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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 *August 7, 2003*

Fire Fighter Collapses and Dies At the Scene of Residential Fire - Florida

SUMMARY

On February 7, 2001, a 65-year-old male Fire Fighter responded to a fire in a double-wide mobile home. On the scene, after setting up a change area for self-contained breathing apparatus (SCBA), operating the pump panel, and replacing a SCBA on the apparatus, he collapsed. Despite cardiopulmonary resuscitation (CPR) and advanced life support (ALS) administered by crew members, ambulance paramedics, and personnel at the local hospital's emergency department (ED), the victim died. The death certificate, completed by the Medical Examiner's Office, listed "hypertensive and arteriosclerotic heart disease" as the immediate cause of death. Pertinent autopsy results included an enlarged heart (concentric left ventricular hypertrophy), coronary atherosclerosis, four vessel bypass, pulmonary edema, and cerebral edema.

Other agencies have proposed a three-pronged strategy for reducing the risk of on-duty heart attacks and cardiac arrests among fire fighters. This strategy consists of: 1) minimizing physical stress on fire fighters; 2) screening to identify and subsequently rehabilitate high risk individuals; and 3) encouraging increased individual physical capacity. Issues relevant to this Fire Department include:

- ***Provide mandatory preplacement medical evaluations to ALL fire fighters to determine their medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.***
- ***Provide mandatory annual medical evaluations to ALL fire fighters to determine their medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others.***
- ***Incorporate exercise stress tests into the Fire Department's medical evaluation program for ALL fire fighters.***
- ***Provide automated external defibrillators (AEDs) as part of the basic life support equipment for fire apparatus.***
- ***Phase in a mandatory wellness/fitness program for fire fighters to reduce risk factors for cardiovascular disease and improve cardiovascular capacity.***
- ***Perform an annual physical performance (physical ability) evaluation.***

INTRODUCTION & METHODS

On February 7, 2001, a 65-year-old male Fire Fighter suddenly collapsed while replacing a SCBA. Despite CPR by fire fighters on the scene and ALS by ambulance paramedics and the hospital's ED, the victim died. NIOSH was notified of this fatality on February 8, 2001, by the United States Fire Administration. On August 13, 2001, NIOSH contacted the affected Fire Department (FD) to

obtain additional information, and then on March 11, 2003 to initiate the investigation. On April 7, 2003, a Safety and Occupational Health Specialist from the NIOSH Fire Fighter Fatality Investigation Team traveled to Florida to conduct an onsite investigation of the incident.

During the investigation NIOSH personnel met and/or interviewed the:

- FD Deputy Chief of Operations
- FD Division Chief, Support Services
- FD Volunteer Fire Fighter Coordinator
- County Risk Manager
- Station Officer on-duty with the victim, and
- Victim's wife

During the site-visit NIOSH personnel reviewed:

- FD incident reports
- FD policies and operating guidelines
- FD training records of the victim
- FD annual report for 2001
- Emergency medical service (ambulance) report
- Death certificate, and
- Autopsy report

INVESTIGATIVE RESULTS

Incident. On February 7, 2001, at 1549 hours, the involved Fire Department was dispatched to a mobile home fire. Station 5 (Engine 5 and Grass Truck 5), Station 24 (Engine 24), Station 21 (Engine 21), and Battalion Chief 2 responded initially. Normally a tanker would respond, however in this instance, Grass Truck 5 responded first and the victim was told to drive Engine 5. There was a delay in getting Engine 5 started, but it did start and the engine became enroute. District Chief 4 and Tanker 24 were dispatched next. A total of 12 fire fighters, including the deceased, a Battalion Chief, and a District Chief responded. For the response timeline, see Table 1. The structure involved was a double-wide mobile home with an extension measuring 60-feet by 28-feet. The home was located in an area with very few paved roads and access was via sand/dirt roads with many deep potholes.

Units began to arrive at the scene at 1559 hours and advised Dispatch that the structure was 50% involved. Fire fighters pulled 1¾-inch hoselines off Engine 5 and Engine 24 and began an exterior attack. The victim, wearing full bunker gear without SCBA, worked the pump panel on Engine 5. He also helped set up an area for changing SCBA bottles beside the engine. The structure became fully involved by 1606 hours. At approximately 1613 hours, the incident commander (IC) asked the victim to lower the pump pressure since the hoseline wasn't being used. As the IC walked away, the victim replaced a SCBA in a side compartment on Engine 5 and suddenly collapsed. Crew members immediately notified the IC, who, at 1615 hours, notified Dispatch and requested an ambulance. Rescue 22 had been dispatched. Rescue 20 notified Dispatch that they were closer, but was advised that Rescue 22 was enroute and to remain at their present location. EMS Unit 3 was dispatched at 1617 hours and responded at 1619 hours. In the meantime, crew members (two emergency medical technicians) assessed the victim and found him unresponsive, not breathing, and pulseless. CPR was provided (chest compressions and assisted ventilations via mouth-to-mouth), while an automated external defibrillator (AED) was attached to the victim. The AED advised and delivered two separate shocks (defibrillations). BC 2 arrived on the scene with ALS equipment at 1631 hours. A cardiac monitor was attached to the victim, which revealed ventricular fibrillation (V.Fib.) and he was shocked two more times with a change in the victim's heart rhythm. The victim was intubated, an IV started, and ALS medications were administered.

EMS Unit 3 arrived on the scene at 1638 hours. The victim was placed onto a stretcher, loaded into the ambulance, and departed for the hospital at 1644

hours. Enroute, the cardiac monitor alternated between V.Fib. and asystole (both heart rhythms incompatible with life) throughout the trip to the hospital. Cardiac pacing was also performed, with no change in patient status. The ambulance arrived at the hospital 1716 hours, more than 60 minutes after his collapse. Inside the ED, ALS procedures continued for another six minutes. At 1722 hours, the Fire Fighter was pronounced dead and resuscitation measures were discontinued.

Medical Findings. The death certificate, completed by the Medical Examiner, listed "hypertensive and arteriosclerotic heart disease" as the immediate cause of death. Pertinent findings from the autopsy, performed by the Medical Examiner's Office on February 8, 2001, are listed below:

- Four vessel coronary artery bypass whose grafted vessels were widely patent
- Marked atherosclerosis of the native coronary arteries with pinhole residual lumens
- Marked ulceration with adherent thrombotic material at distal end of the aorta
- Cardiomegaly (an enlarged heart) weighing 670 grams (normal is 400 grams)
- Marked concentric hypertrophy of the left ventricle
- Minimal fibrosis of the posterior wall of the left ventricle, and
- Pulmonary edema and congestion

His blood carboxyhemoglobin level (a test of carbon monoxide exposure) was not checked.

The victim had six coronary artery disease (CAD) risk factors including: male gender, age over 45, family history, diabetes, mildly elevated blood cholesterol, and high blood pressure. In 1985, he had coronary artery bypass surgery (four vessels). In 1997, an echocardiogram revealed congestive heart failure (CHF) with an estimated left ventricular ejection fraction (LVEF) of 25%. In November of 1998, the deceased FF had a dobutamine stress test which was positive for ischemia by imaging studies [moderate anteroseptal reversibility with slight reversibility of the apex of the left ventricle, and mild peri-infarct reversibility], and by EKG downsloping ST depression in the face of left bundle branch block (LBBB). The test lasted for nine minutes and the victim achieved 88% of his maximum heart rate but no metabolic equivalents (METS) were determined due to the test being a chemical (dobutamine), not an exercise stress test. An EKG also revealed left bundle branch block. He was also diagnosed with chronic obstructive pulmonary disease (COPD). An echocardiogram performed in June 2000 revealed a severely depressed left ventricle function [LVEF of 25-29% (normal typically being 50% or higher)], mildly dilated left atrium, and mild mitral regurgitation. A spirometry test performed in July 2000 revealed normal FVC (forced vital capacity) and FEV_1 (forced expiratory volume during the first second of expiration after full inspiration) of 86%, but a decreased FEV_1/FVC ratio level of 58 (normal is 60 for a male over the age of 60).[1] He did not complain recently of any pain suggestive of angina (heart pain due to reduced blood supply), despite reports of a fair amount of physical activity.

At his last physical evaluation, performed by his primary care physician in January 2001, the Fire Fighter was 5' 10" tall and weighed 180 pounds. His blood pressure was high (154/75). No EKG was performed.

DESCRIPTION OF THE FIRE DEPARTMENT

At the time of this investigation, the Fire Department consisted of 185 career fire fighters and 186 volunteer fire fighters, with 79 support personnel serving a population of 254,000 permanent residents, in a geographic area of 1,600 square miles. There are 26 fire stations. Career fire fighters work the

following shift: 24-hours on-duty, 48-hours off-duty, 0800 hours to 0800 hours. The emergency medical service is operated from a local hospital.

In 2001, the FD responded to 31,311 fires, non-fire emergencies, and medical calls to include: 471 structure fires, 847 grass fires, 412 vehicle fires, 15 dumpster fires, 18,666 EMS calls, 7,780 cancelled calls, 1,268 illegal burns, 569 alarms, 407 power lines down, 392 smoke in the area calls, 359 hazmat (fuel spill/propane/natural gas leak) calls, 67 personal assist, 45 special details, 6 watercraft emergencies, 5 tech rescues, 2 advised incidents, and 1 explosion. Typical engine company staffing is three fire fighters; typical ladder company staffing is three fire fighters. AEDs are not carried on all engines. Prior to the incident, the victim had not responded to any alarms within the previous 24 hours.

Training. Prior to training (initial State fire fighter training and the PAT), a fire fighter/candidate must pass a physical examination. Components of the pre-training evaluation for all fire fighters include:

- A complete medical history and questionnaire
- Height, weight, and vital signs
- Physical examination
- Vision test
- Hearing test
- Resting electrocardiogram, and
- Respiratory questionnaire (OSHA form)

This physical evaluation is completed by the fire fighter's private physician. The results are forwarded to the County contract physician, who makes the final determination for clearance to begin training. Also, just prior to the PAT, an on-scene paramedic monitors each career candidate's vital signs and EKG.

The State requires all career fire fighter candidates to:

- be a high school graduate or equivalent
- pass a medical evaluation prior to training
- not use tobacco products
- be State-certified fire fighters
- have completed the 160 hour Firefighter I, and
- have completed the 200 hour Firefighter II training

In addition to these State requirements, the FD requires all career fire fighter candidates to:

- complete an application
- pass a written exam
- pass an EMS assessment
- complete a fire skills assessment
- pass an interview
- pass a background check, and
- pass a medical screening prior to being offered conditional employment (discussed below)

Once hired, the candidate is given a start date and scheduled for orientation, lasting one week for 40 hours. Fire Fighter I and II training includes certification as hazmat operations level and as a first responder, including CPR. The newly hired fire fighter then completes an additional 120 hours of field work.

There is no mandatory State requirement for volunteer fire fighter certification. The FD, however, requires the volunteer fire fighter candidate to:

- be at least 18 years of age
- be in good health
- reside in the County
- complete an application
- complete an interview, and
- complete a background check prior to being accepted for membership

The volunteer then begins a training program to become certified at the Observer level (36 hours). This must be completed prior to riding the apparatus. The next level is the Support level (an additional 24 hours training within 120 days; training includes CPR and AED use). Support members are issued support gear and are allowed to drive and operate fire

apparatus and to participate in some exterior firefighter operations. The next level of training is Combat level. If the volunteer chooses to attain this level, training includes the FD Firefighter 1001 course (102 hours)(FFI). Support and Combat level fire fighters may receive training to become a First Responder (40 hours). The FD requires all these classes because they are required for those firefighters who wish to take the State Fire Marshal's Volunteer Firefighter Certificate Exam.

For those seeking higher certification, they must enter Fire Fighter II training within one year of FFI certification, or three years if the candidate maintains an affiliation as a volunteer firefighter. Fire fighters who become State-certified must maintain active fire department membership for six continuous months within a three-year period. The victim was a certified as a Support Level Fire Fighter and had seven months of fire fighting experience.

Preplacement Evaluations. Career fire fighter candidates are required to complete a fire skills assessment, similar to a physical ability test, at the time of their application. Once hired, candidates must pass a preplacement medical evaluation. Components of the preplacement evaluation include:

- A complete medical history and questionnaire
- Height, weight, and vital signs
- Physical examination
- Vision test
- Hearing test
- Blood tests: Complete blood count (CBC), chemistry panel (SMA 20) which includes a cholesterol and triglyceride measurement
- Urinalysis
- Urine and breath drug and alcohol test
- Spirometry (lung function tests)
- Resting electrocardiogram, if indicated
- Exercise stress test
- Back assessment
- Respiratory questionnaire (OSHA form), and
- Immunizations administered if proof of vaccination cannot be provided (hepatitis B, flu, and tetanus [if a booster had not been given within the past ten years])

These evaluations are performed by a clinic contracted by the County, who makes a decision regarding medical clearance for fire fighting duties. According to the FD, these decisions are guided by NFPA 1582.[2]

Annual Evaluations. Annual medical evaluations are required only for career fire fighters. Components of this evaluation are identical to the preplacement evaluation. Exercise stress tests are offered to those career fire fighters over the age of 40, for hazmat, tech rescue fire fighters, and driver/operators.

The victim had notified his primary care physician that he was a fire fighter. There were no instances of restrictions from full duty.

Medical Clearance, and Fitness/Wellness Programs. Any fire fighter injured at work must be evaluated and cleared for "return to work" by a private physician, who forwards the results to the County contract physician. A fire fighter who misses work for three or more days because of an illness (work-related or not), must also be evaluated and cleared for "return to work" by their private physician, who forwards the results to the County contract physician. A copy of NFPA 1582 and the Job Tasks are forwarded to each fire fighter's private physician to ensure physician knowledge of fire fighting and training duties. If a FD official believes a fire fighter is not capable of performing fire fighting duties, the fire fighter may be required to obtain a medical clearance.

The State has a Presumptive Law that provides benefits for heart and lung disease that occurs during duty. The fire fighter/candidate must be medically

cleared prior to attending initial State fire fighter training.

All fire houses have exercise (strength and aerobic) equipment, typically purchased by the fire fighters themselves. Fire fighters may exercise while on duty. There are voluntary smoking cessation and weight control programs, but no mandatory wellness/fitness programs.

DISCUSSION

In the United States, coronary artery disease (atherosclerosis) is the most common risk factor for cardiac arrest and sudden cardiac death.[3] Risk factors for its development include age over 45, male gender, family history of coronary artery disease, smoking, high blood pressure, high blood cholesterol, obesity, physical inactivity, and diabetes.[4,5] The victim had six of these risk factors: advancing age (>45 years old), male gender, family history of CAD, hyperlipidemia, hypertension, and diabetes. In 1985 he was found to have significant CAD and underwent a four vessel CABG.

The narrowing of the coronary arteries by atherosclerotic plaques occurs over many years, typically decades.[6] However, the growth of these plaques probably occurs in a nonlinear, often abrupt fashion.[7] 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.[8] This sudden blockage is primarily due to blood clots (thrombosis) forming on top of atherosclerotic plaques. Blood clots, or thrombus formation, in coronary arteries are initiated by disruption of atherosclerotic plaques. Certain characteristics of the plaques (size, composition of the cap and core, presence of a local inflammatory process) predispose the plaque to disruption.[8] Disruption then occurs from biomechanical and hemodynamic forces, such as increased blood pressure, increased heart rate, increased catecholamines, and shear forces, which occur during heavy exercise.[9,10]

Firefighting is widely acknowledged to be one of the most physically demanding and hazardous of all civilian occupations.[11] 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.[12-14] 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.[15] Epidemiologic studies have found that heavy physical exertion sometimes immediately precedes and triggers the onset of acute heart attacks.[16-19] During the incident, while wearing full turnout gear, the victim drove the engine to the scene, operated the pump panel, and set up the SCBA bottle changing area. This is considered a light level of physical exertion.[20] However, the physical stress of responding to the alarm probably increased his heart rate and blood pressure, thereby increasing his cardiac oxygen demand, and his underlying atherosclerotic CAD contributed to this fire fighter's heart attack, subsequent cardiac arrest, and sudden death.

To reduce the risk of heart attacks and sudden cardiac arrest among fire fighters, the NFPA has developed guidelines entitled "Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians," otherwise known as NFPA 1582.[2] NFPA 1582 recommends a yearly physical evaluation to include a medical history, height, weight, blood pressure, and visual acuity test.[2] NFPA 1582 also recommends a thorough examination to include vision testing, audiometry, pulmonary function testing, a complete blood count,

urinalysis, and biochemical (blood) test battery be conducted on a periodic basis according to the age of the fire fighter (less than 30: every 3 years; 30-39: every 2 years; over 40 years: every year). The Department requires a pre-placement medical examination for all career new hires but not for volunteers. Additionally, the Department does not require periodic medical evaluations for all fire fighters. Periodic medical evaluations are offered only to career HazMat fire fighters, Tech Rescue, and Driver/Operators.

NFPA 1582 also recommends, not as a part of the requirements but for informational purposes only, fire fighters over the age of 35 with risk factors for CAD be screened for obstructive CAD by an EST.[2] The victim's most recent dobutamine stress test was conducted in 1998. The stress test was positive for ischemia by 1) symptoms of shoulder pain during the test, 2) EKG (downsloping ST [segment] depression despite left bundle branch block), and 3) imaging studies (mild peri-infarct reversibility and moderate anteroseptal reversibility with slight reversibility of the apex of the left ventricle). The victim's most recent assessment of his CHF was conducted in June 2000 by echocardiogram. This revealed a moderately depressed left ventricular function (LVEF of 25-29%). The echocardiogram also identified mild mitral regurgitation with a mildly dilated left atrium. Despite these findings, no work restrictions were identified for the Fire Fighter. He had notified his physician that he was a fire fighter.

The Fire Fighter had one NFPA "Category A" condition: congestive heart failure (CHF) which would preclude him from performing fire fighting duties. Additionally, he had four "Category B" medical conditions: mild COPD, CAD, mild mitral regurgitation, and left bundle branch block (LBBB). The COPD "can result in the inability to perform functions as a member due to limitations of endurance."[2] CAD and mitral regurgitation are acceptable if the left ventricular ejection fraction, size, and function are normal. In this case, the left ventricle function was moderately depressed. LBBB is acceptable if exercise can be performed with an adequate heart rate response. This criteria was not met. If the Fire Fighter had been examined by a physician familiar with NFPA 1582, he should have been precluded from full duty as a firefighter which involves physically demanding fire suppression tasks. The victim was a support fire fighter and did not perform fire suppression activities, however he did perform driver operator duties, support duties, and other physically demanding tasks.

RECOMMENDATIONS AND DISCUSSION

Other agencies have proposed a three-pronged strategy for reducing the risk of on-duty heart attacks and cardiac arrests among fire fighters. These recommendations have not been evaluated by NIOSH, but represent research presented in the literature or of consensus votes of Technical Committees of the National Fire Protection Association or labor/management groups within the fire service. This strategy consists of: 1) minimizing physical stress on fire fighters, 2) screening to identify and subsequently rehabilitate high risk individuals, and 3) encouraging increased individual physical capacity. Issues relevant to this Fire Department include:

Recommendation #1: Provide <u>mandatory</u> preplacement medical evaluations to <u>ALL</u> fire fighters 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 periodic 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,[2] and in the report of the International Association of Fire Fighters/International Association of Fire Chiefs (IAFF/IAFC) wellness/fitness initiative.[21] The Department is not legally required to follow any of these standards. Nonetheless, we recommend the County and Union **work together** to establish the content and frequency in order to 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.[22]

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: Provide <u>mandatory</u> annual medical evaluations to <u>ALL</u> fire fighters 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 periodic 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,[2] and in the report of the International Association of Fire Fighters/International Association of Fire Chiefs (IAFF/IAFC) wellness/fitness initiative.[21] The Department is not legally required to follow any of these standards. Nonetheless, we recommend the County and Union **work together** to establish the content and frequency in order to be consistent with the above guidelines.

Recommendation #3: Incorporate exercise stress tests into the Fire Department's medical evaluation program for <u>ALL</u> fire fighters

NFPA 1582 and the IAFF/IAFC wellness/fitness initiative both recommend at least biannual EST for fire fighters.[2,21] They recommend that these tests begin at age 35 for those with CAD risk factors, and at age 40 for those without CAD risk factors. The EST could be conducted by the fire fighter's personal physician or the County's contract physician. If the fire fighter's personal physician conducts the test, the results must be communicated to the County's contracted physician, who should be responsible for decisions regarding medical clearance for fire fighting duties.

Recommendation #4: 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.[23] 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.[24] AEDs have caused the cardiac arrest survivability rate to increase from 7 percent (CPR performed only) to 26 percent.[25] When defibrillation is provided within 5-7 minutes, the survival rate is as high as 49 percent.[26] 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 those defibrillators carried on ambulances, would allow the Fire Department to provide a greater level of emergency medical care to the public. The Fire Department 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.[26,27]

Recommendation #5: 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. Additionally, physical inactivity, or lack of exercise, is associated with other risk factors, namely obesity and diabetes.[28] 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.[22] NFPA 1583, Standard on Health-Related Fitness Programs for Fire Fighters, provides the minimum requirements for a health-related fitness program.[29] 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.[21] The Fire Department and the Union should review these materials to identify applicable elements for their Department. Other 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.[30-32] 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.[33]

Recommendation #6: Perform an annual physical performance (physical ability) evaluation.

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.[22]

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INVESTIGATOR INFORMATION

This investigation was conducted by and the report written by Tommy Baldwin, M.S., Safety and Occupational Health Specialist. Mr. Baldwin is with the NIOSH Fire Fighter Fatality Investigation and Prevention Program, Cardiovascular Disease Component located in Cincinnati, Ohio.

Table 1. Incident Timeline

1548 hours:	Dispatch received a telephone call reporting a structural fire
1549 hours:	Engine 5 (including the deceased), Grass Truck 5, Engine 24, Engine 21, and Battalion Chief 2 dispatched
1550 hours:	District Chief 4 dispatched and responded
1551 hours:	Engine 21 responding
	Engine 24 responding
	Tanker 24 dispatched
1552 hours:	Tanker 24 responding
	BC 2 responding
1555 hours:	Engine 5 responding
	Grass Truck 5 responding
1559 hours:	Grass Truck 5 arrived on the scene and advised that double-wide mobile home was 50% involved
	Engine 5 arrived on the scene
1602 hours:	Grass Truck 21 dispatched and responded
1603 hours:	Engine 24 arrived on the scene
	Tanker 24 arrived on the scene
1604 hours:	Car 224 in command
1605 hours:	DC 4 arrived on the scene
1606 hours:	IC advised structure fully involved
1607 hours:	Engine 21 arrived on the scene
1614 hours:	Rescue 22 dispatched
1615 hours:	Rescue 22 responded
	DC 4 advised Fire Fighter down
	Rescue 20 notified Dispatch that their unit was closer, but was advised that Rescue 22 was enroute
1616 hours:	Fire under control
	Fire Fighter down
1617 hours:	Ambulance 220 dispatched
	Grass Truck 21 arrived on the scene
1619 hours:	Ambulance 220 responded
	BC 4 advised possible cardiac arrest of Station 5 personnel
1631 hours:	BC 2 arrived on the scene
1638 hours:	Medic on the scene
1640 hours:	Rescue 22 arrived on the scene
1711 hours:	Ambulance 220 arrived on the scene
1736 hours:	Tanker 24 dispatched and responded
1745 hours:	Tanker 24 arrived on the scene