Characterization of Fire Investigator's Exposure During Fire Scene Examination

Leading Community Risk Reduction

By: Dennis L. Rogers
DuPage County Arson Task Force
DuPage County, Illinois

An applied research project submitted to the National Fire Academy as part of the Executive Fire Officer Program.

March 18, 2005

Abstract

Fire investigators are often placed in an unknown toxic environment during fire scene examinations without knowing the long-term health care risks. The purpose of this applied research project is to have fire service administrators become knowledgeable of the hazardous environments that fire investigators are subjected to during a fire scene examination in a post-fire environment. Through the data obtained during this research, fire service leaders maybe enlighten to think in a strategically manner in order to protect their investigators from the toxic effects of fire. This can only be done if the fire service as a whole understands the toxic characteristics of fire and the impact it has upon fire investigators long-term health care risks. The purpose of the applied research project was to conduct an evaluation of what the fire departments are currently doing and recommend necessary policy changes. This was done with the assistance of the following research questions. When is the fire investigator likely to wear respiratory protection during a fire scene examination? What resources or tools are available to fire investigators to monitor the post-fire environment? What is the impact to the fire service if fire investigators are not protected in post-fire environment? How can the fire service be proactive in addressing potential health care needs to their investigative personnel to operate on the fireground?

Survey instruments were sent to thirty-five fire departments and districts in DuPage County, Illinois, in an attempt to determine their methods to accurately assess their fire investigators exposure to the potential adverse environment during the post-fire scene examination. The descriptive research method of analysis was done of the DuPage County fire experience, which has been ongoing for the past five years as well as

evaluative research performed in an attempt to develop a resolution. Based upon the results that were obtained from the research, the following recommendations are prepared. The United States Fire Administration should develop a national firefighter/investigator exposure reporting system online within their organizations website. The private industry should be tapped as a resource in gaining their perspectives in addition to contrasting points of view in order to increase the efficiency and effectiveness of the fire service in addressing the health and safety of investigators in the post-fire environment. The USFA should create an affiliation between the building industries, OSHA, NIOSH and once again the private industry in taking an active approach in data collection, methodology in statistics, analyses, forecasting and research. The USFA should sanction the United States Fire Academy in developing a pilot program that would assist fire service administrators in making accurate and strategic health and safety related decisions in regards in their respected fire districts from the effects fire has on their fire investigators along with the effects on a community level.

Table of Contents

Table of Figures

Introduction

Fire is deadly, costly and destructive, which is why the fire service and law enforcement officials must take the willful burning of property seriously. The crime of arson triggers such a degree of devastation that all suspicious fires must be investigated thoroughly. According to many of the law enforcement and fire service professionals, no crime has a greater potential for loss of property and human life than bombings and arsons have upon our society.

It has only come to light within the last decade of the health effects from conducting fire scene examinations and the adequacy of the respiratory protection for the fire investigator. In 1996, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the Bureau of Alcohol, Tobacco, and Firearms (ATF), regarding respiratory hazards associated with fire investigation. The Bureau of Alcohol, Tobacco and Firearms have a select group of special agents that are trained fire investigators that work hand and hand with local, county and state fire investigators throughout the country. The safety and health of firefighters have been studied in some detail, but there is only limited information available concerning the toxic hazards encountered by fire investigators. Since this request involved exposure of the post-fire environment, which has not been examined before, NIOSH along with ATF developed a preliminary sampling protocol to be conducted prior to the fire scene examinations. (Kinnes & Hine, 1998).

In 1997, NIOSH along with ATF conducted a preliminary assessment of the health hazards encountered at the fire scenes. This assessment included actual fire/arson scene examinations in the greater Washington, D.C. area along with controlled test burns

in an abandoned building that would emulate residential and commercial structures. Environmental air samples were collected during the fire scene examination for totals in respirable dust, metals, hydrogen cyanide, inorganic acids, aldenhydes including formaldehydes, polycyclic aromatic hydrocarbons (PAHs), elemental carbon, and volatile organic compounds (VOCs). These fire scene examinations were conducted within 30 minutes of the fires being extinguished. In addition, thermal data acquisition equipment was used by ATF to record the fire behavior of the test burns to determine if there was any type of correlation between the materials in the structure and how they burned. (Kinnes & Hine, 1998).

Fire investigators never know what they will be confronted with when they step into a structure to conduct their investigation. As they are sifting through the ashes, these investigators are in the midst of the smoldering fire debris. To the naked eye it's a sooty mess of undistinguishable possessions that once were vital to a home or business. But it is the unseen highly toxic and potentially life-threatening off-gases that rise from the charred ruins that are of concern.

The research purpose is to examine the post-fire environment that fire investigators are subjected to during the fire scene examination. Also, fire administrators must become knowledgeable of the toxic and potentially life-threatening environment that their people are submersed in during every post-fire atmosphere. The data that was derived from this research will be didactic to the fire service leader in identifying requirements to make assessments of the ongoing heath needs and concerns for their people as well as the watchfulness of the organization.

The research questions that are presented here are intended to focus the factors that need to be investigated and the questions that need to be answered in order to accomplish the purpose of this Applied research Project.

1. When is the fire investigator likely to wear respiratory protection during a fire scene examination.
2. What resources or tools are available to fire investigators to monitor the post-fire environment.
3. What is the impact to the fire service if fire investigators are not protected in a post-fire environment.
4. How can the fire service be proactive in addressing potential health care needs to their investigative personnel to operate on the fireground.

Background and Significance

According to recent published research from the National Fire Protection Association (NFPA), in 2003, public fire departments responded to 1,734,500 structure fires in the United States, an increase of 4% from two years ago. Direct property damage from fire was $44 billion dollars. An estimated 38,000 intentionally set structure fires resulted in 305 civilian deaths. There were 111 firefighters killed in the line of duty related incidents. Lastly, fire killed more Americans than all natural disasters combined. (Ahrens, 2003).

Typically the fire department's involvement at a fire scene first begins with responding to the structure fire and extinguishing the fire. The next phase after suppression is the salvage and overhaul stage of the contents of the building and lastly the

investigation phase. During the suppression phase, firefighters are actively extinguishing the fire and ventilating the structure to remove heat and smoke. After the fire has been extinguished, fire fighters will search for hidden fire in walls, ceiling spaces, or other areas that are not easily accessible. This phase is termed overhaul and includes opening walls, pulling down ceiling materials, removing flooring, etc. to ensure that the fire has been completely extinguished. The final phase is the scene investigation, which involves the determination of the origin and cause of the fire. As fire investigators utilize the scientific method in a systematic approach to determine the circumstances as to the cause of the fire, they will need to classify the fire as natural, accidental, incendiary or undetermined in nature. In addition, there are several different approaches that can occur in the way fire investigations are conducted, based on each jurisdictions standard operating procedure. (NFPA 921, 2004)

This study was initiated by the efforts of the DuPage County Arson Task Force in the course of several hundred-fire investigations over the past five-years that had been conducted throughout DuPage County, Illinois. As part of the investigative process, we monitor the toxic environment of the post-fire structure along with recommending that the fire investigators wear approved respiratory protection. This was done primarily for the health and welfare of the investigators, (DuPage County Government, 2000).

In order to gain a perspective of the relevancy of the problem, one needs to take a small glimpse at the heart of America, in particular DuPage County, Illinois. DuPage County is the second most populated county in Illinois with an estimated figure of just under 1 million people. DuPage County is comprised of 336 square miles of land area and its population, and economic growth is considered to be among the greatest in the

region. Most of the populations moving into DuPage County between 1985-1990 are from counties in northeastern Illinois. Located just 20 miles west of Chicago, 49% of the net migration into DuPage County has been from Cook County alone. (DuPage County Government, 2000).

DuPage County has nine townships that contain portions of 36 municipalities, 20 of which lie wholly within the county. Since the 1980's, there have been ongoing endeavors in roadway, utility infrastructure, and other public improvements that have transformed DuPage County into a major population. The county is also considered a significant employment center within the Chicagoland area.

There are 35 fire departments and fire protection districts in the county. These fire service agencies are mostly full-time departments with about 1/5 being combination departments. These fire departments/districts respond to over 2,800 fires a year with approximately 1,300 of these fires being categorized as working structure fires. The unknown combustion products which cause the toxic environment in the post-fire environment is not a problem that plagues only DuPage County, it's widespread throughout the country. Because of the lack of knowledge and awareness to accurately access the toxic environment, what is the implication to the fire service on a national level? (DuPage County Government, 2000).

Through the manufacturing industry along with society's needs, there has been increase in use of synthetic materials in household and commercial products. Because of the increase of synthetics, fire investigators are frequently exposed to respiratory hazards while conducting fire scene investigations. In a standard structure fire, products of combustion contain plastics; foams, insulation, paints and fibered materials are frequently

present. As these materials are exposed to the combustion process of fire, they may release gases and vapors as well as some metal fumes along with other unknown particles. While fire investigators conduct fire scene investigations, they are constantly confronted with suspended particles in the air along with the unburned gases and vapors that are upon the surface of the furnishings within the structure. (NFPA, 2004).

Combustion products typically present at a fire scene include carbon monoxide, hydrogen cyanide, oxides of nitrogen, and aldehydes (formaldehyde). Some of the properties have an odor, but others do not. Exposure of these contaminants can produce acute (immediate) and chronic toxic effects. The respiratory hazards in the form of a gas, vapor, or particulate material are present at all fire scenes and the protection from these hazards should be considered. Interesting enough, past research focused upon firefighters exposure to toxic combustion gases during fire suppression and overhaul activities. The past research did not address the post-fire respiratory hazards that would be of concern to investigators. (Demars,1992).

This particular research will look at the specifics on how the fire service community, specifically fire administrators, perceive the required work of fire investigators for extended periods of time within burned areas as part of the origin and cause determination. Fire investigators generally respond to more fire scenes than the average firefighter. Established research through NIOSH assert that there is a greater amount of particular matter present after the fire has been extinguished as well as during the fire overhaul phase. Fire investigators typically limit their protective equipment to a helmet, coveralls, and gloves. Because of this, investigators may have a higher exposure risk to toxic products of combustion during investigative work than firefighters who wear

SCBA's during overhaul. Based on this analysis, fire administrators will benefit and expand their knowledge base to the post-fire environment, thus making them more advantageous in making informed decisions. (NFPA, 2004).

The United States Fire Administration has four operational objectives that it emphasizes, these include the prevention of the loss of life of firefighters, civilians young and old from fire as well as promote a comprehensive multi-hazard risk reduction plan for communities led by the fire service. The two goals of the Executive Development course are to lead effectively and efficiently within a dynamic and complex organization along with develop and integrate change management which is necessary for complex organizations, which the fire service has fast become. Given the increased speed and complexity of today's business environment, fire service administrator's insight on decision-making is more important and scrutinized more than ever. (NFA, 2003).

As the executive fire officer advances into the next phase of the executive fire officer program, the focus of the second year is leading community risk reduction in order to enhance the skills needed by an executive fire officer to implement and lead a community risk-reduction initiative. The risk-reduction strategy integrates emergency response, code enforcement, legislative processes and prevention related plans along with life-safety education and activities. The chief officer must be at the forefront of community change in order to prevent and minimize unforeseen events. This applies to preventive measures along with improving the quality of life to the investigators in the post-fire environment. (NFA, 2003).

Literature Review

The essence of risk management lies in maximizing the areas that we have some control over the outcome while minimizing the areas where we have absolutely no control over the outcome and the linkage between cause and effect is hidden from us. (Bernstien, 2001).

Risk always results in consequences. The fire and emergency medical service agencies respond to these crises multiple times on a daily basis. Therefore, the purpose of risk reduction in the public sector involves inserting this on a community level to prevent and minimize these events. Prevention and response, the operation function within the organization must be integrated as one force. Both operations and prevention in essence have the same goal; to prevent and reduce harm to the public from fire and preventable injuries. This includes our own personnel. By having the same mind set in integrating operations and prevention will form a synergy to make both functions considerably more effective. (NFA, 2003).

Community vitality is a by-product of numerous factors including the absence of fires and injuries. It is the physical well being of its citizens as well as the economic welfare of the general public. The fire administrator must have a vision of a fire safe community where fire risks and hazards have been addressed through a community risk reduction process. This visualization must examine the community from a broader perspective and apply risk management to all those areas that affect community vitality as seen in service delivery that is being provided by the local fire department to its citizens. (NFA, 2003).

Most fire agencies have a great deal of knowledge about the communities they protect, but they often fall short of providing that essential information in a well-documented fashion that is quantifiable and useful for setting department as well as public policy. Fire administrators through experience have gained intuition in providing good fireground decision-making, but it does fall short of expectations of hard data that is qualitative. Increasingly, such quantifiable data is necessary to describe, define, document and display the communities fire problem and to recommend solutions to policy makers. (FEMA, 2001).

Fire service leaders recognize that there are two different level of decision making relative in controlling a communities fire problem; tactical and strategic. Tactical decision-making is required upon the emergency scene for operational purposes in order to bring a hectic and chaotic emergency situation to a halt. This research project will concentrate upon the strategic decision at the managerial level of the fire service leader. At this executive level, technical and supportive data is essential to identify needs and justify expenditures of funding along with allocating other resources, thus allowing an agency to develop and maintain operational capabilities. (FEMA, 2001).

Today's fire service faces an ever-increasing exposure to liability. This may be fostered through the perception of the public, federal watchdog agency's, but most importantly the men and women that we lead. The fire service needs a methodology to thoroughly evaluate and describe the nature of the fire problem. What is missing is a unifying and comprehensive system of classification based upon levels, or rankings of various fire problems, which would create a framework to use when formulating fire protection policies. (FEMA, 2001).

The fire service often lacks the ability to compile facts that allow comparison of one set of circumstances to another. Too often fire statistics are developed after the event has occurred. Anticipating and developing a level of effort and level of service necessary to mitigate a fire problem is a catastrophe waiting to happen if those levels are based solely on fire statistics. The RHAVE process, which is stands for Risk, Hazard, and Value Evaluation helps support the fire services intuitive, but mostly qualitative observations and experiences with objective and quantitative recommendations developed by using commonly accepted definitions of measurements. (FEMA, 2001).

This conceptual method can assist fire chiefs in setting public policy regarding mitigation practices for many different levels of the fire service. By implementing specific intervention strategies to address those risks and hazards, we can limit the liability associated with the unknown exposures that investigators may encounter at typical fire scenes.

Fire administrators more often than not recognize the importance of evaluating their firefighters activities and keeping them safe on the fireground. Also, fire service leaders know it is essential that regular collection of data and analysis of information be conducted in order to increase efficiency and effectiveness of the services that are provided to the public. But, there is a false sense of security and ineptness to the post-fire scene when the apparent hazards have been alleviated. There is value in taking a closer look at the impact at the dormant chemical compounds that may have been generated and released during fires. (Kinnes & Hine, 1998).

There is validity in conducting environmental sampling of possible contaminants that may be present at fire scenes. Many variables control the resulting by-products of

combustion, especially the composition of the burning material. Other key factors include the temperature at which pyrolysis or combustion occurs, the concentration of oxygen present, and the efficiency of combustion. The focal point is the contaminants most likely present during the investigation phase of a fire scene. (Kinnes & Hine, 1998).

Firefighters are well aware that smoke is the deadliest hazard at fires and that carbon monoxide (CO) is the deadliest component of smoke. When smoke is visible, the hazards are obvious. High levels of carbon monoxide can be present when there is no visible smoke present. Any fire that smolders for a long period of time is generating high levels of CO. Exposures to high concentrations of carbon monoxide for a short time can knock a person out without them ever knowing what hit them. There are countless cases that show that CO can and will bank down several floors below the fire. These documented cases show how this deadly gas alone has killed many firefighters and civilians. All firefighters should have full self-contained breathing apparatus (SCBA), and at least one member on each team should wear an active CO detector. Visual inspection of the current conditions is not enough, because it gives a false sense of security. (Wood, 2001).

An evaluation criteria needs to be in place because fire investigators face many health hazards, which include inhalation of a wide variety of toxic combustion products, chemical exposures by direct skin and eye contact; physical hazards, along with exposure to carcinogenic chemicals or combustion products. In over 200 residential fires in Boston, air monitoring was conducted in which varying concentrations of carbon monoxide, carbon dioxide, hydrogen cyanide, benzene, nitrogen dioxide, hydrogen chloride, and acrolein were found. Also, other toxic components of smoke were present

such as ammonia, halogen acids, sulphur dioxide, particulates and hydrocarbons. (Demeers PA, 1992).

Exposure to respiratory irritants such as acrolein, hydrogen chloride, and nitrogen dioxide may lead to acute and chronic respiratory problems. Disability due to pulmonary disease has long been recognized as a potential work-related hazard for firefighters. However, there is increasing concern about firefighters exposure to carcinogens released from the combustion of synthetic materials used in building construction. This study has been compounded by mortality and morbidity studies of firefighters, which has raised the possibility of increased risk of cardiovascular disease, respiratory disease, and cancers of the nervous, hematopoietic/lymphatic, respiratory and the gastrointestinal system. A small percentage of people may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and or hypersensitivity. (Kinnes & Hines, 1998).

A published study by the City of phoenix of the characterization of firefighters exposures during the overhaul stage, revealed quite a few interesting findings. When there is little or no smoke in the environment, firefighters are most likely to remove his/her respirator face piece and work in this environment without respiratory protection. A typical structure fire may involve destruction of plastics, foams, fabrics, carpets, asbestos containing materials and wood products. When fire, gases, vapors comprise these materials, airborne particulates are liberated and may remain in the overhaul environment for extended periods of time. In addition, organic vapors as well as halogenated compounds may use respirable size particulates as a vehicle for entry into the firefighters lungs. (Bolstad-Johnson, 2000).

The City of Phoenix sampling strategy involved the collection of both personal and area samples. This consisted of taking samples in two areas; the area of fire origin and another area adjacent to the fire origin where overhaul activities occurred within the structure. In order to ensure validity and integrity of the sample collection for their study, an industrial hygiene assistants instrumental in following the scientific method in obtaining their results. Twenty-six fires were evaluated during their study. Concentrated reading were obtained during the first ten minutes of the overhaul stage, the following analytes exceeded published ceiling values; acrolein, formaldehydes, glutaraldhydes, benzenes, NO2, SO2 and polynuclear aromatic hydrocarbon (PNA). Between the twenty-six fires that were analyzed, there were tremendous variations in the concentrations of the sampled contaminants. These variations could be explained by the diverse nature of each fire, which includes contents, number of rooms, commercial vs. residential structure. However, certain contaminants, such as formaldehydes, which are a carcinogen, were always elevated to ceiling levels. (Bolstad-Johnson, 2000).

The chemicals found to exceed occupational exposure limits in the Phoenix's study, demonstrate the potential of adverse health effects to firefighters. This of course applies to fire investigators who exceedingly spend more time in the overhaul or post-fire environment compared to line firefighters. Carbon monoxide is present in all fire environments as a product of incomplete combustion and decreases the oxygen transport in the blood, which results in an inadequate supply of oxygen to the tissues. Chronic exposures may result in fatigue, altered sense of smell and symptoms representing chronic bronchitis. Lastly, concentrations of air contaminants during fire overhaul exceed occupational exposure limits. CO concentrations should not be utilized to predict

the presence of other contaminants found in the overhaul environment. Without the usage of SCBA's, firefighters are exposed to irritants, chemical asphxiants and carcinogens. (Bolstad-Johnson, 2000).

The concept of environmental impact, also know as environmental scanning, addresses the need for fire service leaders to meet the changing duties of a public organization in serving its citizens. It is a technique that fire officers can use to identify and analyze technical, social and political information. This applies both inside and outside of the organization. This is performed in order to determine the current and potential trends that may affect the organization. The primary value of environmental impact is for the fire officer to be in a state of preparedness. As information is being gathered, it can be used to prepare alternate strategies for dealing with the impact of changes and the effects it has upon the fire service. (Kunreuther, 2002).

The California State Firefighters' Association (CSFA), which has a 28,000 members that represent all elements of the fire service in California, has recently over the past two years have a firefighter exposure reporting system online within their organizations website. This exposure reporting system is independent and confidential where firefighters can report their exposures to hazardous substances in an online database. Years down the road if they file a workers compensation claim for a job-related illness they will be able to support their case by instantly pulling up a personalized record of their exposure. Through the State of California, the burden often falls upon firefighters themselves to provide evidence that their health problems are work-related. Illness often develop years down the road at the end of the firefighters

career, accessing fire department records of an individuals exposure may be problematic. (Gerhart, 2002).

By having firefighters exposure recorded, especially in a searchable database format, one can have a personal index to that critical information. The online exposure can provide run number, on this day while working on this unit, this is what happened. The database will collaborate the report from their department. The exposure reporting system is a free service to all members of CSFA and may reach nation-wide through other firefighters associations. The system is designed so that the data can be sorted and charted graphically in the future. Also, in the future the system will have the ability for cross-exposure accounting. This will allow members on the same incident be alerted of exposures on their teams so that appropriate measures can be taken. (Gearhart, 2002).

In the last three decades, there has been heighten awareness that fire investigators and firefighters are exposed to smoke and other by-products of combustion, which is believed to lead to an increased risk of cancer, lung disease, heart disease, and other medical ailments. Since World War II, there has been an enormous increase of the various varieties and production of synthetic chemicals. Today, there are more than 70,000 distinct chemicals that are registered with the U.S. Environmental Protection Agency (EPA), with approximately 1,000 new chemicals being registered each year. What is startling is the facts that these chemicals are combined in more than 7 million mixtures, formulations, and blends that are found in homes, public buildings, and workplaces across the United States. (Brown, 2002).

The absence of toxicology data on majority of chemicals in commercial use means that fire investigators experience exposure to carcinogenic chemicals whose

cancer-causing potential has yet to be identified. There are at least 20 epidemiologic studies of cancer to firefighters, which have demonstrated that there is a risk of developing and dying from certain specific cancers, to include leukemia, non-hodgkin's lymphoma, myeloma as well as cancers of the brain, bladder, prostrate, intestines and skin. (Brown, 2002).

Of great concern to ATF is that occupational chemical exposures known to cause bladder cancer, include several aromatic amines (organic compounds derived from ammonia), solvents, benzidines, polycyclic aromatic hydrocarbons (PAH's), soot and oils, substances commonly encountered by firefighters, particularly at fires in commercial establishments. Some studies reported a threefold increase in bladder cancer deaths to firefighters, when compared to general population rates. In 1995, in conjunction with the Federal Occupational Health (FOH), ATF implemented a voluntary medical surveillance program that included 138 ATF agents who were primarily involved with the investigation of fire and explosion scenes. Through this medical surveillance program, three ATF agents have been diagnosed with bladder cancer. Currently, there is little data available that focuses upon chemical exposures in the post-fire environment. (Brown, 2002).

The John Hopkins Medical Institute, Center for Occupational and Environmental Health has been working on a health hazard assessment project for the Bureau of Alcohol Tobacco and Firearms (ATF). This program was launched because ATF has noticed that field agents, who investigate post-fire and post-explosion scenes, may be linked with an increased risk of bladder cancer. ATF with the support of Federal Occupational Health, is now conducting a health hazard assessments associated with fire scene investigations.

Jointly, they are assessing the relative risk of cancer attributed to fire scene investigations. Also, operational guidelines for field personnel are to be established, which will bring about safe work practices to reduce exposure to hazardous chemicals. (John Hopkins Medical Institute, fire scene epidemiological study, 2004).

The scope of the work will assist with epidemiological design of analysis of medical surveillance and work history. It will develop a proposed monitoring protocol, to include biomarkers along with a monitoring strategy for data preparation and analysis. This process is to be undertaken in close collaboration with the individuals who develop and execute an industrial hygiene exposure characterization plan to include environmental and personal sampling of carcinogens. (John Hopkins Medical Institute, fire scene epidemiological study, 2004).

The Occupational Safety and Health Act (OSHA) sets forth duties and responsibilities for investigators with respect to workplace safety and health. Generally, the Act requires that investigators and their employers be reasonably diligent regarding safety and health requirements. Sections 5 of the Act require employers to protect employees from recognized hazards likely to cause serious harm or death and to comply with all applicable mandatory safety and health standards. (Hilderbrand,1998).

The standard on emergency response to hazardous substance releases [29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*], commonly referred as HAZWOPER, specifies performance-based requirements for emergency planning, safety and health programs, site safety practices, training, medical surveillance, personal protective clothing and equipment, decontamination procedures as well as incident command operations. As a result of these regulations, fire investigators must comply

with applicable HAZWOPER requirements at their level of participation. Investigators involved in operations conducted at scenes where hazardous substances are present, may be in violation of OSHA standards and subject to citations for noncompliance. (Hilderbrand, 1998).

Enforcement activity by OSHA and EPA officials has increased nation-wide at fire scenes involving federal, state, and local agencies. OSHA can issue civil fines for noncompliance with the provisions and standards. This has been seen in recent years with public fire departments and industrial facilities for violations in training requirements of the HAZWOPER standard. Every fire incident presents investigators with a potential hostile environment. Investigators must evaluate the physical working conditions, scene safety, stress of working in personal protective equipment, and the appropriate decontamination procedures based upon the scope and magnitude of the incident. (Hilderbrand,1998).

Programs and strategy analysis often times for the most part assists in the decision-relevant use of data, because it tries to project the future, in particular, the ways in which the future will be different if certain programs or strategies are or are not adopted. Past fire experience is often times a good guide to future fire problems, but the intelligent use of data with other sources of information is an essential part to project an educated approach to the future. (Hutchinson, 2002).

Researchers have uncovered a surprisingly a large amount of evidence that suggests that irrational behavior and repeated errors in judgment have been documented in many academic studies. The evidence reveals repeated patterns of irrationality, inconsistency, and incompetence in the way human beings arrive at decisions and choices

when faced with uncertainty. The fire service leader has a unique role of risk in our present day society. The notion of bringing risk under control distinguishes the decision-maker as one who is able to think logically and frame the problems in relevant, but comparable options. Managing risk has become synonymous with challenge and opportunity. (Bernstein, 1996).

Technology is developing in a non-linear fashion, which means the fire service must continually reassess the manner it delivers products and services. This means that their needs to be frequent assessment and program corrections that must be built into the way we do business. To cope with the rate of change, long-range planning needs to be less than three years because our targets will change and move. Based on this concept, it will be expected that we become more precise for our customers. (Briese, 1999).

Phone Interviews:

In order to remain impartial and be objective, it is important to gain many different perspectives and contrasting views from other organizations, whether it's a public or a private entity, they all have different observations and viewpoints. The Federal Occupation Health is a government organization that promotes conformance with certain public health concerns on a national level. The Federal Occupation Health has a vested interest in exposure hazards to federal investigators in post-fire/bombing incidents. The (FOH) view themselves as a partner in addressing known and analyzing chemical hazard exposures associated at a fire scene.

Phone interviews were conducted with two of the primary individuals that are spearheading the Hazardous Exposure and Protection Program (HEPP) for the Bureau of Alcohol, Tobacco and Firearms (ATF). Jim Brown, a Special Agent (ret.) with the

Alcohol, Tobacco and Firearms has a solid background and is at the forefront in addressing the exposure issues for ATF. As a consultant he has researched and submitted citations in regards to the potential occupational exposure risks to ATF personnel. Mr. Brown is working very close with John Hopkins Medical Institute Center for Occupational and Environmental Health that is conducting epidemiological research on bladder cancer. Also, Mr. Brown has provided documents relating to chemical exposure issues and what ATF is doing to protect their agents. (Phone interview, 120604).

Frank Fitzpatrick, of the Federal Occupational Heath (FOH) is the project manager of the ATF Hazardous Exposure and Protection Program (HEPP). Mr. Fitzpatrick advises that investigators are required by the nature of their work to enter potentially hazardous environments in order to reconstruct the scene of the crime, identify the seat of the blast or the origin the fire. The group of individuals on his committee is probing the hazardous exposures at scenes and developing a protection program for the federal government. Currently they are conducting an exposure characterization study, which entails performing actual air sampling at investigations throughout different parts of the country to be acquainted with what chemical hazards exists at the post-fire scenes. (Phone interview, 112904).

Mr. Fitzpatrick was advised that a part of the National Fire Academy's Executive Fire Officer Program, an applied research project (ARP) is prepared as apart of the curriculum. Currently many fire service administrators do not understand the chemical hazards that their fire investigators are exposed to in the post-fire environment. This (ARP) would examine the current data and exposure potential to the fire investigators. A survey instrument is utilized as part of the descriptive research methodology of data

collection. Mr. Fitzpatrick suggested that the HEPP team explore formalizing a similar survey by incorporating standardized formats with multiple choices. By standardizing and optimizing survey questions may be beneficial, especially if a large number of people from different regions take part in it. (Phone interview, 112904).

Procedures:

The descriptive research methodology was the data collection procedure that was utilized in this applied research project. The techniques used to collect the information were conducted in several different manners, such as in the form of a literature review, the use of a survey instrument along with phone interviews.

The basis for conducting the literature research stemmed from the void that was noticeable within the sphere of the fire service in DuPage County, Illinois. Fire service administrators and investigators appear to be oblivious of the potential dangers in the post-fire environment. This perceptible cavity in addressing issues of risk management in fire service became noteworthy within the function of the DuPage County Arson Task Force's risk prevention methods.

Research was initially conducted at the National Fire Academy's Learning Resource Center (LRC) and later at the local colleges in the Chicagoland area, which include the National-Louis University and the College of DuPage. Also, the Bureau of Alcohol, Tobacco and Firearms made available some of the material that they are currently addressing. In addition, extensive research was conducted on-line through Internet search engines to identify published documents, Web sites, organizations with

content relative to the subject matter in the field that addresses the concept of accurately making informed decisions.

A survey instrument was developed to collect information from Fire service agencies in DuPage County, Illinois. The survey served to collect data relative to the methods employed by the individual fire departments and fire districts characterization of fire investigator's exposure in the post-fire environment. The survey was mailed to all 35-fire chiefs in DuPage County, Illinois. The survey instrument was first viewed by faculty a member from the National-Louis University for validity, understandability of content and practical of design. Furthermore, Mr. Fitzpatrick of the Federal Occupational Heath (FOH) suggested that the HEPP team explore formalizing a similar survey by incorporating standardized formats with multiple choices. By standardizing and optimizing survey questions may be beneficial, especially if a large number of people from different regions take part in it.

The survey requested objective information and quantitative data from each department pertaining to; (1) When is a fire investigator likely to wear respiratory protection during a fire scene examination, (2) What resources or tools are available to fire investigators to monitor the post-fire environment, (3) What is the impact to the fire service if fire investigators are not protected in a post-fire environment, (4) How can the fire service be proactive in addressing potential health care needs to their investigative personnel to operate on the fireground.

The surveys were mailed out on January 4, 2005 to each individual fire chief in DuPage County, Illinois. Included was a cover letter explaining the purpose and objective of the survey, the survey instrument, each mailing included a stamped, self-

addressed enveloped to accommodate return mailing. All 35-fire service agencies responded to the survey giving a 100% level of confidence that the opinions of the sample reflect the opinions of the entire population of fire chiefs in DuPage County, Illinois.

The content of the completed surveys were entered into a table-format database using Microsoft Excel. This method was done in order to give the reader an easier format to follow in viewing the information from the completed surveys. There were limitations from the results of these surveys because the answers only gave a small glimpse of the problem without detailed information addressing an overall comprehensive problem from not only from a local perspective, but also from a national level.

Results:

In this section of the applied research project, there were nine research questions that were presented to fire service administrators in order to ascertain the reasons behind the particular questions. Also, a detailed analysis will be provided of the results from the surveys.

Research questions:

Table A presents data from a survey question that was provided to 35 fire departments /districts in DuPage County; pertaining to when a fire investigator is likely to wear respiratory protection during a fire scene investigation?

Table A presents the facts in a summarized form in a brief sentence on the fire department's/district's fire experience relating to respiratory protection. Interestingly, 34% of fire chiefs advise that they rely upon the atmospheric levels to dictate when their

investigators will wear respirators during the post-fire scene examination. It appears that the majority of fire departments utilize this practice. Also, 14% of the fire officers stated that the application of respiratory protection depended upon the situation at hand. Followed by 11% response by fire administrators stating that in each of the three categories of hazards identified, the incident commander/safety officer and the investigators personal judgment in the use of respiratory protection. Lastly, only 9% of fire chiefs rely upon a written protocol for their fire investigators to wear respiratory protection. The last 9% of the answers were ambiguous in nature with the aim that investigators would rarely or never wear respiratory protection during a post-fire scene investigation. A few fire departments gave multiple answers to the question that slightly altered the percentages.

Table B presents data from a survey question that was provided to 35 fire departments/districts in DuPage County; concerning how knowledgeable is you're organizational about the chemical exposure associated with your work?

In terms of the fire officers' responses from the survey question concerning the organizations knowledge level about chemical exposures, 43% of the respondents felt that they were very knowledgeable about potential chemical exposures associated with their work. Another 23% of the questionnaires believe that they had some / fair amount of knowledge related to potential chemical exposures associated with their work in the fire service. Based on this data that was provided by the fire officers, it appears that 20% of the fire officers that responded to this question feel aware and concerned in this area, but did not address how knowledgeable they were. Also, 6% sense that they are

knowledgeable in this area. This interpretation also shows that 6% of the opinions polled of fire officers felt that they are not aware or it is unknown their level of knowledge of potential chemical exposures associated with their work. Additionally, the other 6% of the survey responses did not understand or answer the question in the right context. A few fire departments gave multiple answers to the same question that slightly alters the percentages.

Table C presents data from a survey question that was provided to 35 fire departments/districts in DuPage County; concerning if they presently monitor the post-fire environment for potential chemical hazards?

The research indicates based upon the fire officers responses to the survey question, 26% of the organizations monitor the post-fire environment with a 4 gas meter. Another 26% of the respondents indicate that they only monitor the carbon monoxide levels in the post-fire environment. In addition, 23% of the fire administrators' advise that they monitor the post-fire environment, but did not elaborate how. Also, 23% of the fire departments do not utilize any monitors at all in the post-fire environment. 6% of the respondent fire departments will monitor based upon the magnitude of the fire. Lastly, 3% will monitor the post-fire environment based upon hazards present. A few fire departments gave multiple answers to the same question that slightly alters the percentages.

Table D presents data from a survey question that was provided to 35 fire departments/districts in DuPage County; concerning how do you identify when chemical hazards are "of concern" at a fire scene?

The research also revealed that 28% of the survey participants typically use gas meters to identify chemical hazards of concern. It appears that 28% of the fire departments/districts use pre-plans of the target structure in question as well as MSDS in determining chemical hazards of concern. Along with the statistical analysis, 20% of the fire officers rely upon visual inspection only or applying visual inspection along with other methods in determining chemical hazards of concern. Also, 11% of the respondents did not answer or respond correctly to the question. Lastly, 17% of those surveyed are not care or have any method available to identify chemical hazards of concern. A few fire departments gave multiple answers to the same question that slightly alters the percentages.

Table E presents data from a survey question that was provided to 35 fire departments/districts in DuPage County; concerning if their scenes are monitored for carbon monoxide?

By means of the research compiled, it's worth noting from this survey question that 86% of the responding fire officers state, based upon their experiences that they monitor for carbon monoxide. Subsequently, 11% of the responses advise that they do not do any monitoring at all for carbon monoxide. An additional, 3% of the responses suggest that sometimes may monitor for carbon monoxide.

Table F presents data from a survey question that was provided to 35 fire departments/districts in DuPage County; concerning how many hours are their investigators on-site for an investigation?

The research identified that 51% of all survey respondents from the fire service advise that their investigators spend between 2-3 hours on-site for an average structure fire investigation. As a result of this question, 20% of those surveyed states that their investigators spend between 4-8 hours on-site for a fire investigation. Another 17% are of the opinion that their fire investigators spend 1 hour on-site for conducting their cause and origin investigation. 6% of the fire chiefs state that their investigators spend a limited time or no time to investigate. Lastly, 3% of respondents advise that their investigators may spend multiple days on-site for an investigation.

Table G presents data from a survey question that was provided to 35 fire departments/districts in DuPage County; concerning what do they see as an overall impact to the fire service if the fire investigators are not protected in a post-fire environment?

The research identified that 66% of all survey respondents from the fire service advise that they believe if their fire investigators are not protected in a post-fire environment, there is great concern for long-term health issues for them. As a result of this question, 14% of those surveyed fire chiefs were concerned of the financial liability to their department if their investigators became sick or injured from the effects of the post-fire environment. Another 6% are of the opinion that their fire investigators may experience

respiratory and or heart disease over the length of their careers. 9 % of the fire chiefs state that they have concern that their fire investigators maybe subjected to cancer. Lastly, 3% of respondents advise that they do not know what the impact would be or that there would be no impact.

Table H presents data from a survey question that was provided to 35 fire departments/districts in DuPage County; concerning if any of the departments investigators ever suffered from any symptoms that would be attributed to exposures? Also, if their department has a formal clean-up or decontamination procedure?

The research identified that 77% of all survey respondent fire chiefs from the fire service advise that their investigators have never experienced any symptoms related to a post-fire environment. As a result of this question, 20% of those surveyed fire chiefs stated that their fire investigators have become sick or injured from the chemical effects of the post-fire environment. Another 49% of fire service leaders state that their fire department has established decontamination procedures in place. 3% of the fire chiefs' state that they follow established hazardous material procedures. Lastly, 3% of respondents appeared to not understand the question.

Table I presents data from a survey question that was provided to 35 fire departments/districts in DuPage County; concerning what additional policies/procedures/information dealing with safety and health at post-fire/blast scenes would they like to see available to them?

The research identified that 57% of all survey respondent fire chiefs from the fire service advise that they would like to have additional information available to them, especially a website to got to. As a result of this question, 11% of those surveyed fire chiefs stated that they would like to see more emphasis on the use of gas monitors and have the latest information available. Another 9% of fire service leaders would like to have training available to them in the area of unknown chemicals in the post-fire environment. 14% of the fire chiefs' state that there is no need for further information on this topic. Lastly, 6% of respondents appeared to not understand the question.

Discussion:

Interpretation

This body of research confirmed details that the fire service as a whole does a poor job in preventive measures in assessing fire investigators health hazards that are encountered at the fire scene. There is still limited information and data available of the possible chemical hazards to the fire service and others involved in the post-fire environment. Through the manufacturing industry along with society's needs, there is an increase in the use of synthetic materials in household and commercial products. In a standard structure fire, products of combustion contain plastics; foams, insulation, paints and fibered materials are frequently present. As these materials are exposed to the combustion process of fire, they may release gases and vapors as well as some metal fumes along with other unknown particles. (Kinnes and Hines, 1998).

While fire investigators conduct fire scene investigations, they are constantly confronted with suspended particles in the air along with the unburned gases and vapors

that are upon the surface of the furnishings within the structure. Exposure of these contaminants can produce acute (immediate) and chronic toxic effects. The respiratory hazards in the form of a gas, vapor, or particulate material are present at all fire scenes and the protection from these hazards should be considered. Interesting enough, past research focused upon firefighters exposure to toxic combustion gases during fire suppression and overhaul activities. The past research did not address the post-fire respiratory hazards that would be of concern to investigators. Through this applied research project, one can see that there is limited data and analysis of the post-fire chemical exposures. (Brown, 2002).

The fact is that the DuPage County fire service is just a glimpse of the fire service in the United States as a whole. In particular, the responses to these questions from these fire service leaders illustrate the need for further study and research as well as provide prevention tools to the fire service on health and safety. Through communication and accountability, federal guidelines and enforcement measures should be implemented in keeping our fire investigators safe and healthy. The USFA should be an integral part in the collection and analysis of this data as well as being at the forefront in providing a periodic publication of recommendations to attend to patterns of performance or operation standards. (FEMA, 1999).

Today's fire service faces an ever-increasing exposure to liability. This liability can be limited with the help of the federal government and other concerned health and safety agencies who can lend a hand to the fire service to thoroughly evaluate and prevent undesired exposures to chemicals. This can be done by evaluating the outcomes associated with the statistical and analytical work in identifying and tracking performance

of indicators in the post-fire environment. This has proven effective for policy making and contributing to the decision-making process for public service agencies. Furthermore, such programs can be capable to examine primary duties, operations as well as assessment of administration data to assist in personnel, budgets, expenditures, policy and procedures. (USDOJ, 2002).

The data on individual post-fire investigations provides a valuable tool for both the fire service and the broader fire protection community in understanding the fires, their growth, and the effects it has on the individuals as well as the entire community. Garry Briese in The Re-Commissioned Panel on America Burning addressed this predicament with the purpose of the need for accurate and timely demographic information on all aspects of the fire service, which the health and safety of fire investigators is of paramount importance. (Briese, 1999).

The United States Fire Administration has four operational objectives that it emphasizes, these include the prevention of the loss of life of firefighters, civilians young and old from fire as well as promote a comprehensive multi-hazard risk reduction plan for communities led by the fire service. Today's fire administrator must lead effectively and efficiently within a dynamic and complex organization along with develop and integrate change management, which the fire service is fast becoming. (NFA, 2003).

Implications:

Based on the survey questionnaire, it is worth noting that only 34% of fire service administrators rely upon the atmospheric levels to dictate when their fire investigators will wear respirators during the post-fire environment. The responses provided by the

these fire officers suggests that 43% of the fire departments/districts felt that they were very knowledgeable about potential chemical exposures associated with their work, with the an additional 43% of the respondents that believe that they have some or a fair amount of knowledge about chemical exposures associated with their work. Based upon the answers given by these chief officers, it appears that 26% of them utilize a standard 4-gas meter, which monitors, carbon monoxide, oxygen, hydrogen sulfides and flammable gases. An additional 26% of the respondents monitor only carbon monoxide. It is evident that there is a lack of knowledge of the serious health consequences of the chemicals that are present in the post-fire environment.

The research revealed that 28% of fire authorities identify chemical hazards of concern only through the 4-gas meter or a CO meter. An additional 28% rely upon pre-plans/MSDS with an added 20% fire officers rely upon on visual inspection. This again appears to be narrow-minded of the fire service, because it only addresses a few chemicals, not fully dealing with other known health hazards of the post-fire environment.

The question was asked concerning the overall impact to the fire service if the fire investigators are not protected in the post-fire environment. An overwhelming 66% of fire chiefs state that there is a great concern for long-term health issues. As a result of this question, 14% of the fire administrators advise that they are concern of the financial liability to their organization if their investigators became sick. An additional 15% were concern of the reality of respiratory and heart disease along with cancer as a result of the work they do. Fire chiefs seem to be sensitive to the possibilities, but there is a lack of available data and resources to them to make significant changes. Even though 77% of

the survey respondent fire chiefs advise that their fire investigators have never experienced any symptoms related to their duties as fire investigators, its interesting to note that Chief Haigh of the Hanover Park Fire Department listed in his survey answer that possibly two of his investigators were diagnosed with non-traceable forms of cancer, one being bladder and the other breast because of the work they perform in the post-fire environment. ATF appears to be taking this potential health concern seriously and are working with John Hopkins University to tackle these issues.

Lastly, the research identified that 57% of fire administrators would like to have additional information available to them, especially a website to go to. 11% of fire chiefs desired more emphasis directed upon the use of gas monitors and the availability of the latest information to their organizations. 9% of fire service leaders would like to have training available to them in the area of unknown chemicals in the post-fire environment.

Understandably, the research identified that the current methodology that the fire service utilizes in monitoring the post-fire environment is grossly inadequate. The surveys conveyed different perspectives in addition to contrasting views of fire chiefs within DuPage County, Illinois. The fire service needs to communicate, educate and bridge the gap with the federal, state and county governments as well as other interested health and safety organizations such as OSHA and NIOSH in order for it to be beneficial for both entities.

Recommendations:

Based upon the information that has been developed from this research, the following recommendations are prepared.

1. The United States Fire Administration should develop a national firefighter/investigator exposure reporting system online within their organizations Website.

2. The private industry should be tapped as a resource in gaining their perspectives in addition to contrasting points of view in order to increase the efficiency and effectiveness of the fire service in addressing the health and safety of investigators in the post-fire environment.

3. The USFA should create an affiliation between the building industries, OSHA, NIOSH and once again the private industry in taking an active approach in data collection, methodology in statistics, analyses, forecasting and research.

4. The USFA should sanction the United States Fire Academy in developing a pilot program that would assist fire service administrators in making accurate and strategic health and safety related decisions in regards in their respected fire districts from the effects fire has on their fire investigators along with the effects on a community level.

Reference List

ATF Health Hazard Assessment Project. (2004). John Hopkins Medical Institute, Statement of work. Baltimore, MD.

Bernstein, P. (1996). Against the gods. John Wiley & Sons: New York.

Bolstad-Johnson, D. (2000). *Characterization of firefighter exposures during fire overhaul.* City of phoenix, AZ

Briese, G. (1999). *Identifying future challenges faced by the fire service,* The re-commissioned panel on American burning.

Brown, J. (2002). *Potential occupational exposure risks to atf and explosive investigators.* Statement of work. Washington, D.C.

Demers, P. (1992). *Mortality among firefighters from three northwestern united states cities.* British journal of firefighters. London.

Ahrens, M. (2003). Department of Homeland Security, Federal Emergency Management Agency, United States Fire Administration, *The overall fire picture-2003.* Retrieved January 11, 2005, Http://www.usfa.fema.gov/statistics/quickstats/

DuPage County Fire & Arson Profile 1998-1999, (2000). DuPage county government.

Federal Emergency Management Agency, United States Fire Administration, National Fire Information Council. (2001). *Risk, hazard and value evaluation.*

Federal Emergency Management Agency, United States Fire Administration, National Fire Information Council. (1999). *America burning recomissioned.*

Gearhart, M. (2002). *Firefighter exposure reporting system.* California State Firefighters Association. Website. Retrieved February 28, 2005, Http://www.csfa.net

Hilderbrand, Michael (1998). Hazardous materials for fire and explosion investigators. Red hat publishing: Chester, MD

Hutchinson, W. (2002). *Are you 90% sure you'll hit that target? Check out your knowledge calibration*. Retrieved October 1, 2003, http://knowledge.wharton.upenn.edu/print_version.cfm?articleid=309&catid=4.

Kinnes & Hines (1998). *Health hazard evaluations report 96-0171-2692*. Bureau of alcohol tobacco and firearms. Washington, D.C.

Kunreuther, H. (2002). *Risk management strategies to protect firms against catastrophic events*. Wharton school of business. Retrieved October 1, 2003, http://knowledge.wharton.upenn.edu/print_version.cfm?articleid=636&catid=13.

National Fire Academy, (2003). Executive development (pilot program). Emmitsburg, MD.

National Fire Protection Association 921 (2004). *Guide for fire and explosion investigations*, Quincy, MA. NFPA.

National Fire Protection Association (1997). *Fire protection handbook*, Quincy, MA. NFPA.

Smith, B. (2004). *Atf hazardous exposure and protection program*. Inside ATF ATF Office of public affairs, Washington, D.C.

U.S. Department of Justice, Bureau of justice statistics. (2002). *Strategic plan for years 2003-2004.*

Wood, D. (2001). *The dangers of carbon monoxide at the routine fire*. Fire Engineering, 41, pp.51-58. New York.

Table of Figures

Table A: When is a fire investigator likely to wear respiratory protection during a fire scene investigation?

	Never	Rarely	Written Policies	Atmosphere Levels	Situation at Hand	Hazards Identified	Incident Cmdr/Safety	Personal Judgment
Addison				X		X		
Argonne					X			
Aurora								X
Bartlett				X				
Bensenville				X				
Bloomingdale			X					
Bolingbrook						X	X	
Carol Stream					X			
Clarendon Hills					X			
Darien-Woodridge				X	X			
Downers Grove								X
Elmhurst							X	X
Fermi Lab			X					
Glen Ellyn							X	
Glenside						X		
Hanover Park					X			
Hinsdale		X						
Itasca		X						
Lemont				X				
Lisle-Woodridge				X				
Lombard				X				
Naperville			X	X				
Oak Brook						X		
Oak Brook Terrace				X				
Pleasantview							X	
Roselle		X						
TriState								X
Villa Park	X							
Warrenville				X				
West Chicago		X						
Westmont					X			
Wheaton				X				
Winfield	X							
Wood Dale	X							
Yorkcenter				X				

Table of Figures

Table B: How Knowledgeable is your organization about the potential chemical exposure associated with your work?

	Unknown / Not Aware	Some / Fairly Knowledge	Knowledgeable	Aware & Concerned	Very Knowledgeable	Rely Upon I.C. / Safety Officer	Fire Chief not answered quest.
Addison				X			
Argonne					X		
Aurora			X				
Bartlett		X					
Bensenville							X
Bloomingdale					X		
Bolingbrook							X
Carol Stream					X		
Clarendon Hills					X		
Darien-Woodridge					X		
Downers Grove					X		
Elmhurst		X					
Fermi Lab					X		
Glen Ellyn		X					
Glenside					X		
Hanover Park					X		
Hinsdale					X		
Itasca					X		
Lemont				X			
Lisle-Woodridge					X		
Lombard			X	X			
Naperville		X		X			
Oak Brook	X						
Oak Brook Terrace				X			
Pleasantview					X		
Roselle				X			
TriState							X
Villa Park		X					
Warrenville		X					
West Chicago					X		
Westmont					X		
Wheaton	X						
Winfield		X					
Wood Dale		X					
Yorkcenter				X			

Table of Figures

Table C: Does your organization presently monitor the post-fire environment for potential chemical hazards?

	Unknown	Not At All	Yes	CO Levels Only	4 Gas Meter	Based upon fire magnitude	Based Upon Hazards Present
Addison				X			
Argonne					X		
Aurora				X			
Bartlett						X	
Bensenville						X	
Bloomingdale				X			
Bolingbrook			X				
Carol Stream				X			
Clarendon Hills				X			
Darien-Woodridge					X		
Downers Grove		X					
Elmhurst		X					
Fermi Lab					X		
Glen Ellyn					X		
Glenside			X				
Hanover Park					X		
Hinsdale				X			
Itasca		X					
Lemont					X		
Lisle-Woodridge				X			
Lombard			X				
Naperville				X			
Oak Brook					X		
Oak Brook Terrace			X				
Pleasantview					X		
Roselle				X			
TriState							X
Villa Park		X					
Warrenville		X					
West Chicago			X				
Westmont		X					
Wheaton		X					
Winfield		X					
Wood Dale					X		
Yorkcenter			X				

Table of Figures

Table D: How do you identify when chemical hazards are "of concern" at a fire scene?

	Do not I.D. chemicals	Visual Inspection	Investigators assessment	Pre-plans / MSDS	Gas Meters	Fire chief did not answer or understand	Human senses	Witness Statements
Addison		X						
Argonne		X						
Aurora			X					
Bartlett				X				
Bensenville		X			X			
Bloomingdale					X			
Bolingbrook						X		
Carol Stream						X		
Clarendon Hills						X		
Darien-Woodridge					X			
Downers Grove	X					X		
Elmhurst				X	X			X
Fermi Lab				X				
Glen Ellyn					X			
Glenside							X	
Hanover Park	X				X			
Hinsdale	X							
Itasca	X							
Lemont					X			
Lisle-Woodridge					X			
Lombard	X							
Naperville			X					
Oak Brook	X							
Oak Brook Terrace		X						
Pleasantview		X						X
Roselle				X				
TriState			X	X				
Villa Park		X		X				
Warrenville		X						
West Chicago						X		
Westmont					X			
Wheaton				X				
Winfield				X				
Wood Dale				X				
Yorkcenter				X				

Table of Figures

Table E: Are your scenes monitored for carbon monoxide?
If so, what sorts of exposures are seen?

	Yes	No	Sometimes			
Addison	X					
Argonne	X					
Aurora	X					
Bartlett	X					
Bensenville	X					
Bloomingdale	X					
Bolingbrook	X					
Carol Stream	X					
Clarendon Hills	X					
Darien-Woodridge	X					
Downers Grove	X					
Elmhurst		X				
Fermi Lab	X					
Glen Ellyn	X					
Glenside	X					
Hanover Park	X					
Hinsdale	X					
Itasca			X			
Lemont	X					
Lisle-Woodridge	X					
Lombard	X					
Naperville	X					
Oak Brook	X					
Oak Brook Terrace	X					
Pleasantview	X					
Roselle	X					
TriState	X					
Villa Park		X				
Warrenville		X				
West Chicago	X					
Westmont	X					
Wheaton		X				
Winfield	X					
Wood Dale	X					
Yorkcenter	X					

Table F: On average, how many hours are your investigators on-site for an investigation?

	None-Limited	1 Hour	2-3 Hours	4-8 Hours	8-12 Hours	Multi-Days
Addison			X			
Argonne				X		
Aurora				X		
Bartlett		X				
Bensenville	X					
Bloomingdale			X			
Bolingbrook				X		
Carol Stream			X			
Clarendon Hills	X					
Darien-Woodridge		X				
Downers Grove			X			
Elmhurst			X			
Fermi Lab						X
Glen Ellyn			X			
Glenside			X			
Hanover Park			X			
Hinsdale				X		
Itasca			X			
Lemont			X			
Lisle-Woodridge		X				
Lombard			X			
Naperville			X			
Oak Brook				X		
Oak Brook Terrace		X				
Pleasantview				X		
Roselle			X			
TriState		X				
Villa Park			X			
Warrenville				X		
West Chicago						X
Westmont			X			
Wheaton			X			
Winfield		X				
Wood Dale			X			
Yorkcenter			X			

Table G: What do you see as an overall impact to the fire service if the fire investigators are not protected in a post-fire environment?

	Unknown / No Impact	Financial Liability	Short-Term Health Issues	Long-Term Health Issues	Fire Chief Not Understanding Question	Respiratory / Hear Disease	Cancer
Addison				X			
Argonne					X		
Aurora						X	X
Bartlett							X
Bensenville	X						
Bloomingdale				X			
Bolingbrook				X			
Carol Stream		X					
Clarendon Hills				X			
Darien-Woodridge				X			
Downers Grove						X	
Elmhurst		X		X			
Fermi Lab					X		
Glen Ellyn				X			
Glenside		X					
Hanover Park				X			
Hinsdale		X					
Itasca				X			
Lemont				X			
Lisle-Woodridge					X		
Lombard				X			
Naperville				X			
Oak Brook				X			
Oak Brook Terrace					X		
Pleasantview					X		
Roselle				X			
TriState				X			
Villa Park				X			X
Warrenville				X			
West Chicago		X		X			
Westmont				X			
Wheaton				X			
Winfield				X			
Wood Dale				X			
Yorkcenter				X			

Table H: Has any of your investigators ever suffer from any symptoms that you attribute to exposures? Do you have a formal clean-up or decontamination procedure?

	No Known Symptoms	Yes - Symptoms	Decontamination Procedure in Place	Fire Chief Not Understanding Question	Clean-Up Procedure in Place	Haz Mat Procedure Followed	Unknown
Addison	X						
Argonne	X						
Aurora	X		X				
Bartlett	X						
Bensenville	X					X	
Bloomingdale	X		X				
Bolingbrook	X		X				
Carol Stream	X		X				
Clarendon Hills	X						
Darien-Woodridge		X					
Downers Grove		X	X				
Elmhurst	X						
Fermi Lab	X						
Glen Ellyn		X	X				
Glenside				X			
Hanover Park		X	X				
Hinsdale		X	X				
Itasca	X						
Lemont		X					
Lisle-Woodridge	X		X				
Lombard	X		X				
Naperville	X		X				
Oak Brook		X					
Oak Brook Terrace	X						
Pleasantview	X		X				
Roselle	X		X				
TriState	X		X				
Villa Park	X						
Warrenville	X		X				
West Chicago	X						
Westmont	X						
Wheaton	X		X				
Winfield	X						
Wood Dale	X						
Yorkcenter	X		X				

Table I: What additional policies/procedures/information dealing with safety and health at post-fire/blast scenes do you think are needed or would like to be made available to you?

	Unknown	None	If Investigators need different SOP	Training on Unk Chemicals	Fire Chief Not Understanding Question	Emphasis Gas Monitors	Additional / Infor. Website
Addison			X				
Argonne				X		X	
Aurora							X
Bartlett		X					
Bensenville		X			X		
Bloomingdale					X		
Bolingbrook							X
Carol Stream							X
Clarendon Hills							X
Darien-Woodridge						X	
Downers Grove							X
Elmhurst	X						
Fermi Lab							X
Glen Ellyn							X
Glenside							X
Hanover Park						X	X
Hinsdale				X			
Itasca						X	
Lemont				X			X
Lisle-Woodridge					X		
Lombard		X					
Naperville					X		
Oak Brook							X
Oak Brook Terrace					X		
Pleasantview							X
Roselle							X
TriState		X					
Villa Park							X
Warrenville							X
West Chicago							X
Westmont							X
Wheaton							X
Winfield		X					
Wood Dale							X
Yorkcenter							X