<sup>®</sup> as a preventative measure. Wildland fires in 2015, proved the tactic. Control of the hazard is the same actions, which FF have always used. Typically FF's use water which, "has the natural ability to slow fire, only FireIce<sup>®</sup> has the ability to stop it." Now, with FireIce<sup>®</sup> FF's can, "Stop fire in its tracks before it can destroy property or claim lives" (FireIce, 2016).

When FF's recognize the ability FireIce<sup>®</sup> has to reduce hazards, numerous FF stresses will be reduced or eliminated. FF's have high stress levels during hazardous material scenes. FireIce<sup>®</sup> is environmentally friendly, which allows it to be applied to grassy areas, into storm drains and any other place it may travel into the ecosystem (FireIce, 2016).

#### **6.1.1. Avoid Job Stress**

Job stress is almost impossible to avoid in the fire service. Stress relief can be substituted with exercise and taking care of mental anguish in anticipation of added stresses (Walker, 2016). One way to avoid stress, according to the International Association of Fire Chief's (IAFC), is to properly utilize rehabilitation. Rehabilitation is not related to an injury, but an attempt to rehabilitate the FF following work on a fire scene.

On structure fire scenes, rehabilitation is a standard, not a recommendation. International Fire Chief's Association defines rehabilitation, "An intervention designed to mitigate against the physical, physiological, and emotional stress of fire fighting in order to sustain a member's energy, improve performance, and decrease the likelihood of on-scene injury or death" (International Fire Chief's Association, 2016).

### **6.1.2. Job Stress Reduction Example Standard Operating Procedures/Standard Operating Guidelines**

Greenville City FD, Ohio, includes mandatory physical training every shift. The Crew works out together, no questions or excuses (Walker, 2016).

IAFC states the elements of rehabilitation must include: initiation, defining responsibilities, maintaining accountability, assuring safety and releasing personnel only when safe to (International Fire Chief's Association, 2016). IAFC adds rehabilitation should be in a safe location from the incident, environment, media, societal threats and prying eyes (International Fire Chief's Association, 2016).

The key to eliminating or controlling stress on the FF through rehabilitation is the proper release of the FF. Three or more slides are dedicated to release in the IAFC presentation. Precisely defined release from rehabilitation is, "The ultimate decision to allow or disallow a member to return to work is vested in the rehab sector officer through authority delegated by the IC" (International Fire Chief's Association, 2016). The rehab sector officer permits release when rehab staff have determined: FF is adequately rested, adequately hydrated and have responded appropriately to care measures. Further guidance and detail on writing SOP/SOG can be found at [http://www.iafc.org/files/ems\\_masimoEstablishingArehabPolicyPart2.pdf](http://www.iafc.org/files/ems_masimoEstablishingArehabPolicyPart2.pdf)

### **6.1.3. Reasons for Implementation**

A study on the CDC site concludes, “it seems likely that a majority of U.S. urban firefighters currently have, or will experience at some time during their career, clinically significant post-traumatic stress symptomatology” (Murphy, 2016).

IAFC notes FF fitness, nutrition and condition should meet NFPA 1583. FF fitness, nutrition and condition contribute to the FF’s ability to handle mental and physical stresses. The same three items are included in the next set of results: ranking of the 16 Life Safety Initiatives.

## **6.2. Health and Wellness #6 of the 16 Firefighter Life Safety Initiatives**

Survey results related to the 16 FF Life Safety Initiatives, brought Initiative 6 to the forefront. Initiative 6 includes topics expected to create, “the most significant reductions in line-of-duty deaths are likely to be achieved through increased medical surveillance and physical fitness programs.”

An article by Chief Ronald J. Siarnicki recommends the following tactics to accomplish initiative 6 (Siarnicki, 2016).



**Table V: Initiative 6 Bullet Points**

Initiative 6 Bullet	IH Step	IH Control Type
Annual medical evaluation	Anticipation, Recognition, Evaluation, Control	Varies according to FF needs
Incorporate “Wellness” into strategic and training plans	Control	Administrative Controls
“Wellness” is high priority for grants	Control, sometimes evaluation	Varies according to department
Identify and pursue resources	Anticipation, Recognition, Evaluation, Control	Varies on FDs and FFs
Identify coordinator or robust wellness program	Anticipation, Control	Varies according to FDs and FFs
Take care of yourself, making health and fitness a priority	Anticipation, Recognition, Evaluation and Control	Varies according to FF

### **6.2.1. Medical & Physical Fitness Initiative 6**

Firefighter leaders agree with those who took the survey. In 2015, the following poster and campaign was created. The poster lists medical and physical fitness throughout the bullet

goals for “Everyone Goes Home” (National Fallen Firefighters Foundation, 2016) .



Figure 2: National Fallen Firefighter’s Foundation Initiative 6 Poster

### 6.2.2. Example Standard Operating Procedures/Standard Operating Guidelines

Fire Departments fall into three categories: no physical qualifications; physical and mental qualifications at employment and the last, all encompassing, physical and mental qualifications and assessment throughout employment. For example: MFD requires a candidate to complete a page with their name and birthday and pass a physical with the candidate’s doctor. The other extreme is common for larger city departments. Candidates must complete physical, hearing test, vision test, urine test, lie detector test, mental stability test and other items prior to being accepted into the hiring process. (Walker, 2016)

According to NIOSH, cardiac events are the number one killer of FF's. NIOSH tasks fire departments with two tasks to accomplish reduction of cardiac events. "Provide medical evaluations to ensure that candidates and members are capable of performing job tasks with minimal risk of sudden incapacitation. Ensure that physicians conducting the medical evaluations are knowledgeable about the physical demands of firefighting, the essential tasks of firefighting, and the consensus guidelines developed by the fire service" (NIOSH, 2016). Further information on reducing cardiac events, can be located through NIOSH search engines.

### **6.2.3. Standard Operating Procedures/Standard Operating Guidelines Implementation Logic**

All FF are required to have physical from their doctor prior to entering class for fire certification. Doctors should, at the time of entry physical, anticipate, recognize and evaluate health hazards. Typical physicals include heart electrocardiogram, occasionally a stress test and any other tests the doctor deems necessary. The doctor may prescribe medicine, therapy or clear the potential FF prior to class. Many departments do not require additional physicals throughout years of employment. Physicals should be updated annually, according to the FF's wellness and health (Walker, 2016).

## **6.3. Training/Educate**

The purpose of including the following example is to demonstrate the ideal fire instructor exists. Not every fire instructor has the ability to capture FF's attention and provide a lesson the FF will remember. Not every fire instructor has a passion for the profession of firefighting and/or instructing. Becoming the ideal instructor is not attainable for many instructors. Annually across the nation, instructors flock to Indianapolis, New York, Las Vegas and many smaller cities for

conferences to learn how to be a better instructor. The drive of being the ideal instructor is difficult to maintain. The state of Ohio Fire Academy is lucky to have one ideal instructor and here is an example of how he reaches his FFs.

A well respected OG (old guy) in the fire service said, “I don’t believe it. Everyone doesn’t go home. I teach it, because they say I have to, but I know it isn’t true. Everyone goes home.” He proceeded to describe a double LODD call where he responded. He discussed the hazards the call presented, all hazards appeared to be routine for a two story structure fire. The incident commander failed to complete a 360 degree walk around the structure. The backside of the structure revealed a walkout basement, a third floor. When the crew was in the structure, the floor was weakened and they fell into the walkout basement fire floor. He added, at the end of his story, one of the dead FF’s grew up best friends with his daughter. His audience of volunteer FF’s attention was caught.

The OG continued his required power point presentation. Towards the end he mentioned the official class slides were over. As he continued, one could hear a pin drop in the classroom. The OG proceeded to recount the death of Oscar Armstrong, a Cincinnati fireman. The OG used unreleased television footage of the fire scene, including Oscar’s “rescue.” His body tossed out a first floor window and landed unceremoniously onto a cot, arms bent in a cooked chicken like appearance. Oscar was loaded into an ambulance, and the presentation flipped to a slide of his rookie picture and the years of his life. “Oscar was a recovery, no one survives a flashover,” said the OG. “Any questions? Let’s go learn something!” he said as he led the class outside to lead them through the flashover simulator. The flashover simulator is a training tool where FF’s can watch the flashover and remain alive.

The OG is an instructor by certification and a trainer by heart and soul. Every training, in the fire service, needs an instructor just like the OG. Unfortunately every training, in the fire service, does not include the quality instruction and deep connection the OG possesses. Results from the survey question related to the National Volunteer Fire Council revealed, “Training” as the top hazard in need of attention.

### **6.3.1. Station Poster**

National Volunteer Fire Council (NVFC) has created a poster, in section A. The poster included an acronym, “BEST.” The “T” stands for training. According to the poster training includes three bullets, all reminders related to safe training. The last bullet is all encompassing, “Establish, maintain, and deliver fire safety programs for all age groups” (NVFC, 2016).

#### **6.3.1.1. Recommendations for Delivery**

Fire departments often hang posters. Location and reference to the posters is vital for the message to be successful (Walker, 2016). Posters hung on the training pegboard are typically ignored. Posters placed on the bathroom mirror or back of the bathroom door are read and discussed at the kitchen table. Forced discussion related to hazards and risk during a formal training session is normally not successful. Casual discussion around the coffee pot and at the television or over text message, are repeated and can cause change in FFs actions (Walker, 2016).

Reminders to wear your PPE are often ignored during training or when delivered by email. Administrative controls could be implemented to enforce firefighters to wear PPE during training and on scenes. Followed up by citations issued to those caught during training without

PPE. Firefighters want to follow the rules, but often do not for numerous reasons. A no excuses policy must be implemented and enforced (Walker, 2016).

## **7. Moving Forward**

In conclusion, FFs must be willing to make a change in everyday behavior to reduce occupational hazards. The above report identified top hazards: job stress, health and well-being and training/education is necessary for the survival of the FF. It will take champions throughout the fire service, throughout each station across the lands to begin reduction these top hazards. Ultimately reduction of each hazard will be different for each FF. Solutions are started and can be expanded to fit the needs of each station and FF. Each year the fire service improves. Knowing top hazards, job stress, health and well-being and training/education, is the first step towards anticipation, recognition, evaluation and control of each hazard.

### **7.1.1. Recognition of Report and Survey Limitations**

Limitations of the report include a possible bias of the author. Her livelihood revolves around the fire service. The report was proofed by multiple people outside of the fire service. To prevent the possible bias, the report should be reviewed by additional parties outside of the fire service.

Further survey data was collected during the FDIC 2016. No significant swing in the results appeared. When report is completed, it will be disseminated to survey respondents who requested a copy.

A second survey should be sent to those who expressed interest. Survey monkey can be utilized. Questions should be direct answers with option to comment. Questions should be oriented around proposed implementation of hazard reduction and the likelihood of FFs implementing a new or changed SOP/SOG.

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## Appendix A: Important Information

### 8. Seating Positions

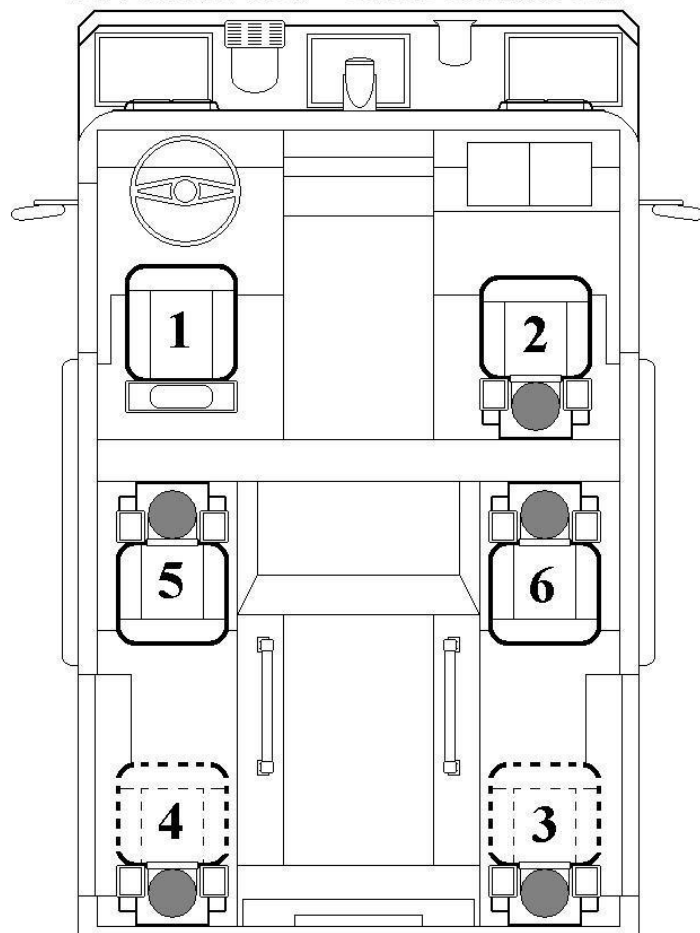
### 9. Line of Duty Death Causes 2015 List

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#### *SEATING POSITIONS*

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#### **ENGINE 331 "OLD SCHOOL"**



#### **4 Man Engine Crew**

- 1. Wagon Driver - Drive safely, Pump**
- 2. Officer - Line placement, Hydra Ram**
- 3. Lineman - Pull Attack Line**
- 4. Layout - Layout, assist with line**

#### **6 Man Engine Crew**

- 1. Wagon Driver - Drive safely, Pump**
- 2. Officer - Line placement, Hydra Ram**
- 3. Lineman - Pull Attack Line**
- 4. Layout - Layout, assist with line**
- 5. Backup - Assist with lines, Irons**

## Line of Duty Death Causes 2015 List

<b>Date of Incident:</b> 04/24/2015	<b>Age:</b> 54	<b>Rank:</b> Lieutenant
<b>State:</b>	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 02/19/2015	<b>Age:</b> 57	<b>Rank:</b> Captain
<b>State:</b> Texas	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 01/22/2015	<b>Age:</b> 49	<b>Rank:</b> Firefighter
<b>State:</b> Kansas	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 10/12/2015	<b>Age:</b> 43	<b>Rank:</b> Fire Apparatus Operator
<b>State:</b> Missouri	<b>Sex:</b> Male	<b>Nature:</b> Crushed
<b>Date of Incident:</b> 10/12/2015	<b>Age:</b> 39	<b>Rank:</b> Firefighter
<b>State:</b> Missouri	<b>Sex:</b> Male	<b>Nature:</b> Crushed
<b>Date of Incident:</b> 06/28/2015	<b>Age:</b> 46	<b>Rank:</b> Engineer
<b>State:</b> Colorado	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 06/10/2015	<b>Age:</b> 33	<b>Rank:</b> Not Available
<b>State:</b> Idaho	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 06/06/2015	<b>Age:</b> 31	<b>Rank:</b> Not Available
<b>State:</b> Arizona	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/24/2015	<b>Age:</b> 46	<b>Rank:</b> Captain
<b>State:</b> Oklahoma	<b>Sex:</b> Male	<b>Nature:</b> Asphyxiation
<b>Date of Incident:</b> 05/06/2015	<b>Age:</b> 44	<b>Rank:</b> Lieutenant
<b>State:</b> District of Columbia	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/06/2015	<b>Age:</b> 44	<b>Rank:</b> Firefighter
<b>State:</b> Mississippi	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/04/2015	<b>Age:</b> 54	<b>Rank:</b> Firefighter
<b>State:</b> New York	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 03/26/2015	<b>Age:</b> 54	<b>Rank:</b> Fire Apparatus Operator
<b>State:</b> Ohio	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 01/07/2015	<b>Age:</b> 42	<b>Rank:</b> Battalion Chief
<b>State:</b> Missouri	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 12/28/2015	<b>Age:</b> 28	<b>Rank:</b> Firefighter
<b>State:</b> Ohio	<b>Sex:</b> Male	<b>Nature:</b> Not Available
<b>Date of Incident:</b> 12/21/2015	<b>Age:</b> 66	<b>Rank:</b> Captain
<b>State:</b> Mississippi	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 12/19/2015	<b>Age:</b> 19	<b>Rank:</b> Captain
<b>State:</b> New York	<b>Sex:</b> Male	<b>Nature:</b> Asphyxiation
<b>Date of Incident:</b> 12/19/2015	<b>Age:</b> 47	<b>Rank:</b> Firefighter
<b>State:</b> Texas	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 12/14/2015	<b>Age:</b> 42	<b>Rank:</b> Firefighter/Paramedic
<b>State:</b> Illinois	<b>Sex:</b> Male	<b>Nature:</b> Trauma

Continued Line of Duty Death Causes 2015 List		
<b>Date of Incident:</b> 12/11/2015	<b>Age:</b> 56	<b>Rank:</b> Firefighter
<b>State:</b> Wisconsin	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 12/06/2015	<b>Age:</b> 67	<b>Rank:</b> Fire Police Officer
<b>State:</b> Pennsylvania	<b>Sex:</b> Male	<b>Nature:</b> CVA
<b>Date of Incident:</b> 12/04/2015	<b>Age:</b> 30	<b>Rank:</b> Firefighter
<b>State:</b> Kentucky	<b>Sex:</b> Male	<b>Nature:</b> Not Available
<b>Date of Incident:</b> 12/04/2015	<b>Age:</b> 49	<b>Rank:</b> Firefighter/Paramedic
<b>State:</b> Illinois	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 11/28/2015	<b>Age:</b> 48	<b>Rank:</b> Captain
<b>State:</b> California	<b>Sex:</b> Male	<b>Nature:</b> CVA
<b>Date of Incident:</b> 11/20/2015	<b>Age:</b> 65	<b>Rank:</b> Captain
<b>State:</b> Michigan	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 11/19/2015	<b>Age:</b> 59	<b>Rank:</b> Sergeant
<b>State:</b> Michigan	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 11/12/2015	<b>Age:</b> 65	<b>Rank:</b> Assistant Fire Chief
<b>State:</b> Kentucky	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 10/25/2015	<b>Age:</b> 58	<b>Rank:</b> Firefighter
<b>State:</b> Texas	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 10/20/2015	<b>Age:</b> 92	<b>Rank:</b> Firefighter
<b>State:</b> North Carolina	<b>Sex:</b> Male	<b>Nature:</b> Other
<b>Date of Incident:</b> 10/14/2015	<b>Age:</b> 70	<b>Rank:</b> Fire Police Officer
<b>State:</b> New Jersey	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 10/13/2015	<b>Age:</b> 54	<b>Rank:</b> Captain
<b>State:</b> Ohio	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 10/06/2015	<b>Age:</b> 46	<b>Rank:</b> Lieutenant
<b>State:</b> Tennessee	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 09/24/2015	<b>Age:</b> 67	<b>Rank:</b> Firefighter
<b>State:</b> Michigan	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 09/23/2015	<b>Age:</b> 50	<b>Rank:</b> Firefighter
<b>State:</b> New Jersey	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 09/23/2015	<b>Age:</b> 50	<b>Rank:</b> Not Available
<b>State:</b> New York	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 09/18/2015	<b>Age:</b> 35	<b>Rank:</b> Firefighter/EMT
<b>State:</b> Texas	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 09/17/2015	<b>Age:</b> 59	<b>Rank:</b> Deputy Fire Chief
<b>State:</b> New Jersey	<b>Sex:</b> Male	<b>Nature:</b> Not Available
<b>Date of Incident:</b> 09/13/2015	<b>Age:</b> 31	<b>Rank:</b> Firefighter/EMT
<b>State:</b> South Carolina	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack

Continued Line of Duty Death Causes 2015 List		
<b>Date of Incident:</b> 09/09/2015	<b>Age:</b> 35	<b>Rank:</b> Firefighter
<b>State:</b> Michigan	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 08/31/2015	<b>Age:</b> 38	<b>Rank:</b> Firefighter/Paramedic
<b>State:</b> Minnesota	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 08/26/2015	<b>Age:</b> 41	<b>Rank:</b> Lieutenant
<b>State:</b> North Carolina	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 08/23/2015	<b>Age:</b> 30	<b>Rank:</b> Firefighter/EMT
<b>State:</b> Texas	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 08/22/2015	<b>Age:</b> 40	<b>Rank:</b> Firefighter
<b>State:</b> New York	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 08/19/2015	<b>Age:</b> 20	<b>Rank:</b> Not Available
<b>State:</b> Washington	<b>Sex:</b> Male	<b>Nature:</b> Burns
<b>Date of Incident:</b> 08/19/2015	<b>Age:</b> 26	<b>Rank:</b> Not Available
<b>State:</b> Washington	<b>Sex:</b> Male	<b>Nature:</b> Burns
<b>Date of Incident:</b> 08/19/2015	<b>Age:</b> 31	<b>Rank:</b> Firefighter
<b>State:</b> Washington	<b>Sex:</b> Male	<b>Nature:</b> Burns
<b>Date of Incident:</b> 08/17/2015	<b>Age:</b> 40	<b>Rank:</b> Lieutenant
<b>State:</b> North Carolina	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 08/14/2015	<b>Age:</b> 59	<b>Rank:</b> Fire Chief
<b>State:</b> North Carolina	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 08/08/2015	<b>Age:</b> 21	<b>Rank:</b> Firefighter
<b>State:</b> California	<b>Sex:</b> Male	<b>Nature:</b> Crushed
<b>Date of Incident:</b> 07/30/2015	<b>Age:</b> 38	<b>Rank:</b> Not Available
<b>State:</b> California	<b>Sex:</b> Male	<b>Nature:</b> Asphyxiation
<b>Date of Incident:</b> 07/26/2015	<b>Age:</b> 44	<b>Rank:</b> Captain
<b>State:</b> North Carolina	<b>Sex:</b> Male	<b>Nature:</b> Not Available
<b>Date of Incident:</b> 07/03/2015	<b>Age:</b> 51	<b>Rank:</b> Firefighter
<b>State:</b> South Carolina	<b>Sex:</b> Male	<b>Nature:</b> Not Available
<b>Date of Incident:</b> 06/20/2015	<b>Age:</b> 45	<b>Rank:</b> Lieutenant
<b>State:</b> Wisconsin	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 06/08/2015	<b>Age:</b> 69	<b>Rank:</b> Firefighter
<b>State:</b> Pennsylvania	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 06/03/2015	<b>Age:</b> 59	<b>Rank:</b> Captain
<b>State:</b> Alabama	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/31/2015	<b>Age:</b> 59	<b>Rank:</b> Firefighter
<b>State:</b> Wisconsin	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/30/2015	<b>Age:</b> 55	<b>Rank:</b> Lieutenant
<b>State:</b> Ohio	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack

Continued Line of Duty Death Causes 2015 List		
<b>Date of Incident:</b> 05/25/2015	<b>Age:</b> 48	<b>Rank:</b> Lieutenant
<b>State:</b> Tennessee	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/25/2015	<b>Age:</b> 71	<b>Rank:</b> Firefighter
<b>State:</b> New Jersey	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/23/2015	<b>Age:</b> 59	<b>Rank:</b> Firefighter
<b>State:</b> Maine	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/03/2015	<b>Age:</b> 60	<b>Rank:</b> Not Available
<b>State:</b> Missouri	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 05/03/2015	<b>Age:</b> 41	<b>Rank:</b> Firefighter
<b>State:</b> Tennessee	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 04/30/2015	<b>Age:</b> 46	<b>Rank:</b> Firefighter
<b>State:</b> Pennsylvania	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 04/27/2015	<b>Age:</b> 68	<b>Rank:</b> Not Available
<b>State:</b> Kansas	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 04/19/2015	<b>Age:</b> 71	<b>Rank:</b> Fire Police Lieutenant
<b>State:</b> Pennsylvania	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 04/16/2015	<b>Age:</b> 42	<b>Rank:</b> Captain
<b>State:</b> Nebraska	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 04/13/2015	<b>Age:</b> 37	<b>Rank:</b> Inmate Firefighter
<b>State:</b> California	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 04/12/2015	<b>Age:</b> 38	<b>Rank:</b> Firefighter
<b>State:</b> South Dakota	<b>Sex:</b> Male	<b>Nature:</b> Not Available
<b>Date of Incident:</b> 03/30/2015	<b>Age:</b> 40	<b>Rank:</b> Pilot
<b>State:</b> Mississippi	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 03/30/2015	<b>Age:</b> 55	<b>Rank:</b> Not Available
<b>State:</b> Mississippi	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 03/25/2015	<b>Age:</b> 63	<b>Rank:</b> Firefighter
<b>State:</b> New Jersey	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 03/07/2015	<b>Age:</b> 38	<b>Rank:</b> Firefighter
<b>State:</b> Mississippi	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 03/06/2015	<b>Age:</b> 72	<b>Rank:</b> Pilot
<b>State:</b> California	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 03/04/2015	<b>Age:</b> 54	<b>Rank:</b> Fire Chief
<b>State:</b> Kentucky	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 03/03/2015	<b>Age:</b> 18	<b>Rank:</b> Firefighter
<b>State:</b> Pennsylvania	<b>Sex:</b> Male	<b>Nature:</b> Crushed
<b>Date of Incident:</b> 02/25/2015	<b>Age:</b> 95	<b>Rank:</b> Fire Police Captain
<b>State:</b> Pennsylvania	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack

Continued Line of Duty Death Causes 2015 List		
<b>Date of Incident:</b> 02/19/2015	<b>Age:</b> 57	<b>Rank:</b> Not Available
<b>State:</b> Minnesota	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 02/15/2015	<b>Age:</b> 52	<b>Rank:</b> Sergeant
<b>State:</b> South Carolina	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 02/11/2015	<b>Age:</b> 46	<b>Rank:</b> Lieutenant
<b>State:</b> Georgia	<b>Sex:</b> Male	<b>Nature:</b> Asphyxiation
<b>Date of Incident:</b> 02/06/2015	<b>Age:</b> 67	<b>Rank:</b> Firefighter
<b>State:</b> West Virginia	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 02/05/2015	<b>Age:</b> 59	<b>Rank:</b> Fire Chief
<b>State:</b> Illinois	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 01/30/2015	<b>Age:</b> 61	<b>Rank:</b> Assistant Fire Chief
<b>State:</b> Iowa	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack
<b>Date of Incident:</b> 01/28/2015	<b>Age:</b> 55	<b>Rank:</b> Firefighter
<b>State:</b> Kansas	<b>Sex:</b> Male	<b>Nature:</b> CVA
<b>Date of Incident:</b> 01/14/2015	<b>Age:</b> 58	<b>Rank:</b> Firefighter
<b>State:</b> Wisconsin	<b>Sex:</b> Male	<b>Nature:</b> CVA
<b>Date of Incident:</b> 01/10/2015	<b>Age:</b> 74	<b>Rank:</b> Firefighter
<b>State:</b> New York	<b>Sex:</b> Male	<b>Nature:</b> Trauma
<b>Date of Incident:</b> 01/09/2015	<b>Age:</b> 58	<b>Rank:</b> Captain
<b>State:</b> California	<b>Sex:</b> Male	<b>Nature:</b> Heart Attack

<http://www.cdc.gov/niosh/fire/>

**Additional Raw Information – Lengthy items available upon request**

**Glossary of Terms**

**Autobiography, Proof of Credible Source**

**Survey Monkey Questions**

**Written Responses Question #1**

**Data All 2-28-16**

**Written Responses**

**Criteria for Inclusion**

**2012 BEST Poster**

**NFPA List**

**Survey Summary**

**All written responses**

**SOPS**

**Glossary of Terms**



## Glossary of Terms

Term	Definition
E-Thesis Coordinator	The person at Montana Tech who will help you format and prepare your thesis for publication online and on paper. Get to know her!
NFPA	National Fire Protection Association: “The leading information and knowledge resource on fire, electrical and related hazards.” (NFPA, 2016) List of all codes and standards located online.
FF	Firefighter, as further defined
SDO	According to NFPA, “SDOs are standards development organizations which work to formulate health and safety standards.” (NFPA, 2016) SDO is further defined in the text.
SOP	Standard Operating Procedure
SOG	Standard Operating Guideline
AHJ	Authority Having Jurisdiction, the person or organization task with overseeing an area, including law, rule or code enforcement (Walker, 2016)
FH	Fire House, referring to the location the firefighters return to after an incident. A fire house may be a station with multiple apparatus, an office area, a station with one apparatus or a combination of these descriptions. (Walker, 2016)
FG	Fireground, the area of an incident where firefighters completed tasks. The fireground may be a training building, training field, training center, an accident scene, a fire scene, an accident site or other area.
IH	Industrial Hygiene
AREC	Anticipation, Recognition, Evaluation and Control, traditional IH process. Prevention is included in AREC. (Anna, 2011)
FD	Fire Department, referring to the governing body over the fire house, firefighters, budgets, management and any other related matters.
Field	Similar to FG, often referenced to an area of work or experience. In one shift a FF may teach elementary school kids, drive a tanker, go SCUBA diving and cook supper. All these activities are working in the “field.” Also referred to any FF activities NOT behind a desk or computer.
LODD	Line of Duty Death, referring to anyone who dies in relation to firefighting activities. Includes responding to scene, at scene, returning or cleaning up from a scene, training, related medical conditions and more. NIOSH creates an official list each year.

## **Autobiography, Proof of Credible Source**

Laura Walker (author of report) completed her level II firefighter certification in 2004, following her level I certification in 2003. She became a fire instructor in 2013. She is also an advanced emergency medical technician and emergency medical services instructor. She is an active volunteer on the Montezuma Fire Department. She responds from her home to the emergency medical calls in Franklin Township, Mercer County, Ohio. She is an active part-time employee of Greenville Township Rescue. She is a fire instructor for Sinclair Community College Fire Academy. Her fulltime job is Assistant Professor of Fire Science, Fire Science Technology Department, Division of Public Services, Sinclair Community College, Dayton, Ohio. She will be taking the position of Program Director of Fire Science in the new department of Public Services. Sinclair Community College requires all tenure track faculty (as she is) to obtain a Master's Degree. Evaluating options, she selected Montana Tech and IH. When tasked with a topic for her report she wanted a topic related to her occupation and a topic where FF's would benefit. She expects her final report to be picked up by fire officials across the Miami Valley in Ohio. Following review of the report, officials will know the top health and safety hazards, according to their peers. The list of health and safety hazards can provide direction for prioritizing health and safety mitigation, training, and incident management. Unions, officers and firefighters are always interested in improving conditions for FF's, reducing injuries, and eliminating line of duty deaths. The report can provide a starting point for unions, officials and FF's to begin addressing health and safety hazards. Officials can voice their opinion on the proposed health and safety mitigation options through a link at survey monkey. For FF's not in mid-west Ohio, the report is relatable to structural firefighting throughout many different locations.