2009 17

NIOSH Fire Fighter Fatality Investigation and Prevention Program

Death in the line of duty...

A summary of a NIOSH fire fighter fatality investigation *June 2010*

Fire Fighter Trainee Suffers Fatal Exertional Heat Stroke During Physical Fitness Training – Texas

SUMMARY

On April 20, 2009, a 26-year-old male career Fire Fighter Trainee began a 2-month fire fighter certification program at the City Fire Training Academy. On April 29, 2009, the Trainee participated in a 4.4-mile jog as part of the physical fitness portion of the program. The temperature was approximately 73 degrees Fahrenheit (°F) dry bulb (70°F wet bulb) with 87% relative humidity. About 50 feet from the finish line, the Trainee became unsteady and told a crew member that he "just wanted to finish." A few steps further, a crew member assisted him to the ground as help was summoned. Vital signs revealed low blood pressure (60 millimeters of mercury [mmHg] systolic) and a fast heart rate (170 beats per minute). An ambulance arrived and treated the Trainee for heat-related illness with ice packs to the skin and intravenous fluids before departing to the hospital. In the hospital's emergency department (ED), a rectal temperature of 105.3°F was documented 45 minutes after the Trainee's collapse and at least 30 minutes after ice packs were placed on his skin. Despite treatment in the ED and hospital for exertional heatstroke, the Trainee died 5 days later. The autopsy report listed the cause of death as "complications of hyperthermia and dehydration." NIOSH investigators agree with the Medical Examiner's assessment. In addition, NIOSH investigators concluded that the Trainee's hyperthermia and exertional heatstroke were precipitated by the heavy physical exertion associated with the physical fitness training.

NIOSH investigators offer the following recommendations to address safety and health issues. Had these recommendations been in place, the Trainee's death probably could have been prevented.

- Structure the recruit physical fitness training program to be consistent with the IAFF/IAFC Candidate Physical Ability Test (CPAT).
- Ensure trainees are hydrated at all phases of physically demanding tasks.
- Ensure ice water immersion therapy is rapidly available at the Fire Training Academy.

The following recommendations are based on general health and safety considerations and would not have prevented the Trainee's death:

- Ensure the personnel responsible for the physical training program are knowledgeable about the Fire Department (FD) heat stress program.
- Ensure the FD Trainee Code of Conduct and Standards does not penalize students for seeking medical attention.

- Use a checklist to screen fire fighters for individual heatstroke risk factors.
- Provide annual medical evaluations consistent with NFPA 1582 to all fire fighters.
- Perform annual physical performance (physical ability) evaluations for all fire fighters.
- Phase in a comprehensive wellness and fitness program.
- Provide fire fighters with medical clearance to wear self-contained breathing apparatus (SCBA) as part of the FD medical evaluation program.

INTRODUCTION & METHODS

On April 29, 2009, a 26-year-old male Trainee suffered exertional heatstroke during physical fitness training. Despite advanced life support treatment by the Fire Training Academy instructors, ambulance personnel, and ED and hospital personnel, the Trainee died. NIOSH was notified of this fatality on May 6, 2009, by the United States Fire Administration. On May 6, 2009, NIOSH contacted the affected FD to gather additional information, and on May 15, 2009, to initiate the investigation. On May 26, 2009, a Safety and Occupational Health Specialist from the NIOSH Fire Fighter Fatality Investigation Team traveled to Texas to conduct an on-site investigation of the incident.

During the investigation, NIOSH personnel interviewed the following people:

- District Fire Chief
- Fire Training Academy Coordinator
- Crew members at the Fire Training Academy
- Fire Chief of the Trainee's previous FD
- Assistant Chief of the Trainee's previous FD
- Crew members of the Trainee's previous FD
- Trainee's family
- Assistant Medical Examiner

NIOSH personnel reviewed the following documents:

- FD policies and operating guidelines
- FD training records
- FD annual report for 2008
- Emergency Medical Service (EMS)/ambulance incident report
- Hospital ED record
- Hospital in-patient records
- Death certificate
- Autopsy record
- Primary care provider medical records

RESULTS OF INVESTIGATION

Incident. On April 29, 2009, the Trainee arrived at the City Fire Training Academy at about 0600 hours to begin the daily training class, which included physical fitness activities, physical ability exercises, and classroom training. The temperature recorded at an airport about 3 miles from the Training Academy was 73°F (dry bulb temperature of 73°F and wet bulb temperature of 70°F), with 87% relative humidity and wind speed at 11 miles per hour [NOAA 2009a]. No black globe reading was available to account for the sun's radiant heat; therefore, a web bulb globe temperature (WBGT) could not be calculated [Lugo-Amador et al. 2004].

The 36 students began the day (Day 6 of the fast track program) with physical fitness training consisting of stretching and jogging two laps around the track (1/4 mile per lap) as a warm up exercise. At about 0610 hours, the group began a 4.4-mile run/jog in formation on neighboring streets. The group was led by an FD vehicle and followed by an FD squad. In addition to the 35 students (one student chose not to run), four instructors participated in the run, which lasted approximately 1 hour, 10 minutes.

A Captain led the group, calling cadence while another Captain ran in the back of the class. Nearing the end of the run, students were instructed to break formation and sprint to the finish line, approximately 1/8 mile. Three students were lagging behind, including the Trainee. Two nearby classmates went to encourage the Trainee, who was stumbling and seemed disoriented. When asked if he was okay, he said "just let me finish." The Trainee stopped running and began walking in an unsteady gait. A class officer, an FD Captain, ran over and helped the Trainee lie down with assistance from the other students. Water and a medical bag (containing oxygen, blood pressure cuff, and a glucometer) were retrieved. According to the students, the Trainee was pale, sweaty, shivering, incoherent, and unable to communicate.

911 was called (0727 hours), and an ambulance was dispatched (0728 hours). A paramedic on the scene found the Trainee to be unresponsive, with a rapid pulse of 170 beats per minute, a rapid breathing rate of 24 breaths per minute, and low blood pressure of 60 mmHg by palpation. Ice packs were placed on the Trainee's skin, oxygen was administered, and an intravenous (IV) line was placed. His blood glucose level was normal (95 milligrams per deciliter [mg/dL]).

The ambulance responded at 0730 hours and arrived on scene at 0739 hours. Paramedics found the Trainee unresponsive, with essentially no change in his vital signs from 0729 hours. A 12-lead electrocardiogram (EKG) revealed sinus tachycardia (rapid heart rate) with inverted T-waves (a nonspecific finding). A second IV line was placed, and the Trainee was given fluids to treat dehydration and heat exhaustion. His axillary (under the arm) temperature was 103.4°F, and four new ice packs were placed on his skin. The ambulance departed the scene at 0752 hours en route to the local hospital's ED. En route, the Trainee's blood pressure increased to 80 mmHg systolic (by palpation), but his fast pulse and respiratory rate remained unchanged. He remained unconscious throughout the remainder of the 19-minute transport.

The ambulance arrived at the hospital's ED at 0811 hours. The Trainee's vital signs revealed a blood pressure of 106/52 mmHg, a heart rate of 150 beats per minute (tachycardia), and a respiratory rate of 24 breaths per minute. He was sweating heavily and had a core body (rectal) temperature of 105.3°F. The initial diagnoses were hyperthermia, severe dehydration, and heatstroke, followed by heatstroke complications including the following:

- Rhabdomyolysis (breakdown of muscle fibers resulting in the release of myoglobin into the bloodstream)
- Acute renal failure due to rhabdomyolysis
- Disseminated intravascular coagulation (DIC) (a blood clotting disorder)
- Electrolyte imbalances (low potassium and calcium)

He was treated in the ED with ice packs, cooling fans, cool IV fluids, and cold towels. Despite this treatment, his rectal temperature was 104.7°F 3 hours after his arrival in the ED, and 101°F 12 hours after his arrival in the ED.

The Trainee was transferred to the intensive care unit where IV fluids and cooling blanket therapy continued. Over the next 4 days his mental status improved; however, many of his organ systems (i.e., muscles, liver, kidneys, and blood coagulation) began to fail from heatstroke complications. On May 3 his neurological status declined, and he began to have respiratory failure that required intubation. A computed tomography (CT) scan of his brain revealed marked cerebral edema with herniation. After consulting with the family, the physician removed the Trainee from life support on May 4; he died 41 minutes later.

Medical Findings. The death certificate and the autopsy report, completed by the Medical Examiner, listed the cause of death as "complications of hyperthermia and dehydration." Pertinent findings from the autopsy are listed in Appendix A.

The Trainee was 70″ tall and weighed 210 pounds, giving him a body mass index (BMI) of 30.1. A BMI >30.0 kilograms per meters squared (kg/m2) is considered obese, although many researchers consider the skinfold thickness test a more accurate method of determining obesity, particularly in muscular individuals [Pollock et al. 1984; Nooyens et al. 2007; CDC 2009]. A skinfold thickness test was not performed on the Trainee, but he was reported to be very muscular.

In January 2001, the Trainee was found to have a slightly elevated total cholesterol, but his high density lipoprotein (HDL) blood level (the "good" cholesterol) was very high and his low density lipoprotein (LDL) blood level (the "bad" cholesterol) was normal. In

April 2007 and September 2008, the Trainee received an annual FD medical evaluation from his previous FD. The results of both evaluations were normal except for mild hearing loss and a mildly elevated blood cholesterol level (noted above). The physician recommended a low cholesterol diet.

In November 2008, the Trainee applied for a position at another FD within the State. In March 2009, he received a preplacement medical evaluation from that FD. Results were the same as the evaluation in April 2007 and in September 2008, and he was cleared to participate in the City Fire Training Academy's cadet training program. The Trainee was on vacation from his previous FD for 2 weeks prior to becoming a trainee. During this time, he concentrated on physical fitness training (running and lifting weights).

DESCRIPTION OF THE FIRE DEPARTMENT

At the time of the NIOSH investigation, the career FD consisted of 3,604 uniformed personnel and served a population of 2,200,000 residents in a geographic area of 618 square miles. The FD had 94 fire stations. In 2008, the FD responded to 593,696 calls: 381,746 EMS calls and 211,950 fire calls.

Employment and Training. The FD requires all new fire fighter applicants to pass a civil service examination. The candidate is ranked based on test score. The candidate must attend an orientation program, pass a physical ability test (PAT) (see Appendix B), followed by an interview, a polygraph, and a background check before receiving a conditional job offer from the City. The newly hired City employee must then pass a drug test and a preplacement medical evaluation (discussed below) prior to acceptance to the 24-week City Fire Training Academy. Upon completion of the City Fire Training Academy program, a candidate becomes Fire Fighter I certified and an FD employee.

During the 24-week training, candidates must pass a series of four PATs about 2 months apart. The first PAT occurs during the first week of training. The components and qualifying scores are listed in Appendix C. The second, third, and fourth PATs are given 2 months apart (Appendices D, E, and F). Fire fighter candidates who are previously State-certified fire fighters are placed into the fast track program, which includes passing the City Fire Training Academy 8-week program, physical fitness testing, and FD standard operating procedures and practices. The Trainee was a member of the affected FD for 9 days and had just begun his 6th day of training. He had been a member of two other FDs for a total of 5 years and was state-certified as a FF-Intermediate, Apparatus Operator, Fire Officer I, Fire Service Instructor, and Hazardous Materials Technician.

Preplacement Medical Evaluations. The City requires a preplacement medical evaluation for all new hires regardless of age. Components of this evaluation include the following:

- Complete medical history
- Physical examination (including vital signs)
- Complete blood count with lipid panel
- Pulmonary function test
- Audiogram
- Vision screen
- Urinalysis
- Urine drug screen
- Resting EKG
- Chest x-ray (baseline only)

These evaluations are performed by a physician contracted with the City. Once this evaluation is complete, the contracted physician makes a determination regarding medical clearance for fire fighting duties and forwards this decision to the City's personnel director and the FD.

Annual Medical Evaluations. Annual medical evaluations are not required by the FD. However, each member's FD health insurance plan includes annual medical evaluations at no cost to the fire fighter. Neither the components of these evaluations nor their results are shared with the FD. Medical clearance to wear SCBA is not required.

Health and Wellness Programs. The FD does not have a wellness/fitness program. However, fitness equipment (strength and aerobic) is available in the fire stations. An annual fitness evaluation is not required. Members injured on duty must be evaluated by their primary care physician and the results are provided to City risk management, who makes the final determination regarding return to work.

DISCUSSION

Hypothermia. Hyperthermia is characterized by an uncontrolled increase in body temperature that exceeds the body's ability to lose heat [CDC 2006; Dinarello and Porat 2008]. The source of the heat can be external (e.g., air temperature), internal (e.g., the body's heat production during exercise), or a combination of the two. Exertional hyperthermia is defined as a core body temperature above 104°F during activity [Armstrong et al. 2007]. The Trainee had a core body (rectal) temperature of 105.3°F approximately 75 minutes after his collapse and subsequent treatment with ice packs. Therefore, his core body temperature was probably significantly higher than 105.3°F at the time of his collapse. Hyperthermia was listed as a cause of death on his death certificate.

Heat-related Illness and Heatstroke. When individuals with hyperthermia become symptomatic, the condition is known as heat-related illness. Heat-related illness represents a wide spectrum of conditions typically ranging from skin rashes and heat cramps, to heat exhaustion, heat syncope, and heatstroke.

Heatstroke, the most severe form of heat-related illness, is a life-threatening condition. It is defined as a core body temperature greater than 104°F with central nervous system disturbances and multiple organ system failure [Donoghue et al. 1997; Armstrong et al. 2007]. The Trainee had exertional heatstroke.

Like hyperthermia, heatstroke is grouped according to the primary source of the heat: exertional (exercise) and nonexertional (environmental). Exertional and nonexertional heatstroke differ clinically and epidemiologically. Exertional heatstroke tends to occur in younger, healthier persons (e.g., military recruits and athletes) who present with sweat-soaked and pale skin at the time of collapse. Nonexertional heatstrokes tend to occur in elderly patients with chronic medical conditions who present with dry, hot, and flushed skin [Lugo-Amador et al. 2004]. Although both types of heatstroke occur more often during hot summer months, only exertional heatstroke occurs during cool winter months. The Trainee's presentation and clinical course is typical of severe exertional heatstroke.

Data on the incidence of exertional heatstroke are limited. The U.S. Army reports from 2 to 14 cases per 100,000 soldiers per year with a fatality rate of 0.3 per 100,000 soldiers per year [Carter et al. 2005]. Among fire fighters, the National Fire Protection Association (NFPA) reported 2,890 "thermal stress" injuries in 2008, with thermal stress being defined as either frostbite or heat exhaustion [Karter and Molis 2009]. It is unclear how many of these 2,890 cases represent exertional heatstroke. NFPA also reports about one heatstroke death every other year, for an approximate incidence rate of 1 per 2.5 million fire fighter-years [Fahy et al. 2009].

The primary risk factors for exertional heatstroke are strenuous exercise in a hot-humid environment (WBGT >82°F), dehydration, lack of heat acclimatization, and poor physical fitness [Armstrong et al. 2007]. Other risk factors include a previous history of exertional heatstroke, obesity, sleep deprivation, sweat gland dysfunction, sunburn, viral illness, diarrhea, or certain medications (e.g., over-the-counter medications containing ephedrine or synephrine). WBGT was not calculated at this incident, but given the nearby wet bulb temperature of 70°F, it would not have exceeded 82°F. In addition, the Trainee did not appear to have any of the other personal risk factors for heatstroke, although data were not available to assess his fitness level or his hydration status before the run. Some athletes tolerate core body temperatures above the threshold for exertional heatstroke without problems while other highly trained and heat-acclimatized athletes can develop exertional heat stress [Armstrong et al. 2007].

***Dehydration and Rhabdomyolysis*.** Dehydration occurs during prolonged exercise when fluid losses from sweating and rapid breathing are greater than fluid intake. The reduced intravascular volume associated with dehydration results in reduced skin blood flow (convection heat loss) and sweating (evaporative heat loss), two of the body's most important cooling mechanisms [Lugo-Amador et al.

2004]. Impaired cooling increases the body's core temperature, which increases the risk of exertional heatstroke. Dehydration has been diagnosed in approximately 20% of all heatstroke hospitalizations [Epstein et al. 1999; Carter et al. 2005].

As the core body temperature increases, the muscle cells begin to break down, releasing their contents (i.e., myoglobin) into the blood stream. This process, known as rhabdomyolysis, has been previously observed during fire fighter physical fitness testing [CDC 1990]. With reduced intravascular volume and kidney blood flow from dehydration, the circulating myoglobin can "clog" the kidneys, resulting in acute tubular necrosis and acute kidney failure [Brown 2004; Sawka et al. 2007]. Kidney failure is one of exertional heatstroke's poor prognostic signs. Thus, dehydration is not only a risk factor for heatstroke, but is also an important indicator regarding its prognosis.

Other Complications. Upon admission into the hospital, the Trainee suffered from liver failure, electrolyte disturbances, and coagulation complications (disseminated intravascular coagulation – DIC). These are relatively common and poor prognostic signs that can accompany severe exertional heatstroke [Lugo-Amador et al. 2004].

Treatment. Rapid core temperature reduction is the most important treatment for exertional heatstroke. This is best accomplished by cold/ice water immersion, a practice endorsed by the American College of Sports Medicine and the National Athletic Trainers' Association [Binkley et al. 2002; Armstrong et al. 2007; McDermott et al. 2009]. The Fire Training Academy did not have the capability to provide ice water immersion. Instead, ice packs were applied to the neck and groin areas, but these measures have little cooling effect [McDermott et al. 2009]. Other treatments including IV fluids, cardiac monitoring, and oxygen administration were given in the field and in the hospital, but these did not successfully lower the Trainee's temperature. Records documented a temperature of 104.7°F 3 hours after he arrived in the ED.

Cardiomegaly/Left Ventricular Hypertrophy. On autopsy, the Trainee was noted to have mild cardiomegaly and left ventricular hypertrophy. These conditions were probably due to undiagnosed high blood pressure, but neither were a factor in his exertional heatstroke.

NIOSH investigators concluded that the Trainee died from complications of exertional heatstroke due to the physical fitness training exercise conducted as part of the Fire Training Academy.

RECOMMENDATIONS

NIOSH investigators offer the following recommendations to help prevent heat-related illness and exertional heatstroke during physical fitness training. Had these recommendations been in place, the Trainee's death probably could have been prevented.

Recommendation #1: Structure the recruit physical fitness training program to be consistent with the IAFF/IAFC Candidate Physical Ability Test (CPAT).

The CPAT recommends a cardiopulmonary endurance program in which candidates are advanced to more strenuous levels depending on their ability and underlying fitness level [IAFF, IAFC 2007]. The recommended program consists of a series of steps. As the trainees adapt to each step, they are advanced to the next level. Phase One begins with a 1-mile run at an easy pace (Level 1) and progresses to a 3-mile run (Phase One, Level 5). Phase Two begins and ends with a 3-mile run at an easy pace (Levels 1–5; does not increase to a faster pace). Other running exercises and distances are interspersed on alternating days during the 5-day cycles. Because the FD CPAT requires a 1.5-mile run within 13 minutes, 7 seconds, the FD should consider using this distance and time requirement for all aspects of recruit fitness training.

Recommendation #2: Ensure trainees are hydrated at all phases of physically demanding tasks.

The training staff provided fluids (water and sports drinks) and reminded trainees to drink fluids before and after the run. For scheduled events, prehydration should include 16 ounces of water fluids 2 hours before the event [NFPA 2008a; USFA 2008]. However, hydrating during the run is also important. The amount and rate of fluid replacement depends on a number of factors including the sweat rate and exercise duration. Given the Trainee's weight, running speed, and air temperature, it is estimated he lost almost a liter of sweat without an opportunity to replenish the loss during the run [Sawka et al. 2007]. If setting up water stations on the current route (public streets) is problematic, consider rerouting the run. Other options include providing trainees with personal water bottles filled with water or a sports drink.

Recommendation #3: Ensure ice water immersion is rapidly available at the Fire Training Academy.

Rapid core temperature reduction by cold/ice water immersion is the most important treatment for exertional heatstroke [Armstrong et al. 2007]. Other treatments including ice packs applied to the neck and groin, IV fluids, and oxygen administration did not cool the Trainee very well. If the Fire Training Academy had cold/ice water immersion available, the Trainee's core temperature could have been reduced sooner, improving his prognosis. Immersion could be accomplished by placing the person into a tank/tub such as a cattle watering trough or a bath tub filled with ice and water. Once these troughs or tubs are acquired, the Academy personnel will need training on the symptoms, signs, and initial management of heatstroke.

The following recommendations are based on general health and safety considerations and would not have prevented the Trainee's death.

Recommendation #4: Ensure the personnel responsible for the physical training program are knowledgeable about the FD heat stress program.

As part of their heat stress program, the Fire Training Academy should establish WBGT benchmarks that, when exceeded, preclude physical fitness training. The American College of Sports Medicine suggests cancelling or rescheduling competitive events when the wet bulb globe temperature is above 82°F [Armstrong et al 2007]. The wet bulb temperature at the time of this incident was approximately 70°F (WBGT could not be calculated); therefore, it was reasonable for the physical fitness training to continue. Subsequent physical ability tests, however, were scheduled during the middle of the summer (Appendix D and E) when more severe environmental temperatures could be expected [NOAA 2009b]. Like the Army, the FD should consider measuring the WBGT whenever the dry bulb temperature reaches 75°F [Sawka et al. 2003]. When the WBGT exceeds the benchmarks established by the FD, the day's physical fitness training should be rescheduled to prevent heat-related illnesses. Another option would be for the FD to offer all of the training courses during the cooler winter months [NOAA 2009b].

Recommendation #5: Ensure the FD Trainee Code of Conduct and Standards does not penalize students for seeking medical attention.

The FD Trainee Code of Conduct and Standards appear to count time needed for medical attention toward the 24-hour maximum missed training hours and the 8-hour maximum missed physical training time. If this maximum time is exceeded, the student could be placed into a makeup class or placed into the next class cycle. As a result, some Trainees expressed reluctance to seek medical attention, thinking it might jeopardize completion of their training. This was not the intent of the FD policy, and Fire Training Academy instructors were unaware of this perception. It is unlikely the Trainee's strong desire to complete his run/jog despite his severe symptoms was due to this policy. Nonetheless, the FD and the Fire Academy instructors should take steps to address this perception.

Recommendation #6: Use a checklist to screen fire fighters for individual heatstroke risk factors.

The FD requires candidates to pass a preplacement medical evaluation before enrolling in the FD Fire Training Academy. As part of this evaluation, NIOSH investigators recommend that the physician complete a checklist for individual heatstroke risk factors on all participants. Individual risk factors include previous history of exertional heatstroke, lack of heat acclimatization, poor physical fitness, obesity, sleep deprivation, sweat gland dysfunction, sunburn, viral illness, diarrhea, or use of certain medications (over-the-counter medications containing ephedrine or synephrine, diuretics, etc).

Recommendation #7: Provide annual medical evaluations consistent with NFPA 1582 to all fire fighters.

The FD provides health insurance coverage for annual medical evaluations. Whether these medical evaluations are intended to ensure medical clearance for fire fighting is unclear. NIOSH investigators recommend that the FD provide annual medical evaluations to comply with NFPA 1582 or the International Association of Fire Fighters (IAFF)/International Association of Fire Chiefs (IAFC) Fire Service Joint Labor Management Wellness/Fitness Initiative [NFPA 2007a; IAFF, IAFC 2008].

Recommendation #8: Perform annual physical performance (physical ability) evaluations for all fire fighters.

NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, requires the FD to develop physical performance requirements for candidates and members who engage in emergency operations [NFPA 2007b]. Members who engage in emergency operations must be annually qualified (physical ability test) as meeting these physical performance standards for structural fire fighters [NFPA 2007b].

Recommendation #9: Phase-in a comprehensive wellness and fitness program.

NFPA 1500 recommends that a fire department have a wellness program that provides health promotion activities for preventing health problems and enhancing overall well being [NFPA 2007b]. 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 [Maniscalco et al. 1999; Stein et al. 2000; Aldana 2001]. 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]. A study conducted by the Oregon Health and Science University reported a savings of over $1 million for each of four large FDs implementing the IAFF/IAFC wellness/fitness program compared to four large FDs 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 2007].

Guidance for implementation and components of a comprehensive wellness/fitness program are found in NFPA 1583, Standard on Health-Related Fitness Programs for Fire Fighters [NFPA 2008b] and in the IAFF/IAFC's Fire Service Joint Labor Management Wellness/Fitness Initiative [IAFF, IAFC 2008]. Although the FD provides exercise equipment (aerobic and strength) in the fire stations, NIOSH investigators recommend a formal, structured wellness/fitness program to ensure all members receive the benefits of a health promotion program.

***Recommendation #10: Provide fire fighters with medical clearance to wear self-contained breathing apparatus (SCBA) as part of the Fire Department medical evaluation program*.**

The Occupational Safety and Health Administration (OSHA) Revised Respiratory Protection Standard requires employers to provide medical evaluations and clearance for employees who use 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. Texas does not operate an OSHA-approved State plan; therefore, public sector employers (including volunteer fire departments) are not required to comply with OSHA standards. Nonetheless, NIOSH investigators recommend voluntary compliance to improve health and safety.

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