



Safety Officer/Instructor Suffers Sudden Death After Training— Montana

Executive Summary

On August 5, 2014, a 46-year-old male volunteer safety officer/instructor (“SO/I”) conducted 2 hours of apparatus equipment training for members of his volunteer fire department. After returning home, the SO/I fell asleep in a living room chair at about 2200 hours. When his spouse awakened at 0800 hours, she found the SO/I unresponsive in the same chair. 911 was called and an ambulance responded. Emergency medical technicians (EMTs) noted obvious signs of death and contacted the county coroner, who pronounced the SO/I dead at the scene. The death certificate, completed by the county deputy coroner, listed “multi-drug toxicity” as the cause of death. No autopsy was performed. At the time of his death the SO/I was taking 13 prescription medications, most of which were prescribed for depression and post-traumatic stress disorder (PTSD) related to his military deployments in Iraq and Kuwait. Although the SO/I did not participate in fire suppression duties, as a volunteer SO/I he responded to fire emergencies. As a result, the SO/I should have received annual medical evaluations to determine his medical fitness for duty.

Key Recommendations

- *Provide preplacement and annual medical evaluations to all fire fighters in accordance with NFPA 1582, Standard on Comprehensive Occupational Medical Program for Fire Departments*
- *Ensure that 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 components of NFPA 1582.*

The following recommendations address general safety and health issues:

- *Phase in a mandatory comprehensive wellness and fitness program for fire fighters*
- *Provide fire fighters with medical clearance to wear a self-contained breathing apparatus (SCBA) as part of the fire department’s medical evaluation program*
- *Conduct annual respirator fit testing*
- *Perform an autopsy on all on-duty fire fighter fatalities.*



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Introduction

On August 5, 2014, a 46-year-old male volunteer SO/I conducted apparatus and equipment training. He was pronounced dead on August 6, 2014. NIOSH contacted the affected fire department on August 14, 2014, to gather information and on October 1, 2015, to initiate the investigation. On October 14, 2015, a safety and occupational health specialist from the NIOSH Fire Fighter Fatality Investigation and Prevention Program travelled to Montana to investigate the incident.

During the investigation, NIOSH personnel interviewed the following people:

- Fire Chief
- Assistant Fire Chief
- SO/I's spouse

NIOSH personnel reviewed the following documents:

- Fire department standard operating procedures
- Emergency medical service (ambulance) report
- Death certificate
- Toxicology report
- Primary care physician records

Investigation

On August 5, 2014, at 1900 hours, the fire department began scheduled apparatus equipment training. All 12 members, including the SO/I wore full turnout gear including coat, pants, boots, helmet, and gloves, however turnout coats were optional during truck re-servicing (putting equipment back where it was originally loaded). Weather conditions included a temperature of 82 degrees Fahrenheit and relative humidity of 27% [NOAA 2014]. Due to the hot/dry conditions, fire fighters were required to hydrate every 20 minutes.

Members were instructed to locate the tools on each apparatus (e.g., ax, halligan, rake, flapper, chain saw, etc.). Members had to describe the tool, demonstrate its use, and then replace it onto the apparatus. These tools weighed between 5-30 pounds each. This training lasted about 2 hours. Trucks were then re-serviced and prepared for response, which included cleaning and repackaging all the tools and hoses (1¾-inch, 2½-inch, and 5-inch large diameter hose). None of the other fire fighters expressed concerns about the environmental conditions, the physical nature of the training, or expressed symptoms of heat stress during the training. After the training was completed at about 2130 hours, the SO/I went home.

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At about 2200 hours, the SO/I fell asleep in a living room chair. His son came home at about 0300 hours and spoke with the SO/I's spouse. Neither noticed anything abnormal about the SO/I. Upon waking at 0800 hours, the SO/I's spouse found the SO/I unresponsive in the same chair. She called 911 and an ambulance responded. Ambulance EMTs noted the SO/I showed obvious signs of death. A cardiac monitor confirmed asystole and the coroner was requested. The SO/I was declared dead by the coroner at 0825 hours, August 6, 2014.

Medical Findings

The death certificate, completed by the county deputy coroner, listed “multi-drug toxicity” as the cause of death. No autopsy was performed. Pertinent findings from the toxicology report blood or urine are listed in Appendix A.

The SO/I had multiple medical problems (listed below) but reported no cardiac signs or symptoms prior to this incident.

- 1) Depression and PTSD - since his last (second) deployment to Iraq and Kuwait with the Montana Air National Guard in 2005. He was diagnosed in 2005 and underwent regular counseling/therapy and was treated with prescription medications.
- 2) Asthma - diagnosed in 2005 and treated with albuterol and home oxygen.
- 3) Idiopathic sleep-related non-obstructed alveolar hypoventilation, treated with home oxygen.
- 4) Low back pain - diagnosed in 2002 and treated with narcotics.
- 5) Diabetes mellitus - diagnosed in 2006 and treated with metformin with no known complications.
- 6) Hyperlipidemia - diagnosed in 2002 and treated with atorvastatin.
- 7) Insomnia – diagnosed in 2005 and treated with zolpidem.
- 8) Obesity – body mass index (BMI) of 39.0 kilograms per meter squared [CDC 2015]. The SO/I was 69 inches tall and weighed 264 pounds at his last primary care physician visit in August 2014.

Fire Department

At the time of the NIOSH investigation, the fire department consisted of four fire stations with 26 volunteer uniformed personnel serving 8,100 residents in a geographic area of 160 square miles.

Membership and Training

The fire department requires new fire fighter applicants to be 18 years of age, have a valid state driver's license, be physically and psychologically fit, pass a background check, and complete Fire Fighter I and Fire Fighter II training. After completing 22 weeks of training, the candidate may respond to emergency calls. The SO/I was trained as a Fire Fighter I and II, Fire Officer, Driver/Operator, Paramedic, Fire Investigator, Fire Inspector, Wildland Fire Fighter, and in technical rescue and hazardous materials operations. He had 20 years of fire fighting experience including 1 year at this fire department. He served as the fire department's safety officer and responded to emergencies in a fire department command vehicle, but did not perform fire suppression duties. He was also an instructor for the fire department.

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Preplacement and Annual Medical Evaluations/ Return to Work Medical Evaluations

Neither preplacement nor annual medical evaluations are required by the fire department. Members injured on duty are evaluated by their primary care physician, who provides return to duty medical clearance. Neither medical clearance to wear a respirator nor an annual SCBA facepiece fit test is required. The SO/I never underwent a medical evaluation at this fire department.

Fitness/Wellness Programs

Physical agility tests are required for candidates and are required annually for all members. In addition, all members must pass the wildland arduous duty “pack test” to fight wildland fires. The SO/I did not take either the physical ability test or the “pack test.” The fire department has a voluntary wellness/fitness program and exercise equipment is available in the fire stations. The SO/I did not use the equipment or participate in a program.

Discussion

Fire fighters respond to challenging situations that may increase the risk for depression and anxiety disorders (including PTSD) [Mitani et al. 2006; Carey et al. 2011; Gist et al. 2011; Del Ben et al. 2013]. The SO/I’s medical records, however, clearly linked his diagnosis of PTSD to his military service. The SO/I was taking over 13 medications. With the exception of citalopram, at the time of his death, all these medications were within therapeutic ranges (see Appendix A). Given the SO/I’s diagnosis of sleep-related non-obstructed alveolar hypoventilation, the NIOSH investigators conclude that the sedative effects of these medications most likely precipitated a respiratory arrest. Although a sudden cardiac event cannot be ruled out, it is unlikely due to the SO/I’s lack of symptoms and mild physical activity preceding his death [approximately 4 metabolic equivalents (METs)] during the training [Gledhill and Jamnik 1992; Ainsworth et al. 2011]. This conclusion is consistent with the coroner’s determination that multidrug toxicity was most likely responsible for his death.

Occupational Medical Standards for Structural Fire Fighters

To reduce the risk of sudden cardiac arrest or other incapacitating medical conditions among fire fighters, the National Fire Protection Association (NFPA) developed NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments* [NFPA 2013]. This voluntary industry standard provides the components of a preplacement and annual medical evaluation and medical fitness for duty criteria. Issues relevant to this case include psychiatric and psychologic disorders (9.14) and medications (9.16) [NFPA 2013].

NFPA 1582 identifies psychiatric and psychologic disorders to include acute, ongoing, chronic, or recurrent disorders that impair psychological or emotional function. These disorders might compromise the member’s ability to safely perform nine of the thirteen essential job tasks. Therefore, NFPA recommends further medical evaluation and a medical determination whether job restrictions are appropriate [NFPA 2013].

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NFPA 1582 also considers that medications, either prescription or over-the-counter, may also interfere with the performance of essential job tasks. “If the member is taking medications, the member shall be individually evaluated in accordance with 9.16.4 through 9.16.12 to determine if the medications compromise the member’s ability to safely perform the essential job tasks” [NFPA 2013]. The medications taken by the SO/I include narcotics, sedatives, and anti-depressants. According to NFPA, any of these medications can affect the ability to safely perform essential job tasks, and therefore should have resulted in job restrictions. Because the SO/I did not perform fire suppression activities, it is unclear if further job restrictions were needed. However, because the SO/I responded to emergencies, he should have been medically cleared to drive in emergency vehicles.

Recommendations

Recommendation #1: Provide preplacement and annual medical evaluations to all fire fighters in accordance with NFPA 1582, Standard on Comprehensive Occupational Medical Program for Fire Departments.

Discussion: Guidance regarding the content and frequency of these medical evaluations can be found in NFPA 1582 [NFPA 2013]. These evaluations are performed to determine fire fighters’ medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others. To ensure improved health and safety of candidates and members, and to ensure continuity of medical evaluations, it is recommended the fire department comply with this recommendation. However, the fire department is not legally required to follow the NFPA standard.

Following this recommendation involves economic repercussions and may be particularly difficult for smaller fire departments to implement. However, it may be cost-effective [Gaetano et al. 2007]. To overcome the financial obstacle of medical evaluations, the fire department could urge current members to get annual medical clearances from their private physicians. Another option is having the annual medical evaluations completed by paramedics and emergency medical technicians from the local ambulance service (vital signs, height, weight, visual acuity, and electrocardiogram). This information could then be provided to a community physician, perhaps volunteering his or her time, who could review the data and provide medical clearance or further evaluation, if needed. The more extensive portions of the medical evaluations could be performed by a private physician at the fire fighter’s expense, by personal insurance, by a physician volunteer, or paid for by the fire department, city, or state. Sharing the financial responsibility for these evaluations between fire fighters, the fire department, the city, the state, and physician volunteers may reduce the negative financial impact on recruiting and retaining needed fire fighters.

Recommendation #2: Ensure that 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.

Discussion: Guidance regarding medical evaluations and examinations for structural fire fighters can be found in NFPA 1582 [NFPA 2013]. According to NFPA, the fire department should have an officially designated physician who is responsible for guiding, directing, and advising the members with regard to their health, fitness, and suitability for duty. The physician should review job

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descriptions and essential job tasks required for all fire department positions and ranks to understand the physiological and psychological demands of fire fighters and the environmental conditions under which they must perform, as well as the personal protective equipment they must wear during various types of emergency operations. Although the SO/I's personal physician knew he was a volunteer fire fighter, it is unknown if his personal physician was aware of NFPA 1582.

The following recommendations address general safety and health issues:

Recommendation #3: Phase in a mandatory comprehensive wellness and fitness program for fire fighters.

Discussion: Guidance for fire department wellness/fitness programs to reduce risk factors for cardiovascular disease and improve cardiovascular capacity is found in NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Fighters*, the IAFF/IAFC *Fire Service Joint Labor Management Wellness/Fitness Initiative*, the National Volunteer Fire Council *Health and Wellness Guide*, and in *Firefighter Fitness: A Health and Wellness Guide* [IAFF, IAFC 2008; NFPA 2008; USFA 2009; Schneider 2010]. Worksite health promotion programs have been shown to be cost effective by increasing productivity, reducing absenteeism, and reducing the number of work-related injuries and lost work days [Pelletier 2009; Baicker et al. 2010]. Fire service health promotion programs have been shown to reduce coronary artery disease risk factors and improve fitness levels, with mandatory programs showing the most benefit [Dempsey et al. 2002; Womack et al. 2005; Blevins et al. 2006; Poston et al. 2013]. A study conducted by the Oregon Health and Science University reported a savings of more than \$1 million for each of four large fire departments implementing the IAFF/IAFC wellness/fitness program compared to four large fire departments not implementing a program. These savings were primarily due to a reduction of occupational injury/illness claims with additional savings expected from reduced future nonoccupational healthcare costs [Kuehl et al. 2013].

The fire department offers a voluntary wellness/fitness program and exercise equipment is available in the fire stations. Given the fire department's structure, the National Volunteer Fire Council program would be applicable [USFA 2009]. NIOSH would recommend a formal, mandatory wellness/fitness program to ensure all members receive the benefits of a health promotion program.

Recommendation #4: Provide fire fighters with medical clearance to wear SCBA as part of the fire department's medical evaluation program.

Discussion: The Occupational Safety and Health Administration (OSHA) respiratory protection standard requires employers to provide medical evaluations and clearance for employees using respiratory protection [29 CFR 1910.134]. These clearance evaluations are required for private industry employees and public employees in states operating OSHA-approved state plans [OSHA 2014]. Montana does not operate an OSHA-approved state plan; therefore, the fire department is not

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required to ensure all members have been medically cleared to wear an SCBA. However, NIOSH investigators recommend voluntary compliance with this recommendation to improve fire fighter health and safety.

Recommendation #5: Conduct annual respirator fit testing.

Discussion: The OSHA respiratory protection standard requires employers whose employees are required to use a respirator (e.g., an SCBA) to have a formal respiratory protection program, including annual fit testing [29 CFR 1910.134]. Therefore, each member should have his or her own SCBA facepiece, or the fire department would have to ensure enough facepieces of each size were made available on each fire apparatus. As mentioned previously, Montana does not operate an OSHA-approved state plan; therefore, the fire department is not required to follow OSHA standards [OSHA 2014]. Nevertheless, NIOSH investigators recommend voluntary compliance with this standard to ensure proper fitting personal protective equipment to improve safety and health.

Recommendation #6: Perform an autopsy on all on-duty fire fighter fatalities.

In 2008, the USFA published the *Firefighter Autopsy Protocol* [USFA 2008]. With this publication, the USFA hopes to provide “a more thorough documentation of the causes of firefighter deaths for three purposes:

1. 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;
2. 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
3. to address an increasing interest in the study of deaths that could be related to occupational illnesses among firefighters, both active and retired.”

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Investigator Information

This incident was investigated by the NIOSH Fire Fighter Fatality Investigation and Prevention Program, Cardiovascular Disease Component in Cincinnati, Ohio. Mr. Tommy Baldwin (MS) led the investigation and co-authored the report. Mr. Baldwin is a Safety and Occupational Health Specialist, a National Association of Fire Investigators (NAFI) Certified Fire and Explosion Investigator, an International Fire Service Accreditation Congress (IFSAC) Certified Fire Officer I, and a former Fire Chief and Emergency Medical Technician. Dr. Thomas Hales (MD, MPH) provided medical consultation and co-authored the report. Dr. Hales is a member of the NFPA Technical Committee on Occupational Safety and Health, and Vice-Chair of the Public Safety Medicine Section of the American College of Occupational and Environmental Medicine (ACOEM). Dr. Douglas M. Wiegand,

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Ph.D. provided consultation for the report. Dr. Wiegand is a Behavioral Scientist/Occupational Health Psychologist with the NIOSH Health Hazard Evaluation Program in Cincinnati, Ohio.

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Appendix A Toxicology Results

Generic Name	Brand Name	SO/I's Blood Level	Therapeutic Level	Toxic Level	Reference
Trazodone	Desyrel®	1.8 milligrams per liter (mg/L)	0.5-2.5 mg/L	>4 mg/L	ARUP 2015
Citalopram	Celexa®	0.46 mg/L	0.01-0.2 mg/L	>0.3 mg/L	Liotier and Coudoré 2011
Hydrocodone	Norco®	0.24 mg/L	10-40 mg/L	>200 mg/L	CLR 2016
Mirtazapine	Remeron®	0.11 mg/L	0.01-0.14 mg/L	>2.7 mg/L	Kirkton and McIntyre 2006
Zolpidem	Ambien®	0.02 mg/L	0.08-0.15 mg/L	>0.5 mg/L	Musshoff et al. 2004; FAA 2014
Caffeine		Not quantified			
Carbamazepine	Tegretol®	Not quantified			
Acetaminophen	Tylenol®	Not quantified			
Clonazepam	Klonopin®	Not quantified			
7-amino-clonazepam		Not quantified			