NFPA® 1584

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

2008 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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NFPA® 1584

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

2008 Edition

This edition of NFPA 1584, *Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises*, was prepared by the Technical Committee on Fire Service Occupational Safety and Health. It was issued by the Standards Council on December 11, 2007, with an effective date of December 31, 2007, and supersedes all previous editions.

This edition of NFPA 1584 was approved as an American National Standard on December 31, 2007.

Origin and Development of NFPA 1584

The first edition of NFPA 1584, *Recommended Practice on the Rehabilitation of Members Operating at Incident Scene Operations and Training Exercises,* was issued in January 2003 to support the requirements in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, for a rehabilitation program for fire department members operating at emergency incidents. An organized approach for fire department members' rehabilitation at incident scene operations is an integral component of both an occupational safety and health program and incident scene management.

For the 2008 edition, the committee felt that rehabilitation is important enough to the health and safety of fire fighters that it should be addressed in a standard rather than in a recommended practice. Accordingly, this edition is completely revised from the previous edition and has been retitled *Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises.*

The committee has reviewed and updated the text so the standard reflects current science and knowledge on rehabilitation of fire service members. Requirements for medical monitoring during rehabilitation have been added with a lengthy discussion in the annex that recognizes that vital signs alone cannot be used to determine if a fire fighter entering or in rehabilitation should receive further medical treatment.

Terminology has been updated to be compatible with the National Incident Management System (NIMS). Annex material has been added to show a sample standard operating procedure for a rehabilitation process, and provide information on the classification, signs, symptoms, and treatment of heat stress and cold stress. Emphasis has been placed on fire fighters maintaining proper nutrition, hydration, and a healthy lifestyle prior to emergency operations or training exercises.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on occupational safety and health in the working environment of the fire service. The Committee shall also have responsibility for documents related to medical requirements for fire fighters.

Contents

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

2008 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex B. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Chapter 1 Administration

1.1 Scope. This standard establishes the minimum criteria for developing and implementing a rehabilitation process for fire department members at incident scene operations and training exercises.

1.2 Purpose. This standard describes the rehabilitation process for members operating within an incident management system.

1.3 Application.

1.3.1 This standard applies to organizations providing rescue, fire suppression, emergency medical services, hazardous materials mitigation, special operations, and other emergency services, including public, military, private, and industrial fire departments.

1.3.2 This standard does not apply to industrial fire brigades that might also be known as emergency brigades, emergency response teams, fire teams, plant emergency organizations, or mine emergency response teams.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program,* 2007 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System,* 2008 edition.

NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Department Members,* 2008 edition.

2.3 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents,* 2008 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program,* 2007 edition.

NFPA 1521, *Standard for Fire Department Safety Officer,* 2008 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System,* 2008 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Shall. Indicates a mandatory requirement.

3.2.4 Should. Indicates a recommendation or that which is advised but not required.

3.2.5 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

3.3.1 Active Cooling. See 3.3.5.1.

3.3.2 Advanced Life Support (ALS). Functional provision of advanced airway management including intubation, advanced cardiac monitoring, manual defibrillation, establishment and maintenance of intravenous access, and drug therapy.

3.3.3* Basic Life Support (BLS). A specific level of prehospital medical care provided by trained responders, focused on rapidly evaluating a patient's condition; maintaining a patient's airway, breathing, and circulation; controlling external bleeding; preventing shock; and preventing further injury or disability by immobilizing potential spinal or other bone fractures.

3.3.4 Company. A group of members (1) under the direct supervision of an officer; (2) trained and equipped to perform assigned tasks; (3) usually organized and identified as engine companies, ladder companies, rescue companies, squad companies, or multi-functional companies; (4) operating with one piece of fire apparatus (pumper, aerial fire apparatus, elevating platform, quint, rescue, squad, ambulance) except where multiple apparatus are assigned that are dispatched and arrive together, continuously operate together, and are managed by a single company officer; (5) arriving at the incident scene on fire apparatus. [**1500**, 2007]

3.3.5 Cooling.

3.3.5.1 ***Active Cooling.*** The process of using external methods or devices (e.g., hand and forearm immersion, misting fans, ice vests) to reduce elevated core body temperature.

3.3.5.2 ***Passive Cooling.*** The process of using natural evaporative cooling (e.g., sweating, doffing personal protective equipment, moving to a cool environment) to reduce elevated core body temperature.

3.3.6* Core Body Temperature. The temperature deep within a living body.

3.3.7 Crew. A team of two or more fire fighters. [**1500**, 2007]

3.3.8 Emergency Incident. Any situation to which an emergency services organization responds to deliver emergency services, including rescue, fire suppression, emergency medical care, special operations, law enforcement, and other forms of hazard control and mitigation. [**1561**, 2008]

3.3.9 Emergency Medical Care. The treatment of patients, using first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other medical protocols prior to arrival at a hospital or other health care facility.

3.3.10 Emergency Medical Services. The provision of treatment, such as first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other pre-hospital procedures including ambulance transportation, to patients. [**1500**, 2007]

3.3.11 Emergency Operations. Activities of the fire department relating to rescue, fire suppression, emergency medical care, and special operations, including response to the scene of the incident and all functions performed at the scene. [**1500,** 2007]

3.3.12* Hydration. The introduction of water in the form of food or fluids into the body.

3.3.13 Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources. [**472,** 2008]

3.3.14* Incident Management System (IMS). A system that defines the roles and responsibilities to be assumed by responders and the standard operating procedures to be used in the management and direction of emergency incidents and other functions. [**1561,** 2008]

3.3.15* Medical Monitoring. The ongoing evaluation of members who are at risk of suffering adverse effects from stress or from exposure to heat, cold, or hazardous environments.

3.3.16* Member. A person involved in performing the duties and responsibilities of a fire department, under the auspices of the organization. [**1500,** 2007]

3.3.17 Passive Cooling. See 3.3.5.2.

3.3.18 Patient. An emergency responder who is provided emergency medical care during the rehabilitation process.

3.3.19 Personnel Accountability System. A system that readily identifies both the location and function of all members operating at an incident scene. [**1500,** 2007]

3.3.20 Procedure. An organizational directive issued by the authority having jurisdiction or by the department that establishes a specific policy that must be followed. [**1561,** 2008]

3.3.21* Recovery. The process of returning a member's physiological and psychological states to normal or neutral where this person is able to perform additional emergency tasks, be re-assigned, or released without any adverse effects.

3.3.22* Rehabilitation. An intervention designed to mitigate against the physical, physiological, and emotional stress of fire fighting in order to sustain a member's energy, improve performance, and decrease the likelihood of on-scene injury or death.

3.3.23 Rehabilitation Manager. The person or officer assigned to manage rehabilitation.

3.3.24 Sports Drink. A fluid replacement beverage that is between 4 percent and 8 percent carbohydrate and contains between 0.5 g and 0.7 g of sodium per liter of solution.

3.3.25 Standard Operating Guideline. A written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely, which can be varied due to operational need in the performance of designated operations or actions.

3.3.26* Standard Operating Procedure. A written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely for the performance of designated operations or actions. [**1521,** 2008]

3.3.27 Supervisor. An emergency services responder who has responsibility for overseeing the performance of other responders assigned to a specific division or group.

Chapter 4 Preparedness

4.1 General.

4.1.1 Standard Operating Guidelines.

4.1.1.1* The fire department shall develop standard operating guidelines (SOGs) that outline a systematic approach for the rehabilitation of members operating at incidents and training exercises.

4.1.1.2* These guidelines shall include but not be limited to 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

(6) Medical monitoring
(7) Emergency medical services (EMS) treatment in accordance with local protocol
(8) Member accountability
(9) Release

4.1.1.3* Crews shall be rotated as necessary to allow for rehabilitation.

4.1.2 Protocols and procedures guiding fire department and other emergency services personnel who care for ill or injured members during emergency operations shall be developed by the emergency medical service (EMS) medical director in collaboration with the fire department physician and fire chief.

4.2 Training and Recognition of Heat/Cold Stress.

4.2.1 All members shall be provided with information on how the body regulates core temperature and how to recognize the signs, symptoms, and controls for heat and cold stress. (*See Annex B.*)

4.2.2* Departments and members shall follow NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Department Members.*

4.2.3 Procedures shall be in place to ensure that rehabilitation operations commence whenever emergency operations pose the risk of members exceeding a safe level of physical or mental endurance.

4.3 Pre-Incident and Training Operations.

4.3.1* Members shall maintain proper hydration, nutrition, and diet to maintain normal body function.

4.3.2* For scheduled events, prehydration shall include an additional 16 oz (500 mL) of fluids within 2 hours prior to the event.

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.

5.1.2 For cold or wet environments, this area shall provide dry protected areas out of the wind, heated areas, and a place to sit.

5.1.3 Multiple Rehabilitation Areas.

5.1.3.1 When the size of the operation or geographic barriers limit members' access to the rehabilitation area, the incident commander shall establish more than one rehabilitation area.

5.1.3.2* Each rehabilitation area shall be given a geographic name consistent with its location at the incident site.

5.2 Site Characteristics.

5.2.1* The site shall be a sufficient distance from the effects of the operation that members can safely remove their personal protective equipment (PPE) and can be afforded physical and mental rest.

5.2.2* The site shall include an area where members can remove and leave their PPE prior to entering the designated rehabilitation area.

5.2.3 The site shall provide protection from the prevailing environmental conditions.

5.2.4 The site shall be free of exhaust fumes from apparatus, vehicles, or equipment.

5.2.5 The site shall be large enough to accommodate multiple crews and rehabilitation personnel, based on the size of the incident.

5.2.6 The site shall include a medical monitoring and treatment area.

5.2.7 The site shall allow access to transport members to a medical treatment facility where required.

5.3* Establishing Rehabilitation Resources. The incident commander or the rehabilitation manager shall identify those resources to be used at an incident rehabilitation facility.

Chapter 6 Incident Scene and Training Rehabilitation

6.1 Criteria for Implementation. Rehabilitation operations shall be provided in accordance with fire department standard SOPs; NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*; and NFPA 1561, *Standard on Emergency Services Incident Management System.*

6.1.1* Rehabilitation operations shall commence whenever emergency operations or training exercises pose a safety or health risk to members.

6.1.2 Members shall be assigned to rehabilitation as prescribed by departmental SOPs.

6.1.3* Emergency medical services (EMS) staff in rehabilitation shall have the authority, as delegated from the incident commander, to use their professional judgement to keep members in rehabilitation or to transport them for further medical evaluation or treatment.

6.1.4* Members shall undergo rehabilitation following the use of a second 30-minute self-contained breathing apparatus (SCBA) cylinder, a single 45-minute or 60-minute SCBA cylinder, or 40 minutes of intense work without SCBA. A supervisor shall be permitted to adjust the time frames depending upon work or environmental conditions.

6.2 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

6.2.1 Members shall be afforded relief from climatic and/or extreme conditions *(see 5.2.1).*

6.2.2 Rest and Recovery.

6.2.2.1 Members entering rehabilitation for the first time shall rest for a minimum of 10 minutes and longer where practical.

6.2.2.2 Members shall rest for a minimum of 20 minutes following the use of a second 30-minute self-contained breathing apparatus (SCBA) cylinder, a single 45-minute or 60-minute SCBA cylinder, or 40 minutes of intense work without SCBA.

6.2.2.2.1 A supervisor shall be permitted to adjust the time frames depending upon work or environmental conditions.

6.2.2.2.2 The member shall not return to operations if he or she does not feel adequately rested; if EMS or supervisory staff present see evidence of medical, psychological, or emotional distress; or if the member appears otherwise unable to safely perform his or her duties.

6.2.3 Cooling and Warming.

6.2.3.1* Members who feel warm or hot shall remove protective clothing, drink fluids, and apply active and/or passive cooling as needed for incident type and climate conditions.

6.2.3.2 Members with cold-related stress shall add clothing, wrap themselves in blankets, or use other methods to regain normal body temperature.

6.2.4* Members entering rehabilitation shall consume fluids to satisfy thirst during rehabilitation and be encouraged to continue hydrating after the incident.

6.2.5* Members shall replace calories and electrolytes as required, particularly during incidents of more than 3 hours and incidents where members are likely to be working for more than 1 hour.

6.2.5.1* Fire departments shall ensure that appropriate calorie and electrolyte replacements are available.

6.2.5.2* Fire departments shall ensure that a means to wash members' hands and faces is available whenever calorie replacement will be used.

6.2.6* Medical Monitoring and Emergency Medical Care.

6.2.6.1* EMS shall be available as part of the incident scene rehabilitation for the evaluation and treatment of members.

6.2.6.2* Basic life support (BLS) shall be the minimum level of available care.

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 *(see Annex B)*
(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

6.2.6.5 Symptomatic members, or members with abnormal findings shall receive additional monitoring during rehabilitation.

6.2.6.6 EMS personnel shall access and provide member treatment in accordance with protocols developed by the fire department physician or medical authority.

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

6.2.7* Member Accountability. All members entering and leaving rehabilitation shall be assigned by the incident commander and shall be tracked through the personnel accountability system.

6.2.8 Release.

6.2.8.1 EMS personnel shall also evaluate members prior to their release from rehabilitation to ensure there are no obvious indications that would prevent them from safely performing full-duty activity.

6.2.8.2 Members being released from rehabilitation shall confirm their accountability with the rehabilitation manager.

6.3 Company/Crew Level Rehabilitation.

6.3.1* Company officers shall ensure that members remain hydrated and that potable fluids are available.

6.3.2 Work-to-Rest Ratio.

6.3.2.1* Company officers shall assess their crew at least every 45 minutes and more frequently when working in extreme conditions to determine their need for rehabilitation.

6.3.2.2 If one or more of the crew members is seriously injured or killed during the incident, all members of the crew shall be removed from emergency responsibilities at the incident as soon as possible. Mental health services shall be made available to all members of the department.

6.4 Documentation.

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

6.4.2 If medical monitoring is provided, a rehabilitation evaluation report shall document the evaluation in the fire department's data collection system.

6.4.3 Where emergency medical care is provided, a medical report shall be generated and a copy placed in the member's employee health record.

Chapter 7 Post-Incident Rehabilitation

7.1 Policy. The authority having jurisdiction shall ensure there is a policy on post-incident rehabilitation.

7.2* Rehydration. Supervisors shall encourage members to continue fluid intake after the incident.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of

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A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.3.3 Basic Life Support (BLS). Basic life support could also include expediting the safe and timely transport of the patient to a hospital emergency department for definitive medical care. Basic life support generally does not include the use of drugs or invasive skills.

A.3.3.6 Core Body Temperature. There is no single core temperature, as temperature varies from one site to another, but valid measures of core body temperature approximate the temperature of the central blood. Clinically measured sites to approximate core body temperature include the rectum, gastrointestinal tract, and bladder. Commonly used sites for determining body temperature include the oral cavity and tympanic membrane. However, the temperatures taken from these sites may differ considerably from actual core temperature. *(See Sawka and Pandolf, "Physical Exercise in Hot Climates: Physiology, Performance, and Biomedical Issues.")*

A.3.3.12 Hydration. Dehydration is the loss of body fluid, or a negative fluid balance. The magnitude of dehydration can vary tremendously following strenuous activity in the heat. Dehydration can cause impairment of thermoregulation, decreased physical performance, increased cardiovascular strain, and a disruption of blood chemistry.

A.3.3.14 Incident Management System (IMS). The system is also referred to as an incident command system (ICS). [**1561,** 2008]

A.3.3.15 Medical Monitoring. This monitoring is done for the purpose of achieving early recognition and prevention of these effects in order to maintain the optimal health and safety of on-scene personnel.

A.3.3.16 Member. A fire department member can be a full-time or part-time employee, can be a paid or unpaid volunteer, can occupy any position or rank within the fire department, and might or might not engage in emergency operations.

A.3.3.21 Recovery. Recovery suggests that all functions have returned to normal and that the member is not suffering any adverse effects from a current or previous activity (e.g., member could still be dehydrated from a previous activity).

A.3.3.22 Rehabilitation. Rehabilitation efforts should include providing relief from extreme climate and/or incident conditions, rest and recovery, rehydration, replacement of calories and electrolytes (as needed for scheduled activities of moderate to high intensity and lasting 1 hour or longer), active and/or passive cooling as needed for incident type and climatic conditions, medical monitoring, and member accountability.

A.3.3.26 Standard Operating Procedure. The intent of standard operating procedures is to establish directives that must be followed. Standard operating guidelines allow flexibility in application.

A.4.1.1.1 This procedure should include the following elements of the rehabilitation process:

(1) Initiate rehabilitation
(2) Responsibilities
(3) Accountability
(4) Safety
(5) Release

A.4.1.1.2 Figure A.4.1.1.2 shows a generic standard operating guideline for rehabilitation that can be adopted for use by a fire department.

A.4.1.1.3 Where limited resources strain existing personnel, crews can be rotated to a less physically demanding task (e.g., operating the pump rather than being part of the interior attack) as part of a strategic approach to limiting exertion.

A.4.2.2 Physical conditioning is known to allow individuals to operate at a higher core temperature, decrease cardiovascular strain associated with strenuous activity, and improve physical performance. Maintaining good physical conditioning will optimize a member's performance under extreme conditions and facilitate effective rehabilitation.

A recommended way to reduce health risks is through sufficient hydration, diet, limited outdoor physical exercise on hot days, acclimatization, and monitoring of weather conditions to ensure members understand the dangers associated with working in climatic conditions. All members should train to acclimate to appropriate environmental conditions. The process of acclimatization should be done in a manner that builds up the member's ability to exercise or perform under more extreme conditions.

A.4.3.1 Members should follow accepted guidelines for hydration and nutrition. Beverages, foods, and substances that should be avoided include the following:

(1) Carbonated, high-fructose-content, and high-sugar drinks [exceeding 7 percent carbohydrate (CHO) solution]
(2) Foods with high fat and/or high protein content
(3) Alcohol within 8 hours prior to duty
(4) Excessive fluids
(5) Tobacco
(6) Creatine
(7) Ephedrine

A.4.3.2 When hydration is taken with a meal, water is appropriate. Sports drinks should be considered for rehydration and calorie and electrolyte replacement when scheduled activities are of moderate to high intensity and last 1 hour or longer.

Consumption of smaller amounts of fluids more frequently is recommended to facilitate excretion and bladder comfort [e.g., 2 oz to 4 oz (60 mL to 120 mL) servings]. Scheduled events can include planned training and mass gatherings. Members should drink water every day, but water can quench thirst without providing needed carbohydrates and electrolytes. If activities such as training exercises or demonstrations

STANDARD OPERATING GUIDELINE FOR REHABILITATION

PURPOSE. To provide guidance on the implementation and use of a rehabilitation process as a requirement of the incident management system (IMS) at the scene of a fire, other emergency, or training exercise. It will ensure that personnel who might be suffering the effects of metabolic heat buildup, dehydration, physical exertion, and/or extreme weather receive evaluation and rehabilitation during emergency operations.

SCOPE. All personnel attending or operating at the scene of a fire/emergency or training exercise.

RULES.

(1) Rehabilitation shall commence when fire/emergency operations and/or training exercises pose a health and safety risk.
(2) Rehabilitation shall be established for large-scale incidents, long-duration and/or physically demanding incidents, and extreme temperatures.
(3) The incident commander shall establish rehabilitation according to the circumstances of the incident. The rehabilitation process shall 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 shall be responsible for the following:

(1) Include rehabilitation in incident/event size-up
(2) Establish a rehabilitation group to reduce adverse physical effects on fire fighter 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 fire fighters as required

The rehabilitation manager shall 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

FIGURE A.4.1.1.2 Sample Rehabilitation Standard Operating Guideline.

STANDARD OPERATING GUIDELINE FOR REHABILITATION *(continued)*

(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 minutes 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 shall 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 properly checked in with the rehabilitation manager and accountability officer (resource unit), and that the company remains intact

Crew members shall 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 stress and cold stress
(3) Promptly inform the company officer when members require rehabilitation and/or relief from assigned duties
(4) Maintain unit integrity

EMS personnel shall 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

FIGURE A.4.1.1.2 *Continued*

STANDARD OPERATING GUIDELINE FOR REHABILITATION *(continued)*

PROCEDURES.

(1) All personnel shall maintain hydration on an ongoing basis (preincident, incident, postincident).

(2) Members shall be sent to rehabilitation as required.

(3) All members shall 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) shall 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 shall be applied following the use of the second and each subsequent SCBA cylinder.

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

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

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

(9) Personnel who are weak or fatigued with pale clammy skin, low blood pressure, nausea, headache, or dizziness shall be assessed by EMS personnel.

(10) Personnel experiencing chest pain, shortness of breath, dizziness, or nausea shall be transported to a medical facility for treatment.

(11) Personnel transported to a medical facility for treatment shall be accompanied and attended to by a department representative.

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

(13) Nutritional snacks or meals shall be provided as required during longer duration incidents.

(14) No tobacco use shall be permitted in or near the rehabilitation area.

FIGURE A.4.1.1.2 *Continued*

that are likely to induce heat stress are planned or scheduled, drinking sports drinks before the activities can help reduce the effects of heat stress during those activities. Proper diet throughout the day can also help reduce these risks.

If high-intensity and/or long-duration activities are anticipated, or for members with recent illness resulting in poor hydration, consider increasing recommended servings of fluid. Carbohydrate (CHO) and electrolyte intake should also be increased under these conditions.

Some medications can increase the need for fluids.

If using powdered mix or concentrate for a sports drink, follow the manufacturer's instructions for mixing to ensure proper balance of carbohydrate and electrolyte content. A mixture that is too concentrated will be absorbed slowly.

A.5.1.3.2 Examples of geographic names are "north rehabilitation," "south rehabilitation," "1st floor rehabilitation," and "12th floor rehabilitation."

A.5.2.1 Rehabilitation shelters (where a rehabilitation area could be established) could include the following:

(1) Nearby garage, building lobby, or other structure
(2) Large tree, overhang, and so forth, for shade
(3) Open area in which a rehabilitation area can be created using tarps, fans, and so forth
(4) Tents or other portable structures
(5) Several floors below a fire in a high-rise building
(6) School bus or municipal bus
(7) Cabs of fire apparatus or any enclosed areas of emergency vehicles at the scene
(8) Retired fire apparatus or surplus government vehicle that has been renovated as a rehabilitation unit, which could respond by request or be dispatched during certain weather conditions
(9) Specially designed rehabilitation apparatus

A.5.2.2 Figure A.5.2.2 gives an example of the layout of a rehabilitation area and treatment area.

A.5.3 Rehabilitation resources could include, but do not have to be limited to, the following:

(1) Portable shelters
(2) Fans/blowers
(3) Blankets
(4) Portable heaters
(5) Dry clothing
(6) Lighting
(7) Electrical generating equipment
(8) Misting and cooling equipment
(9) Rehabilitation area designation marking equipment
(10) Chairs
(11) Beverage-serving equipment
(12) Exposure protective garments for rehabilitation staff
(13) Personnel washing equipment (basins, soap, water, towels)
(14) Cups (hot or cold according to the beverage)
(15) Potable water
(16) Large clock
(17) Traffic cones
(18) Fireline tape
(19) Log book, forms, and writing utensils
(20) Paper towels
(21) Sanitary facilities (portable toilets)
(22) Food (including appropriate serving devices and equipment)
(23) Trash receptacles

A.6.1.1 Rehabilitation operations should consider the scope of the incident, including the following:

(1) *Time.* Extended use of turnout gear; extended exposure to weather conditions.
(2) *Complexity.* Crime scenes, standoffs, search operations, mass gatherings/public events, and so forth.
(3) *Intensity.* Mental and/or physical stress on a member, such as major extrications, actual fire attack, radiant heat load, or interior search and rescue.

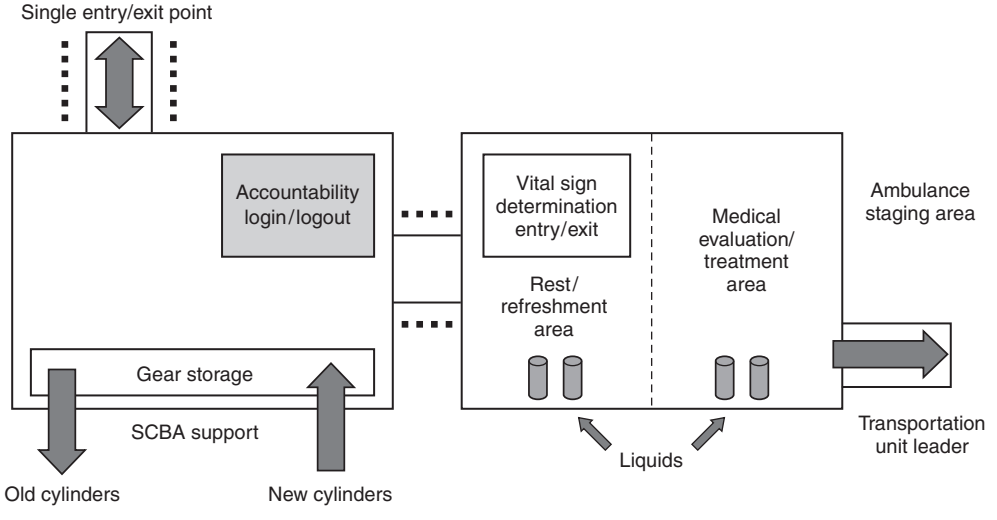

FIGURE A.5.2.2 Sample Layout of a Rehabilitation and Treatment Sector. (Source: Dickinson, E. T., and Wieder, M. A., *Emergency Incident Rehabilitation*, 2nd edition. Pearson Education, Upper Saddle River, NJ, 2004.)

Rehabilitation operations should consider hot weather conditions, including the following:

(1) Temperature *(see Table A.6.1.1)*
(2) Relative humidity *(see Table A.6.1.1)*
(3) Direct sunlight

Rehabilitation operations should consider cold weather conditions, including the following:

(1) Temperature
(2) Wind speed
(3) Moisture

The National Weather Service (NWS) implemented a new wind chill–temperature (WCT) index during the 2001–2002 winter season *(see Figure A.6.1.1)*. The reason for the change was to improve the previous index used by the NWS and the Meteorological Services of Canada (MSC), which was based on the 1945 Siple and Passel index. Most of the changes in the new index are at temperatures below 5°F (–12°C).

The new WCT index makes use of advances in meteorology, biometeorology, and computer modeling to provide a more accurate, more useful formula for calculating the dangers of winter winds and freezing temperatures. In addition, clinical trials have been conducted and the results of those trials have been used to verify and improve the accuracy of the new formula.

Specifically, the improvements of the new WCT index are as follows:

(1) It uses calculated wind speeds at an average height of 5 ft (1.5 m) (typical height of a human face) based on readings from the national standard height of 33 ft (10 m) (typical height of an anemometer).
(2) It is based on the latest heat transfer theory (i.e., heat loss from the body to its surroundings during cold and breezy/windy days).
(3) It uses a standard factor for skin tissue and assumes a no-sunlight scenario.

A.6.1.3 This is intended to prevent stoic members with serious medical conditions from refusing medical evaluation and treatment at the incident.

A.6.1.4 Ideally, members should be provided with rehabilitation or be released from their assignments following the use of a single 30-minute SCBA cylinder or a 20-minute work cycle.

A.6.2.3.1 Active cooling is often advantageous to return a member's core temperature to within the safe, normal range and minimizing the chance of experiencing heat stress.

Scientific studies have demonstrated the effectiveness of using active cooling to quickly and safely lower a member's core temperature. Both forearm immersion and misting fans have been found to be effective. Misting fans might not provide adequate cooling in a humid environment where they are less effective, and personnel wet by mists might become more susceptible to steam burns if they are sent back into a fire environment with wet clothes, and so forth.

Forearm immersion, where the hands and forearms are immersed in cool water, has been found to be more effective than misting fans in hot and humid areas to reduce a member's body core temperature. *(See McLellan and Selkirk, "The Management of Heat Stress for the Firefighter.")* The vascularity of blood vessels close to the skin of the arms and hands acts as an excellent means of heat transfer.

A.6.2.4 During emergency incidents and training exercises, the goal should be to match the volume of fluid intake with the volume of sweat output. Humans can easily exceed a sweat rate of 64 oz (2 L) per hour in hot and humid conditions. *(See Sawka and Pandolf, "Effects of Body Water Loss on Physiological Function and Exercise Performance.")* It is important to remember that fire-fighting gear interferes with heat dissipation and traps moisture next to the skin; hence, as soon as fire fighters don their gear the skin experiences a hot and humid environment and sweating begins. Furthermore, sweating continues even after a fire fighter stops working and enters rehabilitation.

Nausea and loss of thirst can be early signs of dehydration and heat stress. Therefore all members should demonstrate the ability to consume some fluids. If members cannot demonstrate the ability to take in some fluid, they should be medically evaluated.

It is important to consider all of this fluid loss through sweat when trying to match sweat loss with fluid intake. Fire fighters can easily lose 32 oz (1 L) of water in less than 20 minutes of strenuous fire-fighting activity. *(See Smith and Petruzzello, "Selected Physiological and Psychological Responses to Live-Fire Drills in Different Configurations of Firefighting Gear.")*

Dehydration has several detrimental effects on the body, including the following:

(1) Impairs the body's ability to maintain core temperature
(2) Decreases strength
(3) Shortens endurance time
(4) Decreases blood volume, which increases cardiovascular strain

A 15 percent reduction in plasma volume and a 40 percent reduction in stroke volume have been reported following less than 20 minutes of strenuous fire-fighting activity. *(See Smith et al., "Effects of Strenuous Live-Fire Firefighting Drills on Hematological, Blood Chemistry, and Psychological Measures"; and Smith, Petruzzello, and Manning, "The Effect of Strenuous Live-Fire Drills on Cardiovascular and Psychological Responses of Recruit Firefighters.")*

The gastric emptying capacity of an exhausted, warm, and dehydrated fire fighter is likely about 32 oz (1 L) per hour. Forcing large amounts of fluids in a period of as little as 20 minutes during rehabilitation could overwhelm the stomach's ability to handle such fluid and result in nausea and vomiting due to too great a volume of fluid being forced upon the upper GI system.

Overhydration (drinking too much, too fast) during operations can cause gastric discomfort or gastric distention, which can cause vomiting. During high-intensity, long-duration activity (longer than 1 hour), the following precautions are recommended:

(1) Ingest 30 g/hr to 60 g/hr of carbohydrate.
(2) Drink 8 oz (¼ L) of sports drink containing approximately 15 g of carbohydrate.
(3) Consume other readily available carbohydrate sources, such as fruit and meal replacement bars.

In rare instances, overhydration can lead to serious health problems. Drinking too much water can lead to a condition known as hyponatremia (sometimes called water intoxication). In this scenario, excessive water intake dilutes the blood to a dangerous level. This condition can be avoided by ingesting 1 sports drink for every 64 oz to 96 oz (2 L to 3 L) of water that is consumed.

Members who are fighting wildland fires should carry fluids and foods that can be easily transported and maintained (energy bars, fruit, sports drinks, and water bottles).

Table A.6.1.1 Heat Stress Index

Relative Humidity (percent)	Air Temperature (°F)										
	70	75	80	85	90	95	100	105	110	115	120
	Apparent Temperature (°F)										
0	64	69	73	78	83	87	91	95	99	103	107
10	65	70	75	80	85	90	95	100	105	111	116
20	66	72	77	82	87	93	99	105	112	120	130
30	67	73	78	84	90	96	104	113	123	135	148
40	68	74	79	86	93	101	110	123	137	151	
50	69	75	81	88	96	107	120	135	150		
60	70	76	82	90	100	114	132	149			
70	70	77	85	93	106	124	144				
80	71	78	86	97	113	136	157				
90	71	79	88	102	122	150	170				
100	72	80	91	108	133	166					

Apparent Temperature (°F)	Danger Category	Injury Threat
Below 80	None	Little or no danger under normal circumstances
80–90	Caution	Fatigue possible if exposure is prolonged and there is physical activity
91–105	Extreme Caution	Heat cramps and heat exhaustion possible if exposure is prolonged and there is physical activity
106–130	Danger	Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity
Above 130	Extreme Danger	Heat stroke imminent!

Note: Add 10°F when protective clothing is worn and add 10°F when in direct sunlight.
Source: U.S. Fire Administration, FA-114, *Emergency Incident Rehabilitation*, July 1992.

A.6.2.5 Many sports drinks now contain protein and this is something that should be considered to speed glucose uptake by the muscles, to speed muscle recovery, and to mitigate against disruption of the immune system.

A.6.2.5.1 Longer duration or heavy exertion events, time since last meal, and individual conditions should be factors considered when determining if calorie and electrolyte replacements are needed.

A.6.2.5.2 Packaged wipes are an example of a means that members can use to wash their faces and hands.

A.6.2.6 Medical monitoring is the process of monitoring members who are at risk of suffering adverse health or safety effects. Vital sign measurements must be interpreted in context of the overall appearance and health status of the member. The fire department physician or appropriate medical authority should establish medical protocols and procedures with parameters regarding the following:

(1) Immediate transport to an emergency medical facility
(2) Close monitoring and treatment in rehabilitation
(3) Release from rehabilitation

Currently, there are no studies that quantify vital sign measurements with the length of rehabilitation or with the need to direct members to a treatment area. Visual signs and symptoms remain the best method to evaluate members in the rehabilitation area. Vital sign measurements can be used as a baseline and may assist to identify other health or safety concerns.

The following information on vital signs may be of help to the fire department physician or appropriate medical authority in establishing the parameters, with the understanding that some vital signs (e.g., blood pressure) will not be immediately

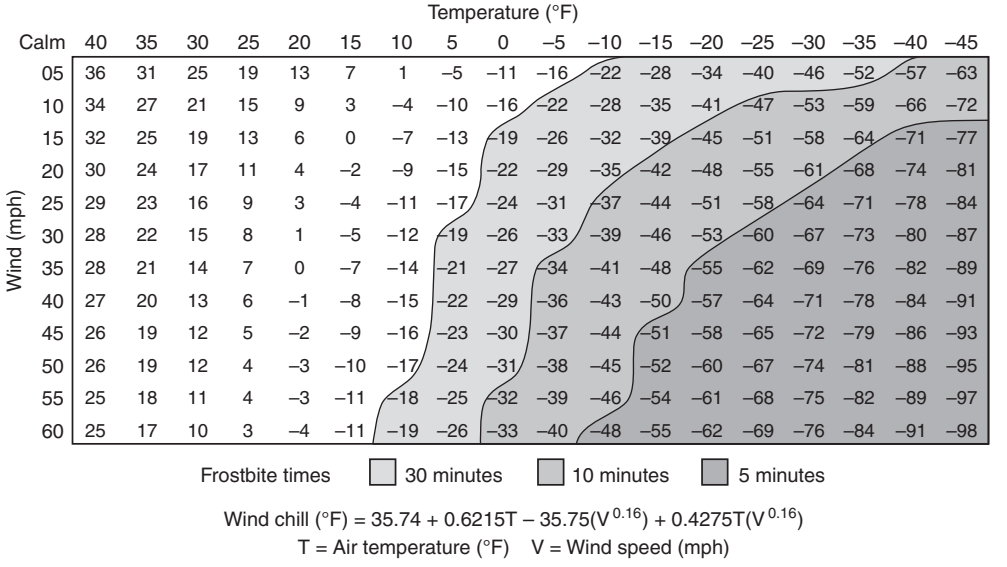

FIGURE A.6.1.1 National Weather Service Wind Chill–Temperature (WCT) Index. (Courtesy of National Weather Service.)

obtainable as the member enters rehabilitation but should be measured as soon as is practical.

Temperature. Body temperature is a vital piece of information to assessing individuals with both heat and cold stress exposures. Normal core body temperatures range from 98.6°F to 100.6°F (37°C to 38.1°C). The core body temperature (typically obtained using a rectal thermometer) provides the most accurate measurement, but is rarely feasible in the field setting. Alternate methods of obtaining body temperature include oral or tympanic (ear) methods. Oral measurements are about 1°F (0.55°C) lower than core body temperature and tympanic measurements may be up to 2°F (1.1°C) lower than core body temperature. It is important to be aware that these alternate methods are subject to error based on several circumstances (e.g., decreased oral temperature in individuals who are hyperventilating).

Elevated temperature, noted by touch or measured, should alert the rehabilitation manager or EMS personnel to the possibility of heat-related illness. However, given the problem of measuring devices underestimating core body temperature, it is essential that a measured temperature in the normal range not be used to exclude the possibility of heat-related problems.

Heart rate (pulse). Heart rate (pulse) is another critical measure used to assess health status. Normal resting heart rates range from 60 to 100 beats per minute. Under stress and exertion, the pulse rate can, and should, increase, frequently above 100 beats per minute. The level of increase depends on the amount of stress and the individual's physical conditioning. As members report to rehabilitation after expending a significant amount of energy in stressful conditions, a pulse rate that is up to 70 percent of maximum heart rate [(220 minus age) × (0.7)] is frequently encountered. After resting in rehabilitation, the member's heart rate should return to near normal resting rates. A fire fighter who has not achieved a heart rate of less than 100 beats per minute by the end of 20 minutes should not be released from rehabilitation, but should be further monitored, and if warranted, sent for further medical evaluation. Part of additional monitoring should include orthostatic pulse and blood pressure.

Respiratory rate. Respiratory rate is a vital indicator used to assess health status and stress, as well as a possible indicator of exposure to other hazards. Normal respiratory rate is 12 to 20 breaths per minute. By the end of the rehabilitation period, the fire fighter should have a respiratory rate within these parameters.

Blood pressure. Blood pressure is a critical indicator used to assess health status and stress. Blood pressures should increase as the level of physical exertion/stress increases. Blood pressures that are too low, too high, or fail to return to normal levels while in rehabilitation can indicate a medical problem. For example, individuals can become hypotensive as they decompensate in their reaction to stress (e.g., heat stroke). Upon recovery during the rehabilitation, a member's blood pressure should return to, or even be slightly lower than, their baseline. A member whose blood pressure is greater than 160 systolic and/or 100 diastolic should not be released from rehabilitation. These members should continue to be monitored and treated.

Pulse oximetry. Pulse oximetry uses a noninvasive medical device to measure the percentage of oxyhemoglobin in blood pulsating through the network of capillaries at the probe site on a subject by utilizing a sensor attached typically to a finger, toe, or ear. It is a helpful assessment tool prior to and during oxygen administration and can be used to detect blood flow in fingers and toes. Normal SpO_2 readings are between 95 and 100 percent. Readings of 91 to 94 percent reflect mild hypoxemia; 86 to 90 percent reflect moderate hypoxemia; and below 85 percent indicate severe hypoxemia. Oximetry has significant limitations and should not replace careful assessment. It can help to detect hypoxemia that is otherwise unnoticed. Black, blue, and green nail polish cause falsely low oximetry readings; when in doubt remove the nail polish or change the probe site. Bright external lighting or sunlight can falsely lower oximeter readings. Most oximeters are unable to differ-

entiate between oxyhemoglobin and carboxyhemoglobin (blood cells saturated with oxygen versus carbon monoxide).

A.6.2.6.1 A transport-capable EMS unit should be considered for rehabilitation areas at all incidents and fireground training.

A.6.2.6.2 Although BLS is the minimum level of care required in rehabilitation, the fire department should consider staffing rehabilitation with advanced life support (ALS) personnel.

A.6.2.6.4(1) These symptoms could be indicative of carbon monoxide intoxication and these members should undergo immediate medical assessment.

Carbon monoxide (CO) is a colorless, odorless gas present in every fire. Symptoms of CO poisoning are nonspecific and easy to miss. Any fire fighter exposed to CO or presenting with headache, nausea, shortness of breath, or gastrointestinal symptoms at an incident where CO is present should be assessed for carbon monoxide poisoning. Carbon monoxide readily attaches to hemoglobin in the bloodstream and is measured as a percentage of carboxyhemoglobin saturation (COHb). At an incident scene, carbon monoxide can be measured with a portable exhaled breath CO monitor or a CO-oximeter (a pulse oximeter designed to measure carboxyhemoglobin). Nonsmokers' COHb levels are normally 0–5%, smokers' are from 5–10%.

A.6.2.6.4(5) Members should know who they are, where they are, etc. Disoriented members may be suffering from carbon monoxide poisoning, heat stress, or cardiac insufficiency.

A.6.2.7 Accountability during member rehabilitation is maintained as it would be during any other incident operation. Each crew or company stays together when entering or exiting the rehabilitation area. Member accountability goes beyond simply tracking the location of people. Equally important to personnel tracking is the function of tracking the completion of an assignment. Members have the responsibility to alert their supervisor of the need for rehabilitation; in most cases, however, the responsibility and accountability for ensuring the safety and welfare of members lie with the supervisor of a company/crew. Thus, the company officer/crew leader will often be charged with making decisions regarding the initiation of rehabilitation and the completion of rehabilitation.

It is important to recognize that rehabilitation can occur in more than one form, each form representing unique accountability concerns. Rehabilitation involves establishing a functional area of operation (group).

Rehabilitation often takes place without the establishment of a formal functional area of operation (group). During routine incidents, such as a single-family dwelling fire or a small wildland fire, companies/crews will often conduct rehabilitation on their own. This can be a result of their own initiative or of an informal order to "take a break." Company/crew-level rehabilitation can occur during a cylinder change, the transition from active fire attack to overhaul, or other similar situations. Self-rehabilitation will also take place when command fails to recognize the need for rehabilitation. In any case, accountability during company/crew-level rehabilitation will most likely show the company/crew as still assigned to an active function. Companies/crews that are not able to continue performing their function will report their status to command.

When a formal assignment and area for rehabilitation is established, accountability is maintained as it would be with any other functional or geographic area of operation. The rehabilitation area should have a check-in/check-out point to manage accountability and become the communication link between command and the company/crew. Members who are not allowed to leave rehabilitation with their company/crew are appropriately moved within the IMS/accountability system to reflect their current assignments. The staff at a formally assigned rehabilitation area should have the option to use a log-in/log-out sheet if required by the management needs of the rehabilitation area.

A.6.3.1 These fluids should be available on apparatus where spare SCBA cylinders are located so that members can replace fluids while changing SCBA cylinders. If the duration of the incident is likely to exceed 1 hour, sports drinks should be considered.

A.6.3.2.1 The company officer or crew leader should ensure that all members in the company or crew seem fit to return to duty following any rehabilitation.

Company/crew-level rehabilitation or reporting to the rehabilitation area should occur based on the following work/rest cycles unless a supervisor adjusts the time frames based upon work or environmental conditions:

(1) There should be at least 10 minutes of self-rehabilitation after using one 30-minute SCBA cylinder, or performing 20 minutes of intense work without SCBA.
(2) There should be at least 20 minutes of rest (with hydration) in a rehabilitation area after using two 30-minute SCBA cylinders, using one 45-minute or greater SCBA cylinder, or performing 40 minutes of intense work without SCBA.

A.6.4.1 Figure A.6.4.1 shows a crew time-in/time-out report.

A.7.2 Fluid intake should be increased following the incident with the goal of completely replacing sweat loss.

Annex B Managing Heat and Cold Stress

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 Heat Stress. Figure B.1(a) from the Toronto Fire Services provides information on heat stress that can be distributed as recommended training for members.

Figure B.1(b) outlines recommended precautions developed by the Toronto Fire Services for four humidex ranges. Due to the variance of individual susceptibility, certain individuals may experience effects of heat stress earlier than expected. Supervisors should therefore begin to remind workers of heat stress prevention strategies as the humidex level approaches the 95°F to 102°F (35°C to 39°C) range.

An emergency service organization cannot choose to not respond to the public when its members are too hot. However, it can modify its own activities to ensure it does not place its personnel at extra risk. The key to adapting to the heat is to consistently use the rehabilitation process and active cooling as a prevention strategy. The information in Table B.1 and Figure B.1(b) can be used to assist a fire department to determine whether or not nonemergency activities should be rescheduled or cancelled.

B.2 Cold Stress. The information in this annex is useful in identifying the cause, signs and symptoms, treatment, and prevention of injuries related to subfreezing conditions.

REHAB SECTOR — COMPANY CHECK IN/OUT SHEET

Crews operating on the scene: _____

Unit No.	Member	Time In	Time Out		Unit No.	Member	Time In	Time Out

FIGURE A.6.4.1 Example of a Rehabilitation Sector Company Check-In/Check-Out Sheet.

HEAT STRESS

PURPOSE. This advisory provides guidance for job-specific, safe work procedures for the prevention of heat-related disorders.

RESPONSIBILITY. The supervisor in charge of the facility or workplace is responsible for implementing these heat stress prevention guidelines on a day-to-day basis. It is the responsibility of the individual fire fighters to follow guidelines outlined in the program. All fire fighters and officers should remain aware of the signs and symptoms of heat stress in order to prevent potential injuries or illnesses.

HEAT STRESS. Fire fighting is hot, strenuous work. We work in environments with extremely high temperatures, with little opportunity to cool our bodies through normal sweating. Our bunker gear makes it difficult to dissipate this heat buildup and can result in heat stress. Heat stress occurs when our body's internal core temperature rises above its normal level. It is a result of our internal, metabolic heat buildup (from working in our bunker gear) and external stress from environmental factors (temperature, humidity, etc.).

MANAGING HEAT STRESS. The management of heat stress requires an understanding of the contributing factors and how heat stress can affect a worker. Factors that affect heat stress are environment (climate), workload, and clothing worn. Combined, these factors will dictate the rate of heat gain and, ultimately, the amount of heat loss required to protect the worker. Aspects of the thermal environment that impact heat stress include air temperature, humidity, radiant heat (from the sun or other heat source), and air movement. A worker's metabolic rate is associated with the physical demands of the work performed; higher work demands increase the metabolic process and result in the internal generation of heat. Clothing material, construction, and usage affect the potential heat exchange between the body and the environment and therefore potentially contribute to the risk of heat stress. Other contributing factors that affect the way we manage heat stress are the fire fighter's physical fitness and body composition. Thus it is essential that the fire fighter stay in good physical condition.

CONTROLS. The key to managing heat stress is to be familiar with the controls used to prevent it and to minimize its effect. Controls for heat stress include the following:

(1) Fluid intake (hydration)

(2) Work rotation

(3) Active cooling

(4) Rest

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FIGURE B.1(a) Sample Advisory on Heat Stress. (Courtesy of Toronto Fire Services)

HEAT STRESS *(continued)*

Heat Stress Classifications, Signs, Symptoms, and Treatment

Type	Cause	Signs and Symptoms	Treatment	Prevention
Heat Rash	Hot, humid environment; plugged sweat glands.	Red, bumpy rash with severe itching.	Change into dry clothes and avoid hot environments. Rinse skin with cool water.	Wash regularly to keep skin clean and dry.
Sunburn	Too much exposure to the sun.	Red, painful, or blistering and peeling skin.	If the skin blisters, seek medical aid. Use skin lotions (avoid topical anesthetics) and work in the shade.	Work in the shade; cover skin with clothing; apply skin lotions with a sun protection factor of at least 15. Fair people at greater risk.
Heat Cramps	Heavy sweating drains a person's body of salt, which cannot be replaced just by drinking water.	Painful cramps in arms, legs, or stomach that occur suddenly at work or later at home. Heat cramps are serious because they can be a warning of other more dangerous heat-induced illnesses.	Move to a cool area; loosen clothing and drink cool salted water (1 tsp. salt per gallon of water) or commercial fluid replacement beverage. If the cramps are severe or don't go away, seek medical aid.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heat stroke.
Heat Exhaustion	Fluid loss and inadequate salt and water intake causes a person's body's cooling system to start to break down.	Heavy sweating; cool moist skin; elevated body temperature over 100.4°F (38°C); weak pulse; normal or low blood pressure; person is tired and weak or faint, has nausea and vomiting, is very thirsty, or is panting or breathing rapidly; vision can be blurred.	GET MEDICAL AID. This condition can lead to heat stroke, which can kill. Move the person to a cool shaded area; loosen or remove excess clothing; provide cool (salted) water to drink. Use active cooling (forearm immersion and misting fans) to lower core body temperature.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heat stroke.
Heat Stroke	If a person's body has used up all its water and salt reserves, it will stop sweating. This can cause body temperature to rise. Heat stroke can develop suddenly or can follow from heat exhaustion.	Body temperature over 105.8°F (41°C) and any one of the following: the person is weak, confused, upset, or acting strangely; has hot, dry, red skin; a fast pulse; headache or dizziness. In later stages, a person can pass out and have convulsions.	IMMEDIATELY TRANSPORT TO A MEDICAL FACILITY. If transport is delayed, immediately immerse body in cold water.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heat stroke.

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FIGURE B.1(a) *Continued*

HEAT STRESS *(continued)*

FLUID INTAKE. Drink water prior to thirst, at the emergency scene, and during training exercises. When exposed to high work rates and/or hot environments, fire fighters should drink water frequently (every 20 minutes). Alcohol and caffeine beverages should be avoided before and after activities that could lead to heat stress. Fluid loss has to be replaced to avoid impairment of bodily functions. Set up the water cooler early in an incident with plenty of cups and ensure personnel are drinking regularly. This is particularly important for personnel working inside a fire structure. It is important to note that the thirst mechanism is a delayed response. By the time you feel thirsty, you are underhydrated by approximately one liter. It is very difficult to make up this liter during vigorous exercise. This is why the fire fighter should prehydrate, hydrate, and rehydrate whenever possible while responding, attending, and when returning from an emergency call. The following chart indicates how your body reacts when it becomes dehydrated.

Percentage of Body Weight (Lost)	Signs and Symptoms
1%	Thirsty
3%	Heart rate elevates
4–5%	Lose up to 30% of work capacity

If the fire fighter is involved in intense physical activities for more than one hour, the supervisor should consider fluid replacements that contain a carbohydrate solution of 4 percent to 8 percent, and 6 oz to 8 oz (175 mL to 235 mL) should be consumed every 15 minutes during the activity. It is recommended that the drinks be cool and flavored, as the fire fighter will tend to consume more.

REST AND WORK ROTATION. Some environments are too hot to allow continuous exposure. Heat stress can be diminished and effective work performance can be maintained through rehabilitation during rest periods. This is often linked to SCBA air cylinder time (approximately 20 minutes). Rest periods will limit accumulation of metabolic heat and when combined with rehydration and active cooling will also allow the release of body heat and the lowering of core body temperature before the fire fighter returns to the task.

Crews can be assigned from other stations to avoid committing first responding crews to a long duration incident. Activate extra alarms if it is likely that you will need to rotate crews more frequently due to the heat. This allows for staging and crew rotation. It should be noted that studies have shown that during intense workloads, core temperatures continue to increase even when the work has discontinued. Fire fighters might feel that adequate cooling has taken place; however, their core temperature can continue to rise.

ACTIVE COOLING. Fire fighters should "dress down," removing their bunker coats, helmets, gloves, and so forth, and open their bunker pants to release trapped heat. The use of active cooling through forearm immersion, misting fans, and/or air conditioning can significantly lower core body temperature during normal rehabilitation periods between cylinder changes. Where active cooling is not provided, a smoke ejector placed where fire fighters can remove protective clothing, drink fluids, and rest will still increase evaporation of perspiration and enhance cooling and recovery. Note: When the air temperature is greater than 104°F (40°C), increasing air motion might actually increase heat stress; therefore, a smoke ejector fan will not be effective. If smoke ejector fans are used, fire fighters should use safety goggles or glasses to avoid debris from blowing into their eyes.

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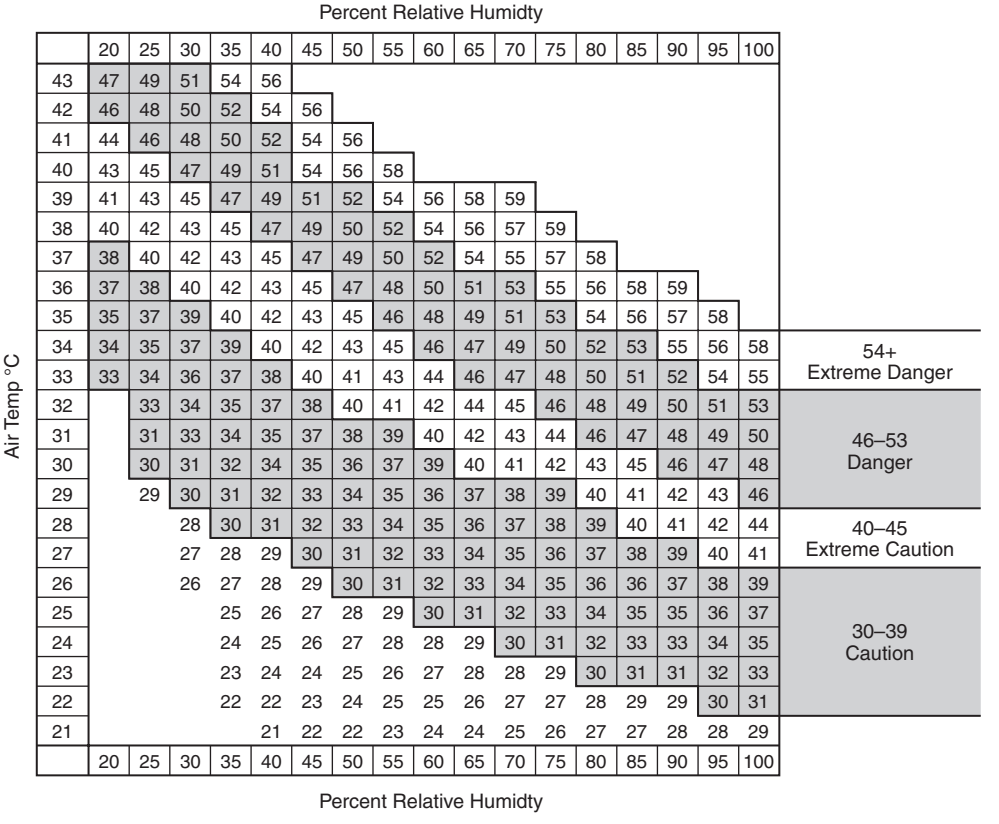
FIGURE B.1(a) *Continued*

HEAT STRESS *(continued)*

HUMIDEX Chart



USING THE HEAT/HUMIDEX INDEX. The danger posed by heat and humidity has led biometeorologists to develop various discomfort indices in order to define the danger and alert the public. These indices are, to some degree, subjective. The level of discomfort or danger will depend on a person's age, health, and physical condition, on the type and amount of clothing worn, and on activity level. In addition to temperature and humidity, weather conditions such as amount of sunshine and windspeed will also affect the "feel" of temperature and humidity.

The Canadian index, called HUMIDEX, combines the temperature and humidity into one number that is intended to reflect perceived temperature. Humidex levels can be heard or seen daily on radio or television and in newspapers. The chart above can be used to determine humidex levels based on identified air temperature in Celsius (°C) using a standard thermometer and percent relative humidity using a hygrometer.

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FIGURE B.1(a) *Continued*

Table B.1 Activity Table (Estimation of Physical Workloads)

Workload	Kcal/hr	Examples of Activities
Light	Up to 200	Sitting or standing to control machines (driving, pump operations), performing light hand or arm work (rope evolutions), intermittent walking
Medium	200–350	Walking with moderate lifting, carrying, pushing or pulling (hose evolutions), SCBA (donning and doffing), fire extinguisher evolutions, mopping floors, mowing lawn on level ground
Heavy	350–500	Intermittent heavy lifting with pushing or pulling, using an axe (live fire burns), SCBA (search and rescue evolutions), auto extrication, ground ladder raises, roof evolutions, special operations evolutions, forcible entry operations

B.2.1 Frostbite. Frostbite occurs when the skin actually freezes and loses water. In severe cases, amputation of the frostbitten area may be required. While frostbite usually occurs when the temperatures are 30°F (16°C) or lower, wind chill factors can allow frostbite to occur in above freezing temperatures. Frostbite typically affects the extremities, particularly the feet and hands.

B.2.1.1 *Signs and Symptoms.* Frostbite symptoms vary, are not always painful, but often include a sharp, prickling sensation. The first indication of frostbite is skin that looks waxy and feels numb. Once tissues become hard, the case is a severe medical emergency. The affected body part will be cold, tingling, stinging, or aching followed by numbness. Skin color turns red, then purple, then white, and is cold to the touch. There may be blisters in severe cases. Severe frostbite results in blistering that usually takes about 10 days to subside. Once damaged, tissues will always be more susceptible to frostbite in the future.

B.2.1.2 *Treatment.* Do not rub the area to warm it. Wrap the area in a soft cloth, move the member to a warm area, and contact medical personnel. Do not leave the member alone. If help is delayed, immerse the affected part in warm, not hot, water [maximum 105°F (40.6°C)]. Do not pour water on the affected part. If there is a chance that the affected part will get cold again do not warm. Warming and recooling will cause severe tissue damage.

B.2.2 Hypothermia. Hypothermia, which means "*low heat*," is a potentially serious health condition. This occurs when body heat is lost faster than it can be replaced. When the core body temperature drops below the normal 98.6°F (37°C) to around 95°F (35°C), the onset of symptoms normally begins.

B.2.2.1 *Signs and Symptoms.* The person may begin to shiver and stomp their feet in order to generate heat. Workers may lose coordination, have slurred speech, and fumble with items in the hand. The skin will likely be pale and cold. As the body temperature continues to fall these symptoms will worsen and shivering will stop. Workers may be unable to walk or stand. Once the body temperature falls to around 85°F (29.4°C) severe hypothermia will develop and the person may become unconscious. At 78°F (25.6°C), the person could die.

B.2.2.2 *Treatment.* Treatment depends on the severity of the hypothermia. For cases of mild hypothermia move the member to a warm area and have them stay active. Remove wet clothes and replace with dry clothes or blankets. Cover the head. To promote metabolism and assist in raising internal core temperature, have the member drink a warm (not hot) sugary drink. Avoid drinks with caffeine. For more severe cases do all the above, plus contact emergency medical personnel, cover all extremities completely, and place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest, and groin. Arms and legs should be warmed last. In cases of severe hypothermia treat the member very gently and do not apply external heat to rewarm. Hospital treatment is required.

If the member is in the water and unable to exit, secure collars, belts, hoods, and similar equipment in an attempt to maintain warmer water against the body. Move all extremities as close to the torso as possible to conserve body heat. As the member is removed from the water, administer the following treatment:

(1) Stop further cooling of the body and provide heat to begin rewarming
(2) Carefully remove casualty to shelter (Note that sudden movement or rough handling can upset heart rhythm.)
(3) Keep casualty awake
(4) Remove wet clothing and wrap casualty in warm covers
(5) Rewarm neck, chest, abdomen, and groin, but not extremities
(6) Apply direct body heat or use safe heating devices
(7) Give warm, sweet drinks, but only if casualty is conscious
(8) Monitor breathing and administer artificial respiration if necessary
(9) Call for medical help or transport casualty carefully to nearest medical facility

B.2.3 Immersion Foot. Immersion foot is caused by having feet immersed in cold water at temperatures above freezing for long periods of time. It is similar to frostbite but considered less severe.

B.2.3.1 *Signs and Symptoms.* Symptoms usually consist of tingling, itching, or burning sensation. Blisters may be present.

B.2.3.2 *Treatment.* Soak feet in warm water, then wrap with dry cloth bandages. Drink a warm, sugary drink.

B.2.3.3 *Prevention.* Plan for work in cold weather. Wearing appropriate clothing and being aware of how your body is reacting to the cold are important to preventing cold stress. Avoiding alcohol, certain medications, and smoking can also help to minimize the risk.