

# TEXAS STATE FIRE MARSHAL'S OFFICE

## Firefighter Fatality Investigation



Investigation Number FFF FY 13-01

Captain Neal Wade Smith

Atascocita Fire Department  
Humble, Texas  
September 17, 2012

Texas Department of Insurance  
Austin, Texas

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## Acknowledgements

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The Texas State Fire Marshal wishes to thank the following entities for their cooperation and assistance in the investigation of this incident and the preparation of this report:

Atascocita Volunteer Fire Department

Beaumont Fire Department

Lumberton Fire Department

Harris County Fire Marshal's Office

Industrial Safety Training Council

Beaumont Emergency Safety Training

State Firemen's and Fire Marshals' Association

East Texas Firemen's and Fire Marshals' Association

Texas Commission on Fire Protection

Texas Engineering and Extension Services

National Institute for Occupational Safety and Health

## Executive Summary

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On September 16, 2012, Atascocita Volunteer Fire Department Captain Neal Wade Smith, a 46-year-old, four-year veteran of the department, collapsed during training at a training facility located in Beaumont, Texas. The 20-hour, multiple-task training class, called *Smoke Divers*, was conducted over two days during the weekend of September 15 and 16, 2012. Smoke divers training is a physically and mentally demanding firefighter survival course, with an emphasis on becoming familiar with and mastering the use of self-contained breathing apparatus (SCBA). Captain Smith was nearing completion of the second day of the course when he collapsed during the final drill on the second floor of a six-floor training tower.

Captain Smith attended the two-day class, which consisted of various drills on firefighter survival techniques. Although it included some classroom instruction, the smoke divers training course mainly focused on practical exercises including SCBA air consumption drills, buddy breathing drills, entanglement exercises, self-rescue drills, wall breaching, "hot bottle" swaps, obstacle course drills, confined space entry and rescue, and a smokehouse maze simulating a collapsed structure. Students completed all training evolutions while wearing a full complement of personal protective equipment (PPE) and an SCBA.

On Sunday, September 16, 2012, at approximately 12:35 p.m., during a search and entanglement exercise, Captain Smith appeared disoriented when he exited the second floor of a six-floor training tower. Instructors noted that he left the room as expected, but then he reentered the room. Instructors gave commands and instructions to him to exit the room, but Captain Smith did not respond. Instructors called a "Mayday," and instructors removed Captain Smith from the structure and took him to the stand-by paramedic. The paramedic removed Captain Smith's PPE, assessed his condition, and determined him to be in cardiac arrest. The paramedic initiated cardio-pulmonary resuscitation (CPR), and a transport ambulance was requested.

The paramedic on scene reported that Captain Smith had a tympanic temperature of 104 degrees, and cooling treatments were initiated. The transport ambulance arrived and medical personnel continued CPR, and they introduced intravenous (IV) fluid treatment and applied ice packs to Captain Smith's body to assist in cooling. Transporting ambulance paramedics reported a temperature of 107.9 that was lowered to 105.2 during transport. Temperature at the ER was recorded at 104.4. Treatment for hyperthermia continued with cold IV fluids, ice packs, fans, and a cooling blanket. Complications of heatstroke occurred on September 17, 2012, and at 1740 hours all resuscitative efforts were stopped.

An autopsy conducted on September 19, 2012, concluded that Captain Smith died as a result of hyperthermia.

The State Fire Marshal's Office recognizes that heat-related illness (HRI) and exertion-related heatstroke is preventable. Fire departments and training facilities should incorporate the following preventative recommendations into policies and procedures. *Portions of the following are reprinted with permission of the National Institute of Occupational Safety and Health (NIOSH).*

- *Institute a heat stress and rehabilitation program to comply with National Fire Protection Association (NFPA) 1584 standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises.*
- *When heat stress criteria are exceeded, discontinue physically demanding training according to the guidelines developed independently by the United States Army, the United States Air Force, and the American College of Sports Medicine (ACSM).*
- *When heat-stress criteria are exceeded, require hourly work and recovery cycles, particularly when the operation does not involve rescue operations.*
- *Measure environmental heat conditions using a Wet Bulb Globe Thermometer (WBGT).*
- *When heat-stress screening criteria are exceeded, consider monitoring firefighters for signs of heat strain.*
- *Instruct firefighters and command staff that hydration alone will not prevent HRI.*
- *Consider incorporating a screening checklist for heatstroke risk factors into any medical screening and medical examination programs.*
- *When exertional heatstroke is suspected, inform responding EMS units of the potential need for cold/ice water immersion therapy.*
- *Consider cases of HRI, particularly severe cases such as heatstroke or rhabdomyolysis that result in death or hospitalization, as a sign that the current heat stress program is inadequate.*
- *Ensure that trainees are hydrated before and during all phases of physically demanding tasks.*
- *Seek input from trainees and instructors about removing barriers, real or perceived, to reporting or seeking medical attention for heat strain or HRI.*

This report is to honor Captain Neal Wade Smith by taking the lessons learned from this tragic incident so others may not perish.



Captain Neal Wade Smith, 46, was a four-year veteran firefighter with the Atascocita Volunteer Fire Department.

# Introduction

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On Sunday September 16, 2012, the State Fire Marshal's Office was notified by the East Texas Firemen's and Fire Marshals' Association that Captain Neal Smith of the Atascocita Volunteer Fire Department collapsed during training exercises at the Beaumont Emergency Services Training (BEST) complex in Beaumont, Texas. On September 17, 2012, the State Fire Marshal's Office was notified that Captain Smith died while being treated for heatstroke at a Beaumont hospital.

The State Fire Marshal's Office (SFMO) commenced the firefighter fatality investigation under the authority of Texas Government Code § 417.0075.

- (a) *In this section, the term "firefighter" includes an individual who performs fire suppression duties for a governmental entity or volunteer fire department.*
- (b) *If a firefighter dies in the line of duty or if the firefighter's death occurs in connection with an on-duty incident in this state, the state fire marshal shall investigate the circumstances surrounding the death of the firefighter, including any factors that may have contributed to the death of the firefighter.*
- (c) *In conducting an investigation under this section, the state fire marshal has the same powers as those granted to the state fire marshal under Section 417.007. The state fire marshal will coordinate the investigative efforts of local government officials and may enlist established fire service organizations and private entities to assist in the investigation.*
- (d) *The state fire marshal will release a report concerning an investigation conducted under this section on completion of the investigation.*
- (e) *Not later than October 31 of each year, the state fire marshal will deliver to the commissioner a detailed report about the findings of each investigation conducted under this section in the preceding year.*
- (f) *Information gathered in an investigation conducted under this section is subject to Section 552.108.*
- (g) *The authority granted to the state fire marshal under this section will not limit in any way the authority of the county or municipal fire marshal to conduct the county or municipal fire marshal's own investigation into the death of a firefighter within the county or municipal fire marshal's jurisdiction.*

State Fire Marshal Chris Connealy assigned Chief Investigator Dean Shirley to investigate the firefighter fatality incident.

The NIOSH Firefighter Fatality Investigation and Prevention Program conducted an investigation of the incident.

# Atascocita Volunteer Fire Department

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The Atascocita Volunteer Fire Department is a combination paid and volunteer department with three fire stations and a 132 uniformed personnel roster. The department is located north of Houston, Texas, in northern Harris County as part of Emergency Services District (ESD) #46, and serves approximately 70,000 residents in a 26-square-mile area (<http://www.avfd.com/history.cfm>). The department has eight full-time and 17 part-time employees. Volunteer officers are required to work three 12-hour shifts per month.

Apparatus includes three engines, one 75-foot ladder truck, four ambulances, one rehab vehicle, one brush truck, five command trucks, and two mass casualty buses. In 2011 the department responded to 795 fire-related incidents and 3000 medical incidents.

## ***Membership and Training***

The department currently requires new firefighter applicants to be 18 years of age, have a valid state driver's license, pass a background check, pass an interview, pass a physical ability test, pass a written test, and pass a drug screening prior to being accepted as a member. The new member must then pass a pre-placement medical evaluation prior to beginning training.

The firefighter training program is based on the State Firemen's and Fire Marshal's Association tiered program similar to NFPA 1001, *Standard for Firefighter Professional Qualifications* [NFPA 2013]. Specific training programs are based on the position (e.g., structural firefighter, driver operator, maintenance, etc.). To respond to emergencies and operate on the exterior only, a new member must complete Module 1, a 70-hour, 11-component program. To become an interior structural firefighter (Fire Fighter 1), the member must complete two additional modules (Modules 2 and 3).

Captain Smith had four years of firefighting experience; he was a certified Basic Fire Fighter and Apparatus Operator.

## ***Pre-placement Medical Evaluations***

The department currently requires a pre-placement medical evaluation for all applicants. Components of this evaluation include the following:

- Complete medical history
- Physical examination (including vital signs – height, weight, blood pressure, pulse, and respirations)

- Vision test (acuity, color, peripheral fields, and depth perception)
- Audiogram
- Spirometry
- Respiratory fit test
- Urinalysis

A contracted physician can perform these medical evaluations. Once this evaluation is complete, the physician makes the decision to give medical clearance to the new member or recruit for firefighting duties, as appropriate, and forwards this decision to the fire department.

### ***Periodic Medical Evaluations***

The fire department does not require additional periodic medical evaluations. Annual medical clearance to wear SCBA is not required. A return-to-duty medical clearance is required for members who are injured on duty. A return-to-duty medical clearance is also required if a member is hospitalized due to an illness.

### ***Health and Wellness Programs***

The department requires applicants to pass an initial physical agility test, the components of which are described in the Appendix of this report. Additionally, an annual physical agility test is required. The fire department has a voluntary wellness and fitness program, but exercise equipment is not available in the fire stations.

### ***Medical Background***

Captain Smith was not required to have a baseline medical examination when he joined the department in 2008. His reported medical background included past treatment for high blood pressure and high cholesterol. Captain Smith began an extensive personal training and fitness program during the previous year in preparation for the smoke divers class, and he lost 50 to 80 pounds (reported estimates). Because of his physical fitness, he reportedly stopped taking the medications for high blood pressure and cholesterol. Captain Smith did not use weight loss supplements and he did not smoke or drink. He started each day with a workout that included cardio exercise at a local gym, and a bike ride if he could fit it in. Captain Smith was scheduled to participate in a marathon and ironman competition the weekend after the smoke divers class.

Captain Smith's recorded baseline vital signs the morning on the first day of training were: blood pressure - 147/87, heart rate - 95 BPM, and an oxygen saturation of 97 percent.

## Training Facility

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The Beaumont Emergency Services Training (BEST) facility is operated by the Industrial Safety Training Council (ISTC), a non-profit organization that assists in safety and emergency response training for people in the Beaumont area's expansive industrial and refinery complex. Training programs presented at the BEST facility include safety, industrial firefighting, rescue, and hazardous materials for certification of contractors, refining and chemical plant employees, and fire departments. The BEST facility was formerly operated by the City of Beaumont; but operational control was transferred to the ISTC in 2004, which allowed contractors and other agencies to provide training programs using the training props and facilities. When a training program is conducted, such as the smoke divers training, the ISTC requires the sponsor to determine the subject matter, length of course, number of evolutions, and props that are to be used. The sponsor provides oversight, safety, and emergency medical support personnel. The BEST facility provides a participant safety manual to all students. The safety manual identifies requirements for personal protective equipment, heat stress prevention, and facility safety.



**The training tower**



**The confined space rescue vessel evolution**



**The maze/smokehouse building**



**Staging, training, and rehab bleachers area**



**Staging and rehab for the smokehouse**

## **Training Facility Heat Stress Program**

The BEST training facility's participant safety manual includes a section on heat stress prevention. Specific prevention requirements include:

- Monitor participants and staff for signs of heat stress throughout the year.
- Remove helmet, hood, coat, and gloves during all critiques, breaks, and when moving from project to project.
- Implement increased cool-down periods, shortened burn evolutions, and regular rehydration during training events.
- Limit alcohol consumption.
- Notify an instructor of anyone exhibiting signs of heat-related symptoms.
- Remove from the training activity anyone exhibiting signs/symptoms of heat stress. Take them to a shaded location for cool-down.
- A qualified paramedic should evaluate the affected individual.
- Participants and staff should closely monitor each other for signs and symptoms of heat stress.

# Training Course

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*The following information is provided by the SFMO and NIOSH investigation teams.*

On September 15, 2012, Captain Smith participated in the smoke divers training program, designed to teach advanced survival skills using the SCBA. The overall objective for the recruits was to instill proficiency in air management techniques, so that if they were ever faced with an out-of-air emergency, they could recall and use these skills to improve their chance of survival.

In 1996, the East Texas Firemen's and Fire Marshals' Association developed the smoke divers curriculum from three different programs from other states: Mississippi, Maryland, and Georgia. It was reported to the investigators by the ETFFMA that the smoke divers curriculum was approved by the State Firemen's and Fire Marshals' Association, a non-profit organization for volunteer departments in Texas, and the Texas Commission on Fire Protection, the state agency that regulates career fire departments in Texas. Neither the State Firemen's and Fire Marshals' Association nor the Texas Commission on Fire Protection could provide records indicating the review and acceptance of the course. There are no records of a periodic review of the course. The Texas Engineering and Extension Service records the training and then provides a certificate of training for reporting the training hours to the State Firemen's and Fire Marshal's Association and/or Texas Commission on Fire Protection.

There have been a few changes to the original course curriculum since 1996. The duration of the course changed from 4 hours of training on Friday, 8 hours on Saturday, and 8 hours on Sunday to 10 hours of training on Saturday and 10 hours on Sunday. Other changes included the addition of a wall breach exercise in 2000, and over the years additional obstacles inside the training tower were added to the second floor to make the final day evolutions more challenging. In 2010, the rescue and extrication evolution in the metal pipe was updated.

According to the course description on the website, "*The Smoke Diver*" course, also called the '*Advanced SCBA Training and Survival*' course, '*is designed to take an experienced firefighter and teach him/her practical advanced survival skills in full gear with SCBA.*' *The course is extremely challenging, intensely physical, and will take the student to his/her limit. Because of the difficulties some may experience, paramedics are on hand to monitor students before, during, and after each exercise. 'Smoke Divers' training consists of some classroom, but mostly practical scenarios that will culminate in a final exercise that requires the use of all skills taught in the course. Within the course curriculum are skill objectives that must be accomplished by the student in order to graduate. The objectives cannot be waived.*

*“A twenty-hour training program, ‘Smoke Divers’ is taught over a single weekend at the aforementioned training facility. Course instruction will necessitate full days on both Saturday and Sunday. Competency in personal protective equipment, SCBA, and fire ground practices are a prerequisite. This is neither an SCBA training course, nor a search and rescue course. While the course is not designed to fail students, they will not be coddled. Any student thinking this is just another training course will have difficulty.”*

The registration for the program consists of a four-page application. Applicants are required to have completed an eight-hour basic SCBA training course. Fire departments are advised to not send beginning firefighters to the smoke divers training. The BEST training complex did not require attendees to provide any experience documentation. The registration package also includes a medical form that the individual applicant completes regarding his or her current and past medical conditions. Completion of the medical registration form completely and accurately is on an honor system.

Applicants receive a course description and logistical information, which identifies the following requirements:

- (1) Be properly hydrated and nutritionally prepared for physical exertion on both days.
- (2) Each student provides his or her own full set of NFPA-compliant personal protective equipment and one complete SCBA with a spare bottle.
- (3) There will be a minimum 3:1 student to instructor ratio.

Applicants are required to complete an application that includes the following information:

- (1) The smoke divers school is an intense advanced SCBA and survival course.
- (2) Attendance requirements are very strict.
- (3) Students must be in good physical health with a thorough understanding of their FD’s SCBA outlines.
- (4) Participants will not be subjected to undue difficulty at the beginning of the course, but as the course progresses the level of difficulty will increase.
- (5) All objectives must be satisfactorily completed or a certificate of completion, the smoke divers patch, and graduate tee shirt will not be awarded.

The application package states, *“This school is NOT intended to be a macho firefighter program. It is, however, designed to train the firefighter to calmly handle potentially dangerous situations.”*

If applicants answer certain medical questions in the medical history affirmatively, a medical evaluation and release statement from the applicant's personal physician is required. The medical history instructions state that recent heart surgery patients literally "sneak" into classes only to suffer from the extreme physical and mental demands of this course.

Finally, the applicant must affirmatively agree that if a representative of the oversight board, city, or training facility determines that immediate care and treatment is needed as a result of injury or sickness, the applicant requests, authorizes, and consents to such care and treatment as may be given by any physician, instructor, nurse, or board, city, or training facility representative.

Two East Texas Firemen's and Fire Marshals' Association elected board members review the applications to determine applicants' eligibility for participation.

Captain Smith answered all the questions indicating he did not have health issues and he was cleared to attend the training.

# Incident Investigation and Timeline of Activities

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*The following information is provided by the SFMO and NIOSH investigation teams.*

## **DAY 1: September 15, 2012**

Twenty-four students registered for the two-day class. Two registered students did not arrive and were withdrawn.

### **0630**

Twenty-one students arrived at the training complex by 0630 hours for training. Sixteen instructors were scheduled for the class. Captain Smith attended the training with another member of the Atascocita Volunteer Fire Department.

### **0700**

Training began with a classroom session lasting about 30 minutes, and which included a course introduction and a smoke divers fire safety presentation. The safety presentation consisted of 57 slides that included "The 16 Firefighter Life Safety Initiatives," "Everyone Goes Home," and "Line of Duty Deaths and Injuries," recognizing the 343 New York City firefighters who perished during 9-11.

One slide, addressing safety, included the question and response communication between the instructor and student, "Green-Green." When an instructor says "Green" to a student, the student should respond with "Green," if he or she is okay to continue the course.

Heat stress, HRI, rehab protocol, hydration, rest breaks, or the NFPA 1584 - *Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises*, were not discussed.

### **0730**

Each student's heart rate, blood pressure (BP), and blood oxygen saturation were checked. The records show that several students who trained with Captain Smith had high blood pressure readings. One student's blood pressure was 190/110 on first reading and 240/90 on the second reading, with a heart rate of 99. (In a statement to investigators that was provided by the student, he indicated his recorded blood pressure reading was unusually high and not representative of his normal blood pressure, stating that the vitals were taken improperly.)

The paramedics relayed these abnormal readings to the instructors, who were responsible for making any disqualifying medical decisions. There were no students disqualified from continuing with the training exercises that day.

A student arrived late while the other students were having their baseline vital signs taken. Instructors required the entire class to perform a number of push-ups as a “punishment” to the whole class for the late arrival. The course was conducted with a military boot camp approach.

### **0800-1200**

The class began with practical exercises, including a safety check by the instructors of the students’ PPE and SCBA, and continued with students donning their SCBA, and a quality exercise that required donning the SCBA while wearing the full complement of PPE. Instructors performed a quality check of the students’ ability to don the SCBA and use the PPE to completely cover the skin. This was done four or five times and each student had to complete at least one donning evolution with 100 percent accuracy in less than one minute. The evolution was conducted on the concrete training pad beside the training tower.

The students separated into four teams: red, blue, black, and green teams. Members of the same department were separated and assigned to teams with members they did not know to “reduce the reliance on members of the same department.” Identifying teams by color later presented some confusion when instructors asked students if they were “Green,” indicating whether they were okay to continue. Some students failed to respond properly by stating they were part of a team that was not the Green team.

The temperature was 73 degrees, relative humidity was 90 percent (resulting in a heat index of 74 degrees), with a slight wind of six miles per hour (NOAA 2012). The temperature<sup>1</sup> high reached 89 with a heat index of 91.

Each team needed to complete exercises including air consumption drills, emergency breathing procedures drills, and room orientation drills. Each team rotated through the scheduled training evolutions.

Each student was required to wear full PPE and the SCBA at all times while on the training ground, except during the scheduled breaks. During the lunch break, students were allowed to remove the

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[http://www.wunderground.com/history/airport/KBMT/2012/9/15/DailyHistory.html?req\\_city=NA&req\\_state=NA&eq\\_statename=NA](http://www.wunderground.com/history/airport/KBMT/2012/9/15/DailyHistory.html?req_city=NA&req_state=NA&eq_statename=NA)

SCBA and turnout coats, and to open the turnout pants to assist in cooling. Students who removed the SCBA mask during any training exercise were immediately disqualified from the class, and the student was sent home.

Two teams conducted air consumption tests, while the other two teams rotated through the darkened third floor of the six-story training tower. The students were either in the training tower to conduct room orientation exercises, or they performed the hot bottle swap exercise in a darkened, large metal cargo container.

During the room orientation exercise, each student went into the third-floor room of the training tower and was required to blindly navigate the room, escape, and then draw a descriptive floor plan of the room and any obstacles encountered. Passing the exercise depended on how accurately the student was able to draw the room.

The bottle swap exercise required each student to enter a metal cargo container (CONEX) to perform a hot bottle swap in complete darkness. Theatrical smoke generated by a smoke machine provided a sense of realism to the exercise. Each student was required to carry a spare cylinder into the cargo container and perform a cylinder exchange by doffing the SCBA, closing the cylinder valve, disconnecting the cylinder from the hose and harness, and then reconnecting and donning. This exercise sometimes required the student to hold his or her breath for a short period or, by using the hood, pulling the hood over the mask mounted regulator (MMR) opening and "filter breathing".

After the first drills were completed, teams were reportedly given a 30-minute break on the metal bleachers on the concrete training pad. The bleachers are not in a shaded area.

The air consumption test required each student to dress in full turnout gear with a full SCBA. The students were to go "on air" and navigate a series of obstacles outside on the concrete training pad, including crawling through a metal container and then climbing the outside tower stairs, to determine how long it would take students to deplete their air supply. The students were placed in a condition of physical and mental stress to increase their breathing and heart rates. Instructors used various methods to increase the students' stress levels including yelling, loud noises, banging on the outside of the vessels, and other intimidation techniques.

When the students consumed nearly all the air in their cylinder, as indicated by their SCBA vibralert or low air alarm, they were instructed to line up on the concrete training pad and continue to use their SCBA until the air supply was totally depleted, collapsing the SCBA face piece against their face. Only instructors were allowed to remove the students' masks for this drill.

Several students had difficulty during the air consumption tests. One student quit the class and another had to be evaluated by paramedics. The student evaluated by the paramedics was the student with extremely elevated blood pressure readings at the start of training. The student told paramedics that he had been diagnosed with an upper gastrointestinal bleed leading to abdominal pain, and most likely that was the cause of the high blood pressure readings. Paramedics recommended that he go to the hospital, and informed the lead instructor. The student refused to go to the hospital and was allowed to continue the class. The lead instructor informed the other instructors to closely monitor the student.

Both sets of teams then switched with the other set so that each team completed two air consumption tests, one room and obstacle orientation, and one SCBA emergency procedure evolution.

After every student completed these evolutions, all the students took a one-hour lunch. The students were allowed to remove their turnout coat and pants during lunch.

Students reported that their turnout gear was soaked with sweat by lunchtime. The students turned their turnout jackets inside out in an attempt to dry them for the afternoon activities, but this was not successful. Up to four bottles were used during the morning course. SCBA bottles were filled on site at three different refill stations set up by the class. Some students reported that their SCBA bottles were filled "hot" up to 4300 psi. Once the bottles cooled, the readings were around 3900 to 4000 psi.

Captain Smith completed the morning courses without difficulty.

### **1300-1700**

After the lunch break, the teams were again divided to conduct the afternoon training drills, which included a room escape, an SCBA cylinder exchange, and a confined space escape.

The room escape drills consisted of breaching walls on the fifth floor of the tower. Students were to gear up and go "on air" in a darkened environment. The drill began with a wall breach scenario, breaking through gypsum panel board between wall studs. They then navigated several obstacles across the floor toward the exit where the students completed another wall breach, which required most students to remove their SCBA in order to pass through the simulated wall studs. The students then performed a SCBA cylinder exchange in the darkened environment on the fourth floor of the training tower. After completing the room escape exercise on the fifth floor, SCBA cylinders were reported to be in the 1200 psi range, which is the psi range prior to the low air alarm sounding. Students were required to carry their spare SCBA cylinders throughout the course.

The total escape drill involved crawling through a 2 foot by 2 foot by 10 foot wooden box. At the exit end of the box, a pipe crossed the opening, requiring the removal of the SCBA inside the box, sliding the SCBA out of the box, and the students then either slipped under or over the pipe to exit the box. The SCBA face piece was to remain in place and students re-donned their SCBA once outside the box.



**Total escape drill box**

Captain Smith did not have any difficulties with this final drill on the first day. His teammates and instructors reported that he excelled at all of the first day's training drills.

The other student from the captain's department reportedly struggled during the SCBA cylinder exchange drill. His team was in the metal cargo container earlier in the afternoon for approximately

20 minutes trying to complete the drill. The lead instructor used a thermal imaging camera to monitor the students. According to the student, the instructor stated that the temperature reading on the thermal imaging camera inside the container read 120 degrees. The student passed out and was removed from the container by the instructor and taken to the paramedics.

The student advised the instructor and paramedics that he had not gone to the bathroom that day. Paramedics took his vitals and gave the student a popsicle, a pickle, and some pickle juice. He was told that in order to get an intravenous fluid (IV) administered he had to go to the hospital's emergency room. Paramedics continued monitoring the student while the rest of his team was on a rest break, and advised the lead instructors. During the approximately 15 minutes the student was monitored at the ambulance, instructors continued to tell the student that his team only had two more smaller drills inside the tower to complete (wall breach and the total escape drill).

The student refused medical treatment and continued the class, and he completed both remaining tower drills. After those two drills were completed, the student was told that he must complete the hot bottle swap inside the cargo trailer. Five instructors helped him complete the drill and he then went to the ambulance for rehab. Paramedics administered a cold saline solution intravenously (IV). The student stated he felt immediate relief and he was advised by instructors that he would be permitted to return for training the next day.

Up to eight SCBA cylinders were used throughout the day, depending on the student.

### **1800**

The other firefighter from the captain's department left the training facility after 1800 hours and went to the hotel where he continued to exhibit effects from dehydration including cramping, chills, and vomiting throughout the night.

## **DAY 2: September 16, 2012**

Eighteen students returned to the training ground to continue the class. Four students did not return to the class Sunday, citing unsafe conditions or that the training class was not the advanced-level training that was advertised.

### **0730**

Paramedics reportedly did not take vital signs prior to the start of, or at any time during, the training on Sunday, September 16, 2012, the second day of training.

**0800-1200**

Weather conditions at 12:35 p.m. on September 16 were 87.8 degrees, relative humidity of 52 percent, with the heat index at 91.4 with a slight wind of 6.9 mph<sup>2</sup>.

The teams rotated between a team rescue drill during which they removed a “victim” from a metal vessel, and going through a SCBA training maze in the smokehouse.



**Team rescue and extrication drill**

Captain Smith and his team completed the rescue drill first. The exercise involved working inside a metal vessel constructed with large diameter pipes. Team members had to work together to move a mannequin weighing 180 pounds by dragging the mannequin approximately 40 feet through a five-foot diameter pipe to a “tee” connection of a two and a half-foot diameter pipe. Inside the smaller pipe, students had to navigate the mannequin up and over a series of smaller pipes.

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[http://www.wunderground.com/history/airport/KBMT/2012/9/16/DailyHistory.html?req\\_city=NA&req\\_state=NA&req\\_statename=NA](http://www.wunderground.com/history/airport/KBMT/2012/9/16/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA)



**Inside the entry of the team rescue exercise**



**The “victim” — a hose filled with concrete**

Captain Smith's team struggled during the rescue drill in the metal vessel, partly due to the weather conditions and their protective clothing and equipment (hot and humid, and wearing a full PPE and SCBA), and partly from the cramped interior of the vessel. The students' turnout gear was still drenched from the previous day's training. Each of the team members consumed two cylinders of air during this drill.

Captain Smith's team took a break for rehab following the drill, and they were then instructed in methods to share their mask-mounted regulators. Students were also instructed on "last resort" bottle breathing, using only the cylinder by inhaling directly from the cylinder valve without a hose or regulator.

Students were not taught how to use their Rapid Intervention Crew / Universal Air Connection (RIC/UAC available on all 2002 and later NFPA-certified SCBA), with a RIT bag; nor were they taught to use an auxillary air connector (buddy breather), available on many SCBA.

The smokehouse maze was constructed inside a concrete block building, measuring approximately 16 feet by 32 feet. Various obstacles constructed from wooden materials simulated ramps, stairs, drop-offs, windows, holes, and entrapment hazards that required students to maneuver through the course by doffing and donning the SCBA at various obstacles. This was not a timed exercise, but students were to complete the course in a "reasonable" amount of time.



**The maze smokehouse**



**Entry to the maze**

Instructors positioned themselves in the rafters above the students to monitor them, and they used various means to raise the student's stress levels and attempted to disrupt students' concentration by playing loud music, yelling, beating on drums, and throwing firecrackers. Instructors used bungee cords or plastic webbing from their monitoring positions overhead to ensnare and entangle students, simulating an entanglement emergency. The students were required to unhook the entanglement and "swim" through the entanglement emergency.



**Views from rafters above the maze at the instructors' posts**

It was reported that while most students used up a full SCBA cylinder of air and then finished the exercise while using the filter breathing technique taught by the instructors, Captain Smith finished the maze with air remaining in the cylinder. Captain Smith did not show any difficulty in completing this exercise.

The student from Captain Smith's department who was suffering from symptoms of heat related illness after the first day continued to struggle through the maze on this second day. After using one full SCBA cylinder and resorting to the filter breathing technique, he had completed much of the maze—when instructors entangled the student by hooking a bungee cord onto his SCBA bottle. Each time he freed himself the instructor would again entangle the student. The student reported that “he felt as if he passed out while attempting to free himself” and stated that he “saw red and was fearful for his life.” Finally, he removed his face piece and was ordered to exit the maze. The exit door of the maze had an approximately 30-inch by 30-inch opening 2 feet above the floor. The instructor opened the door and made the student go through the opening to exit the maze. After the instructor removed him from the maze, the student was disqualified from the class.

Students took about an hour break for lunch before beginning the final four drills inside the six-story training tower.

### **1300-1800**

Fifteen students remained for the final phase in the training tower. The final drills were intended to cover everything that students learned during the course. Windows and doors were blocked to darken the training tower. Theatrical smoke was generated by smoke machines and bug foggers, using a glycerine and water-based fogging liquid. Students wore their full turnout gear and SCBA, and they climbed the outside stairwell to the sixth floor of the training tower while carrying a forcible entry tool and a spare SCBA cylinder. The students staged on the sixth floor while waiting their turn. Two students from another team began the exercise, followed by Captain Smith and the remaining two students from his original group.

Instructors were stationed throughout the training tower to monitor, assist, and encourage the students to move quickly to complete the course. One instructor was stationed at each stairwell landing, and two were inside each room where the drills were conducted.

Captain Smith's group started down the stairway to the fifth floor. Obstacles and hoselines or plastic webbing were woven across the stairs between the handrails and on both sides of the stairway between floor levels. This arrangement required the students to descend head first while lying on

their back, with the SCBA cylinder against the wall and stairs—and while carrying a handtool and a spare SCBA cylinder.

Captain Smith's team arrived at the fifth floor and completed the wall breaching and maneuvered through several obstacles without incident. One of Captain Smith's team members reported that, although his own SCBA low air alarm was sounding, Captain Smith continued to perform well and had air remaining. He stated that Captain Smith seemed to be in better physical condition and was able to control his breathing using less cylinder air. The third member of the team was struggling to keep up and was falling behind. Captain Smith and the other team member would stop and wait for the third member to catch up before moving forward through the exercise.

Captain Smith's team moved to the fourth floor, again using the technique of descending head first with the SCBA cylinder against the wall and stairs. The fourth-floor room exercise required a "hot bottle" swap in darkness, switching the first SCBA cylinder with the cylinder each student had been carrying. Captain Smith had difficulty performing the swap because he cross-threaded the spare cylinder. He told the instructors that he could not complete the task because the threads were damaged. According to the Captain's teammate, the instructors did not believe him for several minutes while they yelled at him and continued to use various techniques to raise his stress level. An instructor used the light on his cell phone to confirm that the cylinder was cross threaded and Captain Smith was permitted to use another spare cylinder. There were several spare cylinders scattered over the floor, adding to the confusion and complexity of this drill.

The struggling teammate withdrew from the class on this floor and exited the tower through the window and down the exterior stairway. The inside stairwell was barricaded with obstacles and hoses for the training, and the only fast way to exit was on the exterior stairs. This same student was the individual who had elevated blood pressure readings the first day and was reportedly suffering from an upper gastrointestinal bleed.

Captain Smith and his remaining teammate descended the stairwell to the third floor. The stairwell was again barricaded with plastic construction fence and hoselines, creating an obstacle that required them to remain low to the floor.

The third floor exercise began by maneuvering around a box that was nailed to the doorway to the inside of the room. There were obstacles and wall breaches to perform before students crawled up and over the box to exit. Captain Smith and his teammate did not experience any problems on this floor, but Captain Smith's partner's SCBA was out of air and he was "filter breathing" when he began his descent down the stairwell to the second floor.

The stairwell was barricaded with construction fencing. The instructor at the stairwell landing going into the second-floor room told investigators that Captain Smith was still “on air” as he went into the room. To enter the room, students had to crawl under a piece of plywood that was screwed to the door frame and that had approximately 30 inches of space under it. The second floor was described by many of the students as a being similar to a “hoarders house.”



**The second-floor obstacles**

There were hoses hanging from the ceiling, and wood landscaping timbers, tires, pallets, golf balls, metal piping, and marbles were on the floor. The final obstacle was crawling through the wooden box used on the first day during the full escape exercise to a small area and returning through the box to the room's center. Captain Smith's teammate reported to investigators that the Captain began “filter breathing” approximately midway through this part of the drill. Instructors told students to turn off their PASS devices when they ran out of air and filter breathe. The teammate stated that Captain Smith was doing fine and was helping him along until they made it to the full escape box.



**The second-floor obstacles**



### **Second-floor obstacles after the confined space box**

The Captain's teammate stated that once they exited the confined space of the full escape box, Captain Smith began to circle and then he re-entered the box and backed out again as the lead instructor was yelling at him. This lasted for approximately five minutes and they continued their right-hand search until they got to a barrel in the room. Captain Smith stopped and kneeled. The lead instructor yelled instructions at Captain Smith to move and then told his teammate to go around him. The teammate stated that he stopped at the doorway before exiting and yelled back for the Captain to follow him. He reached back and felt the Captain's helmet and saw the reflective tape of the helmet.

The lead instructor told Captain Smith's teammate to exit the room and he responded by telling the lead instructor he was waiting on his Captain. The lead instructor again told the teammate to exit, and when he came out on the stair landing by himself, the instructor on the landing asked him where his teammate (Captain Smith) was, and told him to go back in to get him. The teammate turned around to head back into the room to get the Captain when he heard the Mayday call.

Captain Smith's teammate stated he was pushed down the stairwell as the instructor rushed under the plywood nailed to the door frame. Captain Smith's teammate went through the construction fencing and fell down the stairwell. As he neared the exit, two instructors stationed there made him complete the last obstacle before he could exit the tower. This was during the Mayday.



**Construction fencing in the stairwell from the second floor to the ground floor could be quickly removed in case of an emergency on the second floor**

Instructors carried Captain Smith out of the tower through the south exit. Students completing the tower drill exited on the north side. An ambulance was called at 1336 hours. The onsite paramedics removed Captain Smith's turnout gear and SCBA. He was unresponsive, not breathing, and without a pulse, so the paramedics began administering CPR. Paramedics also administered an automatic external defibrillator (AED), but perspiration on Captain Smith's skin prevented proper connectivity, and the AED did not adequately read his vital signs. A cardiac monitor revealed that Captain Smith's heart was in asystole, so paramedics began advanced life support procedures, including the introduction of IV fluids, administration of cardiac resuscitation medications, and intubation.

The responding ambulance arrived at 1342 hours, and Captain Smith was transported via ambulance at 1346 hours. The transporting ambulance reported that Captain Smith regained a pulse of 152 BPM at 1348 hours with blood pressure at 90/66. Within four minutes his blood pressure improved to 118/76.

Captain Smith's temperature was measured at 107.9 degrees and his skin was hot to the touch. Ice packs and cool IV fluids were administered, lowering his temperature to 105.2 degrees.

When Captain Smith arrived at the emergency room at 1353 hours, his core temperature was down to 104.4 degrees. An electrocardiogram showed Captain Smith had sinus tachycardia (rapid heartbeat), a right bundle branch block, an inferior infarction (age undetermined), and T wave abnormality, which is considered a possible lateral ischemia.

The initial diagnoses were hyperthermia, heatstroke, and severe dehydration, followed by heatstroke complications including the following:

- Possible hypoxic encephalopathy (damage that occurs because of lack of blood and/or oxygen to the brain)
- Acute respiratory failure
- Acute renal insufficiency
- Possible rhabdomyolysis (breakdown of muscle fibers resulting in the release of myoglobin into the bloodstream)

Captain Smith's treatment in the emergency room included ice packs, cooling fans, cool IV fluids, cooling blankets, and gastric and bladder lavage. Blood tests revealed an elevated level of blood urea nitrogen (28 milligrams per deciliter [mg/dL]; normal is 6-20 mg/dL). By 1555 hours, Captain Smith's core temperature had decreased to a normal 98.8 degrees.

Captain Smith was transferred to the intensive care unit where IV fluids and cooling blanket therapy continued. A computed tomography (CT) scan of the brain revealed a significant amount of diffuse cerebral edema (brain swelling). The Captain's clinical condition remained unchanged throughout the next day. A Ceretec-aided (nuclear medicine) blood-brain barrier study indicated brain death, and at 1740 hours on September 17, 2012, the attending physician pronounced Captain Smith's death.

## **TRAINING CLASS CONTINUED**

A member of the training facility spoke with the lead instructor who had been on the second floor and discussed canceling the remainder of the course. The lead instructor informed him that there were students in the training tower who were ready to continue, and they decided to continue the course. The lead instructor left the second floor to write his statement on the Mayday events.

An instructor-trainee came up to the second floor to take the position of the instructor who had been inside the elevator shaft, and the instructor who had been in the elevator shaft moved to the lead instructor's position just outside of the box.

The next group of two students came into the second-floor training room and both were "filter breathing." After the right-hand search through the many obstacles around the room, into the box and back, the second student exiting the box was in apparent distress. The new lead instructor asked the student if he was "green," to which he repeated "green." He was asked to respond "green" more times as he was continuing the right-hand search toward the barrel located near the room exit. The student then stood up, lunged forward, and collapsed into the entanglement obstacles, entangling himself. The second Mayday of the day was called as the instructors rushed the student outside where emergency medical care was initiated. The second student was transported to another local hospital emergency room and hyperthermia treatment was provided that included ice water immersion. The student was admitted to the hospital intensive care unit where he continued to receive treatment. The student recovered and was released two days later.

The course was suspended and all the students were removed from the training tower. Students were staged on the metal bleachers next to the training tower on the concrete training pad. The course administrators, including the instructors, discussed allowing the remaining students to complete the course to graduation. The remaining students went back into the tower and completed the course.

Of 24 registered students, two were dropped when they did not show up to start the first day of training. Six students quit or were discharged during the course, and there were three medical emergency withdrawals. Thirteen students graduated.

# Personal Protective Equipment

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*The Texas Commission on Fire Protection (TCFP) conducted an evaluation of the firefighter's personal protective equipment for performance of and compliance with TCFP rules. Examination of the PPE used in this training course may provide important information related to the incident. The following are excerpts of the TCFP evaluation report.*

The TCFP determined that the smoke divers training program, the training providers, sponsors, instructors, and the firefighter did not fall under the regulation of the TCFP. The National Fire Protection Association (NFPA) standards and TCFP regulations referenced in this report are used as a baseline for this component of the SFMO Firefighter Fatality Investigation process. TCFP Compliance Officers Edward Russell and Tim Gardner evaluated the protective equipment for compliance with Texas Administrative Code Title 37, Part 13, §§435.1, *Protective Clothing* and 435.3, *Self-Contained Breathing Apparatus [SCBA]*, and for adherence to NFPA standards adopted by TCFP. Photographs taken during the examination are on file at the Texas Commission on Fire Protection. The TCFP full report is attached in the Appendix, and is part of the SFMO incident investigation file.

The examination of the protective equipment took place at Atascocita Volunteer Fire Department. The gear used by Captain Smith was secured in a locked area maintained by the Harris County Fire Marshal's Office.

## **Firefighting Boots**

The boots presented normal wear and no obvious damage. NFPA and manufacturer identification labels were attached to the boots and were readable.

### **Firefighting Boots Information Summary**

Manufacturer: Pro-Warrington LCC

Manufactured Date: 12/2004

## **Firefighting Coat**

The coat's outer shell presented normal wear. The drag rescue device presented no damage and was in the normal ready-for-use position. The coat's thermal liner/moisture barrier presented normal wear. NFPA and manufacturer identification labels were attached to the outer shell and thermal liner/moisture barrier of the coat and were readable.

### **Firefighting Coat Information Summary**

#### **Outer Shell**

Manufacturer: Morning Pride, Mfg.

Manufactured Date: 06/17/2012

#### **Thermal Liner/Moisture Barrier**

Manufacturer: Morning Pride, Mfg.

Manufactured Date: 06/17/2012

### **Firefighting Gloves**

The gloves presented normal wear with no obvious damage. The accessible interior areas of the gloves presented no obvious damage. NFPA and manufacturer identification labels were attached to the gloves and were readable. Each glove was identified as being manufactured on different dates. The fire department did not provide any inventory, issue date, annual advanced cleaning, or annual advanced inspection documentation on the gloves.

### **Firefighting Gloves Information Summary**

#### **Right Glove**

Manufacturer: American Fireware, Inc.

Manufactured Date: 07/2006

#### **Left Glove**

Manufacturer: American Fireware, Inc.

Manufactured Date: 12/2007

### **Firefighting Helmet**

The helmet presented normal wear with a right and left side attached bracket. The right bracket contained a flashlight. NFPA and manufacturer identification labels were attached to the helmet and were readable.

### **Firefighting Helmet Information Summary**

Manufacturer: Cairn's Helmets - MSA

Manufactured Date: 09/13/2007

### **Firefighting Hood**

The hood material presented normal wear and no obvious discoloration. NFPA and manufacturer identification labels were attached to the hood and were readable.

### **Firefighting Hood Information Summary**

Manufacturer: Majestic Fire Apparel

Manufactured Date: 08/2011

## **Firefighting Trousers**

The outer shell of the trousers presented normal wear and no obvious damage. The trousers' thermal liner/moisture barrier presented normal wear and no obvious damage. NFPA and manufacturer identification labels were attached to the trousers' outer shell and thermal liner/moisture barrier and were readable.

### **Firefighting Trousers Information Summary**

#### **Outer Shell**

Manufacturer: Morning Pride, Mfg.

Manufactured Date: 06/17/2011

#### **Thermal Liner/Moisture Barrier**

Manufacturer: Morning Pride, Mfg.

Manufactured Date: 06/17/2011

## **Examination of the SCBA**

The SCBA and SCBA components provided by the SFMO chief investigator with the cooperation of the Atascocita Volunteer Fire Department were examined by the TCFP compliance officers assigned to the investigation.

### **SCBA Back Frame and Harness Assembly**

The SCBA back frame presented normal wear and no obvious damage. The SCBA harness presented normal wear with no obvious damage. NFPA, NIOSH, and manufacturer identification labels were attached to the harness assembly and were readable.

#### **SCBA Back Frame and Harness Assembly Information Summary**

Manufacturer: Scott Health and Safety

Model: Scott® Air Pak®4.5

### **SCBA Breathing Air Cylinders**

The TCFP compliance officers were advised that Captain Smith was provided with two fire department cylinders for the out-of-town training program. During the training program, one of the cylinders (ALT-639-136976) was found to have damaged threads and was removed from use. The damaged cylinder was replaced with a cylinder (OK 398911) from another participating fire department. The last cylinder identified used was OK 191313 and belonged to the Atascocita Volunteer Fire Department.

The SCBA breathing air cylinders showed normal external wear and no obvious damage with the exception of cylinder ALT-639-136976, which presented damaged threads. The cylinders presented with current hydrostatic test dates and had not exceeded the end of service dates. The cylinder

pressure gauge reading on the damaged cylinder ALT-639-136976 was approximately 3600 psi. The cylinder pressure gauge reading on OK 398911 and OK 191313 indicated 0 psi.

### **SCBA Breathing Air Cylinder Information Summary**

#### **Cylinder 1 Atascocita Fire Department**

Manufacturer: Luxfer

Model: Scott 4500 30-Minute

Manufactured Date: 01/2007

Serial Number: OK 191313

Last Logged Cylinder Fill at the Fire Department: 07/12/2012

Last Hydrostatic Test Date: 06/2012

End of Service Date: 01/2022

Pressure Gauge Reading: 0 psi

#### **Cylinder 2 (Damaged Threads) Atascocita Fire Department**

Manufacturer: Structural Composites Industries (SCI)

Model: Scott 4500 30-Minute

Manufactured Date: 01/2003

Serial Number: ALT-639-136976

Last Logged Cylinder Fill at the Fire Department: 08/02/2012

Last Hydrostatic Test Date: 02/2008

End of Service Date: 01/2018

Pressure Gauge Reading: 3600 psi

#### **Cylinder 3 Port Neches Fire Department**

Manufacturer: Luxfer

Model: Scott 4500 30-Minute

Manufactured Date: 04/2011

Serial Number: OK 398911

Last Logged Cylinder Fill at the Other Participating Fire Department: Undetermined

Last Hydrostatic Test Date: N/A Under 5 Years Old

End of Service Date: 04/2026

Pressure Gauge Reading: 0 psi

### **SCBA Face Piece**

The SCBA face piece showed normal wear. The face piece harness showed normal wear.

#### **SCBA Face Piece Information Summary**

Manufacturer: Scott Health and Safety

Style: AV-2000

Last Full Function Test: 08/02/2012

### **SCBA Face Piece Regulator**

The SCBA face piece regulator showed normal external wear and no obvious external damage. A manufacturer identification label was attached to the SCBA regulator and was not readable due to damage and wear.

#### **SCBA Face Piece Regulator Information Summary**

Manufacturer: Scott Health and Safety

Model: Scott® Air Pak® 4.5

Last Full Function Test: 08/02/2012

### **Heads Up Display (HUD)**

The integrated SCBA HUD device module, visual display unit, and wire harness cover showed normal external wear with no obvious external damage. The automatic activation, visual display, and battery condition of the integrated SCBA HUD during the line-of-duty-death (LODD) incident was undetermined by the TCFP compliance officers. The cover of the Visualert® module was covered with white adhesive tape. A manufacturer identification label was attached to the side of the Visualert® module and was readable.

#### **Integrated SCBA HUD Device Information Summary**

Manufacturer: Scott Health and Safety

Model: Scott® Visualert®

Manufactured Date: 2/2003

Last Full Function Test: 08/02/2012

### **Integrated SCBA PASS Device**

The integrated SCBA Personal Alert Safety System (PASS) device module, control console and wire harness cover showed normal external wear with no obvious external damage. The automatic activation, manual activation, visual display, audible alarm, and battery condition of the integrated SCBA PASS device during the LODD incident was undetermined by the TCFP compliance officers. A NFPA label was attached to the back of the PASS device module and was readable. A manufacturer identification label was attached to the back of the PASS device module and was readable.

#### **Integrated SCBA PASS Device Information Summary**

Manufacturer: Scott Health and Safety

Model: Scott® Pak-Alert® SE

Manufactured Date: 03/2003

Last Full Function Test: 08/02/2012

### **SCBA Pressure Reducer**

The SCBA pressure reducer, high-pressure hose, pressure gauge, and pressure gauge line showed normal external wear and no obvious external damage. A protective cover was missing off a high-pressure auxiliary fitting. A manufacturer identification label was attached to the SCBA pressure reducer and was readable.

#### **SCBA Pressure Reducer Information Summary**

Manufacturer: Scott Health and Safety

Model: Scott® Air Pak® 4.5

Manufactured Date: 03/2003

Last Full Function Test: 08/02/2012

### **SCBA Provided Information and Documentation Summary**

- The information and documentation available to the TCFP compliance officers at the time of this report was insufficient to determine Captain Smith's use of SCBA-provided breathing air during the multiple-task training evolution.
- Based on the documentation provided by the vendors and the fire department, it appears that Captain Smith's SCBA and components were properly serviced and tested by certified technicians prior to the training event. But no documentation of daily SCBA and PASS device maintenance for duty or training periods was provided.

### **Examination of SCBA Breathing Air Cylinder Fill Log Documentation**

The cylinders provided to Captain Smith for use at the training program were reported to have been last filled at the fire department on the dates indicated below:

OK 191313:	07/12/2012
ALT-639-136976:	08/02/2012

Four breathing air refill sources were possibly used to fill Captain Smith's cylinders throughout the two-day training event. Those breathing air providers did not log or document cylinder fills performed during the training program.

- Due to the undocumented cylinder fills, the TCFP compliance officers were not able to determine air refill sources used by Captain Smith.

### **Examination of SCBA Breathing Air Quality Test Documentation**

The TCFP compliance officers examined the most recent SCBA air quality documentation provided by the Atascocita Volunteer Fire Department. The fire department did not provide on-site breathing air fill sources.

Atascocita Volunteer Fire Department's breathing air quality documentation applies to the initial use of the cylinders labeled OK 191313 and ALT-639-136976 (the cylinder with damaged threads), prior to any other fills required during the two-day training program.

The TCFP compliance officers examined the most recent SCBA air quality documentation provided by the sponsors. The TCFP compliance officers were not able to determine air sources used by Captain Smith during the training program due to the lack of cylinder fill logging and documentation.

Three industrial breathing-air source test results presented were not tested to NFPA 1989 and 2008 Edition standards. One of the industrial breathing-air sources was a 2216 psi low-pressure unit that is not compatible to fill the 4500 psi breathing-air cylinders.

### **Examination of Standard Operating Procedures/Guidelines (SOPs/SOGs)**

The fire department-provided SOPs/SOGs appeared to have been compliant with NFPA 1561, NFPA, 1851, NFPA 1852, NFPA 1971, NFPA 1981, NFPA 1982, NFPA 1989, TCFP regulation, and 37 TAC Sections 435.1, 435.3, 435.9, 435.11, 435.15, 435.17, 435.21, and 441.7. But no TCFP regulations currently exist that require a fire department to provide a SOP/SOG that references training activities not conducted by the department. So no copies of the BEST's SOP/SOG are included in this report.

## Examination of Training Records

The Atascocita Volunteer Fire Department provided Captain Smith's continuing education training documentation. If the training had been verified and approved by a TCFP-certified instructor, it would have been compliant with the TCFP regulation 37 TAC 441.7, but it was not.

### Summary

- The TCFP compliance officers determined that at the time the BEST training program was conducted, the multiple-task smoke divers training program, the training providers, sponsors, instructors, and the Atascocita Volunteer Fire Department did not fall under the regulation of the TCFP. So the NFPA standards and TCFP regulations referenced in this report are a baseline for this component of the SFMO Firefighter Fatality investigation process.
- Captain Smith's PPE appears to have been compliant with NFPA 1971 and TCFP regulations at the time of the incident. The Atascocita Volunteer Fire Department was not able to provide documentation on PPE components (boots, coat, gloves helmet, hood, and trousers), inventory, annual advanced cleanings, or annual advanced inspections. The fire department chief provided a letter stating the fire department conducts annual inspections on all members' PPE. The lack of documentation indicates that compliance with NFPA 1851 and TCFP regulations, and the requirements in 37 TAC Section 435.1 was not achieved.
- Captain Smith's SCBA and components, based on the examination and provided documentation, appeared to have been compliant with NFPA 1981 and the TCFP regulations. But no documentation of daily SCBA and PASS device maintenance for duty or training periods was provided. So compliance with NFPA 1852, NFPA 1982, TCFP regulations, or 37 TAC Sections 435.3 and 435.9 was not achieved.
- The information and documentation available to the TCFP compliance officers at the time of this report were insufficient to determine Captain Smith's use of SCBA-provided breathing air during the multiple-task training evolution.
- Based on the inability to identify the breathing-air sources used by Captain Smith during the training program, the lack of cylinder fill logs, and three industrial breathing-air sources tested to Air/Gas Specification CGA D (G-7.1, '04) and not to the NFPA 1989 2008 Edition, it appears compliance with NFPA 1989 and TCFP regulations, and 37 TAC Section 435.3 was not achieved.
- The fire department-provided SOPs/SOGs, appeared to have been compliant with NFPA 1561, NFPA, 1851, NFPA 1852, NFPA 1971, NFPA 1981, NFPA 1982, NFPA 1989, TCFP regulations and 37 TAC Sections 435.1, 435.3, 435.9, 435.11, 435.15, 435.17, 435.21, and 441.7. But no TCFP regulations currently exist that require a fire department to provide a SOP/SOG that references training activities not conducted by the department.

- The fire department provided Captain Smith's continuing education training documentation. If it had been verified and approved by a TCFP-certified instructor, it would have been compliant with the TCFP regulations and 37 TAC Section 441.7, but it was not.

# Findings and Recommendations

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*These recommendations are based upon nationally recognized consensus standards and safety practices for the fire service. Volunteer fire departments in Texas and all firefighting personnel should know and understand nationally recognized consensus standards. Fire departments should create and maintain SOGs and SOPs to ensure effective, efficient, and safe firefighting/training operations.*

*Although the following recommendations may not have prevented the death of Captain Smith, the SFMO offers these recommendations to reduce the risk of heat related illnesses or injury among firefighters.*

## **Finding 1**

Training was not conducted in accordance with national and state standards and recommendations, specifically:

- *NFPA 1041, Standard for Fire Service Instructor Professional Qualifications;*
- *NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, and;*
- *NFPA 1584, Recommended Practice on the Rehabilitation of Members Operating at Incident Scene Operations and Training Exercises.*

During the Smoke Divers course on September 15-16, 2012, several standards identified in NFPA 1041, NFPA 1500, and NFPA 1584, were either not provided or inadequately provided during the training exercises.

## **Recommendation**

All training courses should be conducted in accordance with the following:

*NFPA 1041, Standard for Fire Service Instructor Professional Qualifications;*

*NFPA 1500, Standard on Fire Department Occupational Safety and Health Program; and*

*NFPA 1584, Recommended Practice on the Rehabilitation of Members Operating at Incident Scene Operations and Training Exercises.*

### **NFPA 1041, Section 4.4.2 states:**

Organize the classroom, laboratory, or outdoor learning environment, given a facility and an assignment, so that lighting, distractions, climate control or weather, noise control, seating, audiovisual equipment, teaching aids, and safety are considered.

**(A) Requisite Knowledge.** Classroom management and safety, advantages and limitations of audiovisual equipment and teaching aids, classroom arrangement, and methods and techniques of instruction.

Section 4.4.2 of NFPA 1041 is a part of the Instructor I curriculum through TCFP and SFFMA. This section is covered in pages 35-57 of the **Fire Service Instructor** textbook as published by the International Fire Service Training Association (IFSTA).

According to the *Fire Service Instructor* textbook:

*Through the efforts of fire and emergency services organizations and instructors, jurisdictions can reduce risks through a variety of the following methods:*

- *Establish and adhere to the National Incident Management System (NIMS) Incident Command System (ICS).*
- *Use a personnel accountability system.*
- *Establish and use appropriate rehabilitation based on NFPA 1584, Recommended Practice on the Rehabilitation of Members Operating at Incident Scene Operations and Training Exercises.*
- *Conduct a brief safety critique at the end of every training drill.*
- *Provide a safe training environment.*
- *Provide students with a positive, proactive safety role model. (pp. 39-40)*

Additional information is published on the aforementioned pages in the IFSTA textbook.

**NFPA 1500, section 8.1.1:**

“Emergency operations and other situations that pose similar hazards, **including but not limited to training exercises**, shall be conducted in a manner that recognizes hazards and prevents accidents and injuries.”

NFPA requires the implementation of the NIMS ICS system, personnel accountability, rapid intervention crews and rehabilitation, among several other facets.

**NFPA 1500, section 8.9.3** requires:

“Such on-scene rehabilitation shall include at least rest, hydration, active cooling where required, basic life support care, food where required, and protection from extreme elements.”

In addition to being referenced in the *Fire Service Instructor* textbook, NFPA 1500 is also referenced in several locations throughout the IFSTA *Essentials of Firefighting* textbook, commonly referred to as the *Essentials* book. NFPA 1500 specifically discusses and sets forth the importance of NFPA 1500 for “rehabilitation (rehab) facilities” (p. 57).

In addition to NFPA 1584 being referenced in the IFSTA text correlated to NFPA 1041, NFPA 1584 is also discussed in the *Essentials* book. The **Essentials** book states that NFPA 1584 is one of the standards, ***“that establishes safety programs that departments must adopt ... ”***

### ***Finding 2***

Rehabilitation was not provided in accordance with NFPA 1584 and nationally accepted standards or practices. Students were required to rehab in an open area of the concrete training pad in full sun, on metal bleachers.

### ***Recommendation 2***

Provide areas of rehabilitation in accordance with NFPA 1584 and nationally accepted standards or practices.

### ***NFPA 1584 Chapter 5 Rehabilitation Area Characteristics:***

***5.1 Area for Rehabilitation.*** *The incident commander (IC) shall ensure that an adequate area and/or shelter is available to conduct rehabilitation of members.*

***5.1.1*** *For hot environments, this area shall include shade and/or air-conditioning and a place to sit.*

NFPA 1041 and NFPA 1584, which is referenced in NFPA 1500 and the *Fire Service Instructor* textbook, not only provide the standards for basic instructor requirements, but also specifically identify the necessary rehabilitation efforts that instructors should utilize during training exercises.

***NFPA 1584, Section 6.2,*** states:

**Rehabilitation Efforts.** Rehabilitation efforts shall include providing the following:

- (1) Relief from climatic conditions
- (2) Rest and recovery
- (3) Active and/or passive cooling or warming as needed for incident type and climate conditions
- (4) Rehydration (fluid replacement)
- (5) Calorie and electrolyte replacement, as appropriate, for longer duration incidents  
(see 6.2.5)
- (6) Medical monitoring
- (7) Member accountability
- (8) Release

### ***Finding 3***

Constant medical monitoring was not provided. Although paramedics and emergency medical technicians were available on the training site, they did not medically monitor the students during the training or rehabilitation periods.

### ***Recommendation***

Provide constant medical monitoring of students while training and during rehabilitation by personnel trained to recognize symptoms of a health or safety concern.

### ***NFPA 1584 Chapter 6 Incident Scene and Training Rehabilitation***

**6.2.6.3** *EMS personnel shall evaluate members arriving at rehabilitation for symptoms suggestive of a health and/or safety concern.*

**6.2.6.4** *EMS personnel shall be alert for the following:*

- (1) Personnel complaining of chest pain, dizziness, shortness of breath, weakness, nausea, or headache*
- (2) General complaints such as cramps, aches and pains*
- (3) Symptoms of heat- or cold-related stress*
- (4) Changes in gait, speech, or behavior*
- (5) Alertness and orientation to person, place, and time of members*
- (6) Vital signs considered to be abnormal as established by protocol*

### ***Finding 4***

Students who received treatment for HRI were not removed from the training program.

### ***Recommendation***

Remove students from the training program who exhibit symptoms of heat-related illness.

### ***NFPA 1584 Chapter 6 Incident Scene and Training Rehabilitation***

**6.2.6.7** *Members treated for any heat-related injuries shall be removed from active duties.*

### ***Finding 5***

A qualified incident safety officer was neither present nor assigned during the training.

The designated safety officer was not certified to the level of Fire Officer Level 1 specified in NFPA 1021, *Standard for Fire Officer Professional Qualifications Chapter 4.5.*

## **Recommendation**

A fire department safety officer(s) should be part of all training activities that are technically difficult and challenging or that are performed in extreme or hazardous conditions. The assigned Incident Safety Officer must have, at a minimum, Fire Instructor Level 1 certification.

The *Fire Service Instructor* textbook states that NFPA 1500:

*... requires the presence of a designated ISO (Incident Safety Officer) during high-hazard training evolutions. However, the presence of an ISO does not relieve all instructors who are present of the obligation to monitor the training with safety in mind. Instructors should be aware of and watch for the following safety concerns:*

- *Symptoms of physical and psychological stress in students, instructors and other participants.*
- *Changes in weather conditions, including wind direction, velocity, humidity and temperature. (p. 43)*

Additional information is listed on page 43 in the IFSTA textbook.

The *Fire Service Instructor, 7<sup>th</sup> ed.*, textbook also references NFPA 1041, NFPA 1500, and NFPA 1584 on page 55.

## **Finding 6**

Documentation of student/participant rehab times was not performed.

## **Recommendation**

### ***NFPA 1584 Chapter 6 Incident Scene and Training Rehabilitation***

#### ***6.4 Documentation.***

***6.4.1\**** *Time-in/time-out for members/crews entering or leaving the rehabilitation area shall be documented.*

## **Finding 7**

The smoke divers training program was developed in 1996. An East Texas Firemen's and Fire Marshals' Association Board Officer and the course training coordinator stated that the course was reviewed and accepted by the State Firemen's and Fire Marshals' Association (SFFMA) and the Texas Commission on Fire Protection (TCFP). Neither the SFFMA nor the TCFP have a record of the review and acceptance. Changes to the program since that time have not been reviewed by an approved entity.

### **Recommendation**

*Training programs should undergo periodic review and be updated to meet the current accepted practices and nationally recognized consensus standards.*

**Texas Administrative Code, Title 37, Part 13, Chapter 443.** *Although the Smoke Divers class presented by the East Texas Firemen's and Fire Marshals' Association is not governed by the Texas Commission on Fire Protection, it is recommended that new curricula and changes to curricula meet an approval process.*

**Understanding and Implementing the 16 Life Safety Initiatives** (Fire Protection Publications OSU, 2007) Chapter 7 states *"Without oversight and guidance by organizational policies and proper procedures, the training program can evolve into rites of passage, unsafe practices, and abuses of firefighters."*

### **Finding 8**

Instructors did not fully incorporate risk management systems into the training course to prevent injury to participants. Instructors pushed students to their physical and psychological limits using intimidation, peer pressure, noise distractions, and limited visibility. These methods contributed to causing a proportionate number of the enrolled students to fail, thereby validating the training and keeping the program to the perceived "elite" level.

An example of one unfounded method used was the practice of tossing firecrackers at or near students. The use of firecrackers to cause distractions or as a method of motivation is not found in any nationally accepted standard or training manual.

During the interviews, investigators learned about the pressure on trainees to complete the course as a matter of pride, and that each respective fire department had spent a sum of money for each trainee to attend. Failure to complete the course might be perceived as personal failure, or that the trainee was not fit or "tough" enough to be a firefighter.

### **Recommendation**

Develop and incorporate Risk Management Systems into the training course to predict, identify, and prevent unsafe practices or procedures.

### **NFPA 1500 Chapter 4 Section 4.2.3**

The risk management plan shall include at least the following components (*see Annex D*):

- (1) Risk identification—actual and potential hazards
- (2) Risk evaluation—likelihood of occurrence of a given hazard and severity of its consequences
- (3) Establishment of priorities for action—the degree of a hazard based upon the frequency and risk of occurrence
- (4) Risk control techniques—solutions for elimination or mitigation of potential hazards; implementation of best solution
- (5) Risk management monitoring—evaluation of effectiveness of risk control techniques

Empower the student and/or any instructor to take measures to prevent injury or illness during the training program, including adequate rest and rehabilitation.

Four of the 16 Life Safety Initiatives state:

1. Define and advocate the need for a cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability and personal responsibility.
2. Enhance the personal and organizational accountability for health and safety throughout the fire service.
3. Focus greater attention on the integration of risk management with incident management at all levels, including strategic, tactical, and planning responsibilities.
4. All firefighters must be empowered to stop unsafe practices.

The full 16 Life Safety Initiatives can be found at <http://www.lifesafetyinitiatives.com/initiatives.html>.

Participate in the “Courage to be Safe” (CTBS) program that emphasizes the message “Everyone Goes Home®.” Information on the CTBS program is available online at <http://www.everyonegoeshome.com>.

# Appendix

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## ***Additional recommendations for the prevention of Heat Related Illness (NIOSH)***

### **Instruct students and instructors that hydration alone will not prevent HRI.**

This case, as well as others, demonstrates that heatstroke and heat exhaustion can occur despite adequate hydration [Alexander 2011; Cuddy and Ruby 2011]. Although they can occur together, only 20% of hospitalized heatstroke cases show signs of dehydration [Epstein et al. 1999; Carter et al. 2005]. The training facility's educational materials and training programs focus on maintaining and increasing the body's cooling mechanisms via hydration, nutrition, cool-down periods, training schedules, and use of shaded break areas. Giving equal attention to controlling the primary source of heat generation (metabolic heat produced during work requiring heavy physical exertion) would strengthen these materials and programs, and enhance HRI prevention.

### **Measure environmental heat conditions using a Wet Bulb Global Temperature (WBGT<sup>3</sup>);**

The WBGT is a validated, simple, quick, inexpensive, and widely used index that accounts for all four components of environmental heat: air temperature, humidity, air movement, and radiant heat [Parsons 2006]. Use of the commonly reported heat index does not account for the cooling effect of the wind or the radiant heat of the sun or fire. Thus, heat index alone does not provide a valid estimate of the heat stress experienced by the trainees in the smoke divers program. The estimated WBGT in this case was 29.5.

A variety of organizations have developed guidelines for stopping or restricting physical activities based on the WBGT, metabolic work requirements, and acclimatization (discussed in the next section). For moderate (300 kcal/hour) to heavy (415 kcal/hour) work among acclimatized individuals, the U.S. Army and Air Force cancel all scheduled physical training when WBGT is above 32.0 [Pennington et al. 1980; Nunneley and Reardon 2009]. The military waives these restrictions for "essential operational commitments [...] where the risk of heat casualties may be warranted" [Pennington 1980]. The American College of Sports Medicine (ACSM) recommends cancelling all scheduled events when WBGT is above 32.3 [Armstrong et al. 2007]. For WBGT above 35, NIOSH recommends discontinuing heat exposure (work) for acclimatized workers on moderately physically demanding jobs (300 kcal/hour) [NIOSH 1986]. For WBGT above 31.5, American Conference of Governmental Industrial Hygienist (ACGIH) recommends discontinuing heat exposure (work) [ACGIH 2011]. These guidelines are based on an 8-hour workday and a 40-hour workweek.

***However, when the trainee is wearing firefighter's turnout gear, 10.0 should be added to the WBGT, (ACGIH<sup>®</sup> 2011).*** Discontinue training until the WBGT returns to an acceptable level, or reschedule the training for cooler months of the year.

### **Schedule training involving heavy physical exertion in turnout gear during the cooler season.**

Investigators learned that many students passed the course with ease when the training occurred in

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<sup>3</sup> The **Wet Bulb Globe Temperature (WBGT)** is a composite temperature used to estimate the effect of temperature, humidity, wind speed ([wind chill](#)), and [visible](#) and [infrared radiation](#) (usually sunlight) on humans. It is used by industrial hygienists, athletes, and the military to determine appropriate exposure levels to high temperatures.

cooler months. So the decision was made to provide the training during April and September, when the temperatures are usually warm, but not as hot as summer months.

**When heat stress screening criteria are exceeded, consider monitoring firefighters for signs of heat strain.**

ACGIH® recommends monitoring trainees for signs of heat strain when its screening criteria are exceeded. According to ACGIH®, an individual's heat exposure should be discontinued when **any** of the following signs of heat strain occur:

- Sustained (over several minutes) heart rate that exceeds 180 beats per minute (BPM) less the individual's age in years, for those with normal cardiac performance.
- Core body temperature above 100.4 degrees in unacclimatized personnel and above 101.3 degrees in heat-acclimatized personnel.
- Recovery heart rate above 100 BPM at 1 minute after peak work effort.
- Symptoms of sudden and severe fatigue, nausea, dizziness, or lightheadedness.

When heat stress screening criteria are exceeded, we recommend stopping work when either: (1) symptoms appear (sudden and severe fatigue, nausea, dizziness, or lightheadedness) or (2) an oral temperature above 101.3 degrees.

**Ensure that all organizations using the training facility comply with the facility's heat stress program.**

The smoke divers program does not have a training facility; instead, it contracts with existing training facilities and uses the facility's training props. Additionally, the smoke divers program does not have a stand-alone heat stress program. So the SFMO and NIOSH recommend that the training facilities provide oversight to ensure that all organizations or fire departments that use the facility comply with its safety rules.

***Ensure that ice water immersion is rapidly available at the training facility.***

Rapid core temperature reduction by cold or ice water immersion is the most important treatment for exertional heatstroke [Armstrong et al. 2007]. Paramedics at the scene of the training facility used cooling treatments other than cold or ice water immersion to try to cool Captain Smith, including applying ice packs to the neck and groin, starting IV fluids, and administering oxygen. But if the training facility had cold or ice water immersion available, the captain's core temperature could have been reduced sooner, improving his prognosis. Paramedics and instructors could use a tank or tub, such as a cattle-watering trough or a bathtub filled with ice and water, for cold or ice water immersion treatment. Once a training facility acquires these troughs or tubs, the training facility personnel will need training on the symptoms, signs, and initial management of HRI and heatstroke.

***When instructors or facility personnel suspect that a trainee is suffering from HRI or exertional heatstroke, they should inform responding EMS units of the potential need for cold or ice water immersion therapy.***

Rapid core temperature reduction is the most effective treatment for exertional heatstroke [Costrani 1990; Bouchama et al. 2007; McDermott et al. 2009]. Other treatments (e.g., ice packs applied to the neck and groin, IV fluids, and oxygen administration) are less effective. Although treatment protocols vary and are the responsibility of the EMS provider, the training facility can raise awareness of this issue among those responsible for establishing EMS response protocols and provide the guidance developed by professional organizations [Binkley et al. 2002; Armstrong et al. 2007].

**Consider cases of HRI, particularly severe cases such as heatstroke or rhabdomyolysis that result in death or hospitalization, as a sign that the current heat stress program is inadequate.**

The smoke divers program should:

***Institute a heat stress program.***

Currently, the smoke divers program does not include a heat-stress prevention program. The application for smoke divers training includes a question concerning past complaints of heat exhaustion or heatstroke. If the applicant answers “yes,” a medical release is required from the applicant’s primary care physician. However, the questionnaire relies solely on self-reported medical histories.

***Ensure trainees are hydrated during all phases of physically demanding tasks.***

The training staff provided fluids (water and sports drinks) and reminded trainees to drink fluids during breaks. For scheduled events, pre-hydration should include 16 ounces of water-based fluids two hours before the event [NFFPA 2008a; USFA 2008]. But hydrating during the event is also important. The amount and rate of fluid replacement depends on a number of factors, including the sweat rate and event duration.

***Seek input from trainees and instructors about removing barriers, real or perceived, to reporting or seeking medical attention for heat strain or HRI.***

During the interviews, investigators learned about the pressure on trainees to complete the course as a matter of pride, and that each respective fire department had spent a sum of money for each trainee to attend. Failure to complete the course might be perceived as personal failure, or that the trainee was not fit or “tough” enough to be a firefighter.

Smoke divers policy is that if a trainee reports an HRI, the trainee will likely miss a portion of the training or not complete the course and, consequently, not receive the smoke divers patch. Additionally, if the trainee receives an IV, or if the trainee is transported to the hospital emergency department, which is required by EMS protocol (even though there was an instance of this protocol not being followed during this training), the trainee could not complete the course and would not receive the smoke divers patch. The trainees who did not complete the training would, however, receive a course attendance certificate.

***Provide pre-placement and annual medical evaluations to all firefighters consistent with NFPA 1582, Standard on Comprehensive Occupational Medical Program for Fire Departments.***

The NFPA 1582 and the International Association of Firefighters (IAFF)/International Association of Fire Chiefs (IAFC) *Fire Service Joint Labor Management Wellness/Fitness Initiative* [NFPA 2007a; IAFF, IAFC 2008] provide guidance regarding the content and frequency of these types of medical evaluations. These evaluations can determine firefighters’ medical ability to perform duties without presenting a significant risk to the safety and health of themselves or others. To ensure improved health and safety of candidates and members, and to ensure continuity of medical evaluations, the SFMO and NIOSH recommended the fire departments comply with this recommendation, particularly the section addressing CHD issues. But fire departments are not legally required to follow the NFPA standard or the IAFF/IAFC initiative. Applying this recommendation involves economic repercussions and may be particularly difficult for smaller fire departments to implement.

***Consider incorporating a screening checklist for heatstroke risk factors into the agency's medical screening and medical examination program.***

The fire department currently requires candidates to pass pre-placement and periodic medical evaluations. As part of this evaluation, NIOSH investigators recommend that all candidates and members (or their physician) complete a checklist for individual heatstroke risk factors. Individual risk factors include the following:

- previous history of exertional heatstroke
- lack of heat acclimatization
- poor physical fitness
- obesity
- sleep deprivation
- various medical conditions (e.g., heart disease, renal disease, diabetes mellitus, skin conditions, sunburn, sweat gland dysfunction, viral illness, diarrhea, etc.)
- sunburn
- medications that reduce sweating (e.g., Benadryl®)
- medications that can cause dehydration (e.g., over-the-counter medications containing ephedrine or synephrine, diuretics)
- medications that can inhibit central thermoregulation (e.g., neuroleptics and tricyclic antidepressants)
- drugs that reduce cutaneous blood flow (e.g., stimulants such as cocaine, amphetamines, ephedrine, pseudoephedrine, caffeine, theophylline)

If one of these conditions is present, the examining physician should provide an opinion regarding a work restriction in hot environments. The fire department would determine whether it could accommodate that restriction.

***Fire departments and training facilities should understand and implement the following NFPA 1584 Annex A Guidelines:***

**STANDARD OPERATING GUIDELINE FOR REHABILITATION**

**PURPOSE.**

To provide guidance on implementing and using a rehabilitation process as a requirement of the incident management system at the scene of a fire, other emergency, or training exercise. A standard operating guideline for rehabilitation will ensure that personnel who might be suffering the effects of metabolic heat buildup, HRI, dehydration, physical exertion, and/or extreme weather receive evaluation and rehabilitation during emergency operations.

**SCOPE.**

Applies to all personnel attending or operating at the scene of a fire/emergency or training exercise.

**RULES.**

(1) Rehabilitation must commence when fire/emergency operations and/or training exercises pose a health and safety risk.

(2) Rehabilitation must be established for large-scale incidents, long-duration and/or physically demanding incidents, and extreme temperatures.

(3) The incident commander must establish rehabilitation according to the circumstances of the incident.

The rehabilitation process must include the following:

- (a) Rest
- (b) Hydration to replace lost body fluids
- (c) Cooling (passive and/or active)
- (d) Warming
- (e) Medical monitoring
- (f) Emergency medical care if required
- (g) Relief from extreme climatic conditions (heat, cold, wind, rain)
- (h) Calorie and electrolyte replacement
- (i) Accountability
- (j) Release

## **RESPONSIBILITIES.**

**The incident commander will be responsible for the following:**

- (1) Include rehabilitation in incident/event size-up.
- (2) Establish a rehabilitation group to reduce adverse physical effects on firefighters while operating during fire/emergencies, training exercises, and extreme weather conditions.
- (3) Designate and assign a supervisor to manage rehabilitation.
- (4) Ensure sufficient resources are assigned to rehabilitation.
- (5) Ensure EMS personnel are available for emergency medical care of firefighters as required.

**The rehabilitation manager will be responsible for the following:**

- (1) Don the rehabilitation manager vest.
- (2) Whenever possible, select a location for rehabilitation with the following site characteristics:
  - (a) Large enough to accommodate the number of personnel expected (including EMS personnel for medical monitoring)
  - (b) Have a separate area for members to remove personal protective equipment
  - (c) Be accessible for an ambulance and EMS personnel, should emergency medical care be required
  - (d) Be removed from hazardous atmospheres including apparatus exhaust fumes, smoke, and other toxins
  - (e) Provide shade in summer and protection from inclement weather at other times
  - (f) Have access to a water supply (bottled or running) to provide for hydration and active cooling
  - (g) Be away from spectators and media
- (3) Ensure personnel in rehabilitation “dress down” by removing their bunker coats, helmets, hoods, and opening their bunker pants to promote cooling.
- (4) Provide the required resources for rehabilitation including the following:
  - (a) Potable drinking water for hydration
  - (b) Sports drinks (to replace electrolytes and calories) for long-duration incidents (working more than one hour)

- (c) Active cooling where required
  - (d) Medical monitoring equipment (chairs to rest on, blood pressure cuffs, stethoscopes, checksheets, etc.)
  - (e) Food where required and a means to wash or clean hands and face prior to eating
  - (f) Blankets and warm, dry clothing for winter months
  - (g) Washroom facilities where required
- (5) Time personnel in rehabilitation to ensure they receive at least 10 to 20 minutes of rest.
  - (6) Ensure personnel rehydrate themselves.
  - (7) Ensure personnel are provided with a means to be actively cooled where required.
  - (8) Maintain accountability and remain within rehabilitation at all times.
  - (9) Document members entering or leaving rehabilitation.
  - (10) Inform the incident commander, accountability officer (resource status unit), and EMS personnel if a member requires transportation to, and treatment at, a medical facility.
  - (11) Serve as a liaison with EMS personnel.

**Company officers will be responsible for the following:**

- (1) Be familiar with the signs and symptoms of heat stress and cold stress.
- (2) Monitor their company members for signs of heat stress and cold stress.
- (3) Notify the IC when stressed members require relief, rotation, or reassignment according to conditions.
- (4) Provide access to rehabilitation for company members as needed.
- (5) Ensure that their company is checked-in properly with the rehabilitation manager and accountability officer (resource unit), and that the company remains intact.

**Crew members will be responsible for the following:**

- (1) Be familiar with the signs and symptoms of heat and cold stress.
- (2) Maintain awareness of themselves and company members for signs and symptoms of heat and cold stress.
- (3) Promptly inform the company officer when members require rehabilitation or relief from assigned duties.
- (4) Maintain unit integrity.

**EMS personnel will be responsible for the following:**

- (1) Report to the incident commander and obtain the rehabilitation requirements.
- (2) Coordinate with rehabilitation manager.
- (3) Identify the EMS personnel requirements.
- (4) Check vital signs, monitor for heat stress and signs of medical issues.
- (5) Document medical monitoring.
- (6) Provide emergency medical care and transportation to medical facilities as required.
- (7) Inform the incident commander and the rehabilitation manager when personnel require transportation to and treatment at a medical facility.
- (8) Document emergency medical care provided.

**PROCEDURES.**

- (1) All personnel must maintain hydration on an ongoing basis (pre-incident, incident, post incident).
- (2) Members must be sent to rehabilitation as required.

(3) All members must be sent to rehabilitation following the use of two 30-minute SCBA cylinders or one 45- to 60-minute SCBA cylinder. Shorter times might be considered during extreme weather conditions.

(4) Active cooling (e.g., forearm immersion, misting fans) must be applied where temperatures, conditions, and/or workload create the potential for heat stress.

(5) In hot, humid conditions, a minimum of 10 minutes (20 minutes is preferable) of active cooling must be applied following the use of the second and each subsequent SCBA cylinder.

(6) Personnel in rehabilitation must rest for at least 10 to 20 minutes prior to being reassigned or released.

(7) EMS personnel must provide medical monitoring and emergency medical care as per medical protocol.

(8) If a member is demonstrating abnormal vital signs, he or she must be monitored frequently during rehabilitation.

(9) EMS must assess all personnel who are weak or fatigued, have pale clammy skin, low blood pressure, nausea, headache, or dizziness.

(10) Transport to a medical facility personnel who are experiencing chest pain, shortness of breath, dizziness, or nausea.

(11) A department representative must accompany personnel who are transported to a medical facility for treatment.

(12) Members should drink water during rehabilitation. After the first hour, a sports drink containing electrolytes should be provided. Caffeinated and carbonated beverages should be avoided.

(13) Provide nutritional snacks or meals, as required during longer duration incidents.

(14) Tobacco use is forbidden in or near the rehabilitation area.