



Fire Fighter Dies During the Night At Fire Station - Missouri

SUMMARY

On May 16, 2001, a 30-year-old male career Captain on-duty at his fire station, retired for the evening at approximately 0200 hours. Between 0630 and 0640 hours, the Captain missed two verbal wake-up calls. When the oncoming crew members arrived at approximately 0650 hours and checked on him, he was unresponsive, pulseless, not breathing, cyanotic, and mottled. Due to his clinical (deceased) appearance, cardiopulmonary resuscitation (CPR) was not begun and no ambulance was requested. The death certificate, completed by the County Coroner, listed "asphyxiation due to probable seizure" as the cause of death. No autopsy was performed.

The following recommendations address some general health and safety issues. This list includes some preventive measures that have been recommended by other agencies to reduce the risk of on-the-job sudden death among fire fighters. These selected recommendations have not been evaluated by NIOSH, but represent published research, or consensus votes of technical committees of the National Fire Protection Association (NFPA) or fire service labor/management groups. However, it is unlikely that any of these recommendations could have prevented the unfortunate death of this fire fighter.

- ***Provide mandatory preplacement and annual medical evaluations for ALL fire fighters, not just career personnel, to determine a fire fighter's medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.***

- ***Ensure fire fighters are cleared for duty by a physician knowledgeable about the physical demands of fire fighting, the personal protective equipment used by fire fighters, and the various components of NFPA 1582, the National Fire Protection Association's Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians.***
- ***Follow provisions in the revised OSHA respiratory protection standard***
- ***Perform an autopsy on all deceased fire fighters***
- ***Phase in a mandatory wellness/fitness program for fire fighters to reduce risk factors for cardiovascular disease and improve cardiovascular capacity***

Although unrelated to this fatality, the Fire Department should consider this additional recommendation:

The **Fire Fighter Fatality Investigation and Prevention Program** is conducted by the National Institute for Occupational Safety and Health (NIOSH). The purpose of the program is to determine factors that cause or contribute to fire fighter deaths suffered in the line of duty. Identification of causal and contributing factors enable researchers and safety specialists to develop strategies for preventing future similar incidents. The program does not seek to determine fault or place blame on fire departments or individual fire fighters. To request additional copies of this report (specify the case number shown in the shield above), other fatality investigation reports, or further information, visit the Program Website at www.cdc.gov/niosh/firehome.html or call toll free **1-800-35-NIOSH**



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- *Provide adequate fire fighter staffing to ensure safe operating conditions*

INTRODUCTION & METHODS

On May 16, 2001, a 30-year-old male Captain was found in his bunk unresponsive, not breathing, and pulseless. Due to the victim's clinical (deceased) appearance and condition, CPR and advanced life support were not performed. On July 6, 2001, NIOSH contacted the affected Fire Department to initiate the investigation. On June 17, 2002, a Safety and Occupational Health Specialist and an Occupational Nurse Practitioner from the NIOSH Fire Fighter Fatality Investigation Team traveled to Missouri to conduct an on-site investigation of the incident.

During the investigation NIOSH personnel interviewed:

- The Fire Chief
- The Deputy Chief
- Crew members on duty with the victim
- The victim's wife

During the site-visit NIOSH personnel reviewed:

- Fire Department training records
- The Fire Department annual report for 2001
- Fire Department incident report
- Death certificate
- Past medical records of the deceased

INVESTIGATIVE RESULTS

Incident. On May 15, 2001, the Captain arrived at his fire station for duty at 0645 hours. The Captain and one Fire Fighter were the primary crew for the 24-hour shift. After checking out the equipment and performing station maintenance, the crew was dispatched three times between 0747 hours and 1457 hours. Each dispatch was to fill livestock water tanks on three farms whose water lines were being replaced by the City. During the afternoon, the crew

performed station tours as part of the Fire Department public fire education program. The crew then cleaned the fire station and transported the trash to the public works building approximately two miles away. The crew ate dinner at approximately 1800 hours, after which they were dispatched, at 1852 hours, to a medical assist call. While en route, the call was cancelled at 1902 hours and the crew returned to the station. At approximately 2200 hours an additional fire fighter came to the station to visit and play video games with crew members and remained until approximately 0200 hours, when the duty crew retired for the night. The Captain appeared to be in no distress or having any symptoms of a seizure. There were no emergency calls the remainder of the night.

Oncoming crew members arrived at the fire station at approximately 0650 hours. The Captain's crew member mentioned that the Captain was sleeping late and had missed two wake up calls. An oncoming crew member checked on the Captain and found him face down in a feather pillow, unresponsive, pulseless, not breathing, cyanotic, and mottled. After turning the victim onto his back and seeing his clinical appearance and condition, CPR was not begun. The police were summoned. The police officer, once at the fire station, notified the County Coroner and the Coroner pronounced the Captain dead at the fire station.

Medical Findings.

The death certificate, completed by the County Coroner, listed "asphyxiation due to probable seizure" as the cause of death. No autopsy was performed and laboratory specimens were not collected.

Fire Department records indicated the Captain had a history of seizure disorders. He began service as a fire fighter in a reserve/volunteer/part-time role in February 1990. On November 27, 1991, at the age of 21, the Captain experienced his first grand

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mal seizure while at home. He was transported to the hospital where, during a 2-3 day hospitalization under the care of a Neurologist, he underwent an extensive evaluation including a magnetic resonance imaging (MRI), lumbar puncture (LP), and electroencephalogram (EEG). All of these test results were within normal limits. He was placed on Dilantin 200 milligrams(mg) at night.

In 1992, the Captain had his second seizure described by his Neurologist as a “possible recurrent partial complex second generalized seizure,” probably due to four or five days without Dilantin. The Captain returned to his primary care physician for follow-up and resumed his Dilantin. He has been seizure-free since this second seizure in 1992. On September 9, 1996, he underwent an EEG and the results were found to be within normal limits for his age in wake, drowsy, sleep and hyperventilated states.

In May 1997, the Captain became a full-time, paid fire fighter for the city. Although the Fire Department did not require preplacement medical evaluations, due to the Captain’s seizure history, he was required to get medical clearance from his primary care physician (PCP) who was also the contracted healthcare provider for the Fire Department. Unfortunately, NIOSH was unable to locate the medical records confirming this evaluation.

On October 28, 1997 the Captain went to his PCP to request a referral to a Neurologist and for a refill of Dilantin which was provided at 200 mg qhs. The Neurologist evaluated the Captain in December 1997, and stated, “Although he has apparently been subtherapeutic with his Dilantin level over the last two years, I still believe that it is probably in his best interest to continue with anticonvulsant medication(sic). For that reason, I have asked him to increase his dose of Dilantin to 300 mg qhs (at night) and follow-up with his PCP. Goal would be to have his Dilantin level within therapeutic range.” During the history

interview, the Neurologist was aware that the Captain was a career fire fighter. In March 1998, the Captain received medical clearance regarding his physical ability to perform EMT/EMS duties by his PCP.

A review of pharmacy records, however, suggests the Captain had erratic compliance with his Dilantin. Although his last blood level of Dilantin was therapeutic (10.5 micrograms/ millimeter), his refill records suggest he would frequently take 100 mg. less than was prescribed. It also appears that the Captain may have been out of Dilantin for more than five days immediately prior to his death. He was scheduled to pick up a filled prescription on the day of his death, prior to a planned extended vacation. According to his spouse and co-workers, the Captain did not express any seizure activity during the days or weeks prior to his death. He was not under any restrictions for fire fighting duties.

DESCRIPTION OF THE FIRE DEPARTMENT

At the time of the NIOSH investigation, the Fire Department consisted 29 uniformed fire fighters, nine full-time and 20 reserves, and served a population of 9,000 in a geographic area of three square miles. There is one fire station. Fire fighters work the following schedule: 24-hours on-duty, 48-hours off-duty, from 0700 hours to 0700 hours. Two fire fighters are on-duty for each 24-hour shift. One fire fighter fills in for crew members who are on vacation or sick leave. The Chief and Assistant Chief work 8-hour days, Monday-Friday, but are always on call.

In 2001, the Fire Department responded to 1,188 calls: 515 medical assist calls, 340 police/ emergency management/public works assist calls, 130 inspection/investigations, 74 wildland/ vegetation fires, 66 trash/rubbish fires, 61 motor vehicle accidents, 36 public education calls, 25 structure fires, 20 fire alarms, 12 rubbish fires, 12 helicopter



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landings, ten grass fires, eight hazardous materials calls, seven vehicle fires, six mutual aid calls, five storm watch calls, and one explosive device call.

Training. New career fire fighter applicants are required to have previous fire fighting experience, pass a background check, drug screen, and driver's license check. The full-time officers review the application and make a recommendation to the Fire Chief, who then makes a final recommendation to the Mayor. Once hired, the fire fighter must complete the State 36-hour Basic Fire Fighter course within one year. The new hire must complete the Basic Fire Fighter and First Responder training prior to performing emergency response. Once assigned to a shift, the fire fighter is on probation for one year. Fire fighters receive recurrent training in their station on each shift and attend mandatory fire fighter/EMS training monthly.

Reserve/volunteer fire fighter applicants are not required to have previous fire fighting experience.

There is a voluntary State Fire Fighter I and II training program. There is no State requirement for annual fire fighter recertification. Annual recertification is required for hazardous materials certification. EMTs and Paramedics recertify every two years. The victim was trained as a Fire Fighter I, Hazmat Operations Level, Driver/Operator, EMT, Fire Service Instructor (AED/CPR) and had 11 years of fire fighting experience.

Medical Evaluations.

The Fire Department has no replacement or periodic medical evaluations and, no physical ability tests. Medical clearance for self-contained breathing apparatus (SCBA) is not required.¹ A fire fighter returning for duty following a work related injury/illness must be cleared by the city contracted physician. Those who return following a personal injury/illness must be cleared for return to work by

their personal physician. Although strength training equipment is provided, the Fire Department does not have a health promotion or fitness program.

DISCUSSION

A seizure is a sudden, abnormal discharge of the neurons of the cerebral cortex that results in irregular neurologic function. Approximately, 5-10% of the population will have at least one seizure during their lifetime.² About half of seizures have an organic cause, while the other half have no known etiology (idiopathic)(unknown cause). Fatigue, photo sensitivity, and strenuous activity are known seizure triggers.

Synonymous with idiopathic seizure disorder is the diagnosis of epilepsy. Epilepsy is a chronic condition characterized by recurrent seizures resulting from an underlying process of unknown etiology. According to the National Institute of Neurological Disorders and Stroke, when a person has had two or more seizures they are considered to have epilepsy. This condition is usually diagnosed following a medical history, EEG, and a computerized tomography (CT) scan.³

Importantly, individuals who are diagnosed with epilepsy are also susceptible to another syndrome called sudden unexpected death in epileptic patients (SUDEP).^{4,5} SUDEP usually affects younger patients and occurs at night. The causes are unclear, but some authors have pointed out the possibility of brain activity negatively influencing the cardiac or pulmonary functions during seizures.^{4,5} However, given the position in which the deceased was found, suffocation cannot be ruled out.

As mentioned previously, predisposing events for seizure activity have included sleep deprivation, provocative visual stimuli, medications that lower the seizure threshold, and lowered therapeutic levels of

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anti-seizure medications.^{6,7} The Captain may have experienced all of these predisposing events or risk factors. For example, he did stay up until approximately 0200 hours playing video games in a darkened room (visual stimulation). On the other hand, he had adequate sleep the previous night, did not complain of fatigue, and the seizure did not occur immediately after the visual stimulation (video game in a darkened room). Also, he had a history of playing video games at home and at the firehouse with no ill effects noted. While retrieving the victim's personal effects, an herbal weight loss supplement was found with approximately 22 capsules missing from a 60 count bottle. This herbal supplement contained 300 mg of St. John's Wort (*Hypericum perforatum*) which some studies suggest interferes with Dilantin (Phenytoin) and the seizure threshold.⁸⁻¹⁰ Also, the victim had been out of the Dilantin for 4-5 days prior to his death, similar to the situation leading up to his second seizure in 1992.

In 2000, the National Fire Protection Association (NFPA) updated Standard 1582, Medical Requirements for Fire Fighters and Information for Fire Department physicians.¹¹ This voluntary industry standard specifies minimum medical requirements for candidates and current fire fighters. NFPA 1582 states that it is important to designate whether the fire fighter seeking clearance has epilepsy or a history of seizures. Despite meeting the NINDS criteria for epilepsy, he was never diagnosed with epilepsy by the PCP or two neurologists. He had multiple normal EEG's and had experienced no seizure activity since 1992. It is doubtful that the neurologists or primary care physician were aware of NFPA guidelines, but they were aware of the victim's occupation. Because his Dilantin blood levels were sub-therapeutic, he was advised, in December 1997, to increase his dosage from 200 mg. to 300 mg. nightly. Records indicated that he did not comply with this suggestion and continued to take 200 mg. without side effects or further seizures. According to the Quality

Standards Subcommittee of the American Academy of Neurology the Captain could have been discontinued from his antiepileptic medication because he:

- was seizure-free 2-5 years on anti-epileptic drugs,
- had a normal neurological examination with a normal intelligence quotient (IQ), and
- had normal EEG's (hyperventilated, wake, drowsy, and sleep states).¹²

The decision to not remove him from medication may be due to the suggested guidelines of the Missouri Department of Transportation. According to the State of Missouri, the patient must be seizure free for six months as certified by the private physician before a license can be issued. The private physician does not have statutory immunity from liability for damages caused if the patient has a seizure while driving.^{13,14}

When individuals have had a seizure, recommendations for release vary by organization. For medical certification for the commercial drivers license (CDL) issued by the U.S. Department of Transportation (DOT), DOT recommends that the following individuals are not qualified:

- a driver who has a medical history of epilepsy,
- a driver who has a current clinical diagnosis of epilepsy, or
- a driver who is taking antiseizure medication.

Since the deceased fire fighter was qualified as a driver/operator for the Fire Department, this regulation would seem to have some relevance, but municipal fire department are exempt from the DOT regulations.^{15,16}

RECOMMENDATIONS

The following recommendations address health and safety generally. It is unclear if any of these

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recommendations could have prevented the sudden death of this fire fighter. This list includes some preventive measures that have been recommended by other agencies to reduce the risk of sudden death among fire fighters. These recommendations have not been evaluated by NIOSH, but represent published research, or consensus votes of technical committees of the NFPA or fire service labor/management groups.

Recommendation #1: Provide mandatory preplacement and annual medical evaluations for ALL fire fighters, not just career personnel, to determine a fire fighter's medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.

Guidance regarding the content and frequency of medical evaluations and examinations for fire fighters can be found in NFPA 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians,¹¹ and in the report of the International Association of Fire Fighters/International Association of Fire Chiefs (IAFF/IAFC) wellness/fitness initiative.¹⁷ The Department is not legally required to follow any of these standards. Nonetheless, we recommend the City and the Fire Department be consistent with the above guidelines.

In addition to providing guidance on the frequency and content of the medical evaluation, NFPA 1582 provides guidance on medical requirements for persons performing fire fighting tasks. NFPA 1582 should be applied in a **confidential, nondiscriminatory** manner. Appendix D of NFPA 1582 provides guidance for Fire Department Administrators regarding legal considerations in applying the standard.

Applying NFPA 1582 also involves economic issues. These economic concerns go beyond the costs of

administering the medical program; they involve the personal and economic costs of dealing with the medical evaluation results. NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, addresses these issues in Chapter 8-7.1 and 8-7.2.¹⁸

The success of medical programs hinges on protecting the affected fire fighter. The Department must **1)** keep the medical records confidential, **2)** provide alternate duty positions for fire fighters in rehabilitation programs, and **3)** if the fire fighter is not medically qualified to return to active fire fighting duties, provide permanent alternate duty positions or other supportive and/or compensated alternatives.

Recommendation #2: Ensure fire fighters are cleared for duty by a physician knowledgeable about the physical demands of fire fighting, the personal protective equipment used by fire fighters, and the various components of NFPA 1582, the National Fire Protection Association's Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians.

The decision regarding medical clearance for fire fighters requires knowledge not only of the fire fighter's medical condition, but also of the fire fighter's job duties and NFPA 1582 medical fitness criteria. NFPA 1582 recommends that return-to-duty evaluations (after an injury or illness) be performed by the "fire department physician."¹¹ As part of the return-to-duty evaluation, the fire department physician should review relevant records from the fire fighter's personal physician(s) and/or discuss with them the fire fighter's illness or injury.

The Occupational Safety and Health Administration (OSHA) respiratory protection standard¹ requires employers whose employees are required to use respirators to have a formal respiratory protection

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program, including periodic medical evaluations. Since Missouri does not have an OSHA-approved State plan, public employers, including fire departments, are not legally subject to OSHA standards.¹⁹ Nevertheless, we recommend that the Fire Department voluntarily adhere to the health- and safety-related provisions of the OSHA standard, including periodic medical evaluations. The medical evaluations for respirator use can be performed at the same time as fitness-for-duty examinations, and often they do not involve substantial additional evaluation. (Pulmonary function testing [PFT] may be useful for evaluating respiratory symptoms or physical examination findings, but it is otherwise not needed routinely for a respirator clearance evaluation. NFPA 1582 does not require PFT as part of the limited annual medical evaluation.¹¹⁾

Recommendation #3: Follow provisions in the revised OSHA respiratory protection standard.

OSHA's Revised Respiratory Protection Standard requires employers to provide medical evaluations and clearance for employees using respiratory protection.¹ These clearance evaluations are required for private industry employees and public employees in States operating OSHA-approved State plans. Missouri is not a State-plan State, therefore, public sector employers, including fire departments, are not required to comply with OSHA standards. However, we recommend voluntary compliance for safety reasons. A copy of the OSHA medical checklist has been provided to the Fire Department.

Recommendation #4: Perform an autopsy on all deceased fire-fighters.

In 1995, the United States Fire Administration (USFA) published the *Firefighter Autopsy Protocol*.²⁰ This publication hopes to provide “a more thorough documentation of the causes of firefighter deaths for three purposes:

- to advance the analysis of the causes of firefighter deaths to aid in the development of improved firefighter health and safety equipment, procedures, and standards;
- to help determine eligibility for death benefits under the Federal government’s Public Safety Officer Benefits Program, as well as state and local programs; and
- to address an increasing interest in the study of deaths that could be related to occupational illnesses among firefighters, both active and retired.”

Recommendation #5: Phase in a mandatory wellness/fitness program for fire fighters to reduce risk factors for cardiovascular disease and improve cardiovascular capacity.

NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, and NFPA 1583, Standard on Health-Related Fitness Programs for Fire Fighters, require a wellness program that provides health promotion activities for preventing health problems and enhancing overall well-being.^{18,21} In 1997, the International Association of Fire Fighters (IAFF) and the International Association of Fire Chiefs (IAFC) published a comprehensive Fire Service Joint Labor Management Wellness/Fitness Initiative to improve fire fighter quality of life and maintain physical and mental capabilities of fire fighters. Ten fire departments across the United States joined this effort to pool information about their physical fitness programs and to create a practical fire service program. They produced a manual and a video detailing elements of such a program.¹⁷ The Fire Department should review these materials to identify applicable elements.

Recommendation #6: Provide adequate fire fighter staffing to ensure safe operating conditions, although unrelated to this fatality.

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Currently, the FD maintains two personnel on duty at all times and the Chief and Assistant Chief are on duty Monday-Friday. NFPA 1710 requires that “on-duty personnel be assigned to fire suppression shall be organized into company units and shall have appropriate apparatus and equipment assigned to such companies.”²² Those companies may respond with two apparatus, depending on the seating configuration of the apparatus to ensure four personnel arrive on scene.²² Personnel assigned to the initial arriving company shall have the capability to implement an initial rapid intervention crew (IRIC),²² which requires four personnel (two to enter the structure and two standing by outside). NFPA 1500 recommends that “members operating in hazardous areas at emergency incidents shall operate in teams of two or more.”¹⁸ Under staffing causes those members on-scene to work harder and for longer periods of time. Additionally, it requires the use of extra fire companies in order to meet the demand for manpower. One common staffing model for small combination departments is assignment of a single paid firefighter to drive/operate apparatus that is met at incident scenes by volunteers responding in private vehicles. This approach, used by this FD, may improve apparatus response times over those seen in all volunteer departments, but it does have drawbacks.²³ Therefore, consider staffing engine and ladder companies with four personnel to ensure adequate personnel are available at the scene.

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