

NO MORE ROUTINE RESPONSES

How Prepared are Firefighters for Modern Firefighting

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CERTIFICATION STATEMENT

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ABSTRACT

Cultural, technological, and environmental changes have affected emergency operations. Accepting and adapting to change was a difficult process. Tradition and complacency hindered the fire service in the change process.

The problem investigated was to determine preparedness of firefighters in responding to incidents influenced by newer cultural, technological, and environmental factors.

The purpose of the research was to increase the awareness of the potential impact of the newer factors on emergency operations. A descriptive research method was applied to this research project to answer the following research questions:

1. What were some of the current cultural, environmental, and technological factors that influenced emergency operations?
2. Did firefighters feel prepared to respond to incidents involving newer cultural, environmental, and technological factors?
3. What were some of the reasons that contributed to firefighters feeling ill prepared when responding to incidents affected by those factors?

The procedures used to complete this research included a review of written materials regarding hybrid vehicles, meth labs, domestic terrorism, and hydrogen cyanide. A survey was developed to determine firefighter response preparedness.

The results indicated that the majority of firefighters feel ill prepared to respond to incidents involving meth labs, hybrid vehicles, hydrogen cyanide, and domestic terrorism. Firefighters indicated a lack of training, lack of information, and inadequate procedures as reasons for low preparedness for the given scenarios.

The initial phase to increase preparedness of firefighters was to build a thorough knowledge base. This could be achieved with the assistance of hazard specific experts, lessons learned from other agencies, and utilization of the vast array of written materials. The second phase was to begin intensive training initiatives. Finally, a review of department policies and procedures to determine if they would be effective for an incident influenced by a meth lab, hybrid vehicle, hydrogen cyanide, or domestic terrorism.

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INTRODUCTION

Statement of the Problem

Each time a fire department responded to an emergency, it was the responsibility of the first responders to bring a resolution to the problem. The methods first responders used to control an emergency had been handed down through the generations. Lessons learned from previous events were a primary source of information when developing fire ground strategies and tactics. However, there were many new factors affecting emergency scenes that presented new and often unknown hazards. “When the fire service began to describe how it extinguishes fire, the first explanations of strategy came from chiefs who had studied successful company tactics. The firefighting strategies in use today were developed years ago by chiefs who had analyzed time-proven tactics” (Dunn, 1999).

The problem this study investigated was the level of preparedness of first responders for newer cultural, technological, and environmental factors influencing emergency operations.

In Dunn’s (1999) statements, tradition was the driving force within the fire service. Historically, the fire service was plagued by tradition which made it very difficult to adapt to external changes. The adherence to tradition may explain why the National Institute of Occupational Safety and Health annually investigated 100 firefighter fatalities (NIOSH, 2006).

In today’s fire service, cultural, technological, and environmental factors have added to the dynamics of society. Technological changes made firefighting safer, but offered a false sense of security. Some of the changes included technological advances in communications, firefighting protective clothing, and equipment. While these advances made our job better and safer, over-reliance on these new systems and equipment has caused needless firefighter fatalities and injuries (Avillo, 2002). Building materials were lighter and burned faster which created

major collapse hazards. Synthetic materials burned hotter than natural material causing earlier flashover. The smoke emitted from synthetic materials was extremely toxic. Respiratory protection was imperative in the presence of the products of combustion. Traditional rescue and extrication techniques on hybrid vehicles could kill first responders. The uncontrolled wave of clandestine drug labs in the U.S. continued to move eastward. First responders were finding labs within homes, hotels, motor vehicles, and on the side of the road. Methamphetamine (meth) labs potentially exposed innocent people to hazardous substances. Finally, domestic and international terrorist has targeted first responders to enhance the emotional impact of a terror attack.

Purpose of the Study

The purpose of this study was to increase awareness of the potential impact and influence that cultural, technological, and environmental changes had on firefighting and offer suggestions to assist in the preparation for emergency situations affected by external changes.

The information obtained from this study could be utilized by administrators to update response procedures and filter down to training divisions to educate fire officers and firefighters.

Research Method

The research method chosen for this applied research project was descriptive. A review of several current changes affecting the fire service was evaluated. The review focused on the affects changes had on training, education, and response by fire departments relating to the external changes. A survey was used to get feedback from firefighters' concerning attitudes toward the current trends of firefighting based on external changes.

Research Questions

The following questions were answered by this descriptive research:

1. *What were some of the current cultural, environmental, and technological factors that*

influenced the outcome of emergency scenes?

2. *Did firefighters feel prepared to respond to incidents that involved one or more of the newer cultural, environmental, and technological factors?*
3. *What were some of the reasons that contributed to firefighters feeling ill prepared when responding to incidents affected by those factors?*

BACKGROUND AND SIGNIFICANCE

Firefighters were required to conduct a multitude of tasks during the course of their duties. The responsibilities of a firefighter included medical emergencies, structure fires, hazardous materials incidents, technical rescues and public education events. This amount of expected responsibility hindered firefighters from becoming experts in every field. The dynamics of society continued to create changes that affected emergency scenes. The changes equated to new and unknown hazards that could injure or kill first responders, so how did fire ground commanders develop strategies to approach and mitigate so many different types of situations?

Recently, there were several external changes identified that affected the way firefighters do their job. Success in the mitigation of these events was based on a fire departments ability to recognize the change early and adapt to it through training and procedure development.

Methamphetamine Labs

Statistics showed that clandestine drug labs continued to migrate to the east. The number of methamphetamine drug lab seized in Ohio increased each year. In 2001, the number of labs seized was 89. In 2005, the Drug Enforcement Agency (DEA) reported the number almost tripled to 316. Summit County continued to lead Ohio counties in the number of meth labs (DEA, 2006).

As the number of labs increased, so did the potential harm to individuals and the environment. The harm to individuals that use meth was obvious. Acute effects of meth use included convulsions, dangerous increases in body temperature, strokes, and cardiac arrhythmias. Chronic effects included intense paranoia, hallucinations, violent episodes, open sore (crank

bugs), and eventually death. In 2002, the Office of National Drug Control Policy reported meth related emergency room visits totaled 17,696.

Meth labs were found virtually anywhere including homes, garages, hotels, motor vehicles, and outdoor wooded areas. First responders could find a meth lab during a routine response. Clandestine labs potentially exposed responders to toxic by-products commonly found at meth lab sites. In 2002, the Center for Disease Control (CDC) reported that five Western states initially affected by meth labs logged 112 incidents involving hazardous materials caused by meth labs. Those 112 reported incidents produced 155 total injuries with 79 affecting first responders which accounted for 51% of the injuries.

Fires were another consequence of meth labs. In 2003, the National Drug Intelligence Center (NDIC) reported 529 meth lab fires or explosions in the United States. The chemicals used to produce meth and the by-products of manufacturing meth could dramatically influence fire behavior.

The environment was another casualty of methamphetamine. The Lake County Sheriff's Offices (LCSO) reported that each pound of meth generated in a clandestine lab produced between five and six pounds of waste. This waste was routinely dumped into streams, rivers, and sewage systems creating potential health problems to residents. The costs involved in cleaning abandoned labs can be extensive (LCSO, 2006).

Hydrogen Cyanide

Technological changes in personal protective equipment allowed firefighters to penetrate deeper into buildings under fire conditions. Thermal imaging cuts through smoke for easy navigation of a building. Sophisticated alarm systems alerts occupants and firefighters before a fire has the chance to consume the building. Every aspect of firefighting was improved, assisted

by technology, over the last 20 years. The problem was that buildings were being constructed with materials that failed quickly under fire conditions and emitted highly toxic smoke. The equipment available to firefighters enhanced the effectiveness of fire operations. However, the arenas firefighters operate in became unreliable and dangerous.

Lightweight wood trusses have been problematic to the fire service for several years. Lightweight wood trusses were fast burners. If one truss member failed, the entire truss system would fail. If there was enough heat and fire to require ventilation, the roof was unsafe (Brannigan, 1988). Based on these characteristics, many fire departments developed alternative methods of ventilation and gave serious consideration to the amount of time the trusses were exposed to heat and fire.

The major concern with some building materials and furnishings was their synthetic composition. The synthetic composition created two potentially life threatening problems. First, flashover was occurring in structure fires sooner. The synthetics released gases that reached flash points as low as 430 degrees (Dodson, 2006). The uninhabitable conditions during flashover had decreased rescue timeframes making body recovery a more likely scenario. The technological advancements in personal protective equipment allowed firefighters to penetrate deeper into buildings. This deadly combination of better gear and quicker flashover times equated to firefighter injuries and deaths.

The second problem associated with synthetics dealt with the effects the toxic gases posed to occupants and first responders. Hydrogen cyanide has always been a by-product of combustion. Synthetic material has increased the amount of cyanide found in the smoke at structure fires. Many departments throughout the nation were reporting casualties and even fatalities due to cyanide poisoning. Hydrogen cyanide seemed to be relatively unknown to

members of the fire service. Fire administrators seemed to ignore the problem (Milkovits, 2006). Many deaths originally determined to be related to carbon monoxide poisoning were actually cyanide poisoning (Alcorta, 2004).

Hybrid Vehicles

The rising costs of oil and gasoline was forcing people to seek out fuel alternatives. Hybrid vehicles were manufactured by several large automobile manufacturers including Ford, Honda, GMC, and Toyota. It was estimated that there were currently 200,000 hybrids on the road. It was projected that that number could rise to 2,000,000 in five years (Pound, 2005). Hybrid vehicles combined traditional internal combustion engines with electric motors. The electric motor assisted the engine during periods of increased demand. The design decreased fuel consumption and increased gasoline mileage (Moore, 2005).

The major concern for firefighters was the electric motor. The motor produced about 500 volts. This was 40 times higher than a standard car battery. High voltage cables ran the length of the vehicle and were marked with bright orange covers. Cutting into the high voltage cables could injure or kill first responders.

When the demand on the hybrid was low, the internal combustion engine would shut down and the electric motor became the main source of power. This was referred to the “sleep mode”. To restart the engine, the driver simply began to accelerate. The sleep mode created a condition in that the engine ceased to make any sounds, this led responders to believe that the vehicle was secure. The car was still under power and had the potential to run over any first responder that may be in front of the car (Pound, 2005).

Under fire conditions, the high voltage system could be breeched. The batteries could intensify a fire and produce toxic fumes not normally associated with traditional vehicle fires. Respiratory protection was mandatory throughout the incident (Moore, 2005).

Domestic Terrorism

Domestic and international terrorism was a real threat for every community in the United States. Since 2001, many initiatives were implemented to prepare communities for the possibility of a terror attack. However, many first responders still lacked training in recognizing, responding, and mitigating a terror event (Buck, 2002). Terrorist continued to place bounties on the head of first responders to increase the emotional impact of their attacks. Osama Bin Laden was elated when informed of the World Trade Center collapse and subsequent deaths of many first responders. Eric Rudolf studied the response procedures of the Atlanta Fire Department and placed secondary devices at the anticipated command post and staging areas to harm first responders (Buck, 2002).

Conclusion

The possibility that a firefighter may be exposed to one or more of the cultural, technological, or environmental factors was very high. Fire administrators must develop methods to anticipate then adapt to external changes. Once a significant change was identified, fire departments must educate their members and begin the steps necessary to adapt to the external factors. Fire administrators must review policy and procedures to ensure that current strategies and tactics can effectively mitigate that incident.

The potential impact this study had on the Eastlake Fire Department was the realization that there was a need to have a method of identifying changes that could influence emergency operations. Once a change was identified, appropriate training must be initiated and polices and

procedures must be reviewed and updated to adapt to the factor. A flow chart addressing a specific change may assist fire ground commanders during an emergency operation.

LITERATURE REVIEW

A literature review was initiated at the Eastlake Fire Department's Training Division libraries. Extensive searches were conducted online to identify published documents relating to specific external changes. Previous research projects were reviewed on the NFA website.

The literature review used in the preparation of this research paper included books, published research projects, videos, audio tapes, and periodicals.

Research Question #1

The initial phase of research focused on specific factors that may influence the outcomes of emergency scenes. The first research question was what were some of the current cultural, environmental, and technological factors that influenced the outcome of an emergency scene? Traditional strategies and tactics employed against these new factors could prove to be dangerous to first responders.

Hydrogen Cyanide

New Thinking About Treating Smoke Inhalation Victims was published in EMS Responder Magazine in 2006 by Gary Ludwig. The article reported results from several studies based on the correlation between cyanide and fire victims. Many of the victims that perished in a structure fire were assumed to have died of carbon monoxide poisoning. However, many studies contradicted conventional thinking by showing that many of these victims had significant levels of cyanide in their blood. Traditional treatments for smoke inhalation victims included removing them from the environment, high flow oxygen, and monitoring their vital signs. This treatment modality was very ineffective for a victim of cyanide poisoning. Victims of smoke inhalation should be treated as victims of cyanide poisoning. There was a need to prepare new medical protocols and place cyanide antidote kits on EMS apparatus (Ludwig, 2006).

Growing Cyanide Threat at Fires Gains National Attention was an article that appeared in The Providence Journal in 2005 following the near deaths of several Providence firefighters from cyanide poisoning. The article was written by Amanda Milkovits. Milkovits (2005) called upon several Fire Administrators to offer expert opinions on the subject. Bob Halton, Editor and Chief of Fire Engineering Magazine, emphasized the hidden danger to first responders at structure fires from the products of combustion. Firemen needed to understand that you can never, ever, ever breathe smoke. Smoke today is not your daddy's smoke. It's more toxic. It will kill you (Milkovits, 2005).

Chief Costa from the Providence Fire Department formed a task force to investigate the fires that placed his members in peril from elevated levels of cyanide. The potential lessons learned from the task force may lead to changes in policy and procedures. The changes included requiring firefighters to wear air packs inside and outside of fires even when the fires are out.

Meth Labs

The Center for Disease Control published the following report in 2002, *Public Health Consequences Among First Responders To Emergency Events Associated With Illicit Methamphetamine Laboratories*. This report summarized ways first responders were at risk during emergency events involving clandestine drug labs. Reported injuries ranged from trauma associated with fires and explosions to hazardous chemical inhalation exposures. Recommendations to reduce the risk associated with the discovery of an illicit lab included increased training of the hazards associated with precursor chemicals found in labs, increased awareness of illicit labs detection, early recognition of the presence of a lab, selection of appropriate PPE and respiratory protection, and proper decontamination of exposed first responders.

Hybrid Vehicles

An article published in the Washington Times in 2004 illustrated another possible concern for first responders. *Hybrid Vehicles Driveup Rescue Concerns* was written by Lydia Pound. The cost of oil has made hybrid vehicles very attractive. Sales of hybrid vehicles rose at an average of 88.6 percent since 2000. With the dramatic increase in sales of hybrid vehicles, rescue workers were being forced to handle all the newer hazards associated with hybrid vehicles. The main hazard was associated with the high voltage electric motor. If a hybrid vehicle was involved in a collision that required extrication, a first responder inadvertently cutting into a high voltage cable could result in severe injuries. If a hybrid was involved in a fire, the smoke emitted from the battery system could be lethal.

Domestic Terrorism

A research project from the Executive Fire Officer Program addressed the final factor to be reviewed in this research project. *Domestic Terrorism and Its Affect on the Fire Service* was written by Ed Wilson of the Portland Bureau of Fire in 2001. The project concluded that risks faced in today's fire service posed significant threats that most responders were not prepared for. It was vital that responders understood the implications of these threats and adapt to them through updated response procedures and intense training. It was critical that fire service leaders recognized that the threat of domestic terrorism was real.

Research Question #2

The second research question was to determine if firefighters feel prepared to respond to incidents that involved one or more of the cultural, environmental, or technological factors addressed in question one. A survey was developed to determine the preparedness of firefighters (Appendix 1).

Research Question #3

The Two Towers: A Challenge To Two Professions was published in Firehouse Magazine in April 2002 and addressed the third research question; What were some of the reasons that contributed to firefighters feeling unprepared to respond to incidents affected by the current external factors? John Flynn was a firefighter with FDNY as well as a structural engineer. The article included specific failures of the engineering community and the fire service on 9/11/01. Flynn (2002) supported the need to re-evaluate procedures dealing with incidents influenced by external changes.

A failure of the fire service was outdated tactics. The fire service was socially and professionally traditional in nature. Routine responses today were not much different than responses of the late 19th century. Firefighters exited the same firehouses with approximately the same number of individuals carrying similar tools as their forebears.

Essentially, the tactics and procedures remained the same as in yesteryear (Flynn, 2002).

Flynn (2002) believed that an efficient, organized emergency response to a terror events, natural disasters, or unusual situations at this time did not appear to be possible. To remain unprepared was to guarantee mayhem and confusion when order was most needed. Firefighters must see a larger picture and not get clouded by tradition.

Fireground Strategies was a book used as a guide for the fire ground strategist and tactician. The book was designed to review general information including size-up, building construction, heat transfer theories, and strategic modes of operation. This review was followed by occupancy specific firefighting problems. The author was Anthony Avillo, a Deputy Chief in New Jersey. The author acknowledged that new, written materials regarding the fire service were limited. However, some recent changes in the fire service required a modification in

strategies and tactics. Some of the changes included state and federal funding legislation, changes in building construction materials, new construction methods, increased use of plastics, and several technological advancements in firefighting (Aவில்lo, 2002).

If a change or innovation was discovered relating to the fire service, a prompt review of basic incident management operations was mandatory. Basic operations were the foundation of all strategies and tactics regarding emergency responses. The main component of incident operations was training (Aவில்lo, 2002). This text reinforced the need to continually monitor for external changes. When a change was detected, procedures must be developed or updated, strategies and tactics reviewed for their effectiveness, and training programs designed to educate members regarding that change.

Terrorism Handbook for Operational Responders was a book intended to give first response personnel operational direction at terrorism incidents. The chances of terrorist attacks were remote for many organizations. However, this text challenged traditional approaches to modern firefighting. The book was co-authored by Armando Bevelacqua and Richard Stilp. Bevelacqua and Stilp (2002) believed that the first step in preparedness began with the identification of risks that a response agency may face. This was followed by the development of response procedures to establish guidelines in handling those potential problems.

Planning and preparing was not enough when an external change was identified. There needed to be an understanding that the way the incident was approached and tactics used must deviate from traditional responses (Bevelacqua & Stilp, 2002).

Traditionally, incident commanders developed a list of objectives. These included life safety, property and environmental preservation. Today, the same commanders must broaden those incident objectives to account for external changes. Enhancement of hazard and risk

analysis would change the overall priorities of the incident and affect tactical decisions. External changes that could alter the outcome of traditional incidents should be considered during the incident action plan development phase of emergency operations.

Based on the information obtained in the literature review, several modern factors were discovered that influence emergency scenes. Each of the factors presented several unknown hazards that could injure or kill responders. For each of the factors identified, a need existed for thorough research to fully understand the way that each of them may affect emergency scenes. Based on the identified factors, there was a need to develop new methods of approaching and mitigating these incidents. Specifically, a review of response procedures for timeliness, updating strategy and tactics, and a change in the mind set of the fire service regarding modern responses. Finally, a survey was developed to determine the preparedness of firefighters.

PROCEDURES

There were many new hazards confronting first responders resulting from hybrid vehicles, meth labs, terrorism, staffing reductions, and under preparedness for natural and man-made disasters. As a result of changes, some of the concerns of first responders were the methods used to approach and mitigate these incidents. Conventional tactics were underdeveloped to handle an incident influenced by one of the cultural, environmental, and technological factors.

Further research was needed to understand the impact the newer factors had on a small, suburban fire department. An assessment of ways to approach these new factors included aggressive training initiatives, methods to recognize factors that presented hazards to firefighters, and changing response procedures to reflect updated and appropriate mitigation tactics.

Initial research began with an online search of reports, books, articles, and department websites to identify some of the newer factors affecting the fire service. Several factors were identified. This research project focused on hybrid vehicles, meth labs, hydrogen cyanide as a byproduct of smoke, and domestic terrorism. The main focus was on how these new factors might affect emergency operations.

A survey was developed to determine the preparedness of suburban firefighters for events that involved the newer factors (Appendix 1). The survey presented several scenario based statements. The goal was to determine personal levels of preparedness for those situations. Demographic based questions enhanced the survey to determine preparedness based on years of service, rank within the organization, and presence of a training division within the department.

Contact was made with each Fire Chief of the participating departments to gain permission. The surveys were hand delivered. Once complete, surveys were sealed and picked up.

The survey sample size was 100 and based on a 95% confidence level and had an acceptable margin of error of plus or minus 0.05. Fire departments of similar demographics in the northeast portion of Ohio were the targeted audience for the survey. Seventy-one surveys were returned which equated to a 71% return rate.

Definition of Terms

First Responders. Initial members of an emergency service that arrive during the beginning phases of an emergency (IFSTA, 1993).

Flashover. The final stage of the progress of fire growth; when all the combustible fuels within a room are simultaneously ignited (DeHaan, 1997).

Hybrid vehicles. A vehicle that combines a smaller than normal internal combustion gasoline engine with the electric motor of an electric-powered vehicle (Moore, 2005).

Methamphetamine. “Synthetic” amphetamines or stimulants that are produced and sold illegally in pill form, capsules, powder, and chunks. Amphetamines have stimulant properties that effect the central nervous system and are extremely addictive. Methamphetamines may be known as meth, crank, glass, speed, crystal, ice, batu, chalk, shabu, or zip” (LCSO, 2006).

Hydrogen cyanide. A byproduct of incomplete combustion. Cyanide in a fire comes from synthetic substances, such as plastics and other polymers (Ludwig, 2006).

Limitations of the Study

Due to budgetary constraints within the Eastlake Fire Department, it was necessary to hand deliver and pickup the surveys from the participating departments. This limited the sample size to departments located within Lake County.

The Eastlake Fire Department members were included in the survey. Many of the members received some advanced training regarding hybrid vehicles, meth labs, and domestic terrorism prior to responding to the survey.

Members of the Wickliffe and Willoughby Fire Departments also participated in the survey. Both departments house county haz mat response vehicles. The members of these departments are trained to higher levels regarding hazardous materials responses and air monitoring.

RESULTS

The results of this research project were derived from books, periodicals, after-action reports, videos, audio tapes, and previous research projects.

Research Question #1

What were some of the cultural, environmental, and technological factors that influenced the outcome of an emergency scene?

Hybrid Vehicles

Pound (2005) estimated that the number of hybrid vehicles could increase ten fold in the next five years. This meant there would be approximately two million hybrid vehicles on the road by 2010. As the number of hybrid vehicles on the road increased, so did the chances that a hybrid would be involved in an accident or catch on fire. Firefighters have coped with advancing automotive technologies for years. They would cope with hybrid vehicles the old-fashioned way – with training, and lots of it. That training needed to start with, literally, knowing a hybrid from a regular car (Pound, 2005).

Hydrogen Cyanide

Milkovits (2006) reported that NIOSH initiated an investigation into hydrogen cyanide poisoning in firefighters. Captain Thomas Hales was a physician and a senior medical epidemiologist for NIOSH. Hydrogen cyanide gas was always been present in fires. But, it was more prevalent in modern-day construction materials and furnishings that contained plastics and foam that emitted toxic gases when they burned or smoldered (Milkovits, 2006).

NIOSH chose to investigate the effects of hydrogen cyanide as a byproduct of combustion following two dozen Providence Firefighters being poisoned by cyanide after fighting routine structure fires.

Meth Labs

In an article from *America's First Responders* (2005), a third hazardous factor was addressed. A growing problem confronting America's first responders was the increasing production of methamphetamine in clandestine labs. The article emphasized the need to train all first responder in recognizing meth labs. Being able to recognize a couple of signs can be a life saver. First responders must be trained to slow down and survey the scene.

Domestic Terrorism

Finally, the fourth hazardous factor addressed was domestic terrorism. George Buck (2002) conducted significant research into terrorism preparedness. Buck's (2002) research found that a new challenge to first responders was that of being targets of violence. First responders were at risk more than ever. First responders were perceived as enforcers of policy. Traditionally, these perceived views were limited to the police and government agencies. Now, these responders were targets of terrorism. Responders must rethink the way they responded to emergencies.

Research Question #2

Did firefighters feel prepared to respond to incidents that involve one or more of the newer factors described in question one?

A survey was designed to determine if suburban firefighters in the Lake County region were prepared for incidents involving hybrid vehicle, meth labs, monitoring for hydrogen cyanide, or domestic terrorism. Questions one to four of the survey addressed the demographics of the respondent including years of service, rank within the organization, make-up of the department, and presence of an active training division (Table 1-4).

The years of service were distributed relatively even. A third of the respondents ranged in the five to ten year range (Table 1). The majority of the respondents were firefighters. They accounted for three quarters of the respondents (Table 2). Almost every respondent in the survey came from a department with a training division (Table 3). Finally, the majority of the respondents came from combination department, 64%. A third of the respondents came from a career department (Table 4).

Table 1

Years of Service of Respondents

| <5 years | 5-10 years | 11-15 years | 16-20 years | >20 years |
|----------|------------|-------------|-------------|-----------|
| 23% | 32% | 18% | 10% | 17% |

Table 2

Rank of Respondents

| Firefighters | Lieutenant | Captain | Battalion Chief | Chief of Department |
|--------------|------------|---------|-----------------|---------------------|
| 75% | 17% | 1% | 3% | 4% |

Table 3

Presence of Training Division in Department

| Yes | No |
|-----|----|
| 99% | 1% |

Table 4

Make-up of Department

| Career | Combination | Part-time | Volunteer |
|--------|-------------|-----------|-----------|
| 33% | 64% | 2% | 1% |

Question five contained ten scenario based statements. Respondents were asked to rate their personal preparedness for each of the scenarios. Six of the ten statements were used as control statements. They ranged from a basic public education assignment to a working fire with trapped occupants.

The rating system was formatted on a scale of one to five. One to two signified a low preparedness rating while a four to five signified a higher level of preparedness (Table 5). A three was considered to be somewhat prepared, but requires some additional preparation.

Table 5

Percentage of Level of Preparedness for Given Scenario

| | Preparedness Level: Low Somewhat High | | | <i>Avg. Rating</i> |
|--|---------------------------------------|----------|------|--------------------|
| | Low | Somewhat | High | |
| Structure fire with trapped occupants. | 3% | 24% | 73% | 3.9 |
| MVA with multiple victims. | 0% | 10% | 90% | 4.3 |
| Meth lab discovery. | 59% | 31% | 10% | 2.4 |
| 70 y/o male in cardiac arrest. | 0% | 3% | 97% | 4.7 |
| Hybrid vehicle accident with entrapment. | 35% | 34% | 31% | 2.8 |
| White powder with threatening letter at city hall. | 41% | 25% | 34% | 2.9 |
| Gasoline tanker spill on freeway. | 6% | 25% | 69% | 3.8 |
| Boy scout tour of the station. | 1.5% | 1.5% | 97% | 4.7 |
| Monitor an atmosphere for carbon dioxide. | 0% | 6% | 94% | 4.6 |
| Monitor an atmosphere for hydrogen cyanide. | 52% | 30% | 18% | 2.5 |

Question five results (Table 5) reflected that over half of the firefighters perceived a low preparedness for emergencies involving meth labs and the ability to monitor an atmosphere for hydrogen cyanide. Almost half of the respondents perceived a low preparedness for incidents involving a white powder incident at city hall. Over a third of the respondents perceived a low preparedness for an incident involving a hybrid vehicle.

Research Question #3

What were some of the reasons that contributed to firefighters feeling unprepared when responding to incidents affected by the factors addressed in question one?

Flynn (2002) investigated the performance of the World Trade Center structure following the attacks on September 11th. Flynn (2002) reported that a main failure of the fire service were outdated tactics in approaching the incident. Firefighters must see the larger picture and not get clouded by tradition. Flynn (2002) offered some remedies to the fire service which included aggressive training, a proactive approach to firefighting, intense preparation, state of the art communication, and encouraging members to develop a broader view of the job.

Avillo (2002) wrote a textbook regarding strategies and tactics. The text encouraged the fire service to seek out external factors that affected emergency operations. Once a new factor was detected, a department began training members regarding response and mitigation techniques. Procedures were reviewed for effectiveness. Finally, strategies and tactics were be adjusted appropriately.

Bevelacqua and Stilp (2002) published a textbook concerning operational direction at terrorism incidents. The authors challenged traditional approaches to modern responses to emergency scenes. The first step in proper preparedness was identifying risks that face each

department. This was followed by the development of procedures to mitigate situations based on those risks.

Question six of the survey required the respondent to identify reasons that they felt contributed to their low preparedness to a given situation. Five specific reasons were identified in the survey. Those five reasons were based on the readings that supported research question three in the literary review. A final option was offered for the respondent for write in responses. The respondent was asked to identify a reason for low preparedness for any situation that they rated a one or a two in question five. There were only 51 responses to question six out of the 71 total returned surveys. Some respondents answered more than one of the choices offered in question six. The results to question six were listed in table six.

Table 6

Reasons for Low Preparedness for a Given Situation

| | |
|---|-----|
| Lack of information on the subject. | 43% |
| Lack of training in the specific area. | 76% |
| No need to prepare for the specified situation. | 2% |
| Department procedures are inadequate for the situation. | 41% |
| Responsibility falls on another agency. | 10% |
| Other: | |
| New hire on the department. | 6% |
| Lack of proper equipment. | 4% |
| Inadequate staffing levels. | 8% |
| Lack of funding. | 2% |
| Other. | 2% |

The results of question six (Table 6) indicated that three quarters of the respondents felt that lack of training was the major reason for their low preparedness. Almost one half of the respondents felt that a lack of information regarding the scenario and inadequate department procedures led to the low preparedness.

DISCUSSION

Fire ground commanders were burdened with great responsibilities. They must ensure successful mitigation of a variety of emergency scenes, while maintaining crew integrity and firefighter safety. Historically, successful operations relied on properly trained firefighters, appropriate equipment, and lessons learned from the previous generation of tacticians.

The dynamics of society were constantly changing. Change was measured in minutes as opposed to years. Training, equipment, and old strategies and tactics were not sufficient enough to mitigate a situation and ensure firefighter safety. Modern firefighters needed a broader vision and a cultural change within the fire service was necessary on how firefighters approach emergency scenes.

This research was initiated to determine preparedness levels of firefighters to newer changes within our society. These changes dramatically affected fire ground operations. Would a meth lab enhance fire travel in a house fire? If a hybrid vehicle was submerged in an accident, would first responders face electrical shock hazards? How much hydrogen cyanide were firefighters being exposed to in a residential house fire? These were the type of questions every fire officer should be considering each time they set up a command post.

Survey Question #5: Scenario Based Questions

The survey was designed to gauge responder preparedness. Question five contained ten scenario based questions. The respondent rated their personal preparedness for each situation. The rating system was from one to five. One indicated the low side of preparedness while five shifted to the high side of preparedness. The results focused on any situation that averaged below a three, indicating low preparedness. The average for each scenario was calculated based on a total of 71 responses. Using the rating system as a guide, six out of the ten scenarios

averaged above three. This indicated a moderate level of preparedness or higher for those six situations. The final four scenarios averaged below three indicating a low level of preparedness. These four scenarios involved a meth lab discovery, hybrid vehicle accident, white powder incident, and monitoring for hydrogen cyanide.

Meth Labs

The meth lab discovery average was the lowest level of preparedness of the ten scenarios in the survey. The average for the meth lab response was 2.4 on the one to five preparedness rating. This indicated a low level of preparedness. The Georgia Tech Research Institute (GTRI) developed training initiatives to teach first responders methods to recognize labs and protect themselves from the contents. The GTRI concluded that dangers posed at meth labs could be much greater than those at environmental hazard sites associated with traditional industrial hazardous materials, but the formal training programs necessary for first responders were not available at the right level yet (Toon, 2005).

Hydrogen Cyanide

Monitoring for hydrogen cyanide averaged the next lowest level of preparedness of the ten scenarios. The average for the hydrogen cyanide scenario was 2.5, indicating a lower level of preparedness. Recently, the Providence Fire Department had several firefighters poisoned by hydrogen cyanide after fighting residential structure fires. The Chief of Department, David Costa, confessed of never hearing of firefighters being poisoned by hydrogen cyanide at residential structure fires. Chief Costa has been attending the National Fire Academy for the past 10 years and figured if it was such a huge problem, he would have heard about it there. Chief Costa has formed a task force to investigate the poisoning of the firefighters. Results of the

investigation should mandate the use of respiratory protection even after the fire has been extinguished (Milkovits, 2005).

Hybrid Vehicles

Responding to a hybrid vehicle accident received the third lowest preparedness rating at 2.8. In 2004, The Arizona Republic published an article regarding hybrid vehicles and firefighter concerns. Several Phoenix Firefighters participated in the interview. The main concern about hybrid vehicles related to the gigantic electrical source. The electric motor operated on voltages as high as 500 volts which was more than eight times lethal voltage. Even though there were not any reports of injuries to first responders, training initiatives must be implemented. As the sales of hybrids continued to increase, so did the likelihood that a hybrid would be involved in a significant accident. The world's constantly changing and there were different dangers that responders must be prepared to encounter (Villa, 2004).

Domestic Terrorism

The final scenario with a preparedness rating below a three was a white powder incident at city hall which averaged a 2.9. As a result of the World Trade Center attacks, significant threats, and the increased availability and proliferation of nuclear, biological, and chemical materials, there was an increasing concern for the potential of terrorist's incidents occurring within the United States involving a weapon of mass destruction and endangering the lives of every first responder (Buck, 2002).

Survey Question #6: Reasons for Low Preparedness

Question six of the survey assessed several reasons for low preparedness in the given scenarios. Respondents were asked to identify reasons for low preparedness for any scenario that was rated a one or two.

Lack of Training

Over three quarters of the respondents identified training as a main reason for low preparedness in the given scenarios. If a change was detected relating to the fire service, a prompt review of basic operations was mandatory. Basic operations determined the strategies and tactics used by fire departments. Strategies and tactics guided responders through preparation and mitigation of emergency operations. Changes dramatically affected the strategies and tactics used by fire departments. The core component to all incident operations was training. A lack of training and preparation would ensure failure in handling an emergency incident and possibly cause injuries or death to first responders (Aville, 2002).

Inadequate Procedures

A total of 41% of the respondents pointed to inadequate procedures as the reason for low preparedness. The fire service was aggressive in its attempts to identify and understand new methods of construction and materials. It was slow to adapt to changes in existing protocols. There was a heavy reliance on previously developed strategies and tactics. Each time a significant change occurred within our society, the fire service must review and update procedures accordingly (Flynn, 2002).

Now was the time to study lessons learned from previous disasters to assess and plan for the future. Each community must have individual procedures reflective of its particular needs and resources. Outdated procedures were ineffective and difficult to implement (Buck, 2002).

Lack of Information

A total of 43% of the respondents indicated a lack of information as the reason for low preparedness for a given scenario. The fire service must develop relationships with subject matter experts to provide training to first responders. These experts could be available to

develop training initiatives, provide on-site technical advice, and develop technical and written reference materials relating to the given hazard (Wilson, 2000).

Interpretation of Results

The demographic portion of the study accurately represented the fire departments within Lake County. Lake County was made up of sixteen communities. The majority of the departments within the county were designed as a combination of career and part-time employees. The years of service of the respondents to the survey were evenly distributed. Finally, the majority of the respondents were firefighters and line officers. Captains, lieutenants, and firefighters represented the initial responders to virtually every emergency scene.

The results of the scenario based questions reflected that most respondents perceived an adequate level of preparedness for routine incidents involving medical emergencies, structure fires, carbon monoxide investigations, and public education events. There was a large discrepancy in the average preparedness level for meth lab responses and monitoring for hydrogen cyanide relative to the routine incidents. Hybrid vehicle accidents and white powder incidents averaged significantly lower than the routine incidents. Based on this information, respondents to the survey perceived a lower level of preparedness to incidents involving meth labs, hybrid vehicles, white powder incidents, and monitoring for hydrogen cyanide.

The reasons indicated by respondents for low preparedness for a given scenario focused on three areas. Lack of training, lack of information, and inadequate procedures represented the highest percentages of responses. A correlation existed between the three reasons stated for lower levels of preparedness. If information was limited regarding meth labs, hybrid vehicles, terrorist acts, or hydrogen cyanide, it would be difficult to train firefighters to respond to

incidents involving them. Also, limited information made it difficult to develop procedures on effective mitigation techniques for fire officers.

Organizational Implications

The Eastlake Fire Department must ensure that every member was prepared to respond to an incident involving a meth labs discovery, white powder scare, hybrid vehicle accident, and hydrogen cyanide exposures. Based on information obtained in the literary review, there was a high probability that the Eastlake Fire Department could respond to a meth lab explosion or hybrid vehicle accident. Eastlake Firefighters would be exposed to hydrogen cyanide at the next structure fire.

According to the survey, the department was not completely prepared to effectively respond to those incidents and ensure firefighter safety. Effective preparedness was developed through intense training, increased awareness, and appropriate procedures. Change was a constant and rapid process within the dynamics of society. Adapting to societal changes must occur as rapid as the change itself.

RECOMMENDATIONS

Change was a constant force in society since the beginning of time. Tradition has hindered the fire service in the recognition and adaptation to change. Some of the current changes in culture, technology, and the environment were more complicated than in the past. The implications of these changes dramatically affected the way firefighters responded to and mitigated emergency scenes. Today's firefighters must have a broader vision of the fire service than previous generations. First responders must expect the unexpected, anticipate the unimaginable, and think outside the box during preparation.

The Eastlake Fire Department must continue to ensure the safety of every member of the department. Members of the department must be aware of any factor that may influence an emergency scene. If a cultural, technological, or environmental change was detected, the potential impact on the fire service must be investigated. The dynamics of the fire service must keep pace with the dynamics of society.

The results of this research project indicated that the majority of firefighters in Lake County were ill prepared to respond to an incident involving meth labs, hybrid vehicles, domestic terrorism, and hydrogen cyanide.

Recommendation #1

Establish contact with hazard specific experts relating to meth labs, hybrid vehicles, domestic terrorism, and hazardous materials. These experts could provide advice on the particular subject, lessons learned from other agencies, and reference materials to aid first responders. This was the first step in building a knowledge base of the related subjects. The next step would be initiating research through the internet, libraries, and other agencies for any

information relative to meth labs, hybrid vehicles, domestic terrorism, and hydrogen cyanide. The objective would be to gain as much knowledge in the subject of interest as possible.

Recommendation #2

Once a thorough knowledge based was established, didactic and practical training sessions should be initiated. The didactic training built the knowledge base of the entire department. The practical portion of training allowed the members to utilize the knowledge and information gained in the classroom.

Recommendation #3

Department administrators must evaluate the timeliness of administrative and response guidelines and the influence that meth labs, hybrid vehicles, domestic terrorism, and hydrogen cyanide had on them. Careful analysis should be conducted into response procedures, staging areas, personal protective equipment, disaster planning, contingency planning, and training. Enhancement of tactical worksheets with hazard specific flow charts would aid incident commanders.

Recommendations for Future Readers

Future readers could continue this research to examine how much influence tradition had on the fire service. Tradition and complacency has continued to influence firefighters. Future readers could investigate the types of cultural changes that were needed to escape from tradition and routine responses. The only acceptable level of firefighter fatalities was zero.

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APPENDIX 1 – PREPAREDNESS SURVEY

1. How many years have you been in the fire service?
 - < 5 years 5-10 years 11-15 years 16-20 years > 20years
2. What is your current rank in your organization?
 - Firefighter Lieutenant Captain Battalion Chief Administrative Chief
3. Does your department have an active training division?
 - Yes No
4. What is the make up of your fire department?
 - Career Combination Part-Time Volunteer
5. How prepared are you to handle the following situations?

Rate your response from 1 to 5. (1 = lowest preparedness and 5 = highest preparedness.)

| | | | | | |
|---|---|---|---|---|---|
| a. Structure fire with trapped occupants. | 1 | 2 | 3 | 4 | 5 |
| b. MVA with multiple victims. | 1 | 2 | 3 | 4 | 5 |
| c. Meth lab discovery. | 1 | 2 | 3 | 4 | 5 |
| d. 70 y/o male in cardiac arrest. | 1 | 2 | 3 | 4 | 5 |
| e. Hybrid vehicle accident with entrapment. | 1 | 2 | 3 | 4 | 5 |
| f. White powder with threatening letter at city hall. | 1 | 2 | 3 | 4 | 5 |
| g. Gasoline tanker spill on freeway. | 1 | 2 | 3 | 4 | 5 |
| h. Boy Scout tour of the fire station. | 1 | 2 | 3 | 4 | 5 |
| i. Monitor an atmosphere for carbon monoxide. | 1 | 2 | 3 | 4 | 5 |
| j. Monitor an atmosphere for hydrogen cyanide. | 1 | 2 | 3 | 4 | 5 |
6. If you answered a 1 or 2 to any of the questions in #5, what has contributed to the low preparedness?
 - Lack of information on the subject.
 - Lack of training in the specified area.
 - No need to prepare for the specified situation.
 - Department procedures are inadequate for the situation.
 - Responsibility falls on another agency.
 - Other _____

APPENDIX 2 – COVER LETTER FOR SURVEY



EASTLAKE FIRE DEPARTMENT
35150 Lakeshore Blvd.
Eastlake, OH 44095
Phone (440) 951-2287 Fax (440) 946-0616
Fire Chief Richard Sabo



November 17, 2005

Lt. John Cook
 ABC Fire Department
 123 Main Street
 Anywhere, OH 44123

Dear Lt. Cook:

I would like to take this opportunity to introduce myself. My name is Ted Whittington and I am a Lieutenant with the Eastlake Fire Department. I am currently enrolled in the Ohio Fire Executive Program. We are required to complete a research project as part of the curriculum.

My research project is investigating how external cultural and environmental factors affect the fire service. Some examples include meth labs and hybrid vehicles. As part of my research, I am surveying several fire departments in the area to try and determine firefighters and fire officer's attitudes toward some of these factors.

I have enclosed several copies of a survey. I was hoping that you would distribute the surveys to the members of the department, feel free to make more copies if necessary. Please let your members know that I appreciate their opinions and ideas.

I hope that my research will identify specific hazards that may change the way we do business. This information should help each of us to prepare our members for responding to and mitigating these newer and potentially dangerous hazards. I appreciate your time and if you should have any questions about the project, please feel free to contact me. The department's numbers are listed above and my cell phone number is (440) 463-4120.

Respectfully submitted,

Lieutenant Ted Whittington
 Lieutenant Ted Whittington
 Eastlake Fire Department

