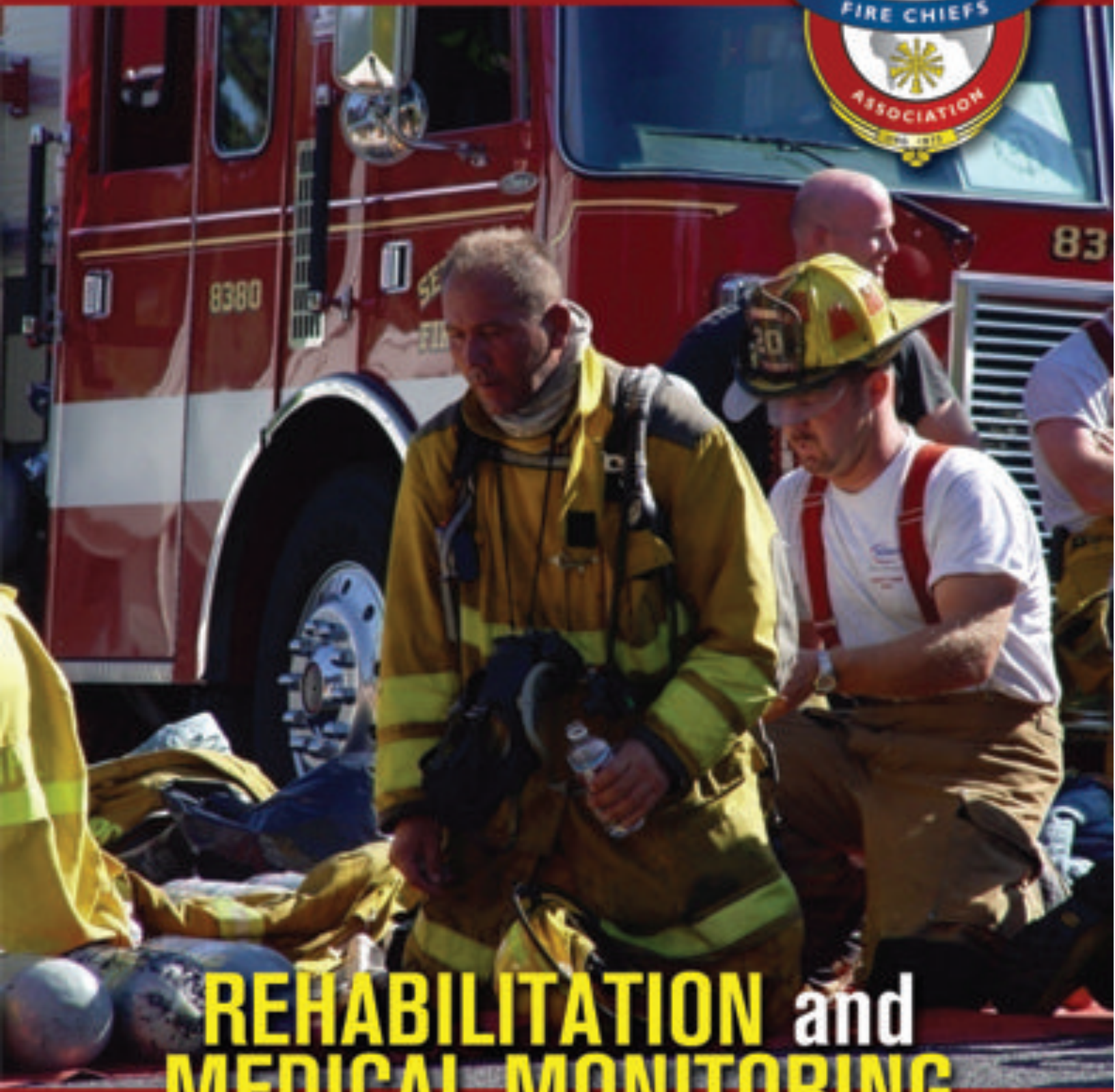
EDUCATIONAL OBJECTIVES AND CURRICULUM



REHABILITATION and MEDICAL MONITORING

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REHABILITATION and MEDICAL MONITORING
A Guide for Best Practices: NFPA 1584 Standards

Curriculum Outline

Educational Standard:

Standard on the Rehabilitation Process for Members during Emergency Operations and Training Exercises.

Enabling Objectives:

The Firefighter must be able to:

01. Introduction
    a. Review case study for pertinent issues and lessons learned.
02. Discuss the historical development of strategies designed to improve the health and safety of firefighters.
    a. All aspects of fire operations (training, practice, fire ground).
    b. 2003 release of NFPA 1584 *Recommended Practices on the Rehabilitation of Members Operating at Incident Scene Operations and Training Exercises*.
    c. 2008 release of NFPA 1584 *Standard on the Rehabilitation Process for Members during Emergnecy Operations and Training Exercises*.
03. Rehabilitation
    a. *Rehabilitation* means to restore to a condition of good health, to restore the ability to work, or the like.
    b. Studies show that most injuries and deaths occur during the active phases of suppression, and can be prevented.
    c. Rehabilitation should be integral to the IMS for fire ground and training exercises.
04. Overview rehabilitation steps:
    a. Initiate rehabilitation
        i. Initiated by IC or previously established person
        ii. Rehab sector should be readily accessible.
    b. Responsibilities
        i. Clearly defined authorities of those staffing rehab sector
    c. Accountability
        i. Essential task of rehab center
        ii. Track personnel who enter and leave sector
        iii. Clearly defined method to discharge people from rehab sector by rehab officer (or the officer's delegate)
    d. Safety
        i. Ensure safety of those working within and rotating through sector
        ii. Safety from incident, environment, media, societal threats, onlookers, etc.

e. Release
    i. Only occur after personnel are determined to be adequately rested, hydrated, and provided treated as needed.
    ii. Refer personnel that are in rehab for a prolonged period without improvement in condition to treatment sector.
    iii. Decision to allow or disallow members to return to work is vested in rehab sector officer via the IC.

05. Preparedness
a. Essential for each department to have a *standard operating guideline (SOG)* that details systematic approach to rehabilitation activities
b. Standard operating guidelines should include (but may not be limited to)
    i. Relief from climatic conditions
    ii. Rest and recovery
    iii. Active and/or passive cooling or warming as needed
    iv. Rehydration
    v. Calorie and electrolyte replacement
    vi. Medical monitoring
    vii. EMS treatment according to local protocol
    viii. Member accountability
    ix. Release
c. Multiple smaller departments may want to develop joint plans with other departments to share equipment and resources
d. During situations of limited resources, consider rotating personnel to less physically demanding positions
e. Creation of EMS protocols and procedures that guide both the fire department and non fire department EMS providers during emergency operations.
    i. Protocols developed by EMS medical director, fire department physician, fire chief, and fire department medical personnel
f. Firefighter Fitness
    i. Essential component of safety and longevity for personnel
    ii. Cultural and dietary impact on personnel wellness
        1. Processed foods
        2. Fast foods
        3. Decline in exercise
        4. Obesity
    iii. NFPA 1583 details level of physical fitness for fire personnel
    iv. Fire personnel should also have a working knowledge of how the body regulates its core temperature
    v. Physical fitness has been shown to increase performance and optimize rehab efforts
g. Preparing for scheduled physical activities
    i. Prescheduled events can still be physically demanding
    ii. Stress importance of pre-event hydration, nutrition, and diet
        1. Guidelines for pre-hydration
        2. Guidelines for caloric intake

iii. All fire members should train so as to acclimate to environmental conditions that may be encountered on the job.

06. Rehabilitation area characteristics
    a. Covered in Section Five of *NFPA 1584* standards
    b. Ultimate responsibility falls with the IC for establishing and maintaining a rehabilitation area.
    c. Establishing the Site
        i. First priority of the IC to ensure proper location, or delegate this to the rehabilitation manager (or rehab officer). IC still provides final approval
            1. Consider environmental conditions, need for warmth or A/C. Should be dry and protected from wind.
            2. Systems may incorporate a vehicle dedicated to these activities
                a. An ambulance may also be used as rehab center, but if done it should not be "pulled" for transport duties.
            3. Use of water misters, shading, folding chairs, portable heating devices
        ii. Multiple Rehabilitation Centers
            1. May be warranted as the incident expands resulting in additional personnel
            2. Geographical barriers also increase as rehab center enlarges
            3. IC should have plan for initiating secondary rehab centers and should implement that process early
            4. Characteristics used to establish the first rehab sector apply to any additional sectors as well
            5. Naming of rehab sector should be consistent, intuitive, and understood by all personnel onscene to avoid confusion
        iii. Site Characteristics
            1. Safe distance from the main operation, but easily accessible
            2. Personnel should be able to safely remove their PPE
            3. PPE should be kept on the perimeter of the rehab center
            4. If portable heating or a vehicle is being used for rehab center, ensure that exhaust fumes are not a hindrance to rehab efforts
            5. Always assess the current size of the rehab center versus the size of the incident or personnel onscene so to enlarge the rehab sector if needed.
        iv. Preparing for Medical Monitoring
            1. Part of the rehab site
            2. Personnel operating this site should be medically trained
            3. Equipment needed/available may include
                a. Oxygen
                b. Airway supplies
                c. Carbon monoxide monitor
                d. Automated external defibrillator

e. ECG monitor
f. Blankets
g. Pulse oximeter
h. Supplies for orthopedic injuries
i. Supplies for bleeding control
j. Cardiac medications
k. Cyanide antidote kits
l. Portable stretchers
m. Hand washing and decontamination supplies
n. Other (stethoscopes, thermometers, etc.).

v. Establishing Rehabilitation Resources
1. Preplanning integral to success of program
2. Usually include vehicles, personnel, and equipment
3. Some agencies utilize vehicles designated for this purpose
4. As suggested in *National Incident Management Systems (NIMS)*, there should be one EMS provider per every five members in rehab
5. External organization involvement (Red Cross, Salvation Army, local EMS agency, etc.).

07. Incident and Training Rehabilitation
1. NFPA 1500 *Standard of Fire Department Safety and Health Programs*
2. NFPA 1561 *Standard of Emergency medical Services Incident Management Services*

a. Implementation of Rehab
i. IC should have low threshold for implementing rehab
ii. Need for rehab should be the same regardless if event is actual firefighting or training exercise

b. Assignment to Rehab
i. Should be prescribed in departmental SOP's
ii. Each crew member should be assessed at least every 45 minutes

c. Authority for Rehab
i. Authority should be delegated from the IC to the rehab staff to mandate personnel to remain in rehab or transport them for medical care/treatment
ii. Rehabilitation operations should consider the scope of the incident
1. Time
2. Complexity
3. Intensity

d. Rehab Criteria
i. Ideally, personnel should be provided with rehab it
4. Following use of single 30-minute SCBA cylinder
5. End of a 20-minute work cycle without an SCBA
6. At a minimum, personnel should undergo rehab when a 45-minute or 60-minute SCBA cylinder is used or following 40 minutes of intense work without an SCBA

e. Rehabilitation Efforts
    i. Rehab efforts should include the following
        a. Relief from climatic conditions
        b. Rest and recovery
        c. Active and/or passive cooling or warming
        d. Rehydration
        e. Caloric and electrolyte replacement
        f. Medical monitoring
        g. Member accountability
        h. Release
    1. Rest and Recovery
        a. 10 minute minimum, longer when practical
        b. 20 minute minimum following second SCBA cylinder use
        c. 20 minute minimum following 40 minutes of intense work without an SCBA
    2. Weather
        a. Constantly assess and reassess in hot weather
            i. Temperature
            ii. Relative humidity
            iii. Direct sunlight
        b. Constantly assess and reassess in cold weather
            i. Temperature
            ii. Wind speed
            iii. Relative humidity
        c. Warm weather events
            i. Thermal gradient effects, if environment is warmer than the firefighter, heat will flow from the environment to the firefighter – and vice versa.
            ii. As humidity increases, the cooling capacity of the body decreases
            iii. Understanding effects of the *Heat Index*
                2. Ambient temperature and dew point
            iv. *Heat Stress Index*
                2. Incorporates Humidex into danger categories
        d. Cool Weather Events
            i. Effects of wind speed increasingly important during cold weather
            ii. *Wind-Chill Temperature (WCT) Index* more commonly called Wind Chill Index
                1. Devised by using wind speeds at 5 feet above ground, at night, with standard exposure factor for skin tissue

3. Cooling and Warming
    a. Humans are to maintain a core temperature of 98.6 degrees Fahrenheit (37 degrees Celsius) when taken orally
    b. With environmental extremes, rectal readings may be more accurate
    c. Heat Generating Mechanisms
        i. Thermogenesis
            1. Metabolism (Basal metabolic rate)
            2. Muscles at work
    d. Cooling Mechanisms
        i. Themolysis
            1. Increased respirations
            3. Shunting of blood to the skin
            4. Sweating (may result in loss of electrolytes)
    e. Cooling and Warming on the Fireground
        i. Cooling
            1. Natural body-cooling processes (passive cooling)
                a. Common techniques to maximize passive cooling
            2. Application of cold (active cooling)
            3. Active cooling generally preferred to efficiently drop core temperature
                a. Cooling fans
                b. Misting fans
                c. Forearm immersion in cool water
                d. Wet towel application
            4. Implement heat stress prevention strategies when WCT Index exceeds 95 to 102 degrees Fahrenheit
        ii. Heating
            1. The greater the thermal gradient, the more likely the emergence oc cold stress
            2. Hypothermia sets in with a core temperature of less than 95 degrees Fahrenheit
                a. Passive Warming
                    i. Application of measures that slow the loss of body heat
                b. Active Warming

i. Application of heat to the body

4. Fluids and Electrolytes
    a. Fluid loss through evaporation and breathing in an attempt to cool the body can result in loss of large amounts of fluids
    b. Electrolytes balance is also integral to normal bodily activities, and may become deranged with heavy sweating
        i. More common to incidents exceeding 3 hours in duration, or require constant work for more than 1 hour
        ii. Can be replaced by use of sport drinks in minor cases, and intravenous therapy in severe cases
5. Calories
    a. Energy is measured in calories
    b. Calories derived from carbohydrates, lipids, and proteins
    c. Caloric replacement should also occur during rehab
        i. Consider the following when supplementing
            1. Duration of event
            2. Amount of exertion
            3. Time since last meal
            4. General condition of the individual
6. Hydration, Electrolyte and Calorie Replacement
    a. Replacement therapy is to match what was lost
        i. Monitoring Hydration can be done by assessing degree of thirst, urine color, and urine specific gravity.
        ii. Of these, serial weight measurements pre/post activity is useful
            1. Prevent dehydration
                a. <5% body weight loss is mild dehydration
                b. 5%-10% body weight loss is moderate dehydration
                c. >10% body weight loss is severe dehydration
            2. Dehydration has several detrimental effects on firefighter performance and safety
            3. Oral replacement should not exceed 32 ounces (one liter) per hour due to fixed gastric emptying

a. Prevent hyponatremia by consuming one sports drink for every 65-96 ounces of water ingested

7. Replacement guidelines for high-intensity long duration activity (> 1 hour)
    a. 30-60 grams/hr carbohydrates
    b. 8 oz (1/4 liter) sports drink (15 grams carbs)
    c. Eat other readily available carb sources such as fruit and meal replacement bars
6. Medical Monitoring and Emergency Care
    a. Medical monitoring is process of observing personnel for possible adverse health effects
    b. Emergency medical care is the treatment of personnel who exhibit adverse effects or injury
    c. Medical monitoring, treatment, and transport may be done by EMS in some systems
    d. Documentation of assessment and services rendered in essential to any rehab operation
    e. Credentials of providers in rehab sector should be minimally BLS providers, and ideally ALS providers
    f. Signs and symptoms of concern
        i. Chest pain
        ii. Dizziness
        iii. Shortness of breath
        iv. Weakness
        v. Nausea
        vi. Headache
        vii. Cramping, aches/pains
        viii. Environmental stress signs (heat/cold)
        ix. Mental status changes
        x. Behavioral changes
        xi. Changes in speech
        xii. Changes in gait
        xiii. Vital sign abnormalities
    g. FD physician or local medical authority should develop medical monitoring protocols that define the following
        i. Immediate transport to medical facility
        ii. Close monitoring and treatment in rehab area
        iii. Release from rehab
    h. Vital Signs
        i. Reliable method for evaluation and medical monitoring

ii. NFPA 1584 does provide some guidance for considering vital signs during rehab\

i. Utility of Vital Signs
    i. Extremes in heart rate, blood pressure, and respiratory rate, and temperature often seen initially when personnel enter rehab.
    ii. Failure of vitals to return to acceptable levels can be cause for referral
j. Temperature
    i. Most accurate temp is rectal core temp, but not practical during rehab
    ii. Tympanic and oral assessment most common, but read lower than actual temp (oral 1 degree less and tympanic 2 degrees less)
    iii. Temp should return to pre-activity temp within 20 minutes with appropriate cooling techniques employed
k. Heart rate
    i. Ranges from 60-100 beats per minute
    ii. May exceed 100 beats per minute with exertion
    iii. Heart rate fluctuates given general health of firefighter
    iv. If heart rate is above 100/minute after 20 minutes of rehab, firefighter should not be released from rehab and should receive further medical evaluation
l. Respiratory rate
    i. Normal is 12-20 per minutes
    ii. Rate should return to normal before being cleared from rehab
m. Blood pressure
    i. Most frequently measured and least understood of vital signs
    ii. Personnel with systolic pressure >160 mmHg or diastolic pressure >100 mmHg after rehab should not be released
n. Pulse oximetry
    i. Noninvasive measurement of oxygen saturation in arterial blood
    ii. Normal saturation (SpO2) between 95% and 100%
        1. 91%-94% mild hypoxia
        2. 86%-91% moderate hypoxia
        3. <85% severe hypoxemia

iii. Understand limitations for pulse oximetry monitoring
iv. Any personnel with pulse ox reading <92% on room air should not be released following rehab

o. Carbon monoxide assessment
i. Leading cause of death at fire scenes
ii. CO gas is invisible yet present in every fire
iii. Findings from CO poisoning are nonspecific and mimic many other medical conditions
1. Headache, nausea, vomiting, shortness of breath, dizziness
iv. Rehab should employ CO monitoring with a pulse CO-Oximeter
1. Non-smokers 0-5%
2. Smokers may register 5%-10%
3. Values >15% should be treated with oxygen and not released from rehab till normal levels returned
v. Remain alert for cyanide poisoning as well

p. Release from Medical Monitoring
i. Personnel should not be released from rehab until aforementioned assessment parameters (or others specified in SOG's) are met.
ii. Personnel may require ongoing medical monitoring, treatment, or transport as needed

q. Accountability
i. Maintained as it would be during any other incident or operation
ii. Crew or company remains together on entering or exiting rehab unless extraneous variable necessitating change exist
iii. Notify IC of personnel status for ongoing assignment

2. Release
a. EMS personnel should evaluate members prior to their release from rehab
b. Confirm accountability with rehab officer

8. Company /Crew Level Rehabilitation
9. Work-to-Rest Ratios
a. Assessment should occur at least every 45 minutes
b. Decrease assessment interval with extreme conditions or exertion

10. Mental Health

a. Remain alert for signs of psychological or emotional stress
b. Services of a competent, licensed mental health professional should be made available to members of the department as needed
c. CISD and CISM no longer recommended

11. Documentation
    a. Important part of rehabilitation process
    b. Time in and time out of rehab
    c. Done on all persons entering rehab
    d. Retain all records should interventions beyond traditional rehab be warranted (emergency medical care)

08. Post Incident Rehabilitation
    a. Just as important as rehabilitation on the incident scene
    b. Each department should have a post incident rehab policy
        i. At a minimum, this should include ongoing fluid intake

09. Summary
    a. Reinforce primary concern at incident scene is physical well-being of crews.