NFPA®

1584

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

2022

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2022 Edition

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

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ISBN: 978-145592807-1 (Print)

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NFPA® 1584

Standard on the

Rehabilitation Process for Members During Emergency Operations and Training Exercises

2022 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. It was issued by the Standards Council on March 18, 2021, with an effective date of April 8, 2021, and supersedes all previous editions.

This edition of NFPA 1584 was approved as an American National Standard on April 8, 2021.

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 was an integral component of both an occupational safety and health program and incident scene management.

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

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

Terminology was updated to be compatible with the National Incident Management System (NIMS). Annex material was 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 was placed on firefighters, maintaining proper nutrition, hydration, and a healthy lifestyle prior to emergency operations or training exercises.

For the 2015 edition, the committee updated the document to emphasize the importance and need for rehabilitation not just during emergency incidents and training exercises, but for post-rehabilitation hydration as well. This included differentiating sports drinks from energy drinks and how such drinks can affect or impede the rehabilitation process. Environmental effects on the rehabilitation process were also addressed.

The committee also included requirements so that members of the incident command system could have a greater responsibility in the effectiveness of the rehabilitation process. A focus was placed on individual members to know their limitations and to report them during rehabilitation.

Carbon monoxide monitoring was also included among the vital signs taken during rehabilitation.

The 2022 edition includes several significant changes. It includes new and expanded coverage of prehabilitation and rehabilitation at events. New chapters on preliminary exposure reduction and post-incident recovery are added, as well as a new reserved chapter on process implementation that will be developed in future editions. New and revised requirements address contamination control measures.

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Committee Scope: This Committee shall have primary responsibility for documents on occupational safety and incident command in the working environment of the fire service, not including hazardous materials or cross functional events. The committee shall also have responsibility for documents related to medical requirements for firefighters, and the professional qualifications for fire department safety officer. It shall coordinate its work with NFPA technical committees dealing with emergency responder safety and wellness.

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Standard on the

Rehabilitation Process for Members During Emergency Operations and Training Exercises

2022 Edition

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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. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex C.

Chapter 1 Administration

1.1 Scope. This standard establishes the minimum criteria for developing and implementing processes for member prehabilitation, contamination control, rehabilitation, and recovery from incident scene operations and training exercises.

1.2 Purpose. This standard describes the prerehabilitation, contamination control, rehabilitation, and post-incident recovery processes for members prior to, during, and after incident scene operations, training, and exercises.

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 1403, *Standard on Live Fire Training Evolutions,* 2018 edition.

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program,* 2021 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety,* 2020 edition.

NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Department Members,* 2022 edition.

NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting,* 2020 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,* 2018 edition.

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program,* 2021 edition.

NFPA 1521, *Standard for Fire Department Safety Officer Professional Qualifications,* 2020 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety,* 2020 edition.

NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting,* 2020 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. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Active Cooling. See 3.3.7.1.

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,** 2021]

N **3.3.5 Contaminants.** Harmful, irritating, or nuisance material foreign to the normal atmosphere. [**1500,** 2021]

N **3.3.6 Contamination.** The accumulation of products of combustion and other hazardous materials on or in an ensemble element that includes carcinogenic, toxic, corrosive, or allergy-causing chemicals, body fluids, infectious microorganisms, or [chemical, biological, radiological, and nuclear defense] CBRN terrorism agents. [**1851,** 2020]

3.3.7 Cooling.

3.3.7.1 ***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.

3.3.7.2 ***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.

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

3.3.9 Crew. A team of two or more fire fighters. [**1500,** 2021]

3.3.10 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,** 2020]

3.3.11 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.

3.3.12 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,** 2021]

3.3.13 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,** 2021]

3.3.14 Energy Drink. A type of beverage containing stimulant drugs (caffeine and other ingredients such as taurine, ginseng, and guarana) that is marketed as providing mental or physical stimulation.

N **3.3.15 Gross Decontamination.** A term used in the hazardous materials response industry to indicate the partial removal of exterior contamination from protective clothing, usually by rinsing with water, sometimes with detergent, to allow for the safe exit of the responder from the protective clothing in the contamination reduction zone of an emergency incident. [**1851,** 2020]

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

3.3.17 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,** 2018]

3.3.18* 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,** 2020]

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3.3.19* Member. A person involved in performing the duties and responsibilities of a fire department, under the auspices of the organization. [**1500,** 2021]

3.3.20 Passive Cooling. See 3.3.7.2.

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

3.3.22 Personnel Accountability System. A system that readily identifies both the location and function of all members operating at an incident scene. [**1500,** 2021]

N **3.3.23 Prehabilitation.** Physical and lifestyle preparation strategies to increase capability and capacity, reduce the potential for injury, and improve readiness in anticipation of an upcoming stressor.

N **3.3.24* Preliminary Exposure Reduction.** Techniques for reducing soiling and contamination levels on the exterior of protective clothing and equipment following incident operations. This is not the same as cleaning or decontamination.

3.3.25 Procedure. An organizational directive issued by the authority having jurisdiction or by the department that establishes a specific policy that must be followed. [**1561,** 2020]

3.3.26 Recovery. The process of returning a member's physiological and psychological states to levels that indicate the person is able to perform additional emergency tasks, be reassigned, or released without any adverse effects.

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

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

3.3.29 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.

3.3.30 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. [**1521,** 2020]

3.3.31* 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,** 2020]

3.3.32 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 Procedures/Guidelines.

4.1.1.1* The fire department shall develop standard operating procedures/guidelines (SOP/Gs) that outline a systematic approach for the prehabilitation, contamination control, rehabilitation, and recovery of members operating at incidents and training exercises.

Δ **4.1.1.2*** These SOP/Gs shall, at a minimum, address the following:

(1) Relief from climatic conditions
(2) Processes for contamination reduction prior to rehabilitation
(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 assessment
(7) Emergency medical services (EMS) treatment in accordance with local protocol
(8) Member accountability
(9) Member release disposition from rehabilitation (reassignment, EMS evaluation, or post-incident recovery)

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 EMS medical director in collaboration with the fire department physician and fire chief.

4.1.3 Procedures shall be in place to ensure that contamination control, rehabilitation, and recovery efforts commence whenever emergency operations or training activities pose the risk of members becoming exposed to contaminants and/or exceeding a safe level of physical or mental endurance.

N **4.1.4*** The fire department shall develop SOP/Gs that outline a systematic approach to post-incident recovery in order to return a member to where they can safely perform additional emergency tasks, be reassigned, or be released from duty.

N **4.1.4.1** These SOP/Gs shall include, but are not limited to, the following:

(1) On-scene contamination reduction
(2) Criteria for release to post-incident recovery
(3) Post-incident requirements to return to service
(4) Mental and physical rest periods
(5) Post-incident hydration and nutrition
(6) Sleep deprivation recognition and prevention
(7) Recognition and response to potentially traumatic events

4.2 Recognition of Heat/Cold Stress.

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

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4.2.2 Education shall be provided on wind chill and heat index considerations.

4.2.3 Education shall be provided on the importance of proper hydration, nutrition, and rest.

4.3 Member Prehabilitation.

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

N **4.3.2*** Members shall maintain a physical fitness regime in accordance with NFPA 1583 as a prehabilitation strategy for incident response demands.

N **4.3.3** Members assigned to incident response duties shall not engage in activities that may diminish their ability to safely perform the essential job tasks.

N **4.3.4** Members engaged in nonincident strenuous physical activities shall be allowed recovery time prior to returning to in-service status for incident response.

N **4.3.5** When a physically demanding event is scheduled (training/drill), members shall engage in pre-event warm-up activities to help prevent injuries.

N **4.3.6*** The department shall develop and implement SOP/G's to provide strategies to manage the effects of acute and chronic sleep and circadian rhythm disruption that lead to sleep deprivation, fatigue, and other adverse health effects.

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N Chapter 5 Preliminary Exposure Reduction

N 5.1 Implementation.

N 5.1.1* Preliminary exposure reduction activities shall be implemented whenever members are exposed to a contaminant during incident operations or training exercises that pose a potential safety or health risk to members.

N 5.1.1.1 Incident-related life safety, rescue, fire control, and patient care shall take priority over preliminary exposure reduction.

N 5.1.1.2 Preliminary exposure reduction activities shall be completed prior to rehabilitation or demobilization from the incident but shall not interfere with fireground priorities.

N 5.2 Hazard Control Zones.

N 5.2.1 Hazard control zones shall be established in accordance with NFPA 1500 whenever the potential for contamination exists.

N 5.2.2 The perimeters of the hazard control zones shall be designated and communicated by the incident commander and marked when possible.

N 5.2.3 The incident commander shall ensure that the protective clothing and equipment requirements of each control zone are commensurate with the hazards in the zone.

N 5.2.3.1 All officers and members shall ensure the use of personal protective equipment is appropriate for the risks encountered in each zone.

N 5.2.4 The process of utilizing hazard control zones shall continue until the incident hazards have been mitigated or the incident is over.

N 5.2.5* A no-entry zone is an area at an incident scene that no person(s) shall be permitted to enter due to imminent hazard(s), dangerous conditions, or the need to protect evidence.

N 5.2.6* The hot zone is the area presenting the greatest risk of contamination to members.

N 5.2.6.1 All members shall wear appropriate PPE for the risks that might be encountered while in the hot zone.

N 5.2.7* The warm zone shall serve as a limited access area where contamination reduction activities are implemented if the threat of cross-contamination persists.

N 5.2.7.1 Preliminary exposure reduction shall be conducted in the warm zone.

N 5.2.8* A cold zone shall be established outside the area where contamination is being mitigated.

N 5.3 Contamination Reduction.

N 5.3.1* When protective clothing or equipment has become soiled or contaminated, members shall carry out preliminary exposure reduction followed by advanced or specialized cleaning in accordance with NFPA 1851.

N 5.3.1.1* Dry or wet mitigation techniques shall be conducted prior to the removal of any ensemble or ensemble elements.

N 5.3.2* Members shall remain on supplied air or other appropriate respiratory protection during preliminary exposure reduction.

N 5.3.2.1 Members assisting with preliminary exposure reduction shall use appropriate protective clothing, including respiratory protection.

N 5.3.3 Incidents where known hazardous materials, industrial chemicals, or asbestos are involved shall require a decontamination or disposal process for the hazards encountered.

N 5.3.4 Preliminary exposure reduction of proximity firefighting ensembles and ensemble elements shall comply with the requirements in NFPA 1851.

N 5.3.5 Personnel shall doff contaminated protective clothing prior to entering the cold zone.

N 5.3.6* Following mitigation, potential contaminated and exposed items (PC&E) shall be isolated and bagged prior to entering the cold zone or being transported away from the scene.

N 5.4 On-Scene Personal Hygiene.

N 5.4.1* Immediately after doffing contaminated protective equipment, and prior to entering the cold zone, personnel shall wipe all exposed skin areas with soap and water or an appropriate skin wipe if soap and water are not available.

Chapter 6 Incident Scene and Training Rehabilitation

6.1 Criteria for Implementation. Rehabilitation shall be provided in accordance with fire department standard SOP/Gs, NFPA 1500, and NFPA 1561.

6.1.1 Rehabilitation shall commence whenever the physical or mental demands of an incident operation or training exercise poses a potential safety or health risk to members.

N 6.1.1.1* Rehabilitation at small-scale and routine incidents shall be crew-based, also known as self-rehab.

N 6.1.1.2* Rehabilitation shall be formalized into a rehabilitation group based on the incident size, scope, duration, or complexity.

6.1.2 Members shall be assigned to rehabilitation as prescribed by departmental SOP/Gs.

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

Δ 6.1.4* Members shall undergo rehabilitation following the use of a self-contained breathing apparatus (SCBA) cylinder, or after 40 minutes of intense work without SCBA.

6.1.4.1 A supervisor shall be permitted to adjust the requirements in 6.1.4 in order to address incident-related life safety, rescue, and patient care.

N 6.1.4.2* Crews shall be rotated as necessary to allow for rehabilitation.

N 6.1.4.3 For incidents, training, and exercises involving training fires, crew rotation shall be in accordance with NFPA 1403.

N 6.2 Responsibilities of the Incident Commander.

N 6.2.1 The incident commander (IC) shall ensure that a rehabilitation group is established when indicated.

N 6.2.2 The IC shall assume the rehabilitation responsibility if it is not delegated.

N 6.2.3 The IC shall consider the circumstances of each incident and make adequate provisions early in the incident for the rest and rehabilitation of all members operating at the scene.

N 6.3 Responsibilities of the Supervisor.

N 6.3.1 Supervisors shall maintain an awareness of the physical and mental conditions of each member operating within their span of control and ensure adequate steps are taken to provide for each member's safety and health.

N 6.3.2* Supervisors shall ensure that members remain hydrated and that potable fluids are available.

N 6.3.3 Supervisors shall continuously assess their crew members to determine their need for rehabilitation.

N 6.3.4 Company officers shall assess incident demobilization and post-incident recovery processes and ensure their members are ready to return to service.

N 6.4 Responsibilities of the Rehabilitation Manager.

N 6.4.1 When formal rehabilitation is established, the rehabilitation manager shall be responsible for all rehabilitation activities.

N 6.4.2 The rehabilitation manager shall designate responder rehabilitation location(s) and have the location(s) communicated to incident personnel.

N 6.4.2.1 The rehabilitation manager shall ensure that the location(s) include a gateway and process for contamination reduction prior to rehab entry.

N 6.4.3* The IC or rehabilitation manager shall identify those resources that might be needed at the rehabilitation location.

N 6.4.4 The rehabilitation manager shall request necessary medical personnel to evaluate symptomatic members being rehabilitated.

N 6.4.4.1 EMS personnel shall be alerted for members with any of the following:

(1)* 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, balance, coordination, speech, or behavior
(5) Alertness and orientation to person, place, and time of members

N 6.4.4.2 Minimum list of symptoms and shall not replace good judgment, experience, and training.

N 6.4.5 The rehabilitation manager shall request necessary resources for rehabilitation of personnel.

N 6.4.6 The rehabilitation manager shall release personnel for reassignment or for demobilization and post-incident recovery following rest and recovery.

N 6.4.7 The rehabilitation manager shall release those individuals needing additional medical care to EMS.

N 6.4.8 The rehabilitation manager shall maintain the accountability of all personnel in the rehabilitation location.

N 6.4.9 The rehabilitation manager shall maintain appropriate records and documentation.

N 6.5 Responsibilities of the Member.

N 6.5.1 Members shall participate in rehabilitation activities when assigned.

N 6.5.2 Members shall maintain their hydration.

N 6.5.3 Members shall advise their company officers when they believe their level of fatigue or exposure to heat or cold is approaching a level that could negatively affect them, their crew, or the operation in which they are involved.

N 6.5.4 Members shall remain aware of the health and safety of other members of their crew.

N 6.6 Formal Rehabilitation Location Characteristics.

N 6.6.1* Formal rehabilitation shall be located in the cold (clean) zone.

N 6.6.1.1 The location shall include a gateway and a process for contamination reduction prior to PPE doffing.

N 6.6.2 The location shall provide protection from the prevailing environmental conditions.

N 6.6.2.1 For hot environments, the location shall include shade and/or air-conditioning and a place to sit.

N 6.6.2.2 For cold or wet environments, the location shall provide dry, protected areas out of the wind, heated areas, and a place to sit.

N 6.6.3 The location shall be free of exhaust fumes from apparatus, vehicles, or equipment.

N 6.6.4 The location shall be large enough to accommodate multiple crews and rehabilitation personnel, based on the size of the incident.

N 6.6.5 The location shall allow access for EMS to transport members to a medical treatment facility when necessary.

N 6.6.6 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.

N 6.6.7* Each rehabilitation area shall be given a geographic name consistent with its location at the incident site.

6.7 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 6.8.4)*
(6) Medical treatment when indicated
(7) Member accountability
(8) Member release disposition from rehab (reassignment, EMS evaluation, or post-incident recovery)

6.7.1 Rest and Recovery Criteria.

6.7.1.1* Members shall rest for a minimum of 20 minutes following the use of an SCBA cylinder or after 40 minutes of intense work without SCBA.

6.7.1.2 The member shall not return to operations in the following situations:

(1) If the member does not feel adequately recovered
(2) If EMS or supervisory staff present see evidence of medical, psychological, or emotional distress
(3) If the member appears otherwise unable to safely perform his or her duties

6.8 Cooling and Warming.

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

6.8.2 Members with cold-related stress shall be moved to a warm environment, remove any wet or damp clothing, and add additional warming layers, blankets, or use other methods to regain normal body temperature.

6.8.3* Members entering rehabilitation shall consume fluids, regardless of thirst, during rehabilitation and be encouraged to continue hydrating after the incident.

6.8.3.1* Members shall avoid overhydration, which can lead to hyponatremia.

6.8.4* Departments shall ensure that appropriate calorie and electrolyte replacements are available.

Δ **6.9* Emergency Medical Care.**

6.9.1* During incident scene operations, transport-capable basic life support (BLS) EMS shall be on-site as part of the incident scene rehabilitation for the evaluation and treatment of symptomatic members.

6.9.2 During training exercises, basic life support (BLS) personnel and equipment shall be on-site.

N **6.9.2.1** For live fire training in acquired structures, emergency medical services with transport capabilities shall be available in accordance with NFPA 1403.

N **6.9.2.2** For all other training activities, the instructor-in-charge shall evaluate the need for on-site transport capabilities based on a risk assessment of the training activity.

6.9.3 EMS personnel shall evaluate members with symptoms suggestive of a health and/or safety concern.

6.9.4 Members with abnormal signs or symptoms shall be removed from active duty until cleared by the appropriate medical personnel.

N **6.9.4.1** Symptomatic members shall be treated and transported in accordance with local EMS protocol.

6.9.4.2* Symptomatic members exposed to fire smoke shall be assessed for carbon monoxide poisoning.

Δ **6.9.5** 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

6.10 Rehabilitation Disposition.

6.10.1 The rehab manager or their designee shall determine when a member or company can be as follows:

(1) Cleared for further incident assignment or demobilization
(2) Maintained in rehabilitation for further rest and recovery
(3) Transported for more definitive medical evaluation/treatment

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

N **6.11 Documentation.**

N **6.11.1*** A rehabilitation documentation report shall be created and include the following information:

(1) Unit number
(2) Member name
(3) Time-in/time-out for members/crews entering or leaving the rehabilitation area
(4) If the member is referred for medical evaluation
(5) Rehab disposition

N **6.11.2** When emergency medical care is provided, the incident commander and the health and safety officer shall be notified.

N **6.12 Wildland Incidents. (Reserved)**

N **6.13 USAR Incidents. (Reserved)**

N **6.14 Special Operations Incidents. (Reserved)**

N Chapter 7 Post-Incident Recovery

N **7.1 Demobilization.** Personnel and crews released from the incident shall follow a demobilization process that includes the following:

(1) Communication of post-incident status
(2) Time for post-incident personal hygiene
(3) A plan for station, apparatus, protective clothing, and equipment decontamination
(4) Identification of potentially traumatic events
(5) Completion of exposure reporting

N **7.2 Post-Incident Status.**

N **7.2.1** Crews released from an incident scene for post-incident recovery shall be deemed one of the following:

(1) In service
(2) Limited availability
(3) Out of service

N **7.2.2*** Post-incident recovery shall include, as needed, the following:

(1) Personal hygiene
(2) Rest
(3) Hydration
(4) Nourishment
(5) Securing clean personal protective clothing
(6) Changing into clean clothing

(7) Addressing behavioral health needs, as appropriate
(8) Returning the apparatus to service

N **7.2.3** Company officers shall determine when post-incident recovery has been completed prior to returning the company to service.

N **7.3* Post-Incident Personal Hygiene.**

N **7.3.1** Members exposed to fireground contamination shall take a warm (not hot) shower using a mild soap as soon as possible upon return to quarters.

N **7.3.2** Members shall dress in clean clothing after a shower.

N **7.3.3** Soiled or contaminated clothing shall be handled with nitrile examination gloves before laundering.

N **7.3.3.1*** Cleaning of clothing worn during incidents where members were exposed to contaminants shall be laundered separately from non-exposed clothing.

N **7.4 Station, Apparatus, Protective Clothing, and Equipment Decontamination.**

N **7.4.1** Personal protective equipment exposed to fireground contamination shall be decontaminated in accordance with NFPA standards and manufacturer recommendations.

N **7.4.2** Soiled or contaminated equipment shall be stored and cleaned or disinfected away from living, sleeping, or eating areas.

N **7.4.3*** Cleaning and decontamination of apparatus and equipment shall be done wearing nitrile examination gloves.

N **7.5 Potentially Traumatic Events.**

N **7.5.1** Supervisors and members shall monitor members for signs of post-incident stress.

N **7.5.1.1** Following occupational exposure to potentially traumatic events or signs of post-incident stress, assistance or intervention shall be offered in accordance with department policies and Chapter 13 of NFPA 1500.

N **7.5.2** 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.

N **7.5.2.1** Behavioral health services shall be made available to all members of the department.

N **7.6 Exposure Reporting.** Following a possible exposure to toxic substances or harmful biological, chemical, or physical agents, the appropriate exposure report(s) shall be completed.

N **7.6.1** Members that experience symptoms associated with occupational exposure to toxic substances or harmful biological, chemical, or physical agents shall request medical evaluation and report the exposure to their supervisor for appropriate exposure report documentation.

N **7.6.2*** An incident exposure report shall be utilized to document the possible exposure to toxic substances or harmful biological, chemical, or physical agents during an incident or response.

N **7.6.2.1** The incident exposure report shall be completed as part of an electronic incident reporting system where responding members are linked with the incident response record.

N **7.6.3** A personal exposure report shall be utilized by the member to document an exposure or an injury related to exposure to toxic substances or harmful biological, chemical, or physical agents.

N **7.6.3.1*** A personal exposure report shall be completed by the member following an exposure to toxic substances or harmful biological, chemical, or physical agents during a training exercise or an incident or response.

N **7.6.3.2** Following a training event or other nonincident-related exposure where toxic substances or harmful biological, chemical, or physical agents are present, a personal exposure report shall be completed by the member.

N **7.7 Exposure Report Retention and Access.**

N **7.7.1*** Exposure reports shall be retained by the fire department for 30 years.

N **7.7.2** The fire department shall provide member access to their exposure records.

N Chapter 8 Process Implementation (Reserved)

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 such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

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.

Δ **A.3.3.8 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. Accurate measurement of core body temperature is not possible on the fireground. 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.3.3.16 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.

Δ **A.3.3.18 Incident Management System (IMS).** The system is also referred to as an incident command system (ICS).

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A.3.3.19 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 can engage in emergency and non-emergency operations. [**1500,** 2021]

N **A.3.3.24 Preliminary Exposure Reduction.** This term describes the exposure reduction process that is utilized for regular exposure in day-to-day operations and training. This is not designed for the increased exposure at a hazardous materials incident.

Δ **A.3.3.27 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, and member accountability and medical treatment, if indicated.

A.3.3.31 Standard Operating Procedure. The intent of standard operating procedures is to establish directives that must be followed. Standard operating guidelines allow flexibility in application. [**1521,** 2020]

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.

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N **A.4.1.4** Recovery from the physical demands of an emergency incident or training activity is more effective when a member or company can return to quarters and reset themselves prior to being made available for another incident or activity. In addition to returning equipment to service, the members should take time for a shower (after exposure to contaminants), get additional rest (mental and physical), and make sure they have hydrated and nourished themselves. In the case of volunteer or recalled members, the post-incident recovery process provides time to observe members for lingering incident physical and mental stressors prior to being released from duty to their homes.

Δ **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 supplements
(7) Ephedrine
(8) Beverages exceeding 400 milligrams of caffeine per day
(9) Energy drinks

Energy drinks, not to be confused with sports drinks, contain ingredients that can significantly raise heart rate and blood pressure and increase the cardiac risk to firefighters, especially when operating at high intensities. Due to the risk of sudden cardiac death, some countries have banned the sale of energy drinks.

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N **A.4.3.2** Physical conditioning is known to enable individuals to operate at a higher core temperature, decrease cardiovascular strain associated with strenuous activity, and improve physical performance. Maintaining good physical conditioning can 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.

STANDARD OPERATING PROCEDURE/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 firefighter 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 firefighter 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

Δ FIGURE A.4.1.1.2 Sample Rehabilitation Standard Operating Procedure/Guideline.

STANDARD OPERATING PROCEDURE/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

Δ **FIGURE A.4.1.1.2** *Continued*

STANDARD OPERATING PROCEDURE/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 or 45-minute SCBA cylinders or one 60-minute SCBA cylinder. Shorter times might be considered during extreme environmental conditions.

(4) Passive cooling shall be employed to reduce firefighter heat stress. This could include moving to a shaded or air-conditioned area, removal of PPE, ingestion of cool fluids, and rest.

(5) Active cooling shall be employed to reduce firefighter heat stress when passive cooling is ineffective or when a member is experiencing heat-related illness. This could include forearm immersion, misting fans, and cold towels.

(6) 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.

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

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

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

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

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

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

(13) 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.

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

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

Δ **FIGURE A.4.1.1.2** *Continued*

N **A.4.3.6** Research indicates that firefighters are at high risk of sleep deprivation, fatigue, and sleep disorders. Firefighters who grapple with their internal body clock or circadian rhythm due to shift work or other long work hours and who are sleep deprived often struggle with memory, focus impairment, irritability, depression, and relationship/social problems. In turn, these can lead to an increased risk of accidents and injuries. These studies also note that firefighters also face potential health problems, including a higher risk of ulcers, insulin resistance, metabolic syndrome, heart disease, and cancer. Strategies to consider to combat acute and chronic sleep and circadian rhythm disorders include the following:

(1) Strategic caffeine use
(2) Taking naps
(3) Proper sleep hygiene
(4) Identification and treatment of sleep disorders

N **A.5.1.1** Preliminary exposure reduction is an essential first step toward minimizing cross-contamination prior to cleaning protective clothing and equipment. Preliminary exposure reduction is an attempt to remove some exterior soiling and contamination from protective clothing and equipment by the end user to minimize the transfer of soil and contaminants away from the incident scene. Whenever possible, preliminary exposure reduction should be conducted as personnel exit the hot zone and before beginning rehabilitation.

While it is possible to conduct dry mitigation without the elements being taken out of service, wet mitigation might require protective elements to be taken out of service. While the selected procedures for preliminary exposure reduction might not result in the elements being taken out of service, a determination by the organization can be made that the elements be isolated and bagged if they are determined to be contaminated and warrant more extensive cleaning.

Some organizations might consider having spare gear available for members or, alternatively, other spare clothing, such as disposable clothing to be worn until the member can shower and change into clean clothing.

Preliminary exposure reduction after the termination of an incident can remove substantial amounts of surface contaminants before they have a chance to set in and can help limit the transfer of contaminants to apparatus, personal vehicles, and stations. Many of the contaminants that can cause damage to visibility markings and other materials and components of ensembles or ensemble elements also can be removed if preliminary exposure reduction is done as soon as possible after exposure to those contaminants.

It is recognized that it is not always practical for organizations to carry out preliminary exposure reduction on scene because of constraints with personnel, on-scene resources, the availability of spare gear, weather, and other operational factors. Nevertheless, it is important that organizations implement some form of preliminary exposure reduction procedures as soon as practically possible, particularly following any event where ensembles or ensemble elements are contaminated.

Use of a portable decontamination shower unit that conforms to the requirements in ANSI/ISEA 113, *American National Standard for Fixed and Portable Decontamination Shower Units*, offers one means for providing wet mitigation as part of preliminary exposure reduction.

N **A.5.2.5** In the event that personnel are exposed to a no-entry zone, appropriate contamination reduction strategies for the hazards encountered should be utilized.

N **A.5.2.6** The hot zone includes, but is not limited to, the area of the smoke plume.

N **A.5.2.7** The warm zone is the portion of the emergency scene where the contaminants might have been transported by the firefighters as they left the hot zone with contamination. The need to wear PPE continues and, in many respects, the warm zone is an equal risk to the responders as the hot zone. Until the contaminants have been removed from the PPE or the contaminated PPE has been removed from the firefighters, the precautions used in the hot zone should continue to be used.

Most incident activities outside of the hot zone take place in the warm zone. Apparatus will often be located in the warm zone, as well.

N **A.5.2.8** The cold zone represents the area where there are minimal risks for human injury or exposure. Contamination exposure has been mitigated in this area and no further control measures are necessary to protect against that contamination. The cold zone might also be known as the clean zone. Cold zone activities include member rehabilitation, incident debriefing, media interactions, and patient treatment in a public exclusion area.

N **A.5.3.1** Preliminary exposure reduction is not considered by itself to be cleaning or decontamination of protective clothing and equipment. Rather, it is intended to provide a means for helping to reduce the exposure of firefighters to soils and contaminants that arise from exposures occurring during structural or proximity fires or other emergency response events.

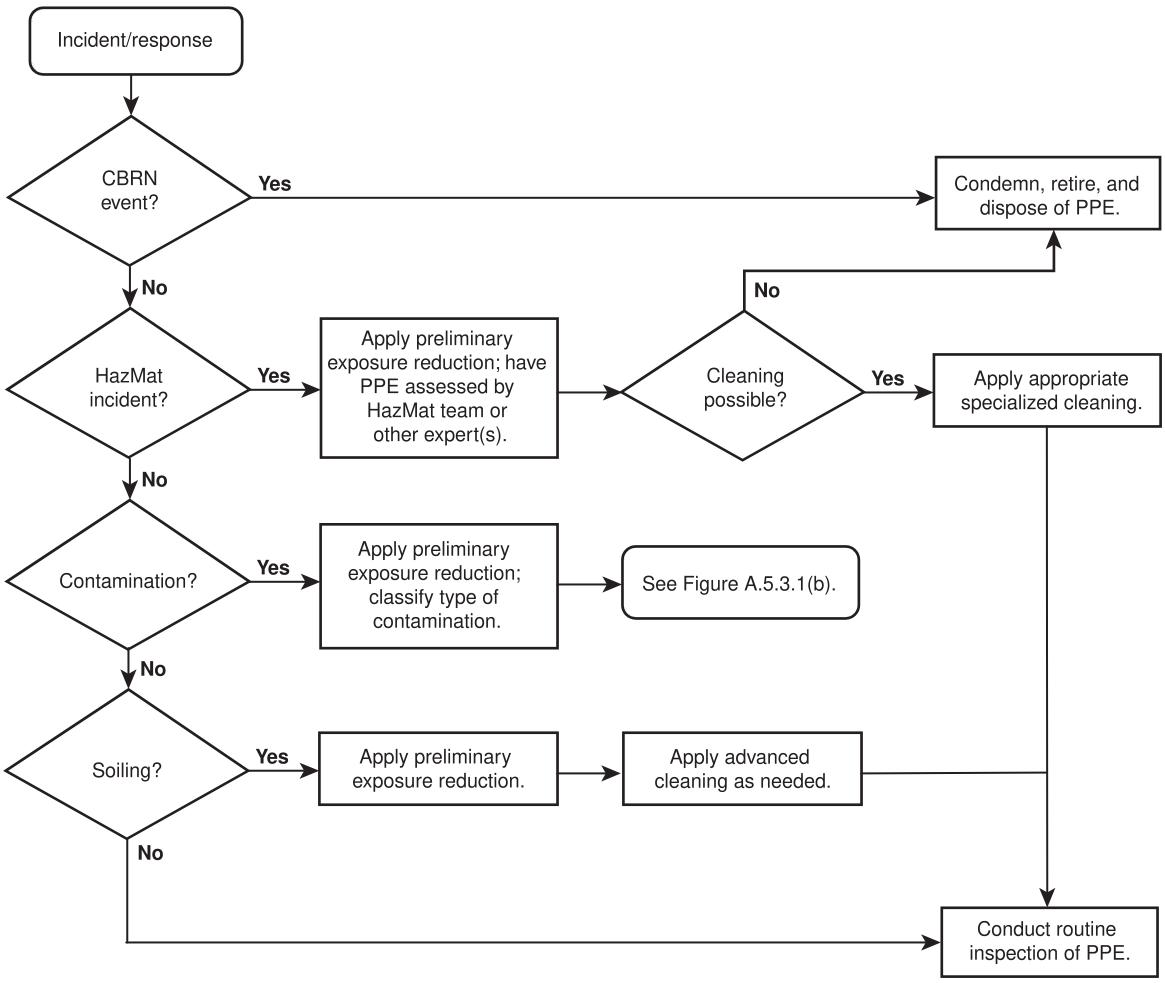
Preliminary exposure reduction is also required to aid in minimizing the transfer of soils and contaminants from the emergency scene to the apparatus, station, and personal vehicles. Other forms of cleaning, such as advanced or specialized cleaning, are required to provide full cleaning of the ensemble or ensemble elements.

The decision to apply preliminary exposure reduction should be based on the following considerations for suspected contamination:

(1) Is there visible soot on any of the ensemble elements?
(2) Is there an obvious odor on any of the ensemble elements?
(3) Did personnel operate in conditions that required the use of an self-contained breathing apparatus (SCBA)?
(4) Did personnel operate in the presence of burning chemicals, plastics, synthetics, or metals?

In addition to the above, preliminary exposure reduction and/or advanced or specialized cleaning should always be applied if decided by the incident commander or safety officer or when requested by a member.

Where ensembles and ensemble elements have been suspected or found to have contamination from bulk chemicals, asbestos, or other designated hazardous substances, body fluids, other forms of microbial contamination, or products of combustion products from a structural or other fire, the organization should apply the steps shown in Figure A.5.3.1(a) and Figure A.5.3.1(b).



Note: Contaminants shown in relative hierarchy of exposure risk. Multiple forms of contamination might apply. Clean according to highest risk.

N **FIGURE A.5.3.1(a) Approach for Deciding Handling, Cleaning, and Disposition of Ensemble Elements. [1851:Figure 7.1.1.2(a)]**

N **A.5.3.1.1** The decision between dry and wet mitigation will depend on the resources available to the organization and the conditions at the emergency scene or other location. Work by the Illinois Fire Service Institute under an Assistance to Firefighters Grant from the U.S. Department of Homeland Security has shown that wet mitigation techniques are more effective at removing surface contamination as compared to dry mitigation techniques.

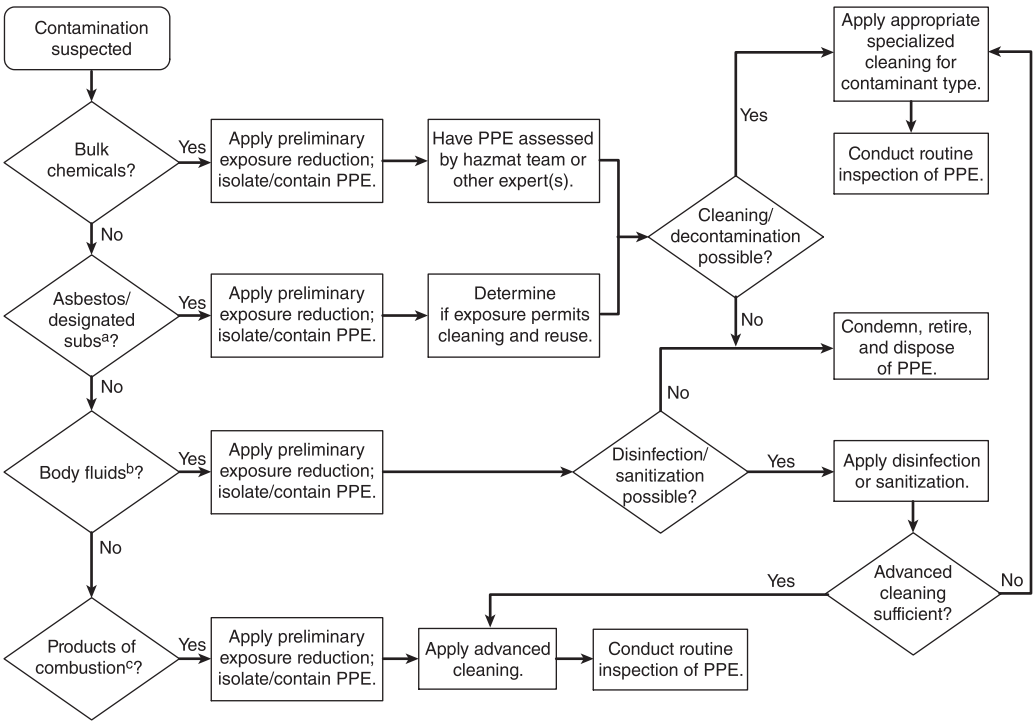
Wet mitigation techniques remove a significant amount of products of combustion, whereas dry mitigation techniques only remove a portion of this contamination. Techniques involving blowing air onto ensembles or ensemble elements such as a leaf blower have very low effectiveness and might only redistribute contamination at the emergency scene and create inhalation hazards for unprotected personnel, and thus should be avoided. See Fent, Kenneth W., et al., "Contamination of firefighter personal protective equipment and skin and the effectiveness of decontamination procedures."

The dry mitigation technique should be performed by brushing debris from the exterior of ensembles and ensemble elements with a soft bristle brush prior to removal.

Dry mitigation techniques are best achieved with a soft bristle brush starting at the top of the end user's ensemble and working downward.

The wet mitigation technique should be performed by gently rinsing the exterior of ensembles and ensemble elements using low-pressure and low-volume flow water. A mild detergent can be used to aid in the wet mitigation technique, followed by gentle rinsing. Heavy scrubbing or spraying with high-velocity water jets, such as a power washer, should not be used.

There are several means by which wet mitigation techniques can be carried out. One method is to use a reducer from the apparatus pump panel to supply a small hose line, such as a forestry hose or a garden hose with an adjustable nozzle, at low pressure and low volume. Caution should be used when using ordinary fire hoses and nozzles for this technique where the



Notes:
[a]And other designated substances
[b]Includes other microbial contamination
[c]Includes any significant structural fire exposure

N **FIGURE A.5.3.1(b) Approach for Addressing Specific Types of Contamination. [1851:Figure 7.1.1.2(b)]**

lowest possible flow rate is used. Most departments have a booster line or trash line that is usually ¾ in. or 1 in. in diameter that can be applied at a low pressure (less than 30 psi). Portable decontamination showers that conform to ANSI/ISEA 113, *American National Standard for Fixed and Portable Decontamination Shower Units*, can also be used and can assist where weather, modesty, or other issues can arise.

The process of wet mitigation should start at the top of the user's ensemble and rinse downward. Where necessary, a soft bristle brush can be used to gently scrub the ensemble or ensemble elements during the wet mitigation technique. The important aspects for this technique are that the spray be light, not soak through the clothing, and be able to be applied over the entire firefighter, as the purpose of this mitigation technique is to primarily remove surface contamination. Wet mitigation techniques cannot remove interior layer soiling or contamination.

It is further recommended that a mild detergent be used as an aid in wet mitigation where the surfactant in the detergent is helpful for removing exterior soils. Where a mild detergent is used, it should be followed by gentle rinsing of the ensemble or ensemble elements.

Organizations performing wet mitigation should apply procedures that take into consideration the runoff of any contaminated rinse water to minimize the spread of contamination to the environment.

If used in combination, dry mitigation should precede wet mitigation.

Gross decontamination should require personnel being decontaminated to remain in full PPE with face piece donned and breathing on air. Personnel performing decontamination should be in appropriate PPE to support personnel in the operational area. Such PPE can include nitrile gloves, eye protection, and fit-tested P100 mask at a minimum for particulate inhalation protection.

During preliminary exposure reduction, the use of a brush or any other abrasive cleaning devices on radiant reflective outer shells and other components of proximity firefighting protective ensembles and ensemble elements should not be permitted.

N **A.5.3.2** The purpose of remaining on air is to minimize the end user's exposure to products of combustion from the ensemble or ensemble elements following contaminant exposure during a structural fire and to avoid breathing in any particulates that can be dislodged from the ensemble or ensemble elements during dry mitigation.

N **A.5.3.6** Ensembles or ensemble elements, even when bagged, should not be transported in the passenger areas of apparatus or personal vehicles. There is a risk of contamination to the inside of the vehicle due to the possible presence of contaminants on the outside of the container.

The removal of ensembles or ensemble elements at the scene might require additional clothing to be present, particu-

larly under inclement or cold weather conditions. Portable facilities might be required for end users to change. Portable decontamination showers conforming to ANSI/ISEA 113, *American National Standard for Fixed and Portable Decontamination Shower Units*, can be set up at the scene in a relatively short period of time and require limited resources for protection from weather and modesty for firefighters. In addition, it is recommended that personnel use soap and water or disposable wet wipes if soap and water are not available to clean portions of their face and skin when it has been directly exposed to contaminants, change into a clean station/work uniform, and take a shower as soon as possible.

For isolation of ensembles and ensemble elements, airtight protective containers or bags should be used to minimize cross-contamination. Examples include disposable, heavy-duty polyethylene bags, or sealable plastic cases, which are cleanable. If a plastic bag is used, it is recommended that the bag be clear to ensure that the contents of the bag can be readily identified.

If the protective ensemble or ensemble elements are wet, the protective ensemble or ensemble elements must be removed as soon as possible following transport from the fire or other emergency scene since ensembles and ensemble elements that remain wet under closed conditions can result in the growth of damaging mold and mildew. It is further important that, following their transport, protective ensembles and ensemble elements be stored under conditions where they can dry until appropriate cleaning procedures can be conducted as specified in Chapter 7 of NFPA 1851.

The manufacturer's guidelines for the proper cleaning of face shields, flip-downs or goggles should be followed. Most manufacturers list specific products that will clean these components without causing damage. For example, repeatedly using ammonia-based window cleaner will eventually cause fogging that will decrease visibility.

N **A.5.4.1** Personal hygiene tasks should occur as soon as possible after the operating member exits the hot zone. After the fire, members who operated in the hot zone should immediately remove soot from their hands, head, and neck using soap and water or skin cleansing wipes, if available. Washing should occur during air cylinder changes and in rehabilitation areas between operational periods whenever possible. Personal hygiene steps should be employed prior to entering the rehabilitation area and the consumption of fluids and/or food. Drinking and eating is permissible outside the area where smoke and contamination can occur after operating personnel have conducted a preliminary exposure reduction of contaminated gear and performed personal hygiene steps.

N **A.6.1.1.1** Crew based (self-rehab) may occur in either the warm zone or cold (clean) zone. Preliminary exposure reduction and on-scene personal hygiene should occur before crew based (self-rehab).

A.6.1.1.2 Rehabilitation operations should consider the scope of the incident, including the following:

(1) *Time.* Extended use of turnout gear and 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.

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

(1) Temperature *(see Table A.6.1.1.2)*
(2) Relative humidity *(see Table A.6.1.1.2)*
(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.6.1.1.2)*. The reason for the change was to improve the previous index used by the NWS and the Meteorological Service 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 to 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 SCBA cylinder or a 20-minute work cycle.

N **A.6.1.4.2** 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.

N **A.6.3.2** 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.

N **A.6.4.3** Rehabilitation resources could include, but are not limited to, the following:

(1) Portable shelters
(2) Fans/blowers
(3) Blankets
(4) Portable heaters
(5) Dry clothing
(6) Lighting

Δ Table A.6.1.1.2 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 and heatstroke possible if exposure is prolonged and there is physical activity
Above 130	Extreme Danger	Heatstroke imminent!

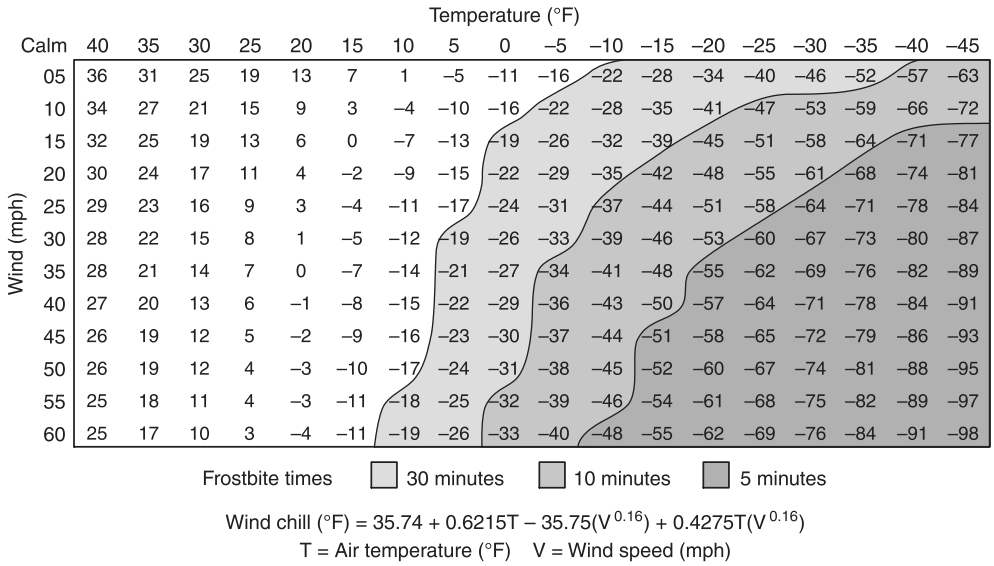
Note: Add 10°F when protective clothing is worn and add 10°F when in direct sunlight.
Source: U.S. Fire Administration, FA-114, *Emergency Incident Rehabilitation.*

(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

***N* A.6.4.4.1(1)** These symptoms could be indicative of serious medical issues including, but not limited to, cardiac events and carbon monoxide poisoning. 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 firefighter 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 designed to measure carboxyhemoglobin or a CO-oximeter (a pulse oximeter designed to measure carboxyhemoglobin). Nonsmokers' COHb levels are normally 0 percent to 5 percent and smokers' are normally 5 percent to 10 percent.



Δ FIGURE A.6.1.1.2 National Weather Service Wind Chill Temperature (WCT) Index. (Courtesy of National Weather Service.)

***N* A.6.6.1** 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 that can respond by request or be dispatched during certain weather conditions
(9) Specially designed rehabilitation apparatus

***N* A.6.6.7** Examples of geographic names are north rehabilitation, south rehabilitation, first floor rehabilitation, and 12th floor rehabilitation.

***N* A.6.7.1.1** Time frames should be adjusted depending on work or environmental conditions.

Δ A.6.8.1 Members could be passively cooled if ambient conditions are favorable [temperature < 75°F (< 24°C) and low humidity] and if the majority of turnout gear is removed. On hot and humid days, favorable conditions can be created through the use of an air-conditioned vehicle or a structure. To be most effective, passive cooling should be conducted with the turnout coat, helmet, and flash hood removed. The turnout pants should be opened and, if possible, pushed down to the knees while seated. See Hostler, et al., "Comparison of Active Cooling Devices with Passive Cooling for Rehabilitation of Firefighters Performing Exercise in Thermal Protective Clothing: A Report from the Fireground Rehab Evaluation (FIRE) Trial" and Colburn, et al., "A Comparison of Cooling Techniques in Firefighters After a Live Burn Evolution."

However, under hot and humid environmental conditions additional cooling might be necessary. 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.

Δ A.6.8.3 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 firefighting gear interferes with heat dissipation and traps moisture next to the skin; hence, as soon as firefighters don their gear the skin experiences a hot and humid environment and sweating begins. Furthermore, sweating continues even after a firefighter 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. Firefighters can easily lose 32 oz (1 L) of water in less than 20 minutes of

strenuous firefighting 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) Impairment of the body's ability to maintain core temperature
(2) Decreased strength
(3) Shortened endurance time
(4) Decreased 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 firefighting 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 firefighter 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.

Δ **A.6.8.3.1** 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 carbohydrates.
(2) Drink 8 oz (¼ L) of sports drink containing approximately 15 g of carbohydrates.
(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).

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).

A.6.8.4 When determining if carbohydrate and electrolyte replacements are needed, factors such as longer duration or heavy exertion events, time since last meal, and individual conditions should be considered.

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Δ **A.6.9** The rehabilitation manager and company officers should monitor members who are at risk of suffering adverse health or safety effects and alert EMS personnel when appropriate. 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.

The following information on vital signs can help the fire department physician or appropriate medical authority establish the parameters of medical monitoring.

A.6.9.1 Although BLS is the minimum level of care required in rehabilitation, the department should consider staffing rehabilitation with advanced life support (ALS) personnel, where available.

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A.6.9.4.2 Possible effects of CO exposure on persons depend on individual susceptibility, as shown in Table A.6.9.4.2.

CO produces the following effects on exposed people, with variations based on individual susceptibility.

Δ **A.6.9.5(1)** These symptoms could be indicative of serious medical issues including, but not limited to, cardiac events and carbon monoxide poisoning. These members should undergo immediate medical assessment.

Carbon monoxide is a colorless, odorless gas present in every fire. Symptoms of CO poisoning are nonspecific and easy to miss. Any firefighter 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 percent–5 percent and, smokers' are normally 5 percent–10 percent.

A.6.9.5(5) Members should know who they are, where they are, and so forth. Disoriented members might be suffering from carbon monoxide poisoning, heat stress, or cardiac insufficiency.

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N **A.6.11.1** Data collection systems can be impacted by Health Insurance Portability and Accountability Act (HIPAA) regulations, as well as various state laws. The sources from which the information is collected, the type of information retained, and the manner in which it is stored are factors that might determine what requirements apply. Procedures can vary from department to department and, consequently, no single answer might be applicable. Legal advice regarding the department's data collection system can be very helpful.

Table A.6.9.4.2 Possible Effects of CO Exposure

CO Blood Level (COHb)	Symptoms
5% to 14%	Asymptomatic or mild symptoms
15% to 29%	Headache, nausea/vomiting, shortness of breath, chest pain, loss of judgment
30% to 40%	Dizziness, weakness, vision problems, confusion, increased heart rate, increased breathing rate
>40%	Arrhythmias, seizures, coma, death

N **A.7.2.2** Fire departments should have resources to provide members with clean PPE following a fire or other incident where gear can become contaminated. Issuing a second set of personal protective clothing or using an exchange system can help crews return to incident response status quicker than waiting for all the gear to be appropriately decontaminated.

N **A.7.3** Saunas can cause dehydration and heat stress. Data supporting detoxification through sweating are very limited. A recent review summarized 24 articles that examined metal levels in sweat. However, although the authors conclude that sweating should receive additional consideration for toxic element detoxification, they noted that much of the data they reviewed was old and that research was needed to establish safe, effective therapeutic protocols. Additionally, they did not select their studies based on quality. Small participant numbers were common and variation in collection and measurement methods make comparisons difficult.

A research project entitled the "Blood, Urine, and Sweat (BUS) Study" analyzed these three fluids for approximately 120 chemicals. The authors reported that some toxic elements were present in sweat but not serum in some participants. As noted above, that might have been due to smaller volumes resulting in more concentrated, easier to measure chemical levels in sweat. The authors also noted loss of required trace minerals into sweat. They specifically mentioned firefighters as a group "who by the nature of their occupations are exposed to toxic elements, may be advised to regularly undertake induced sweating." The authors noted that "Further research is required, however, to determine whether induced sweating on the day of exposure is beneficial or detrimental because enhanced circulation to the skin associated with sauna may stimulate greater absorption of toxicants on the skin." Importantly, this was a small study that included only 20 participants.

Firefighters are concerned about reducing health risks from their occupational chemical exposures. However, there are a number of reasons why the use of saunas after fire suppression activities is not recommended:

(1) The science on sauna use is still too limited to determine whether this increases excretion of chemicals in a significant way. Most chemicals are not stored long term in the body and are excreted normally.
(2) Sauna use immediately after fire suppression activities has the potential to increase absorption. Chemicals on the skin could evaporate and be inhaled. The heat in the sauna increases blood flow to the skin, which also has the potential to increase absorption across the skin including any contaminants on the skin.
(3) Fire suppression can cause heat stress and heat illnesses. Increased body temperature results in sweating and fluid loss, which can cause serum electrolyte changes and dehydration. The lower blood volume from dehydration causes less blood to be pumped with each heartbeat. These effects contribute to the well-documented increased risk of heart attack during and in the hours immediately after firefighting. Use of saunas after firefighting can increase the potential for dehydration, heat-related illnesses, and heart and kidney disorders. Just walking on a treadmill in turn-out gear increases body temperature.

In summary, at the present time, there is insufficient medical evidence to support a recommendation for use of saunas to remove toxicants from the body after firefighting, and the potential adverse health effects outweigh potential benefits.

N **A.7.3.3.1** The machine should have an empty tub cleaning cycle done prior to using the machine for other nonexposed items.

N **A.7.4.3** Cleaning and decontamination of apparatus and equipment should occur prior to post-incident personal hygiene.

N **A.7.6.2** Possible inhalation, dermal, or ocular exposure hazards include fire smoke, products of combustion, chemical vapors, diesel exhaust, burning synthetics, bed bugs, vermin, biological hazards, asbestos, perfluorooctanoic acid (PFOA), heavy metals, black mold, hazardous materials, radiation, infectious disease, unknown vapors or mists, etc.

Toxic substances and harmful physical agents can include the following:

(1) Metals and dusts, such as lead, cadmium, and silica
(2) Biological agents, such as bacteria, viruses, and fungi
(3) Physical stress, such as noise, heat, cold, vibration, repetitive motion, and ionizing and non-ionizing radiation

Biological agent is a term used to describe microorganisms that are biological in nature and origin to which exposure in sufficient quantities and duration may result in illness or injury to human health. Biological agents include bacteria, viruses, fungi, and parasites, or parts thereof or products they generate. Reporting exposures to common agents, such as a cold or common influenza, is not required.

Chemical agent is a term used to describe all chemical elements and compounds in a natural state or in a processed state and their byproducts, the exposure to which, in sufficient quantities and duration, may result in illness or injury to human health.

Physical agent is a term used to describe energies, the exposures to which, in sufficient quantities and duration, may result in illness or injury to human health. Physical agents include noise, ionizing or non-ionizing radiation, extremes in temperature and pressure, vibration, and electric and magnetic fields.

N **A.7.6.3.1** Exposures include direct dermal, respiratory, or ocular exposure to a toxic substance or harmful biological, chemical, or physical agent.

A personal exposure report should collect responder-specific information about the potential exposure and activities undertaken during the response. A personal exposure reporting system, such as the National Fire Operations Reporting System (NFORS), should be utilized.

The NFORS exposure tracking module serves as a personal database providing a detailed history of work and exposures in a private, encrypted, and secure online environment.

With the mobile app, any firefighter, paramedic, or officer can access and use the exposure tracker. The NFORS exposure tracking module is available as an app in the Google Play Store and the Apple App Store.

N **A.7.7.1** This is required in OSHA 3110; *Access to Medical and Exposure Records* (https://www.osha.gov/Publications/osha3110.pdf).

Annex B Managing Heat Stress, Cold Stress, and Heat - Related Illness

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) provides information on heat stress that can be distributed as recommended training for members.

Figure B.1(b) outlines recommended precautions developed for four humidex ranges. Due to the variance of individual susceptibility, certain individuals might 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.

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 can 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.

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.2.1.2 *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 might begin to shiver and stomp their feet in order to generate heat. Workers might 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 can 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

HEAT STRESS/HEAT-RELATED ILLNESS

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 firefighter to follow guidelines outlined in the program. All firefighters and officers should remain aware of the signs and symptoms of heat stress in order to prevent potential injuries or illnesses.

HEAT STRESS. Firefighting 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/HEAT-RELATED ILLNESS. 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 firefighter's physical fitness and body composition. Thus it is essential that the firefighter 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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Δ **FIGURE B.1(a) Sample Advisory on Heat Stress.**