



# The Fire Service Response

## Fire Fighter Occupational Cancer, Heart Disease and Infectious Disease Protections



COVER PHOTO BY JOE STONE

**T**his booklet reflects the position of the fire fighters in the state of South Carolina regarding amendments to the Workers' Compensation Act, which would address fire fighter occupational diseases. We collectively present this information to refute the inaccurate materials on fire fighter exposures and occupational illnesses that have been promulgated by opponents of these amendments.

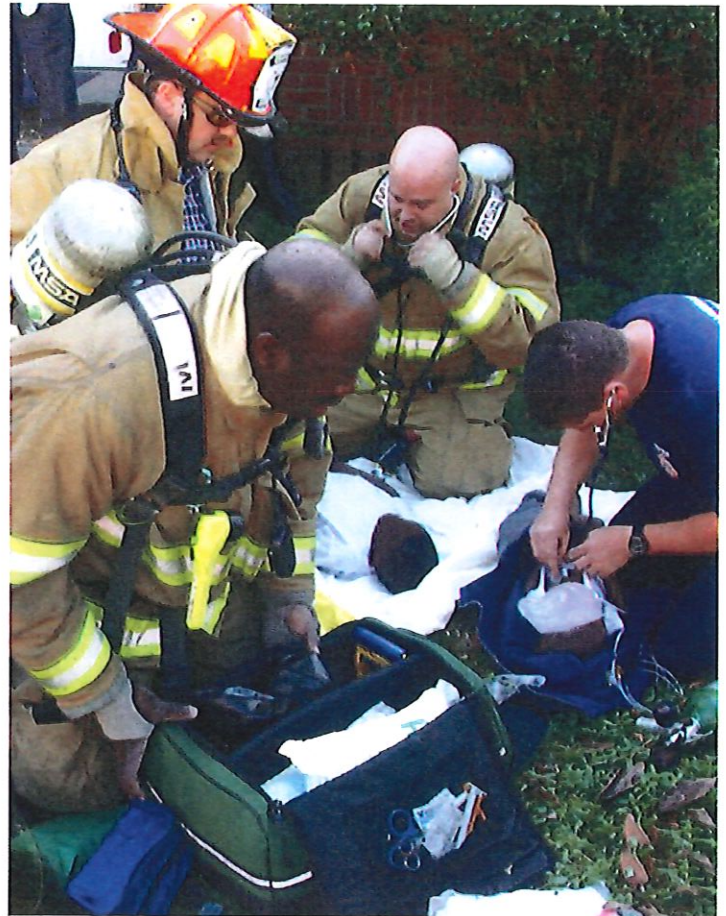
**Professional fire fighters and fire chiefs throughout the state of South Carolina strongly support legislation addressing fire fighter occupational diseases.**

### Medical Justification for Legislation Addressing Fire Fighter Cancer, Heart and Infectious Diseases

South Carolina fire fighters are required by necessity to take great personal risks of serious injury, illness and death in their duties to protect the people of South Carolina from the dangers of catastrophic emergencies, including, but in no way limited to, terrorist attacks and epidemics. Fire fighters have little idea about the identity of many of the materials to which they are exposed or the hazards of such exposures. Nevertheless, South Carolina fire fighters continue to respond to the scene and work immediately to save lives and reduce property damage without regard to the potential health hazards that may exist. A fire emergency is an uncontrollable environment that is fought by fire fighters using personal protective equipment and clothing that has been proven to provide less than perfect protection against toxic chemicals.

The workers' compensation system was designed decades ago to handle injuries easily linked to the workplace, such as a broken leg or a cut hand. As medical science has improved, we have learned that some cancers as well as heart, lung and infectious diseases are related to the work environment, including toxic chemicals in smoke. Not surprisingly, fire fighters are more likely to suffer from these occupational diseases, which can take years to develop. These illnesses are the result of a career of responding to fires and chemical spills, breathing toxic smoke and fumes, and performing medical runs or extricating wounded victims at accidents. Because cancer and heart disease develop over time, it is impossible to say, "This specific emergency response caused my disease," yet fire fighters continue to get sick. The workers' compensation system needs to be improved to reflect the reality that fire fighters suffer from these types of occupational illnesses.

Variability in exposures among South Carolina fire fighters can be great; however, a number of chemicals are commonly found in many fire scenarios. The common combustion products encountered by fire fighters that present a cancer hazard include but are not limited to: acrylonitrile, asbestos, arsenic, benzene, benzo(a)pyrene and other polycyclic aromatic hydrocarbons (PAHs), cadmium,



chlorophenols, chromium, diesel fumes, carbon monoxide, dioxins, ethylene oxide, formaldehyde, orthotoluide, polychlorinated biphenyls and vinyl chloride. Also, findings from monitored fire fighters during the overhaul phase (fire is extinguished, clean-up begins and search for fire extension) of structural fires indicates that short-term exposure levels are exceeded for acrolein, benzene, carbon monoxide, formaldehyde, glutaraldehyde, nitrogen dioxide and sulfur dioxide. Fire fighters in South Carolina are routinely exposed to a variety of these chemical substances. Equipment for body and respiratory protection is only partially effective. The mixture of hazardous chemicals is different at every fire and the synergistic effects of these substances are unknown. Carbon monoxide and soot are found in all fires and benzene has been found in more than 90 percent of fires.

### South Carolina Fire Fighters and Heart Disease

Similar to efforts addressing fire fighters' cancer experience, studies that link firefighting with heart disease fall into three main groups: laboratory studies, field studies and epidemiological studies. The first, laboratory studies, have identified exposure to noise and certain chemicals (such as the common solvent carbon disulfide; carbon

## A further description of the common toxic substances encountered by fire fighters includes:

**Acrolein** — present in most fires as a combustion product of wood, cotton, carpeting and upholstery. Carcinogenicity is not well studied, but one of its metabolites is a known carcinogen.

**Acrylonitrile** — used in textiles and rubber for clothing, building materials and household products converted in the body to cyanide; known to cause cancer in animals and probably humans, especially cancers of the lung, prostate, stomach, colon, brain, blood and lymphatic system.

**Asbestos** — used widely in buildings for insulation; *known to cause cancer in humans*, especially lung, laryngeal and gastrointestinal cancers.

**Benzene** — used in the manufacture of a variety of products (plastics, synthetic fibers, dyes, rubbers) and as a solvent *known to cause cancer in humans*, especially leukemia; a complex mixture of PAHs, benzene, formaldehyde and other chemicals; released from fire engines known to cause cancer in animals and probably humans, especially lung and bladder cancer.

**Carbon Monoxide** — a natural product of combustion, it blocks the body from carrying and using oxygen.

**Diesel Exhaust and Soot** — contain a variety of chemicals including PAHs; fire fighters often have direct skin contact with soot that penetrates their clothing; *known to cause cancer in humans*, especially cancer of the skin, scrotum, lung, liver, esophagus and leukemia.

**Formaldehyde** — used in manufacture of textiles, plastics, adhesives, wood products, insulation, paints, leather and rubber; known to cause cancer in animals and probably humans, especially Hodgkin's disease, leukemia and cancers of the mouth, pharynx, lung, nose, prostate, bladder, brain, colon, skin and kidney.

**Vinyl Chloride** — used in the manufacture of plastics and present in building materials and consumer goods; *known to cause cancer in humans*, especially cancer of the liver, brain, lung, blood, lymphatic system, gastrointestinal system and malignant melanoma.

**Polycyclic Aromatic Hydrocarbons (PAHs)** — formed during the combustion of many organic materials associated with cancer in humans, especially cancer of the lungs, colon, pancreas, stomach, pharynx, bladder, brain, leukemia, kidney and ureter.

monoxide; arsenic; the common combustion by-products; polycyclic aromatic hydrocarbons; and elevated levels of the stress hormone, adrenalin) that contribute to the atherosclerotic process.

The second group, field studies, documents the exposure of fire fighters to these agents through industrial hygiene, biological and physiological monitoring. Industrial hygiene data indicate that the fire environment contains a number of potentially dangerous toxins. Most frequent exposures affecting the cardiovascular system include carbon monoxide, polyaromatic hydrocarbons, cyanide, benzene and hydrochloric acid.

Arsenic and other toxic metals, organic solvents — such as carbon disulfide — and many other toxins may also be present depending upon the products of combustion and conditions at the scene. Due to the highly unpredictable nature of the fire environment, it is impossible to predict all of the exposures that could be encountered at any given fire. Blood testing of fire fighters has demonstrated elevated levels of carboxyhemoglobin, a biological marker for carbon monoxide exposure, that exceed levels found in both the smoking and non-smoking population. Increased levels of urinary catecholamines (a metabolite of adrenalin) in fire fighters following fire operations have demonstrated increased adrenalin levels. Electrocardiographic monitoring of fire fighters performing maximal exercise without the benefit of warm-up time, a situation that mimics real conditions, suggests diminished oxygen supply to the heart during the initial stages of activity under these circumstances.

The third group, epidemiologic studies of fire fighters and other occupational groups, is performed to determine if exposures actually result in elevated rates of heart disease.

For example, three epidemiologic studies of fire fighters in South Carolina, Connecticut and Toronto have demonstrated increased mortality rates from heart disease in comparison to the general pop-

ulation. However, a number of other epidemiologic studies have not found an increased risk. This could be due to a number of factors:

- Statistical constraints — the number of individuals studied may not be sufficient to detect a difference between fire fighters and the reference population.
- Some studies investigate mortality, and measure only deaths from heart disease. Differences in survivorship between an occupational group and the general population resulting from disparities in the quality and accessibility of medical care or other factors may result in misleading conclusions about disease prevalence.
- Mortality studies rely on death certificates, which are frequently inaccurate and may erode the ability of the study to detect real differences.
- Due to the physical and medical requirements, fire fighters may be healthier than the general population, with disease incidence significantly less than the general population. An increase in the prevalence of a medical condition arising from workplace exposures may therefore be missed if fire fighters are compared to the general population. This "healthy worker effect" may be controlled by using another, similarly healthy occupational group as a control. A number of studies of fire fighters have used police officers as a comparison group. Comparing fire fighters to police officers may not be appropriate for the evaluation of heart disease, however, since a number of studies have also demonstrated an elevated rate of heart disease in police officers.

- When studying an occupational group, certain sub-populations may be at greater risk for a disease due to differences in exposures, administrative policies or other reasons. The ability of a study to identify and establish the increased rates in these subgroups may be limited due to statistical and study design constraints.

Any of these factors could result in an otherwise well-designed epidemiologic study failing to find an increased risk of an illness even if one existed (i.e., a “false negative” result).

Despite these challenges, several studies have found an association between firefighting and heart disease. Dr. Stefanos Kales and colleagues at the Harvard School of Public Health examined the link between cardiovascular disease deaths and firefighting and looked at specific job duties to determine which tasks might increase the risk of dying from a coronary event. The study found conclusive evidence that the risk of dying from heart disease was significantly higher during fire suppression, responding to alarms, returning from alarms and during certain physical training activities.

Further, in a report released by NIOSH after the Kales study was published, the federal government again recognized that cardiovascular disease among fire fighters is due to a combination of personal and workplace factors. NIOSH stated that hiring and maintaining medically and physically fit fire fighters is an important step in reducing cardiovascular disease. We agree and, in fact, fully support the International Association of Fire Fighters and International Association of Fire Chiefs Wellness-Fitness Initiative (WFI). NIOSH further recommends that jurisdictions adopt the WFI.



Fire department wellness programs do make economic sense. Adopting and implementing an occupational wellness program, such as the WFI, can reduce occupational claims and costs while simultaneously improving the quality and longevity of a fire fighter’s life. We would hope that the state of South Carolina would formally endorse such programs.

## South Carolina Fire Fighters and Cancer

South Carolina fire fighters are at an increased risk of exposure to certain carcinogens, and are therefore at an increased risk of developing cancer. Epidemiologic studies have consistently shown that fire fighters are at increased risk for “all site” cancer, meaning cancer anywhere in the body. Specific cancer types that have been strongly linked to firefighting include colorectal cancer, lung cancer, prostate cancer, and skin cancer. Firefighting also appears to be associated with mesothelioma, multiple myeloma, non-Hodgkin lymphoma, and gastric cancer, although the evidence is less strong.

It is important to point out that epidemiologic studies are likely to underestimate cancer risk among fire fighters for several reasons. Fire fighters as a group may be more resistant to disease. Due to the rigorous physical demands of firefighting, fire fighters are healthier when compared with the general population. In addition, cancer may be underreported among fire fighters because many retire at age 50-55, and there is a long latency period for several cancers. As a result, fire fighters who are diagnosed with cancer after retirement from the fire service may not be included in epidemiologic studies.

In 2006, Dr. Grace LeMasters and her colleagues conducted a comprehensive review of 32 studies on fire fighters to quantitatively determine the cancer risk of the occupation.

For these reasons, 36 states have adopted legislation or revised compensation regulations that provide a rebuttable presumption when a fire fighter develops cancer. Based on actual experience in those states, the cost per claim is substantially less than the unsubstantiated figures asserted by others. The reason for this, unlike benefits for other occupations, is the higher mortality rate and significantly shorter life expectancy associated with public safety occupations. These individuals are dying too quickly from cancer, unfortunately producing a significant savings in pension annuities for states and municipalities.

Therefore, South Carolina fire fighters and police officers strongly believe that sufficient evidence is available that shows fire fighters suffer from cancer due to their firefighting exposures. We believe it is time to enact legislation to clearly indicate that cancer is occupationally related to firefighting.

## South Carolina Fire Fighters and Infectious Diseases

Occupational infectious diseases are diseases that are transmitted from person to person and are contracted through the course of a person performing his or her work. These infectious diseases are usually caused by viruses or bacteria. Occupationally contracted contagious diseases should be considered compensable through the workers compensation system, just like any other occupationally caused disease. By far the most important occupationally related infectious diseases for fire fighters and other emergency response personnel are tuberculosis, hepatitis B, hepatitis C and HIV. Other infectious diseases that may be transmitted via occupational expo-

sure include methicillin-resistant *Staphylococcus aureus* (MRSA) and respiratory viruses such as influenza.

Fire fighters may be involved in emergency medical treatment involving close face-to-face contact with patients, including administering CPR, maintaining an airway and inserting intravenous lines. The infectious disease status of the victim is almost never known to the fire fighter while he or she is rendering emergency care. All of these factors combine to place the fire fighter at increased risk of contracting an infectious disease. Fire fighters may be exposed through needle sticks, eye splashes, mucous membrane contact, inhalation and skin contact. Due to their status as emergency responders, they often work in uncontrolled, chaotic settings that may involve sharp surfaces, the presence of large volumes of blood and other body fluids, the need to perform urgent, invasive procedures, and combative or excited victims. All of these uncommon occupational conditions increase the risk for exposure to bloodborne pathogens such as hepatitis B and C viruses and human immunodeficiency virus. Studies conducted before the availability of the hep-

atitis B vaccination showed antibody levels in Houston fire fighters that were almost three times higher than levels in blood donors in that city, suggesting an occupational exposure. Prevalence increased with years of occupational exposure. Similar findings have been observed in studies in other cities.

Fire fighters and other first responders may also develop infectious disease as a result of exposure to infectious aerosols, such as tuberculosis. The Centers for Disease Control and Prevention guidelines for preventing the transmission of tuberculosis specifically discuss ventilation settings in ambulances. In fact, this risk is such a concern that the National Institute of Occupational Safety and Health has a new research area focused on minimizing the infectious exposure potential for emergency medical personnel through ambulance ventilation design, engineering controls and decontamination. Skin contact with infectious agents is also a concern. MRSA, which used to be an organism confined to hospitals and other health care institutions, is becoming an issue for fire fighters due to its dramatic rise in community settings where



## CANCERS

**Digestive (Gastrointestinal) System Cancers** — Once cleared from the airways, inhaled particles and the carcinogens that adhere to them are transferred to the GI tract by swallowing. Asbestos, soot and vinyl chloride are all known to cause cancer of the human GI system.

**Colon Cancer** — Several early studies found increased risk, as did the 2006 LeMasters meta-analysis. A more recent U.S. cohort also found an increased risk of colon cancer. Asbestos, present in older buildings, and diesel exhaust have been linked to colon cancer.



**Rectal Cancer** — Excess rectal cancer (up to two times higher risk) was found consistently in many early studies of fire fighters. An increased risk was also found in a recent large U.S. cohort study.

**Stomach (Gastric) Cancer** — Many early studies found an increased risk, up to two times higher than the risk in the general population. The stomach cancer summary risk estimate was elevated in the LeMasters meta-analysis. A recent U.S. cohort study found increased risk of stomach cancer in fire fighters with more than 30 years of service.

## Respiratory Cancers

**Lung Cancer** — Fire fighters had increased lung cancer mortality in a recent large U.S. cohort study. In a recent European cohort study, the overall risk of lung cancer was not increased, but fire fighters had higher risk of a specific type of lung cancer (adenocarcinoma). Fire fighters are exposed to many lung carcinogens, including asbestos, arsenic, diesel engine exhaust and soot.

**Mesothelioma** — Mesothelioma is caused almost exclusively by exposure to asbestos. Two recent large cohort studies showed highly increased risk of mesothelioma in fire fighters in the U.S. and Europe. In the European study, risk was only increased in fire fighters older than age 70, which is consistent with the long latency period (40 years or more) for development of mesothelioma after exposure to asbestos.

## Genitourinary Cancers

**Kidney Cancer** — Several early studies found increased risk for fire fighters. One study found a greater than four times increased risk. Although the overall risk estimate was not elevated in the LeMasters meta-analysis, more recent large cohort studies in the U.S. and Korea found an increased risk of kidney cancer in fire fighters. Arsenic and formaldehyde probably cause kidney cancer in humans.

**Prostate Cancer** — Several studies found an increased risk. Two early studies found a greater than two times higher risk. A more recent large cohort study in Europe also found increased risk. Acrylonitrile, arsenic and cadmium may cause prostate cancer in humans.

## Hematological (Blood) and Lymphatic Cancers

Formaldehyde and benzene are known to cause hematological and lymphatic cancers in humans.

**Lymphomas** — Early studies, including the LeMasters meta-analysis, found an increased risk of non-Hodgkin lymphoma in fire fighters. A more recent large U.S. cohort study found that mortality from non-Hodgkin lymphoma was elevated in older fire fighters.

**Multiple Myeloma** — Fire fighters appear to be at increased risk for multiple myeloma based on the 2006 LeMasters meta-analysis as well as a 2014 European cohort study that found increased incidence of multiple myeloma in older fire fighters.

**Skin Cancer** — Several studies have found an increased risk of both melanoma and non-melanoma skin cancers. Fire fighters often have direct skin contact with soot, which is known to cause skin cancer in humans.





fire fighters are often the first responders. Also, in terms of uncontrolled settings, fire fighter involvement in bioterrorism response places them at increased risk not only for common pathogens, but also for covert and novel bacterial and viral agents, such as multidrug-resistant tuberculosis, disseminated in unexpected ways.

South Carolina's professional fire chiefs and fire fighters strongly believe sufficient evidence is available that shows fire fighters suffer from cancer, heart disease and infectious diseases due to their exposures in performing the tasks involved in firefighting and emergency medical care. We believe it is time for you to pass this legislation to clearly indicate that such diseases are occupationally related to firefighting. Doing so will provide those that suffer from these diseases a rebuttable presumption for compensation benefits.

### **South Carolina Fire Fighters and Cost of Legislation**

Some may be confused on the issue of paying for treatment of a fire fighter injured at work, in this case through an exposure to a carcinogen, toxic combustion products or an infectious agent that results in disease. The legislation only provides for a rebuttable presumption — that is, the employer can demonstrate that the exposure did not occur in the line of duty — to compensate a fire fighter if an exposure leads to a disease. Just as a fire fighter would be compensated for injuries that occurred after falling through the roof of a burning structure, a fire fighter who has acquired a disease from a job exposure would be compensated. Based on actual experience, the cost per cancer claim for those states having presumptive occupational disease statutes is substantially less than the unsubstantiated figures asserted by some. One reason for this, unlike benefits for other occupations, is the higher mortality rate and significantly shorter life expectancy associated with firefighting.

Fire fighters are dying too quickly from cancer and other occupational diseases, unfortunately producing a significant pension annuity saving for states and municipalities.

**South Carolina's professional fire chiefs and fire fighters strongly believe sufficient evidence is available that shows fire fighters suffer from cancer, heart and infectious diseases due to their exposures in performing the tasks involved in fire fighting and emergency medical care. We believe it is time for you to pass this legislation to clearly indicate that such diseases are occupationally related to fire fighting and provide those that suffer from these diseases a rebuttable presumption for compensation benefits.**

If, as some may claim, the existing worker's compensation system is fair as well as the appropriate mechanism to address such claims, then such legislation may not be needed. However, as testimony and experience have demonstrated, municipalities throughout South Carolina categorically deny fire fighter claims when such individuals suffer from an occupationally acquired disease. It is therefore an appropriate public policy to modernize the workers' compensation system in this state to ensure the meeting of the critical needs of public safety workers who are South Carolina's first line of defense in the event of catastrophic emergencies, epidemics and terrorist attacks, and ensure that those workers are not denied a level of support that is commensurate to the sacrifices they and their families make for the safety and wellbeing of the citizens of the state and the nation.

Thank you for your support.

# State Presumptive Disability Laws

The following states have presumptive disability laws which recognize that fire fighters are at increased risk for certain illnesses. The laws create a presumption that the specified diseases are job related.

STATE	HEART DISEASE	LUNG DISEASE	CANCER	INFECTIOUS DISEASES
ALABAMA	X*	X*	X	X*
ALASKA	X	X	X	
ARIZONA	X		X	
ARKANSAS			X*	
CALIFORNIA	X		X	X
COLORADO	X*		X	X
CONNECTICUT	X		X*	X*
DELAWARE				
FLORIDA	X		X	X
GEORGIA			X*	
HAWAII	X	X	X*	
IDAHO	X*	X*	X	X*
ILLINOIS	X*	X*	X	X*
INDIANA	X	X	X	
IOWA	X	X	X	X
KANSAS	X	X	X	
KENTUCKY			X*	
LOUISIANA	X	X	X	X
MAINE	X	X	X	X
MARYLAND	X	X	X	
MASSACHUSETTS	X	X	X	
MICHIGAN	X	X	X	
MINNESOTA	X		X	X
MISSISSIPPI			X*	
MISSOURI	X	X	X	X
MONTANA			X	
NEBRASKA	X	X	X	X
NEVADA	X	X	X	X
NEW HAMPSHIRE	X	X	X	
NEW JERSEY	X	X	X	
NEW MEXICO	X		X	X
NEW YORK	X*	X*	X	X
NORTH CAROLINA			X*	
NORTH DAKOTA	X	X	X	X
OHIO	X	X	X	
OKLAHOMA	X	X	X	X
OREGON	X	X	X	
PENNSYLVANIA			X	X
RHODE ISLAND		X	X	X
SOUTH CAROLINA	X	X		
SOUTH DAKOTA	X	X	X*	
TENNESSEE	X	X	X	X
TEXAS	X	X	X	X
UTAH	X*	X*	X	X
VERMONT	X	X	X	X
VIRGINIA	X	X	X	X
WASHINGTON	X	X	X	X
WEST VIRGINIA	X	X	X	
WISCONSIN	X	X	X	X
WYOMING	X		X	
<b>TOTALS</b>	<b>41</b>	<b>34</b>	<b>48</b>	<b>27</b>
	<b>35+6*</b>	<b>29+5*</b>	<b>41+7*</b>	<b>23+4*</b>

\*AL has a death/disability eligibility for heart, lung and infectious disease

\*AR has a death/disability eligibility for certain cancers

\*CO has a death/disability eligibility for heart and lung disease

\*CT has a death/disability eligibility for cancer and infectious disease

\*GA has a death/disability eligibility for cancer

\*ID has a death/disability eligibility for heart, lung and Infectious disease

\*IL has a death/disability eligibility for heart, lung and infectious disease

\*KY has a death/disability eligibility for cancer

\*NY heart and lung disease presumptions only apply to fire fighters in New York City

\*SD has a death/disability eligibility for cancer

\*UT has a death/disability eligibility for heart and lung disease