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NIOSH
Fire Fighter Fatality Investigation
and Prevention Program

Death in the line of duty...

A Summary of a NIOSH fire fighter fatality investigation *March 31, 2005*

Assistant Chief Suffers Sudden Cardiac Death During Response to Boat Fire – Wisconsin

SUMMARY

On September 26, 2004, a 42-year-old male volunteer Assistant Chief (AC) responded to his fire station after being dispatched to a boat fire. As he donned his turnout gear, he collapsed. Despite cardiopulmonary resuscitation (CPR) and advanced life support (ALS) performed by crew members, emergency medical service (EMS) personnel, and hospital emergency department (ED) personnel, the AC died. The death certificate, completed by the County Medical Examiner, listed "severe arteriosclerotic cardiovascular disease" as the cause of death and "previous myocardial infarction" as other significant condition. The autopsy, performed by another County Medical Examiner, listed "severe coronary artery disease due to arteriosclerotic cardiovascular disease" as the cause of death.

The first six recommendations are preventive measures recommended by other fire service groups to reduce the risk of on-the-job heart attacks and sudden cardiac arrest among fire fighters. The last three recommendation address potential safety issues related to this particular event. These recommendations are listed in order of priority.

Provide pre-placement and periodic medical evaluations to ALL fire fighters consistent with NFPA 1582 or equivalent to determine their medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.

Conduct exercise stress tests for fire fighters with two or more risk factors for coronary artery disease (CAD).

Provide fire fighters with medical evaluations and clearance to wear self-contained breathing apparatus (SCBA).

Ensure a City/County/FD-contracted physician reviews all "return to work" clearances.

Ensure that fire fighters are cleared for duty by a physician knowledgeable about the physical demands of fire fighting.

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

Provide automated external defibrillators (AEDs) as part of the basic life support equipment for fire apparatus.

Use a secondary (technological) test to confirm appropriate placement of the endotracheal (ET) tube during emergency intubations.

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**

Assistant Chief Suffers Sudden Cardiac Death During Response to Boat Fire – Wisconsin

Perform a pre-placement and an annual physical performance (physical ability) evaluation to ensure fire fighters are physically capable of performing the essential job tasks of structural fire fighting.

INTRODUCTION AND METHODS

On September 26, 2004, a 42-year-old male AC suffered sudden cardiac death as he prepared to respond to a boat fire. Despite CPR and ALS performed by crew members, EMS personnel, and hospital ED personnel, the AC died. NIOSH was notified of this fatality on September 27, 2004, by the United States Fire Administration. NIOSH contacted the affected Fire Department (FD) on October 3, 2004, to obtain further information, and on October 6, 2004, to initiate the investigation. On October 13, 2004, a Safety and Occupational Health Specialist from the NIOSH Fire Fighter Fatality Investigation Team traveled to Wisconsin to conduct an on-site investigation of the incident.

During the investigation NIOSH personnel met, interviewed, and/or reviewed the following:

- Fire Chief
- FD training records
- FD annual response report for 2003
- AC's primary care physician records
- Ambulance report
- Hospital ED report
- Death certificate
- Autopsy report

INVESTIGATIVE RESULTS

Incident. On September 26, 2004, the FD involved in this incident was dispatched to a boat fire at 1121 hours. The AC, his brother, and his father (the Fire Chief), together in church at the time, responded to the fire station. The AC and his brother arrived first with the Fire Chief just behind. Inside the station, the AC told the Chief that he and his brother would respond in Engine 6; the Fire Chief would drive the Incident Command van (24). As the AC donned his turnout gear, he suddenly collapsed.

The Chief looked around, did not see the AC, and walked over to where he had been standing. The AC was found collapsed on the floor. Initial assessment revealed the AC was unresponsive with no pulse and no respirations. The Chief began CPR immediately while the AC's brother notified Dispatch. Dispatch notified Ambulance 680 of the cardiac arrest at 1124 hours. Ambulance 680, en route to the boat fire, was near the fire station and arrived on the scene within 2 minutes.

Initial assessment by EMTs and paramedics revealed the AC was unresponsive, had no pulse, and had no respirations with CPR being performed. ALS treatment (establishing an intravenous [IV] line, intubation [breathing tube inserted into the windpipe], and cardiac monitoring) began. Tube placement was confirmed bilaterally by auscultation of breath sounds. The cardiac monitor revealed an initial heart rhythm of ventricular fibrillation (Vfib) (heart rhythm incompatible with life), and six shocks (defibrillation attempts) were administered. However, his heart rhythm reverted to asystole (no heart beat), then back to Vfib with each attempt. The AC was placed onto a long back board and stretcher and transferred into the ambulance, which departed the scene at 1143 hours. While en route to the hospital, cardiac resuscitation medications were administered. The ambulance arrived at the hospital ED at 1210 hours.

Inside the ED, ALS treatment continued. A cardiac monitor revealed pulseless electrical activity (PEA). Placement of the endotracheal tube was

again confirmed by auscultation. Cardiac pacing was attempted without improvement in the AC's condition. His heart rhythm reverted to asystole. CPR and ALS continued until 1232 hours, when he was pronounced dead and resuscitation measures were stopped.

Medical Findings. The death certificate, completed by the Chief Medical Examiner, listed "severe arteriosclerotic cardiovascular disease" as the cause of death with "previous myocardial infarction" as other significant condition. Pertinent findings from the autopsy, performed by the County Medical Examiner on September 27, 2004, included:

- Ischemic heart disease
  - Heavily calcified coronary arteries with severe atherosclerotic plaquing
  - Total occlusion of the mid right coronary artery
  - Significant narrowing (60%-95%) of the left anterior descending coronary artery
  - Mild plaquing in the left circumflex coronary artery
- Cardiomegaly (enlarged heart) – heart weighing 450 grams (normal less than 400 grams)[1]
- A large area of white fibrosis with thinning of the posterior wall of the left ventricle
- Severe dilatation of the heart chambers
- No evidence of pulmonary thromboemboli
- Negative drug and alcohol tests
- Carboxyhemoglobin (carbon monoxide) test was not performed

On autopsy, the AC weighed 180 pounds and was 68½ inches tall, giving him a body mass index (BMI) of 26.9 kilograms per square meter (kg/m). A BMI between 25.0 kg/m^2 and 29.9 kg/m^2 is considered overweight.[2] At a routine physical evaluation conducted in February 2003, laboratory tests revealed a normal blood glucose level, elevated blood cholesterol (241 milligrams per deciliter [mg/dL] [normal 0-239 mg/dL]), elevated triglycerides (234 mg/dL) (normal 0-200 mg/dL), elevated low density lipoprotein (LDL) (165.5 mg/dL) (normal 80-160 mg/dL), an elevated cholesterol/high density lipoprotein (HDL) ratio (8.1) (normal 3.0-4.5), and a low HDL level (29.7 mg/dL)(normal 35-55 mg/dL). He was placed on a low cholesterol diet. A retest in December 2003 revealed persistently elevated levels of cholesterol, LDL, triglycerides, and cholesterol/HDL ratio.

Subsequent treatment with a cholesterol-lowering medication resulted in normal lipid levels (June 2004). In February 2004, the AC experienced exertional chest pain for which he sought medical attention in March 2004. This pain occurred while exercising on a particular aerobic fitness machine that he had not used for a couple of weeks. Work-up included an electrocardiogram (EKG) that showed a normal sinus rhythm with no changes consistent with ischemia or infarction. A thalium exercise stress test (EST) was conducted according to the Bruce protocol.[3] He exercised for 10 minutes, achieving a work level of 11.7 metabolic equivalents (METS) and a maximum heart rate of 160 bpm (89% of the maximal age-predicted heart rate). His resting blood pressure was 138/90 mmHg, which rose to 174/102 mmHg during exercise. During late Stage III, this EKG showed some downsloping ST segment depression in leads V4-6 (suggestive of ischemia). The EST was stopped due to mild chest discomfort and "maximum" heart rate. The test was initially interpreted as a positive stress test suggestive of ischemia due to the EKG tracing and his symptoms of chest discomfort. The radiopharmaceutical portion of the EST found a small fixed defect consistent

with an old infarct (heart attack) involving the anteroseptal region. His left ventricular ejection fraction was estimated to be 46% (normal typically ≥ 50%). Due to his minimal symptoms and the small fixed lesion, the final interpretation of the EST attributed the area of defect to artifact and the chest pain was diagnosed as probable musculoskeletal chest wall pain and his elevated, varied blood pressure was attributed to job stress.

During a follow-up visit to his primary care physician (PCP) in June 2004, the AC reported that exertional chest pain still occurred during exercise. His PCP assumed this was musculoskeletal pain and referred the AC to physical therapy for stretching before exercise. Prior to the physical examination in February 2003, the AC had not had a physical examination since approximately 1979. From 2003 to 2004, the AC was noted to have intermittently elevated blood pressure, but was never diagnosed with hypertension, or treated for it. He was also noted to weigh 213 pounds (BMI 31.9) but was not diagnosed with obesity. According to the AC's father, the AC exercised regularly by walking and lifting weights and had lost weight (33 pounds).

DESCRIPTION OF THE FIRE DEPARTMENT

At the time of the NIOSH investigation, this volunteer FD consisted of 10 uniformed personnel, served a population of 353 in a 12 square mile area, and had one fire station.

In 2003, the FD responded to 99 calls: 9 structure fires, 21 alarm calls, 22 vehicle accidents, 30 mutual aid calls, and 17 other calls.

Training. The FD requires all fire fighter applicants to possess a valid state driver's license and pass a background check prior to being selected for membership. The member then begins an in-house training program. Fire fighters must complete 30 hours of basic State fire fighting training to fight interior structure fires and be classified as a Fire Fighter 1 (FF1) entry level. The State has additional voluntary training programs: State-certified FF1 (30 hours), FF2 (30 hours), State-certified FF2 (30 hours), Driver/Operator (60 hours), Aerial Apparatus Operator (30 hours), Fire Officer (30 hours), and Hazardous Materials (9 hours). State-certified FF1s must recertify every 5 years. State-certified FF2s are grandfathered in and no recertification is required. EMTs and First Responders must recertify every 2 years.

The AC was certified as a Fire Fighter 2, Fire Officer 1, Fire Investigator, Fire Service Instructor, and in hazardous materials awareness. He had 25 years of fire fighting experience.

Pre-placement/Periodic Physical Examination. No pre-placement or periodic physical examination is required by this FD due to the cost and its presumed effect of reducing recruitment. No physical agility test is required. No wellness/fitness programs are in place. A return-to-duty medical clearance is required from their PCP for illnesses and injuries that prevent fire fighters from performing their duty. Annual SCBA fit tests are conducted.

DISCUSSION

Coronary Artery Disease (CAD) and the Pathophysiology of Sudden Cardiac Death. In the United States, coronary artery disease (atherosclerosis) is the most common risk factor for cardiac arrest and sudden cardiac death.[4] Risk factors for its development include age over 45,

male gender, family history of coronary artery disease, smoking, high blood pressure (systolic >140 mmHg or diastolic > 90 mmHg), high blood cholesterol (total cholesterol > 240 mg/dL, obesity/physical inactivity, and diabetes.[5,6] The AC had four of these risk factors (male gender, high blood pressure, high cholesterol, and obesity). The AC was overweight at the time of death but had been considered obese by BMI measurement.

The narrowing of the coronary arteries by atherosclerotic plaques occurs over many years, typically decades.[7] However, the growth of these plaques probably occurs in a nonlinear, often abrupt fashion.[8] Heart attacks typically occur with the sudden development of complete blockage (occlusion) in one or more coronary arteries that have not developed a collateral blood supply.[9] This sudden blockage is primarily due to blood clots (thrombosis) forming on the top of atherosclerotic plaques. The AC had a large area of white fibrosis with thinning of the posterior wall of the left ventricle and evidence of atherosclerotic disease in his coronary arteries with total occlusion of the right coronary artery, significant narrowing (60%-95%) of the left anterior descending coronary artery, and mild plaquing in the left circumflex coronary artery on autopsy.

Atherosclerosis in a coronary artery may cause ischemic heart disease which occurs when the blood flow within a coronary artery (the right coronary artery and the left anterior descending coronary artery in this case) is limited to the point where the oxygen needs of the heart muscle cannot be met. Chronic ischemic heart disease causes hypertrophy of the heart muscle and cardiomegaly. All of these factors, independently and in combination (ischemia, cardiomegaly, or myocardial infarction), increase the risk of cardiac arrhythmia and sudden cardiac death.

It cannot be determined whether the AC suffered a fatal heart attack. Autopsy findings (thrombus formation), blood tests (cardiac isoenzymes), or ECG findings are required to confirm a heart attack, also known as a myocardial infarction (MI). No thrombus was identified on autopsy, the AC died prior to the cardiac isoenzymes becoming positive, and the EKG did not reveal an acute MI. However, he had recently complained of exertional chest pain, which is suggestive of a MI.

Angina is the most common presenting symptom of myocardial ischemia and underlying CAD, but in many persons the first evidence of CAD may be myocardial infarction or sudden death.10 Some individuals may not experience angina with ischemia, as evidenced by up to 20% of heart attacks being "silent," i.e., painless.[7] The AC reported recent episodes of chest pain during physical exertion (exercise) that subsided during rest periods. However, the chest pain was diagnosed as musculoskeletal pain. Whether this exertional chest pain actually expressed angina versus musculoskeletal pain cannot be determined from the available information.

Firefighting activities are strenuous and often require fire fighters to work at near maximal heart rates for long periods. The increase in heart rate has been shown to begin with responding to the initial alarm and persist through the course of fire suppression activities.[11-13] Even when energy costs are moderate (as measured by oxygen consumption) and work is performed in a thermoneutral environment, heart rates may be high (over 170 beats per minute) owing to the insulative properties of the personal protective clothing.[14] Epidemiologic studies have found that heavy physical exertion sometimes immediately

precedes and triggers the onset of acute heart attacks.[15-18] The physical stress of responding to the alarm and his underlying atherosclerotic CAD probably contributed to this AC's cardiac arrest and sudden 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) has developed the NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments*.[19]

Use of Exercise Stress Tests to Screen for CAD. To screen for CAD, NFPA 1582 recommends an EST for asymptomatic fire fighters with two or more risk factors for CAD (family history of premature [first degree relative less than age 60] cardiac event, hypertension [diastolic blood pressure greater than 90 mmHg], diabetes mellitus, cigarette smoking, and hypercholesterolemia [total cholesterol greater than 240 mg/dL]).[19] This recommendation is consistent with recommendations from the American Heart Association/ American College of Cardiology (AHA/ACC) and the Department of Transportation (DOT) regarding EST in asymptomatic individuals.[20,21]

Since the AC had two CAD risk factors (high blood pressure and hypercholesterolemia) for EST determination, an EST would have been recommended by NFPA 1582 and the AHA. The AC underwent an EST due to his CAD symptoms (exertional chest pain). Additionally, a mandatory comprehensive wellness/fitness program, including weight reduction, dietary education, and exercise would have benefited this AC.

Conducting EST on asymptomatic individuals is controversial. As mentioned above, NFPA Standard 1582 recommends, not as a part of the requirements but for informational purposes only, that all fire fighters with two or more risk factors for CAD take an EST.[19]
The AHA/ACC goes on to say the evidence is "less well established" (Class IIb) for the following groups:

1. Evaluation of persons with multiple risk factors as a guide to risk-reduction therapy with the risk factors essentially the same as the NFPA listed above

2. Evaluation of asymptomatic men older than 45 years, and women older than 55 years:
   - Who are sedentary and plan to start vigorous exercise
   - Who are involved in occupations in which impairment might jeopardize public safety (e.g., fire fighters)
   - Who are at high risk for CAD due to other diseases (e.g., peripheral vascular disease and chronic renal failure)[20]

The U. S. Department of Transportation (DOT) also addresses the subject of EST. To obtain medical certification for a commercial drivers license, the DOT recommends an EST for drivers over the age of 45 with more than two CAD risk factors.[21] Finally, the U.S. Preventive Services Task Force (USPSTF) does not recommend EST for asymptomatic individuals, even those with risk factors for CAD; rather, they recommend the diagnosis and treatment of modifiable risk factors (hypertension, high cholesterol, smoking, and diabetes).[22] The USPSTF indicates that there is insufficient evidence to recommend screening middle age and older men or women in the general population but notes that "screening individuals in

certain occupations (pilots, truck drivers, etc.) can be recommended on other grounds, including the possible benefits to public safety."

The AC had an EST which was stopped prior to reaching his maximal heart rate due to mild chest discomfort.

RECOMMENDATIONS

The first six recommendations are preventive measures recommended by other fire service groups to reduce the risk of on-the-job heart attacks and sudden cardiac arrest among fire fighters. The last three recommendation address potential safety issues related to this particular event. These recommendations are listed in order of priority.

Recommendation #1: Provide pre-placement and periodic medical evaluations to ALL fire fighters consistent with NFPA 1582 or equivalent to determine their 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 pre-placement and periodic medical evaluations and examinations for structural fire fighters can be found in NFPA 1582,[19] and in the report of the International Association of Fire Fighters/ International Association of Fire Chiefs (IAFF/ IAFC) wellness/fitness initiative.[23] The FD is not legally required to follow any of these standards but should implement the recommendation to improve safety and health.

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

The physical evaluation could be conducted by the fire fighter's primary care physician or a City/County/FD-contracted physician. If the evaluation is performed by the fire fighter's primary care physician, the results must be communicated to the contracted physician, who should be responsible for decisions regarding medical clearance for fire fighting duties.

Recommendation #2: Conduct exercise stress tests for fire fighters with two or more risk factors for coronary artery disease CAD.

NFPA 1582 recommends EST for fire fighters with two or more risk factors[19] and the IAFF/IAFC wellness/fitness initiative recommends EST at any age.[23] The AHA states EST may be indicated for individuals with two or more risk factors for CAD who are over 45 years of age.[20] We suggest the FD use the AHA guideline to determine who should be required to undergo an EST and which protocol to follow (maximal or symptom-limiting EST). The EST could be conducted by the fire fighter's personal physician (at FD expense) or a City/County-contracted physician. If the fire fighter's personal physician conducts the test, the results must be communicated to the City/County-contracted physician, who should be responsible for decisions regarding medical clearance for fire fighting duties.

Recommendation #3: Provide fire fighters with medical evaluations and clearance to wear SCBA.

The Occupational Safety and Health Administration (OSHA)'s Revised Respiratory Protection Standard requires employers to provide medical evaluations and clearance for employees who use respiratory protection.[24] This includes fire fighters who utilize SCBA while performing their duties. These clearance evaluations are required for private industry employees and public employees in states operating OSHA-approved State plans. Wisconsin is not a state-plan state. However, we recommend voluntary compliance with OSHA standards. We have provided the FD with a copy of the OSHA-approved respiratory protection clearance form and recommend the FD provide SCBA clearance medical evaluations.

Recommendation #4: Ensure a City/County/ FD-contracted physician reviews all "return to work" clearances.

NFPA 1582 requires the FD physician to review and approve medical evaluations conducted by a physician or medical provider other than the FD physician.[19] NFPA 1582 also recommends protocols that require physician evaluation following specific lengths of absence from duty and/or certain medical conditions that require the FD physician to evaluate a member.[19]

Currently, the primary care physician provides medical clearance for return to work in this FD. The FD should ensure the FD physician reviews all return to work clearances to ensure continuity and increased safety and health.

Recommendation #5: Ensure that fire fighters are cleared for duty by a physician knowledgeable about the physical demands of fire fighting.

Frequently, private physicians are not familiar with a member's job duties or with guidance documents such as NFPA 1582. To ensure physicians are aware of these guidelines, we recommend that the FD provide the contract and private physicians of its members with a copy of NFPA 1582. In addition, we recommend the FD carefully evaluate the opinion of the member's private physician regarding return to work. This decision requires knowledge not only of the member's medical condition but also of the member's job duties. Lastly, we recommend that all return-to-work clearances be reviewed by a FD contracted physician. Thus, the final decision regarding medical clearance for return to work lies with the FD with input from many sources including the employee's private physician.

Recommendation #6: Phase in a mandatory wellness/fitness program for fire fighters to reduce risk factors for cardiovascular disease and improve cardiovascular capacity.

Physical inactivity is the most prevalent modifiable risk factor for CAD in the United States. Physical inactivity, or lack of exercise, is associated with other CAD risk factors: obesity and diabetes.[25] NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, requires a wellness program that provides health promotion activities for preventing health problems and enhancing overall well-being.[26] NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Fighters*, provides the minimum requirements for a health-related fitness program.[27] 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.[23] Large-city negotiated programs can also be reviewed as potential models. Wellness programs have been shown to be cost effective, typically by reducing the number of work-related injuries and lost work days.[28-30] A similar cost savings has been reported by the wellness program at the Phoenix Fire Department, where a 12-year commitment has resulted in a significant reduction in their disability pension costs.[31]

Recommendation #7: Provide automated external defibrillators (AEDs) as part of the basic life support equipment for fire apparatus.

Preservation of human life is the primary responsibility of the fire department during fires and other emergencies. Fire departments should be prepared to perform rescue work and provide emergency care for those injured.[32] Such injuries include cardiac arrest. Most of the sudden cardiac deaths in the United States result from ventricular fibrillation. The chain of survival from cardiac arrest includes: 1) early access to the emergency medical system (EMS and 9-1-1 system), 2) early CPR, 3) early defibrillation when indicated, and 4) early advanced emergency treatment.[33] AEDs have caused the cardiac arrest survival rate to increase from 7% (CPR performed only) to 26%.[34] When defibrillation is provided within 5-7 minutes, the survival rate is as high as 49%.[35] To provide emergency medical care, adequate supplies and equipment should be available to treat bleeding, fractures, cardiac arrest, etc. Placing AEDs on fire apparatus, in addition to carrying defibrillators on ambulances, would allow the FD to provide a greater level of emergency medical care to the public. The FD has medical first responder responsibilities and fire fighters may find themselves in the position of having to provide CPR. The timely use of an automatic external defibrillator, even by minimally trained first responders, can increase the likelihood of survival following cardiac arrest.[35,36]

Recommendation #8: Use a secondary (technological) test to confirm appropriate placement of the endotracheal (ET) tube during emergency intubations.

To reduce the risk of improper intubation, the American Heart Association and the International Liaison Committee on Resuscitation published recommendations in the Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.[37] These guidelines recommend confirming tube placement by primary and secondary methods. Primary confirmation is the 5-point auscultation: left and right anterior chest, left and right midaxillary, and over the stomach. Secondary confirmation requires a technology test, either an end-tidal carbon dioxide detector or an esophageal detector device. In this incident, the AC had bilateral breath sounds confirmed by auscultation, but no secondary confirmation. The medical professional performing intubation should perform this task to ensure proper tube placement and adequate oxygen delivery.

Recommendation #9: Perform a pre-placement and an annual physical performance (physical ability) evaluation to ensure fire fighters are physically capable of performing the essential job tasks of structural fire fighting.

NFPA 1500 requires fire department members who engage in emergency operations to be annually evaluated and certified by the fire department as meeting the physical performance requirements identified in paragraph 8-2.1.[26]

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INVESTIGATOR INFORMATION

This investigation was conducted by and the report written by:

Tommy N. Baldwin, MS
Safety and Occupational Health Specialist

Mr. Baldwin, 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 Kentucky Certified Fire Fighter and Emergency Medical Technician (EMT), is with the NIOSH Fire Fighter Fatality Investigation and Prevention Program, Cardiovascular Disease Component located in Cincinnati, Ohio.