

NFPA®

1994

**Standard on
Protective Ensembles for
First Responders to Hazardous
Materials Emergencies and
CBRN Terrorism Incidents**

2018



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NFPA® 1994

Standard on

Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents

2018 Edition

This edition of NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, was prepared by the Technical Committee on Hazardous Materials Protective Clothing and Equipment and released by the Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment. It was issued by the Standards Council on August 1, 2017, with an effective date of August 21, 2017, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See “Codes & Standards” at www.nfpa.org for more information.

This edition of NFPA 1994 was approved as an American National Standard on August 21, 2017.

Origin and Development of NFPA 1994

The Technical Committee on Hazardous Materials Protective Clothing and Equipment began work on this document in 1998 to answer the need for personal protective equipment (PPE) for fire and emergency services personnel operating at domestic terrorism incidents involving dual use industrial chemicals, chemical terrorism agents, or biological terrorism agents.

The committee developed this new standard, NFPA 1994, *Standard on Protective Ensembles for Chemical/Biological Terrorism Incidents*, to provide three levels of protective ensembles — Class 1, Class 2, and Class 3 ensembles — that could be selected for protection of fire and emergency services personnel based on what the incident risk analysis indicated is necessary protection for the intended operations.

The goal of this standard is to establish personal protection requirements for ensembles that would be available in quantity, pristine condition, designed for single exposure use, and easily donned and used by fire and emergency services personnel to reduce the safety risks and health risks to personnel during assessment, extrication, rescue, triage, and treatment operations at or involving chemical or biological terrorism incidents.

The jurisdiction of this committee does not include respiratory protection that is necessary for these operations; the appropriate respiratory protection needs to be addressed by the emergency responder organizations.

The first (2001) edition was acted on by the NFPA membership at the Annual Meeting in Anaheim, California, on May 16, 2001.

The 2007 edition was a complete revision. The title of the document was changed to *Protective Ensembles for First Responders to CBRN Terrorism Incidents*. The former requirements for Class 1 CBRN ensembles, for protection from chemical, biological, and radiological terrorism agents, were incorporated into NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*, 2005 edition, and were then incorporated into the base requirements for all vapor-protective ensembles. For the 2007 and 2012 editions, NFPA 1994 no longer specified a Class 1 ensemble but left the designation “Class 1” vacant. A new Class 4 ensemble was added to provide particulate protection for emergency responders to incidents where no chemical agent is identified but a particulate threat is present (including “white powder” incidents).

The CBRN protection requirements were developed to apply to all emergency first responders at hazardous materials and CBRN incidents. Individual agencies (law enforcement, emergency medical, medical first receivers, fire, and hazardous materials) need to define the operations for which their

personnel are trained and develop detailed purchase specifications to ensure their ensembles best support their operational needs while providing CBRN protection.

In the 2007 edition, the committee also included new requirements in Chapter 4 for manufacturers' quality assurance programs and for situations in which hazards involving compliant products are believed to exist, including the appropriate actions in addressing these situations if there is a previously unknown threat to the users. These requirements apply to all emergency services product standards that are the responsibility of this project. All labeling, design, performance, and testing requirements were reviewed and refined as necessary.

The 2007 edition was presented to the Association membership at the 2006 Association meeting in Orlando, Florida on June 7, 2006, and issued by the Standards Council with an effective date of August 17, 2006.

The 2012 edition was extensively revised and included an updated permeation resistance test method with associated criteria for toxic industrial chemicals based on the cumulative permeation mass in one hour rather than breakthrough time; several new definitions; updates to several ANSI, ISO/IEC, and ASTM standards; and editorial, numbering, and formatting changes. The slip resistance test was revised based on new information that was proposed during the revision process related to the requirements necessary for evaluating the entire footwear sole. Additionally, the section on a Manufacturers' Quality Assurance Program was revised, and the Puncture Resistance Test 2 and the Impact and Compression Resistance Test were deleted from the standard and replaced with a design requirement that the footwear meet an ASTM specification for puncture and impact-resistant footwear.

The 2018 edition modifies the scope and title of the standard to include both hazardous materials and CBRN to minimize confusion as to the applicability of the standard for incidents that are not terrorism in nature. In addition, Class 1 ensemble requirements have been re-established within the standard, thereby reversing the decision to remove them in 2007. The Class 1 criteria parallel those in the 2016 edition of NFPA 1991 but provide practical criteria for both material barrier performance and overall design that result in a more form-fitting and tactical-based product. Ruggedized categories of certification (Type R) have been added for Classes 2, 3, and 4 to address the increasing use of the garments in harsher environments, such as urban search and rescue and law enforcement applications. These criteria involve more rigorous preconditioning of ensemble material prior to material barrier testing and ensemble integrity evaluations and higher levels of material physical property performance. Based upon recent research published by the U.S. Department of Defense, the chemical challenges have been modified to represent the vast diversity of chemicals found in the global chemical industry and to cover the breadth of fundamental chemical reactivity principles. Material breathability as measured by evaporative resistance and total heat loss has been addressed by reporting results for Class 2 and Class 2R ensembles and applying specific requirements for Class 3/3R and Class 4/4R ensembles. Footwear options have been broadened to allow for more flexibility when a chemical protective sock is used in coordination with the boot. Specific criteria have been developed to address separate hoods and elastomeric gasket materials. Optional criteria have been added for flash fire protection for all ensemble levels with a minimum level of flame resistance established for Class 1 ensembles. Finally, new stealth optional indicators for audible signatures and color have been added to address tactical operator concerns. Many other test methods have been modified for consistency following interlaboratory and intralaboratory validation efforts.

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

Chapter 1 Administration

1.1 Scope.

1.1.1* This standard shall establish the minimum requirements for the design, performance, testing, documentation, and certification of protective ensembles and ensemble elements used during hazardous materials and chemical, biological, radiological, or nuclear (CBRN) terrorism incidents.

1.1.2* This standard shall establish requirements for protective ensembles and ensemble elements that are worn for a single exposure at incidents involving hazardous materials and CBRN terrorism agents.

N 1.1.2.1* This standard shall also establish requirements for ruggedized ensembles that can be used multiple times where there is no exposure to hazardous materials and CBRN terrorism agents and that provide a greater level of physical hazard resistance and increased durability.

N 1.1.2.2 This standard shall also establish additional optional requirements for hazardous materials and CBRN protective ensembles for escape protection only from chemical flash fires encountered during hazardous materials and CBRN incidents.

N 1.1.2.3 This standard shall also establish additional optional requirements for hazardous materials and CBRN protective ensembles addressing stealth characteristics of ensembles.

1.1.3 This standard shall establish requirements for new hazardous materials and CBRN protective ensembles and ensemble elements.

1.1.4* This standard shall not establish requirements for respiratory protection for incidents involving hazardous materials or CBRN terrorism agents. Appropriate respiratory protection for the incidents involving specific hazardous materials or CBRN terrorism agent exposure is a critical part of overall protection and shall be specified and provided by the authority having jurisdiction.

1.1.5 This standard shall not establish requirements for any fire-fighting applications.

1.1.6* This standard shall not establish requirements for protection at incidents involving ionizing radiation, liquefied gas, cryogenic liquid hazards, explosives, or explosive atmospheres.

1.1.7 This standard shall not apply to any accessories that could be attached to the certified product, before or after purchase, but are not necessary for the certified product to meet the requirements of this standard.

1.1.8 This standard shall not be construed as addressing all of the safety concerns associated with the use of compliant hazardous materials and CBRN protective ensembles and ensemble elements. It shall be the responsibility of the persons and organizations that use compliant hazardous materials and CBRN protective ensembles and ensemble elements to establish safety and health practices and to determine the applicability of regulatory limitations prior to use.

1.1.9 This standard shall not be construed as addressing all of the safety concerns, if any, associated with the use of this standard by testing facilities. It shall be the responsibility of the persons and organizations that use this standard to conduct testing of hazardous materials and CBRN protective ensembles and ensemble elements to establish safety and health practices and to determine the applicability of regulatory limitations prior to using this standard for any designing, manufacturing, and testing.

1.1.10 Nothing herein shall restrict any jurisdiction or manufacturer from exceeding these minimum requirements.

1.2 Purpose.

1.2.1* The purpose of this standard shall be to establish minimum levels of protection for emergency first responder personnel assigned to incidents involving hazardous materials and CBRN terrorism agents.

1.2.1.1 To achieve this purpose, this standard shall establish minimum requirements for hazardous materials and CBRN protective ensembles and ensemble elements for emergency first responder personnel responding to incidents involving hazardous materials and CBRN terrorism agents, and for emergency first responder personnel exposed to victims or materials during assessment, extrication, rescue, triage, decontamination, treatment, site security, crowd management, and force protection operations at incidents involving hazardous materials and CBRN terrorism agents.

1.2.1.2 This standard shall provide emergency first responder personnel with four levels of hazardous materials and CBRN protective ensembles and ensemble elements that could be selected for minimum protection of emergency first responder personnel based on what the incident risk analysis indicates is necessary protection for the intended operations.

N 1.2.1.3 This standard shall establish a level of physical hazard resistance for three of the four levels of CBRN ensembles and ensemble elements that could be selected for those operations where ensembles are used multiple times without exposure to hazardous materials and CBRN terrorism agents and for operations requiring increased durability.

N 1.2.1.4 This standard shall establish a minimum level of limited chemical flash fire protection for escape only in the event of a chemical flash fire, as an option for compliant CBRN protective ensembles and ensemble elements.

N 1.2.1.5 This standard shall establish a minimum level of stealth characteristics, as an option for compliant CBRN ensembles.

1.2.2 Controlled laboratory tests used to determine compliance with the performance requirements of this standard shall not be deemed as establishing performance levels for all situations to which personnel can be exposed.

1.2.3 This standard is not intended to be utilized as a detailed manufacturing or purchase specification, but shall be permitted to be referenced in purchase specifications as minimum requirements.

1.3 Application.

1.3.1* The requirements for Class 1 hazardous materials and CBRN protective ensembles and ensemble elements shall apply to ensembles designed to provide protection to emergency first responder personnel at incidents involving vapor or liquid chemical hazards where the concentrations are at or above immediately dangerous to life and health (IDLH), requiring the use of self-contained breathing apparatus (SCBA).

1.3.2 The requirements for Class 2 hazardous materials and CBRN protective ensembles and ensemble elements shall apply to ensembles designed to provide limited protection to emergency first responder personnel at hazardous materials or terrorism incidents involving vapor or liquid chemical hazards where the concentrations are at or above immediately dangerous to life and health (IDLH), requiring the use of self-contained breathing apparatus (SCBA).

1.3.3 The requirements for Class 3 hazardous materials and CBRN protective ensembles and ensemble elements shall apply to ensembles designed to provide limited protection to emergency first responder personnel at hazardous materials or terrorism incidents involving low levels of vapor or liquid chemical hazards, where the concentrations are below immedi-

ately dangerous to life and health (IDLH), permitting the use of air-purifying respirators (APR).

1.3.4 The requirements for Class 4 hazardous materials and CBRN protective ensembles and ensemble elements shall apply to ensembles designed to provide limited protection to emergency first responder personnel at terrorism incidents involving particulate hazards, including biological hazards or radiological particulate hazards, where the concentrations are below immediately dangerous to life and health (IDLH), permitting the use of air-purifying respirators (APR).

1.3.5 This standard shall apply to the design, manufacturing, and certification processes for new hazardous materials and CBRN protective ensembles and ensemble elements for incidents involving CBRN terrorism agents.

1.3.6 This edition of NFPA 1994 shall not apply to any CBRN protective ensembles and ensemble elements manufactured to prior editions of this standard.

1.3.7 This standard shall not apply to any hazardous materials or CBRN protective ensembles and ensemble elements for incidents involving hazardous materials or CBRN terrorism incidents, which are manufactured in accordance with other specifications or the standards of other organizations.

Δ 1.3.8 This standard shall not apply to use requirements for hazardous materials and CBRN protective ensembles and ensemble elements for incidents involving hazardous materials or CBRN terrorism agents, as these requirements are specified in NFPA 1500.

1.3.9* The requirements of this standard shall not apply to any accessories that might be attached to any CBRN protective ensemble and ensemble elements.

1.4 Units.

1.4.1 In this standard, values for measurement are followed by an equivalent in parentheses, but only the first stated value shall be regarded as the requirement.

1.4.2 Equivalent values in parentheses shall not be considered as the requirement, as these values are approximate.

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 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, 2018 edition.

NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, 2013 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2013 edition.

NFPA 1986, *Standard on Respiratory Protection Equipment for Tactical and Technical Operations*, 2017 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2016 edition.

NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2018 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials and CBRN Terrorism Incidents*, 2018 edition.

NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations*, 2018 edition.

2.3 Other Publications.

2.3.1 AAFA Publications. American Apparel and Footwear Association, 1601 No. Kent Street, Suite 1200, Arlington, VA 22209.

FIA Standard 1209, *Whole Shoe Flex*, 1984.

2.3.2 AATCC Publications. American Association of Textile Chemists and Colorists, P. O. Box 12215, Research Triangle Park, NC 27709.

AATCC Evaluation Procedure 6, *Instrumental Color Measurement*, 2008.

2.3.3 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI/ISEA Z87.1, *American National Standard for Occupational and Educational Eye and Face Protective Devices*, 2015.

ANSI/ISEA Z89.1, *American National Standard for Industrial Head Protection*, 2014.

2.3.4 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D412, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers — Tension*, 2015a.

ASTM D747, *Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam*, 2010.

ASTM D751, *Standard Test Methods for Testing Coated Fabrics*, 2011.

ASTM D1776/D1776M, *Standard Practice for Conditioning and Testing Textiles*, 2016.

ASTM D2582, *Standard Test Method for Puncture Propagation Tear Resistance of Plastic Film and Thin Sheet*, 2009.

ASTM D3884, *Standard Guide for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)*, 2013 e1.

ASTM D4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, 2013.

ASTM D5151, *Standard Test Method for Detection of Holes in Medical Gloves*, 2015.

ASTM F392/F392M, *Standard Practice for Conditioning Flexible Barrier Materials for Flex Durability*, 2015.

ASTM F1052, *Standard Test Method for Pressure Testing Vapor Protective Suits*, 2014.

ASTM F1154, *Standard Practices for Qualitatively Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles and Ensemble Components*, 2011.

ASTM F1301, *Standard Practice for Labeling Chemical Protective Clothing*, 2011 e1.

ASTM F1342/F1342M, *Standard Test Method for Resistance of Protective Clothing Materials to Puncture*, 2013.

ASTM F1358, *Standard Test Method for Effects of Flame Impingement on Materials Used in Protective Clothing not Designated Primarily for Flame Resistance*, 2016.

ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, 2016a.

ASTM F1671/F1671M, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X174 Bacteriophage as a Test System*, 2013.

ASTM F1790, *Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing*, 2005.

ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, 2014.

ASTM F2010/F2010M, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test*, 2010.

ASTM F2412, *Standard Test Methods for Foot Protection*, 2011.

ASTM F2413, *Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear*, 2011.

ASTM F2700, *Standard Test Method for Unsteady-State Heat Transfer Evaluation of Flame Resistant Materials for Clothing with Continuous Heating*, 2013.

2.3.5 IEC Publications. International Electrotechnical Commission, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland.

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*, 2013.

2.3.6 ISO/IEC Publications. International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO 4649, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*, 2010.

ISO 11092, *Textiles — Physiological effects — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)*, 2014.

ISO 13287, *Personal protective equipment — Footwear — Test method for slip resistance*, 2012.

ISO 9001, *Quality management systems — Requirements*, 2008.

ISO/DIS 9001, *Quality management systems — Requirements*, 2015.

ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, 1983.

ISO/IEC 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*, 2004.

ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems — Part 1: requirements*, 2015.

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, 2005.

ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes, and services*, 2012.

2.3.7 NIOSH Publications. National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, GA 30333.

Statement of Standard for NIOSH CBRN APR Testing, 2003.

Statement of Standard for NIOSH CBRN PAPR Testing, 2006.

Statement of Standard for NIOSH CBRN SCBA Testing, 2002.

2.3.8 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 29, Code of Federal Regulations, Part 1910.132, Subpart I, “Personal Protective Equipment.”

2.3.9 Other Publications.

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

2.4 References for Extracts in Mandatory Sections. (Reserved)

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 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

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

3.2.7 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 Agents.

3.3.1.1 Biological Terrorism Agents. Liquid or particulate agents that can consist of a biologically derived toxin or pathogen used to inflict lethal or incapacitating casualties, generally on a civilian population as a result of a terrorist attack.

3.3.1.2 CBRN Terrorism Agents. See 3.3.7.

3.3.1.3 Chemical Terrorism Agents. See 3.3.16.

3.3.1.4* Chemical Warfare (CW) Agents. See 3.3.17.

3.3.1.5* Radiological Particulate Terrorism Agents. Particles that emit ionizing radiation in excess of normal background levels used to inflict lethal or incapacitating casualties, generally on a civilian population, as the result of a terrorist attack.

3.3.2 Assembly. The portion of the manufacturing process including, but not limited to, sewing, gluing, laminating, tacking, or other means of attaching whereby materials or component parts are put together to form a portion of the compliant product, or the complete compliant product.

3.3.2.1 Garment Closure Assembly. The combination of the garment closure and the seam attaching the garment closure to the garment, including any protective flap or cover.

3.3.3 Biological Terrorism Agents. See 3.3.1.1.

3.3.4 Care. Procedures for cleaning, decontamination, and storage of protective ensembles and ensemble elements.

3.3.5 CBRN. Abbreviation for Chemical, Biological, Radiological, and Nuclear.

3.3.6 CBRN Barrier Material. The part of the composite that is intended to provide protection against CBRN terrorism agents.

3.3.7 CBRN Terrorism Agents. The term used to refer to chemical terrorism agents including both chemical warfare agents and toxic industrial chemicals, biological terrorism agents, and radiological particulate terrorism agents. (See also 3.3.1.1, *Biological Terrorism Agents*, 3.3.1.3, *Chemical Terrorism Agents*, and 3.3.1.5, *Radiological Particulate Terrorism Agents*.)

3.3.8 CBRN Terrorism Incident Protective Ensembles and Ensemble Elements. Multiple elements, categorized as Class 1, Class 2, Class 3, or Class 4 CBRN protective ensembles and ensemble elements, designed to provide minimum full-body protection against exposure to chemical/biological terrorism agents occurring during chemical/biological terrorism emergencies.

N 3.3.8.1 Class 1 CBRN Protective Ensemble and Ensemble Elements. A CBRN protective ensemble and ensemble elements designed to protect emergency first responder personnel at terrorism incidents involving vapor or liquid chemical hazards where the concentrations are at or above immediately dangerous to life and health (IDLH), requiring the use of self-contained breathing apparatus (SCBA).

3.3.8.2 Class 2 CBRN Protective Ensemble and Ensemble Elements. A CBRN protective ensemble and ensemble elements designed to protect emergency first responder personnel at terrorism incidents involving vapor or liquid chemical hazards where the concentrations are at or above immediately dangerous to life and health (IDLH), requiring the use of self-contained breathing apparatus (SCBA).

Δ 3.3.8.3 Class 3 CBRN Protective Ensemble and Ensemble Elements. A CBRN protective ensemble and ensemble elements designed to protect emergency first responder personnel at terrorism incidents involving low levels of vapor or liquid chemical hazards where the concentrations are below immediately dangerous to life and health (IDLH), permitting the use of CBRN air-purifying respirators (APR) or CBRN-powered air-purifying respirators (PAPR).

Δ 3.3.8.4 Class 4 CBRN Protective Ensemble and Ensemble Elements. A CBRN protective ensemble and ensemble elements designed to protect emergency first responder personnel at terrorism incidents involving biological hazards or radiological particulate hazards where the concentrations are below immediately dangerous to life and health (IDLH), permitting the use of air-purifying respirators (APR) or powered air-purifying respirators (PAPR).

3.3.9 CBRN Terrorism Incident Protective Footwear. The element of the protective ensemble that provides protection to the foot, ankle, and lower leg.

3.3.10 CBRN Terrorism Incident Protective Footwear Cover. The item of the protective ensemble to be worn over standard footwear to provide barrier and physical protection to the wearer's feet.

3.3.11 CBRN Terrorism Incident Protective Garment(s). The element of the protective ensemble that provides protection to the upper and lower torso, head, arms, and legs; excluding the hands and feet.

3.3.12 CBRN Terrorism Incident Protective Glove(s). The element of the protective ensemble that provides protection to the wearer's hands and wrists.

N 3.3.13 CBRN Terrorism Incident Protective Hood. The element of the protective ensemble that provides protection to the wearer's head and neck.

3.3.14 Certification/Certified. A system whereby a certification organization determines that a manufacturer has demonstrated the ability to produce a product that complies with the requirements of this standard, authorizes the manufacturer to use a label on listed products that comply with the require-

ments of this standard, and establishes a follow-up program conducted by the certification organization as a check on the methods the manufacturer uses to determine continued compliance with the requirements of this standard.

3.3.15* Certification Organization. An independent, third-party organization established for product testing and evaluation that administers a labeling/listing/follow-up program.

3.3.16 Chemical Terrorism Agents. Liquid, solid, gaseous, and vapor chemical warfare agents and toxic industrial chemicals used to inflict lethal or incapacitating casualties, generally on a civilian population as a result of a terrorist attack.

3.3.17 Chemical Warfare (CW) Agents. Liquid, solid, and gas chemical agents (most are liquids) traditionally used during warfare or armed conflict to kill or incapacitate an enemy. (See also 3.3.1.3, *Chemical Terrorism Agents*, and 3.3.75, *Toxic Industrial Chemicals*.)

N 3.3.18 Class 1 CBRN Protective Ensemble and Ensemble Elements. See 3.3.8.1.

3.3.19 Class 2 CBRN Protective Ensemble and Ensemble Elements. See 3.3.8.2.

3.3.20 Class 3 CBRN Protective Ensemble and Ensemble Elements. See 3.3.8.3.

3.3.21 Class 4 CBRN Protective Ensemble and Ensemble Elements. See 3.3.8.4.

3.3.22 Compliance/Compliant. Product that meets or exceeds all applicable requirements of this standard and is certified.

3.3.23* Component. Any material, part, or subassembly used in the construction of the compliant product.

3.3.24 Composite. The layer or layers of materials or components.

3.3.25 Cryogenic Gas. See 3.3.43.1.

N 3.3.26 Elastomer. A polymeric material that returns to its original length and shape after stretching.

N 3.3.27* Elastomeric Interface Material. An exposed elastomeric material that is not otherwise used as garment material, which provides an interface between components of the ensemble and ensemble elements, other than seams, and if applicable, the interface between the respirator facepiece and the ensemble or ensemble elements.

3.3.28 Emergency First Responder Personnel. Those persons, including members of fire departments, police departments, other law enforcement agencies, hazardous materials response teams, emergency medical services, and other organizations that have public safety responsibilities and who would respond to rescue and treat victims, and who would protect the public during an emergency incident.

3.3.29* Encapsulating. A type of CBRN protective ensemble that provides vaportight or liquidtight protection to the upper and lower torso, head, hands, and feet and completely covers the wearer and the wearer's respirator. (See also 3.3.61.1, *CBRN Terrorism Incident Protective Ensembles and Ensemble Elements*, and 3.3.53, *Nonencapsulating Ensemble*.)

N 3.3.30 Encapsulating Ensemble. A type of ensemble that completely covers the wearer and the wearer's respirator.

3.3.31 Ensemble(s). See 3.3.8, CBRN Terrorism Incident Protective Ensemble and Ensemble Elements.

3.3.32 Ensemble Elements. Multiple elements, including garments, gloves, footwear, and hoods.

3.3.33* External Fittings. Any fitting externally located on, and part of, the ensemble which is not part of the garment material, visor material, gloves, footwear, seams, or closure assembly.

3.3.34 First Responder Personnel. See 3.3.28, Emergency First Responder Personnel.

3.3.35 Follow-Up Program. The sampling, inspections, tests, or other measures conducted by the certification organization on a periodic basis to determine the continued compliance of labeled and listed products that are being produced by the manufacturer to the requirements of this standard.

3.3.36 Footwear.

3.3.36.1* CBRN Terrorism Incident Protective Footwear. See 3.3.9.

3.3.36.2 Protective Footwear. An abbreviated term for CBRN Terrorism Incident Protective Footwear. (See also 3.3.9, CBRN Terrorism Incident Protective Footwear.)

3.3.36.3 Standard Footwear. Footwear approved by the authority having jurisdiction (AHJ) for wear with protective garments as defined in 3.3.11 and, where required, worn with a CBRN terrorism incident protective footwear cover. (See 3.3.10.)

3.3.37 Footwear Cover. See 3.3.37.1, CBRN Terrorism Incident Protective Footwear Cover.

3.3.37.1* CBRN Terrorism Incident Protective Footwear Cover. See 3.3.10.

3.3.38 Footwear Upper. That portion of the footwear element above the sole.

3.3.39 Garment(s).

3.3.39.1* CBRN Terrorism Incident Protective Garment(s). See 3.3.11.

3.3.39.2 Outer Garment. A garment worn over another garment component to meet the requirements of this standard.

3.3.39.3 Protective Garment(s). An abbreviated term for CBRN Terrorism Incident Protective Garment(s). [See 3.3.11, CBRN Terrorism Incident Protective Garment(s).]

3.3.40 Garment Closure. The garment component designed and configured to allow the wearer to don (put on) and doff (take off) the CBRN terrorism incident protective ensemble and ensemble elements.

3.3.41 Garment Closure Assembly. See 3.3.2.1.

3.3.42 Garment Material. See 3.3.51.2.

3.3.43 Gas.

3.3.43.1 Cryogenic Gas. A refrigerated liquid gas having a boiling point below -130°F (-90°C) at atmospheric pressure.

3.3.43.2* Liquefied Gas. A gas that, under its charged pressure, is partially liquid at 21°C (70°F).

3.3.44 Glove(s).

3.3.44.1* CBRN Terrorism Incident Protective Glove(s). See 3.3.12.

3.3.44.2 Outer Glove. A glove worn over another glove component for the purposes of providing additional protection to the wearer and to meet the requirements of this standard.

3.3.44.3 Protective Glove(s). An abbreviated term for CBRN Terrorism Incident Protective Glove(s). [See 3.3.12, CBRN Terrorism Incident Protective Glove(s).]

N 3.3.45 Hood(s).

N 3.3.45.1 CBRN Terrorism Incident Protective Hood(s). See 3.3.13.

N 3.3.45.2 Protective Hood(s). An abbreviated term for CBRN Terrorism Incident Protective Hood(s). [See 3.3.13, CBRN Terrorism Incident Protective Hood(s).]

3.3.46 Integrity Footwear Cover. A component of the protective footwear element designed and configured to be worn over an outerboot to provide footwear with liquid-splash protection when integrated with the protective ensemble.

3.3.47 Ionizing Radiation. Radiation of sufficient energy to alter the atomic structure of materials or cells with which it interacts, including electromagnetic radiation such as x-rays, gamma rays, and microwaves, and particulate radiation such as alpha and beta particles.

3.3.48 Liquefied Gas. See 3.3.43.2.

3.3.49 Maintenance. Procedures for inspection, repair, and removal from service of CBRN protective ensembles and ensemble elements.

3.3.50 Manufacturer. The entity that directs and controls compliant product design, compliant product manufacturing, or compliant product quality assurance; or, the entity that assumes the liability for the compliant product or provides the warranty for the compliant product.

3.3.51 Material.

3.3.51.1 CBRN Barrier Material. See 3.3.6.

3.3.51.2 Garment Material. The principal protective clothing material used in the construction of CBRN terrorism incident protective ensembles and ensemble elements.

3.3.51.3 Protective Clothing Material. Any material or composite used in CBRN protective ensemble and ensemble elements for the purpose of protecting parts of the wearer's body against chemical/biological terrorism agents, or against physical hazards.

3.3.51.4 Visor Material. The transparent chemical-protective clothing material that allows the wearer to see outside the CBRN terrorism incident protective ensemble and ensemble elements.

3.3.52 Model. The collective term used to identify a group of individual elements of the same basic design and components from a single manufacturer produced by the same manufacturing and quality assurance procedures that are covered by the same certification.

3.3.53* Nonencapsulating Ensemble. A type of ensemble that does not fully cover the wearer's respirator and relies on the facepiece of the respirator to have an interface with the garment and complete the enclosure of the wearer.

3.3.54 Outer Boot. A boot worn over other footwear components to meet requirements of this standard.

3.3.55 Outer Garment. See 3.3.39.2.

3.3.56 Outer Glove. See 3.3.44.2.

3.3.57* Particulates. Solid matter that is dispersed in air as a mixture.

3.3.58 Percent Inward Leakage. The ratio of vapor concentration inside the ensemble versus the vapor concentration outside the ensemble expressed as a percentage.

3.3.59* Product Label. A label or marking affixed by the manufacturer to each compliant product or product package. Such labels contain compliance statements, certification statements, general information, care, maintenance, or similar data.

3.3.60 Protective Clothing Material. See 3.3.51.3.

3.3.61 Protective Ensemble(s) and Ensemble Elements. An abbreviated term for CBRN Terrorism Incident Protective Ensembles.

3.3.61.1* CBRN Terrorism Incident Protective Ensembles and Ensemble Elements. See 3.3.8.

3.3.62 Protective Ensembles. See 3.3.61.

3.3.63 Protective Footwear. See 3.3.36.2.

3.3.64 Protective Garment(s). See 3.3.39.3.

3.3.65 Protective Glove(s). See 3.3.44.3.

3.3.66 Puncture-Resistant Device. A reinforcement to the bottom of protective footwear that is designed to provide puncture resistance.

3.3.67 Radiological and Nuclear Particulate Terrorism Agents. See 3.3.1.5.

3.3.68* Respirator. A device that provides respiratory protection for the wearer.

3.3.69 Sample. The element, item, component, or composite that is conditioned for subsequent testing. An amount of the material, product or assembly to be tested that is representative of the item as a whole. (See also 3.3.72, *Specimen*.)

3.3.70 Seam. Any permanent attachment of two or more protective clothing materials, excluding external fittings, gaskets, and garment closure assemblies, in a line formed by joining the separate material pieces.

3.3.71* Sock. An extension of the garment or suit leg or a separate item that covers the entire foot and is intended to be worn inside a protective outer boot.

3.3.72 Specimen. The conditioned element, item, component or composite that is tested. Specimens are taken from samples. (See also 3.3.69, *Sample*.)

3.3.73 Storage Life. The life expectancy of the CBRN protective ensemble and ensemble elements from the date of manufacture when it is only stored and inspected and has undergone proper care and maintenance in accordance with manufacturer's instructions, but not used, donned, doffed, or repaired.

N 3.3.74* Tethered Applications. Applications in which a hose or line is attached to the garment or hood portion of an ensemble via an external fitting mounted on the garment material that is further connected to a fixed location external to the suit.

3.3.75 Toxic Industrial Chemicals. Highly toxic solid, liquid, or gaseous chemicals that have been identified as mass casualty threats that could be used as weapons of terrorism to inflict casualties, generally on a civilian population, during a terrorist attack. [See also 3.3.16, *Chemical Terrorism Agents*, and 3.3.17, *Chemical Warfare (CW) Agents*.]

3.3.76 Visor Material. See 3.3.51.4.

Chapter 4 Certification

4.1 General.

4.1.1 The process of certification for product as being compliant with NFPA 1994 shall meet the requirements of Section 4.1, General; Section 4.2, Certification Program; Section 4.3, Inspection and Testing; Section 4.4, Recertification; Section 4.5, Manufacturers' Quality Assurance Program; Section 4.6, Hazards Involving Compliant Product; Section 4.7, Manufacturers' Investigation of Complaints and Returns; and Section 4.8, Manufacturers' Safety Alert and Product Recall Systems.

4.1.2* All compliant products that are labeled as being compliant with this standard shall meet or exceed all applicable requirements specified in this standard and shall be certified.

Δ 4.1.3 All certification shall be performed by a certification organization that meets at least the requirements specified in Section 4.2, Certification Program, and that is accredited for personal protective equipment in accordance with ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes, and services*. The accreditation shall be issued by an accreditation body operating in accordance with ISO/IEC 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*.

4.1.4 Manufacturers shall not claim compliance with portions or segments of the requirements of this standard and shall not use the NFPA name or the name or identification of this standard, NFPA 1994, in any statements about their respective products unless the products are certified as compliant to this standard.

4.1.5 All compliant products shall be labeled and listed.

4.1.5.1 Glove elements, footwear elements, and hood elements that are provided, sold, or distributed as part of a specific ensemble shall not be required to be separately labeled or listed, but shall be included as a part of the ensemble product label and listing.

4.1.5.2 Glove elements, footwear elements, and hood elements that are provided, sold, or distributed as individual elements shall be required to be separately labeled and listed. The individual element product listing shall include the ensemble with which the element is certified.

4.1.6 All compliant products shall also have a product label that meets the requirements specified in Section 5.1, Product Labeling Requirements.

4.1.7 The certification organization's label, symbol, or identifying mark shall be part of the product label, shall be attached to the product label, or shall be immediately adjacent to the product label.

4.1.8 The certification organization shall not issue any new certifications to the 2012 edition of NFPA 1994 on or after the effective date for NFPA 1994, 2017 edition, which is August 21, 2017.

4.1.9 The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the 2012 edition of NFPA 1994, on or after August 21, 2018.

Δ 4.1.10 The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2012 edition of NFPA 1994, from all products that are under the control of the manufacturer on August 21, 2018 and the certification organization shall verify this action is taken.

4.2 Certification Program.

4.2.1* The certification organization shall not be owned or controlled by manufacturers or vendors of the product being certified.

4.2.2 The certification organization shall be primarily engaged in certification work and shall not have a monetary interest in the product's ultimate profitability.

Δ 4.2.3 The certification organization shall be accredited for personal protective equipment in accordance with ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes and services*. The accreditation shall be issued by an accreditation body operating in accordance with ISO/IEC 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*.

4.2.4 The certification organization shall refuse to certify products to this standard that do not comply with all applicable requirements of this standard.

4.2.5* The contractual provisions between the certification organization and the manufacturer shall specify that certification is contingent on compliance with all applicable requirements of this standard.

4.2.5.1 The certification organization shall not offer or confer any conditional, temporary, or partial certifications.

4.2.5.2 Manufacturers shall not be authorized to use any label or reference to the certification organization on products that are not compliant with all applicable requirements of this standard.

Δ 4.2.6* The certification organization shall have or have access to laboratory facilities and equipment for conducting proper tests to determine product compliance.

4.2.6.1 The certification organization laboratory facilities shall have a program in place and functioning for calibration of all instruments, and procedures shall be in use to ensure proper control of all testing.

4.2.6.2 The certification organization laboratory facilities shall follow good practice regarding the use of laboratory manuals, form data sheets, documented calibration and calibration routines, performance verification, proficiency testing, and staff qualification and training programs.

4.2.7 The certification organization shall require the manufacturer to establish and maintain a quality assurance program that meets the requirements of Section 4.5, Manufacturers' Quality Assurance Program.

4.2.7.1* The certification organization shall require the manufacturer to have a product recall system specified in Section 4.8, Manufacturers' Safety Alert and Product Recall Systems, as part of the manufacturer's quality assurance program.

4.2.7.2 The certification organization shall audit the manufacturer's quality assurance program to ensure that the quality assurance program provides continued product compliance with this standard.

4.2.8 The certification organization and the manufacturer shall evaluate any changes affecting the form, fit, or function of the compliant product to determine its continued certification to this standard.

4.2.9* The certification organization shall have a follow-up inspection program of the manufacturer's facilities of the compliant product with at least two random and unannounced visits per 12-month period to verify the product's continued compliance.

4.2.9.1 As part of the follow-up inspection program, the certification organization shall select sample compliant product at random from the manufacturer's production line, from the manufacturer's in-house stock, or from the open market.

4.2.9.2 Sample product shall be evaluated by the certification organization to verify the product's continued compliance in order to assure that the materials, components, and manufacturing quality assurance systems are consistent with the materials, components, and manufacturing quality assurance that were inspected and tested by the certification organization during initial certification and recertification.

4.2.9.3 The certification organization shall be permitted to conduct specific testing to verify the product's continued compliance.

4.2.9.4 For products, components, and materials where prior testing, judgment, and experience of the certification organization have shown results to be in jeopardy of not complying with this standard, the certification organization shall conduct more frequent testing of sample product, components, and materials acquired in accordance with 4.2.9.1 against the applicable requirements of this standard.

4.2.10 The certification organization shall have in place a series of procedures, as specified in Section 4.6, Hazards Involving Compliant Product, that address reports of situations in which a compliant product is subsequently found to be hazardous.

4.2.11 The certification organization's operating procedures shall provide a mechanism for the manufacturer to appeal decisions. The procedures shall include the presentation of information from both sides of a controversy to a designated appeals panel.

4.2.12 The certification organization shall be in a position to use legal means to protect the integrity of its name and label. The name and label shall be registered and legally defended.

4.3 Inspection and Testing.

4.3.1 For both initial certification and recertification of compliant products, the certification organization shall conduct both inspection and testing as specified in this section.

4.3.2 All inspections, evaluations, conditioning, and testing for certification or for recertification shall be conducted by a certification organization's testing laboratory that is accredited in accordance with the requirements of ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*.

4.3.2.1 The certification organization's testing laboratory's scope of accreditation to ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, shall encompass testing of personal protective equipment.

4.3.2.2 The accreditation of a certification organization's testing laboratory shall be issued by an accreditation body operating in accordance with ISO/IEC 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*.

4.3.3 A certification organization shall be permitted to utilize conditioning and testing results conducted by a product or component manufacturer for certification or recertification provided the manufacturer's testing laboratory meets the requirements specified in 4.3.3.1 through 4.3.3.5.

4.3.3.1 The manufacturer's testing laboratory shall be accredited in accordance with the requirements of ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*.

4.3.3.2 The manufacturer's testing laboratory's scope of accreditation to ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, shall encompass testing of personal protective equipment.

4.3.3.3 The accreditation of a manufacturer's testing laboratory shall be issued by an accreditation body operating in accordance with ISO/IEC 17011, *General requirements for accreditation bodies accrediting conformity assessment bodies*.

4.3.3.4 The certification organization shall approve the manufacturer's testing laboratory.

4.3.3.5 The certification organization shall determine the level of supervision and witnessing of the conditioning and testing for certification or recertification conducted at the manufacturer's testing laboratory.

4.3.4 Sampling levels for testing and inspection shall be established by the certification organization and the manufacturer to ensure a reasonable and acceptable reliability at a reasonable and acceptable confidence level that products certified to this standard are compliant, unless such sampling levels are specified herein. This information shall be included in the manufacturer's technical data package.

4.3.5 Inspection by the certification organization shall include a review of all product labels to ensure that all required label attachments, compliance statements, certification statements, and other product information are at least as specified in Section 5.1, Product Labeling Requirements.

4.3.6 Inspection by the certification organization shall include an evaluation of any symbols and pictorial graphic representations used on product labels or in user information, as permitted in 5.1.1.6, to ensure that the symbols are clearly explained in the product's user information package.

4.3.7 Inspection by the certification organization shall include a review of the user information required by Section 5.2, User Information, to ensure that the information has been developed and is available.

4.3.8 Inspection by the certification organization shall include a review of the technical data package to determine compliance with the requirements of Section 5.3, Technical Data Package.

4.3.9 Inspection by the certification organization for determining compliance with the design requirements specified in Chapter 6 shall be performed on whole or complete products.

4.3.10 Testing to determine product compliance with the performance requirements specified in Chapter 7 shall be conducted by the certification organization in accordance with the specified testing requirements of Chapter 8.

4.3.10.1 Testing shall be performed on specimens representative of materials and components used in the actual construction of the compliant product.

4.3.10.2 The certification organization also shall be permitted to use sample materials cut from a representative product.

4.3.11 The certification organization shall accept from the manufacturer, for evaluation and testing for certification, only product or product components that are the same in every respect as the actual final product or product component.

4.3.12 The certification organization shall not allow any modifications, pretreatment, conditioning, or other such special processes of the product or any product component prior to the product's submission for evaluation and testing by the certification organization.

4.3.13 The certification organization shall not allow the substitution, repair, or modification, other than as specifically permitted herein, of any product or any product component during testing.

4.3.14 The certification organization shall not allow test specimens that have been conditioned and tested for one test method to be reconditioned and tested for another test method unless specifically permitted in the test method.

4.3.15 The certification organization shall test ensemble elements with the specific ensemble(s) with which they are to be certified.

4.3.16 Glove and footwear ensemble elements that are manufactured as separate items and are not intended to be provided, sold, or distributed as part of a complete ensemble shall be certified as ensemble elements.

4.3.16.1 The certification organization shall test ensemble elements with the specific ensemble(s) with which they are to be used.

4.3.16.2 The designation of the certified ensemble(s) with which compliant ensemble elements have been certified shall be clearly indicated on the product label of the certified ensemble element.

4.3.17 Any change in the design, construction, or material of a compliant product shall necessitate new inspection and testing to verify compliance to all applicable requirements of this standard that the certification organization determines can be affected by such change. This recertification shall be conducted before labeling the modified product as being compliant with this standard.

4.3.18 The manufacturer shall maintain all design and performance inspection and test data from the certification organization used in the certification of the manufacturer's compliant product. The manufacturer shall provide such data, upon request, to the purchaser or authority having jurisdiction.

4.3.19* Unless otherwise noted in this standard, any combination of materials or multipiece ensemble element that is needed to meet any of the performance requirements specified in Chapter 7 shall be required to meet all the requirements for that particular part of the ensemble or ensemble element.

4.4 Annual Verification of Product Compliance.

4.4.1 All products that are labeled as being compliant with this standard shall undergo recertification on an annual basis.

4.4.1.1 This recertification shall include inspection and evaluation to the design requirements and testing to the performance requirements as required by this standard on all manufacturers' compliant product models.

4.4.1.2 Any change that affects the compliant product performance under design or performance requirements of this standard shall constitute a different model.

4.4.1.3 For the purpose of this standard, models shall include each unique pattern, style, or design of the compliant products.

4.4.2 Samples of manufacturer's models and components for recertification shall be acquired from the manufacturer or component supplier during random and unannounced visits as part of the follow-up program specified in 4.2.9.

4.4.2.1 For recertification, the certification organization shall acquire at least one complete compliant product.

4.4.2.2 The certification organization shall also acquire a sufficient quantity of components to be tested for recertification as required by 4.4.3.

4.4.3 Compliant products and components shall be inspected, evaluated, and tested as specified in 4.4.3.1 and 4.4.3.2. Inspection, evaluation, and testing performed as part of the follow-up program shall be permitted to be used for recertification to avoid duplication.

4.4.3.1 One sample of each compliant product shall be inspected and evaluated to the design requirements specified in Chapter 6.

4.4.3.2 One specimen of each compliant ensemble shall be permitted to be tested for each overall ensemble performance

test as specified in the ensemble general requirements in Chapter 7.

4.4.3.3 Each compliant element and component shall be tested for overall performance as specified in the appropriate element requirements in Chapter 7, with the following modifications:

- (1) Chemical permeation resistance testing specified for Class 1 ensembles shall be limited to the following chemicals:
 - (a) Ammonia
 - (b) Acrolein
 - (c) Acrylonitrile
 - (d) Chlorine
 - (e) Dimethyl sulfate
- (2) Chemical permeation resistance testing specified for Class 2, Class 2R, Class 3, and Class 3R ensembles shall be limited to the following chemicals:
 - (a) Acrylonitrile
 - (b) Ammonia
 - (c) Dimethyl sulfate

4.4.3.3.1 With the exception of chemical permeation testing, a total of two specimens shall be permitted for ensemble material and component testing requirements. If the testing is specified for both directions of a material, a total of two specimens per material direction shall be permitted for testing requirements.

4.4.4 The manufacturer shall maintain all design, inspection, performance, and test data from the certification organization produced during the recertification of manufacturers' models and components. The manufacturer shall provide such data, on request, to the purchaser or to the authority having jurisdiction.

4.5 Manufacturers' Quality Assurance Program.

4.5.1 The manufacturer shall provide and operate a quality assurance program that meets the requirements of this section and that includes a product recall system as specified in 4.2.7.1 and Section 4.8, Manufacturers' Safety Alert and Product Recall Systems.

4.5.2 The operation of the quality assurance program shall evaluate and test compliant product production to the requirements of this standard to assure production remains in compliance.

4.5.3* The manufacturer shall be registered to ISO/DIS 9001, *Quality management systems — Requirements*.

4.5.3.1 Registration to the requirements of ISO/DIS 9001, *Quality management systems — Requirements*, shall be conducted by a registrar that is accredited for personal protective equipment in accordance with ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems*.

4.5.3.2 The scope of the ISO registration shall include at least the design and manufacturing systems management for the personal protective equipment being certified.

4.5.3.3 The registrar shall affix the accreditation mark on the ISO registration certificate.

4.5.4* Any entity that meets the definition of *manufacturer* specified in Section 3.3, General Definitions, and therefore is considered to be the “manufacturer” but does not manufacture or assemble the compliant product, shall meet the requirements specified in Section 4.5.

4.5.5* Where the manufacturer uses subcontractors in the construction or assembly of the compliant product, the locations and names of all subcontractor facilities shall be documented, and the documentation shall be provided to the manufacturer's ISO registrar and the certification organization.

4.5.5.1 Component manufacturers shall be considered as subcontractors.

4.5.5.2 Subcontractors shall include but not be limited to a person or persons, or a company, firm, corporation, partnership, or other organization having an agreement with or under contract with the compliant product manufacturer to supply or assemble components of the compliant product, or to assemble portions of the compliant product.

4.5.5.3 The assembly portion of the manufacturing process shall include but not be limited to the sewing, gluing, laminating, tacking, or other means of attaching whereby materials or component parts are joined together to form a portion, a component, or a complete compliant product.

4.5.6 All subcontractors, where different from the manufacturer, shall also be registered to the requirements of ISO/DIS 9001, *Quality management systems — Requirements*, for manufacturing, unless the provisions specified in 4.5.6.1 and 4.5.6.2 apply.

4.5.6.1 The manufacturer shall be permitted to include subcontractors in the manufacturer's ISO/DIS 9001 registration in lieu of requiring the subcontractor to have their own ISO registration.

4.5.6.2 Where the manufacturer applies their ISO registration to subcontractors, this action shall require the inclusion of the subcontractors' addresses and functions on the manufacturer's ISO/DIS 9001 registration certificate, and the manufacturer shall provide the certification organization with copies of the ISO/DIS 9001 registrar's reports showing acceptable inclusion of these locations for the functions they perform for the manufacturer.

4.6 Hazards Involving Compliant Product.

4.6.1* The certification organization shall establish procedures to be followed where situation(s) are reported in which a compliant product is subsequently found to be hazardous or unfit for use. These procedures shall comply with the provisions of ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, and as modified herein.

4.6.2* Where a report of a hazard involved with a compliant product is received by the certification organization, the validity of the report shall be investigated.

4.6.3 With respect to a compliant product, a hazard shall be a condition or create a situation that results in exposing life, limb, or property to an imminently dangerous or dangerous condition.

4.6.4 Where a specific hazard is identified, the determination of the appropriate action for the certification organization and

the manufacturer to undertake shall take into consideration the severity of the hazard and its consequences to the safety and health of users.

4.6.5 Where it is established that a hazard is involved with a compliant product, the certification organization shall determine the scope of the hazard including products, model numbers, serial numbers, factory production facilities, production runs, and quantities involved.

4.6.6 The certification organization's investigation shall include, but not be limited to, the extent and scope of the problem as it might apply to other compliant products or compliant product components manufactured by other manufacturers or certified by other certification organizations.

4.6.7 The certification organization shall also investigate reports of a hazard where compliant product is gaining widespread use in applications not foreseen when the standard was written, such applications in turn being ones for which the product was not certified, and no specific scope of application has been provided in the standard, and no limiting scope of application was provided by the manufacturer in written material accompanying the compliant product at the point of sale.

4.6.8 The certification organization shall require the manufacturer of the compliant product, or the manufacturer of the compliant product component if applicable, to assist the certification organization in the investigation and to conduct its own investigation as specified in Section 4.7, Manufacturers' Investigation of Complaints and Returns.

4.6.9 Where the facts indicating a need for corrective action are conclusive and the certification organization's appeal procedures referenced in 4.2.11 have been followed, the certification organization shall initiate corrective action immediately, provided there is a manufacturer to be held responsible for such action.

4.6.10 Where the facts are conclusive and corrective action is indicated, but there is no manufacturer to be held responsible, such as when the manufacturer is out of business or the manufacturer is bankrupt, the certification organization shall immediately notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

4.6.11* Where the facts are conclusive and corrective action is indicated, the certification organization shall take one or more of the following corrective actions:

- (1) Notification of parties authorized and responsible for issuing a safety alert when, in the opinion of the certification organization, such a notification is necessary to inform the users.
- (2) Notification of parties authorized and responsible for issuing a product recall when, in the opinion of the certification organization, such a recall is necessary to protect the users.
- (3) Removing the mark of certification from the product.
- (4) Where a hazardous condition exists and it is not practical to implement item (1), (2), or (3), or the responsible parties refuse to take corrective action, the certification organization shall notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

4.6.12 The certification organization shall provide a report to the organization or individual identifying the reported hazard-

ous condition and notify them of the corrective action indicated, or that no corrective action is indicated.

4.6.13* Where a change to an NFPA standard(s) is felt to be necessary, the certification organization shall also provide a copy of the report and corrective actions indicated to the NFPA, and shall also submit either a Public Proposal for a proposed change to the next revision of the applicable standard, or a proposed Temporary Interim Amendment (TIA) to the current edition of the applicable standard.

4.7 Manufacturers' Investigation of Complaints and Returns.

4.7.1 Manufacturers shall provide corrective action in accordance with ISO/DIS 9001, *Quality management systems — Requirements*, for investigating written complaints and returned products.

4.7.2 Manufacturers' records of returns and complaints related to safety issues shall be retained for at least 5 years.

4.7.3 Where the manufacturer discovers, during the review of specific returns or complaints, that a compliant product or compliant product component can constitute a potential safety risk to end users that is possibly subject to a safety alert or product recall, the manufacturer shall immediately contact the certification organization and provide all information about their review to assist the certification organization with their investigation.

4.8 Manufacturers' Safety Alert and Product Recall Systems.

4.8.1 Manufacturers shall establish a written safety alert system and a written product recall system that describes the procedures to be used in the event that it decides, or is directed by the certification organization, to either issue a safety alert or to conduct a product recall.

4.8.2 The manufacturers' safety alert and product recall system shall provide the following:

- (1) Establishment of a coordinator and responsibilities by the manufacturer for the handling of safety alerts and product recalls
- (2) Method of notifying all dealers, distributors, purchasers, users, and the NFPA about the safety alert or product recall that can be initiated within a 1-week period following the manufacturer's decision to issue a safety alert or to conduct a product recall, or after the manufacturer has been directed by the certification organization to issue a safety alert or conduct a product recall
- (3) Techniques for communicating accurately and understandably the nature of the safety alert or product recall and in particular the specific hazard or safety issue found to exist
- (4) Procedures for removing product that is recalled and for documenting the effectiveness of the product recall
- (5) Plan for either repairing, or replacing, or compensating purchasers for returned product

Chapter 5 Labeling and Information

5.1 Product Labeling Requirements.

5.1.1 General.

- ▲ **5.1.1.1** Each protective ensemble shall have a product label permanently and conspicuously attached to, embossed on, or printed on each separable element of the ensemble when the

ensemble is properly assembled with all layers, components, and component parts in place.

5.1.1.2 Each glove element shall have a product label permanently and conspicuously attached to, embossed on, or printed on the top outside of the gauntlet of each glove piece when the glove is properly assembled with all layers, components, and component parts in place. In place of the product label being affixed to the glove, the product label shall be permitted to be attached to, printed on, or inserted into each package containing one or more pairs of gloves.

5.1.1.3 Each footwear element shall have a product label permanently and conspicuously attached to, embossed on, or printed on the inside of each footwear piece when the footwear is properly assembled with all layers, components, and component parts in place. In place of the product label being affixed to the footwear, the product label shall be permitted to be attached to, printed on, or inserted into each package containing one or more pairs of footwear.

5.1.1.4 Multiple label pieces shall be permitted in order to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

5.1.1.5 All worded portions of the required product label shall at least be in English.

5.1.1.6 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s) where such symbols and other pictorial graphic representations are clearly explained in the user information.

5.1.1.7* The certification organization's label, symbol, or identifying mark shall be legibly printed on the product label. All letters shall be at least 6 mm ($\frac{1}{4}$ in.) high.

5.1.1.8 The compliance and information statements specified in 5.1.2 or 5.1.3, as applicable for the specific ensemble or ensemble element, shall be legibly printed on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high.

- ▲ **5.1.1.9** In addition to the compliance and information statements required by 5.1.1.8, at least the following information shall also be printed legibly on the product label(s) and shall be at least 1.6 mm ($\frac{1}{16}$ in.) high:

- (1) Manufacturer's name, identification, or designation
- (2) Manufacturer's address
- (3) Country of manufacture
- (4) Model, style, or serial number
- (5) Size
- (6) Garment, glove, footwear, ensemble material(s)
- (7) Visor material(s) if provided
- (8) Glove element for the ensemble
- (9) Footwear element for the ensemble
- (10) Hood element for the ensemble
- (11) "Breathable (see manufacturer's Technical Data Package)" as required by 6.2.7

- ▲ **5.1.1.10** Where detachable components, including but not limited to outer garments, outer gloves, or outer boots, must be worn with an ensemble or ensemble element in order for the ensemble or ensemble element to be compliant with this standard, at least the following statement and information shall also be printed legibly on the product label of the ensemble or ensemble element that requires an additional component. All

letters shall be at least 1.6 mm ($\frac{1}{16}$ in.) high. The appropriate term *ensemble* or *ensemble element* shall be inserted where indicated in the label text. The statement shall be followed by the detachable component(s) type and identification and instructions for proper wear.

"TO BE COMPLIANT WITH NFPA 1994, THE FOLLOWING ADDITIONAL COMPONENTS MUST BE WORN IN CONJUNCTION WITH THIS HAZARDOUS MATERIALS AND CBRN PROTECTIVE [insert the term ENSEMBLE or ENSEMBLE ELEMENT here]:"

[The detachable component(s) information shall appear here.]

5.1.1.11 Detachable components specified in 5.1.1.10 shall be identified by the type of item, the manufacturer, and the style or model number.

5.1.1.12 The manufacturer shall be permitted to list the detachable components in the technical data package. Where the manufacturer chooses to list detachable components in the technical data package, the manufacturer shall provide an additional statement in the label statement required by 5.1.1.10 as follows:

"SEE TECHNICAL DATA PACKAGE FOR A LIST OF DETACHABLE COMPONENTS."

5.1.1.13 Detachable components specified in 5.1.1.10 shall meet the label requirements specified in ASTM F1301, *Standard Practice for Labeling Chemical Protective Clothing*.

5.1.2 Ensemble Compliance Statements.

5.1.2.1 Each protective ensemble shall have at least the following compliance statement on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The appropriate numeral for the class of the ensemble, 1, 2, 3, or 4, and the appropriate term for the type of ensemble, *encapsulating* or *nonencapsulating*, shall be inserted where indicated in the label text.

"THIS CLASS [insert 1, 2, 2R, 3, 3R, 4, or 4R here] [insert ENCAPSULATING or NONENCAPSULATING here] HAZARDOUS MATERIALS AND CBRN PROTECTIVE ENSEMBLE MEETS THE REQUIREMENTS OF NFPA 1994, STANDARD ON PROTECTIVE ENSEMBLES FOR FIRST RESPONDERS TO HAZARDOUS MATERIALS EMERGENCIES AND CBRN TERRORISM INCIDENTS, 2018 EDITION, FOR THE ABOVE-NOTED CLASS. DO NOT REMOVE THIS LABEL."

5.1.2.2 Following the text in 5.1.2.1, the following statement shall be made on the product label. All letters shall be at least 1.6 mm ($\frac{1}{16}$ in.) high.

"THE TECHNICAL DATA PACKAGE CONTAINS INFORMATION ON HAZARDOUS MATERIALS AND CBRN AGENTS FOR WHICH THIS ENSEMBLE IS CERTIFIED. CONSULT THE TECHNICAL DATA PACKAGE AND MANUFACTURER'S INSTRUCTIONS BEFORE USE. DO NOT REMOVE THIS LABEL."

N 5.1.2.3 Where the manufacturer specifies outer footwear element options as permitted in 6.1.3.1, the following additional language shall be provided as part of the product label:

"OUTER BOOT FOOTWEAR OPTIONS WORN WITH THIS ENSEMBLE MUST MEASURE AT LEAST 200 MM (8 IN.) HIGH AND BE CERTIFIED TO NFPA 1951, 1971, 1991, 1992, 1994, or 1999."

5.1.3 Glove and Footwear Elements Compliance Statements.

5.1.3.1 Each glove element and footwear element shall have at least the following compliance statement on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The appropriate number for the class of the ensemble 1, 2, 3, or 4; and the appropriate term for the type of element, *glove* or *footwear*, shall be inserted where indicated in the label text.

"THIS CLASS [insert 1, 2, 2R, 3, 3R, 4, or 4R here] HAZARDOUS MATERIALS AND CBRN PROTECTIVE [insert GLOVE or FOOTWEAR here] ELEMENT MEETS THE REQUIREMENTS OF NFPA 1994, STANDARD ON PROTECTIVE ENSEMBLES FOR FIRST RESPONDERS TO HAZARDOUS MATERIALS EMERGENCIES AND CBRN TERRORISM INCIDENTS, 2018 EDITION, FOR THE ABOVE-NOTED CLASS. DO NOT REMOVE THIS LABEL"

5.1.3.2 Following the text in 5.1.3.1, the following statement shall be made on the product label. All letters shall be at least 1.6 mm ($\frac{1}{16}$ in.) high.

"THE TECHNICAL DATA PACKAGE CONTAINS INFORMATION ON HAZARDOUS MATERIALS AND CBRN AGENTS FOR WHICH THIS (INSERT GLOVE OR FOOTWEAR HERE) ELEMENT IS CERTIFIED. CONSULT THE TECHNICAL DATA PACKAGE AND MANUFACTURER'S INSTRUCTIONS BEFORE USE. DO NOT REMOVE THIS LABEL."

Δ 5.1.3.3 Where footwear is designed and configured according to 6.4.10, the sock, the outer boot, and the integrity cover shall have at least the following compliance statement on each component, and all letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high:

"THE [insert component], WHEN WORN WITH [insert other two components], MEETS THE HAZARDOUS MATERIALS AND CBRN FOOTWEAR REQUIREMENTS OF CLASS [insert 1, 2, 2R, 3, 3R, 4, or 4R] OF NFPA 1994, STANDARD ON PROTECTIVE ENSEMBLES FOR FIRST RESPONDERS TO HAZARDOUS MATERIALS EMERGENCIES AND CBRN TERRORISM INCIDENTS, 2018 EDITION, FOR THE ABOVE-NOTED CLASS. DO NOT REMOVE THIS LABEL."

N 5.1.4 Hood Elements Compliance Statements.

N 5.1.4.1 Each Class 3, 3R, 4, or 4R hood element shall have at least the following compliance statement on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The appropriate number for the class of the ensemble (3 or 4) shall be inserted where indicated in the label text.

"THIS CLASS [insert 3, 3R, 4, or 4R here] CBRN PROTECTIVE HOOD ELEMENT MEETS THE REQUIREMENTS OF NFPA 1994, STANDARD ON PROTECTIVE ENSEMBLES FOR FIRST RESPONDERS TO HAZARDOUS MATERIALS EMERGENCIES AND CBRN TERRORISM INCIDENTS, 2018 EDITION, FOR THE ABOVE-NOTED CLASS. DO NOT REMOVE THIS LABEL"

N 5.1.4.2 Following the text in 5.1.4.1, the following statement shall appear on the product label. All letters shall be at least 1.6 mm ($\frac{1}{16}$ in.) high.

“THE TECHNICAL DATA PACKAGE CONTAINS INFORMATION ON HAZARDOUS MATERIALS AND CBRN AGENTS FOR WHICH THIS HOOD ELEMENT IS CERTIFIED. CONSULT THE TECHNICAL DATA PACKAGE AND MANUFACTURER'S INSTRUCTIONS BEFORE USE. DO NOT REMOVE THIS LABEL.”

N 5.1.5 Optional Compliance Statements.

N 5.1.5.1 Where a protective ensemble meets the additional optional requirements for flash fire protection, the protective ensemble shall have the following additional compliance statement as part of the product label. All letters shall be at least 1.6 mm ($\frac{1}{16}$ in.) high.

“THIS ENSEMBLE HAS BEEN CERTIFIED FOR LIMITED CHEMICAL FLASH FIRE PROTECTION ESCAPE ONLY IN THE EVENT OF A CHEMICAL FLASH FIRE. DO NOT REMOVE THIS LABEL.”

N 5.1.5.2 Where the protective ensemble has also been evaluated to the optional stealth requirements, the protective ensemble shall have the following additional statement as part of the product label. All letters shall be at least 1.6 mm ($\frac{1}{16}$ in.) high.

“THIS ENSEMBLE HAS BEEN EVALUATED TO THE OPTIONAL STEALTH REQUIREMENTS OF THIS STANDARD. REFER TO THE TECHNICAL DATA PACKAGE FOR SPECIFIC INFORMATION. DO NOT REMOVE THIS LABEL.”

5.2 User Information.

5.2.1 The manufacturer shall provide user information including, but not limited to, warnings, information, and instructions with each individual hazardous materials and CBRN protective ensemble and ensemble element.

5.2.2 The manufacturer shall attach the required user information, or packaging containing the user information, to hazardous materials and CBRN protective ensembles and ensemble elements in such a manner that it is not possible to use the hazardous materials and CBRN protective ensemble and ensemble elements without being aware of the availability of the information.

Δ 5.2.3 The manufacturer shall provide at least the following instructions and information with each hazardous materials and CBRN protective ensemble and ensemble element:

- (1) Pre-use information, as follows:
 - (a) Safety considerations
 - (b) Limitations of use
 - (c) Ensemble element marking recommendations and restrictions
 - (d) Statement that most performance properties of the ensemble and ensemble elements cannot be tested by the user in the field
 - (e) Closure lubricants, if applicable
 - (f) Visor antifog agents or procedures, if applicable
 - (g) Recommended undergarments
 - (h) Respirator considerations for ensembles
 - (i) Warranty information
- (2) Recommended storage practices

- (3) Inspection frequency and details
- (4) Don/doff, as follows:
 - (a) Donning and doffing procedures
 - (b) Sizing and adjustment procedures
 - (c) Ensemble interface issues
 - (d) Respirator interface with ensemble
- (5) Proper use in accordance with the following:
 - (a) NFPA 1500
 - (b) For users in the United States, 29 CFR 1910.132, “Personal Protective Equipment”
 - (c) For users in other countries, a statement to advise users to consult national or other applicable personal protective equipment regulations
- (6) Maintenance and cleaning, as follows:
 - (a) Cleaning instructions and precautions with a statement advising users not to use clothing or ensembles that are not thoroughly cleaned and dried
 - (b) Inspection details
 - (c) Maintenance criteria and repair methods, where applicable
 - (d) Decontamination procedures for both chemical/biological contamination
- (7) Retirement and disposal criteria and consideration

5.2.4 The manufacturer shall state the storage life for all hazardous materials and CBRN protective ensembles and ensemble elements.

5.3 Technical Data Package.

5.3.1* The manufacturer shall furnish a technical data package for the hazardous materials and CBRN protective ensemble and ensemble elements upon the request of the purchaser.

5.3.2* The technical data package shall contain all documentation required by this standard and the values obtained from the initial certification showing compliance with the requirements of Chapter 7 in the current edition of this standard, using the reporting formats provided in Table 5.3.2(a) and Table 5.3.2(b) for each ensemble, element, material, or component, as applicable.

N 5.3.2.1 The technical data package information shall indicate “Pass” for those requirements where there is no quantitative value reported and “Not applicable” for specific requirements that do not apply to the protective ensemble.

N 5.3.2.2 The manufacturer shall be permitted to make modifications in the tabular format in order to accommodate specific product features or additional materials as applicable to the certified product.

5.3.3 In the technical data package, the manufacturer shall describe the hazardous materials and CBRN protective ensemble and ensemble elements in terms of manufacturer trade name and model number, manufacturer replaceable components, available options, accessories, testing devices, and sizes.

5.3.4* In the technical data package, the manufacturer shall describe the available sizes of the hazardous materials and CBRN protective ensemble and ensemble elements.

5.3.4.1 Descriptions of size shall include the range in height and weight for persons fitting each particular size for ensembles, or sizes specific in Chapter 6 for glove, hood, and footwear elements.

N Table 5.3.2(a) Format for Reporting Certification Test Data in Technical Data Package

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
<i>Class 1 Ensembles</i>				
Nonencapsulating ensemble or encapsulating ensemble	Liquidtight integrity	Procedure A of ASTM F1359/F1359M (Section 8.4)	No liquid penetration	
	Overall inward leakage (MIST)	Section 8.2	$PPDF_i \geq 871$	
	Overall ensemble function and integrity	Procedures A and B, in ASTM F1154 (Section 8.3)	$PPDF_{ys} \geq 441$ Test subject completes task ≤ 20 minutes Accommodates head protection devices meeting ANSI/ISEA Z89.1 (Type 1, Class G) Protective flap remains closed over closure system Test subject has visual acuity through facepiece lens and visor 20/35 or better Test subject properly identifies 3 out of 4 numbers on NFPA 704 placard at each angle	
Encapsulating ensemble	Gastight integrity	ASTM F1052 (Section 8.26)	Ending suit pressure ≥ 80 mm ($\geq 3 \frac{3}{32}$ in.) water gauge	
	Overall ensemble function and integrity	ASTM F1154 (Section 8.3)	Time to remove and reinsert hands in gloves 5 times ≤ 2.5 minutes	
External fitting	Maximum ensemble ventilation rate	Section 8.27	Internal suit pressure ≤ 150 mm (≤ 6 in.) water gauge	
	Gastight integrity	ASTM F1052 (Section 8.26)	Ending suit pressure ≥ 80 mm ($\geq 3 \frac{3}{32}$ in.) water gauge	
External fittings intended for tethered applications	Pull out strength	Section 8.6	Strength ≥ 1000 N (≥ 225 lbf)	
External fittings not intended for tethered applications	Pull out strength	Section 8.6	Strength ≥ 135 N (≥ 30 lbf)	
Exhaust valves	Exhaust valve mounting strength	Section 8.24	Strength ≥ 135 N (≥ 30 lbf)	
	Exhaust valve inward leakage	Section 8.25	Leakage rate ≤ 30 mL/min (≤ 1.83 in. ³ /min) 1.8	
<i>Class 1 Garment Elements</i>				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
Garment materials	Burst strength	Section 8.9	Strength ≥ 200 N (≥ 45 lbf)	
Sock materials	Burst strength	Section 8.9	Strength ≥ 156 N (≥ 35 lbf)	
Garment materials	Puncture propagation tear resistance	ASTM D2582 (Section 8.10)	Tear resistance ≥ 49 N (≥ 11 lbf)	
Sock materials	Puncture propagation tear resistance	ASTM D2582 (Section 8.10)	Tear resistance ≥ 31 N (≥ 7 lbf)	
Garment materials	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (0.5 in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	
Garment materials	Flammability resistance	ASTM F1358 (Section 8.28)	Afterflame time of ≤ 2.0 s and does not melt and drip	
Seams and closure assemblies	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 67 N/25 mm (≥ 15 lbf/1 in.)	
<i>Class 1 Garment Visors</i>				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
Materials	Visor high-mass impact resistance	Section 9.11 of ANSI/ISEA Z87.1 (Section 8.13)	No full-thickness punctures, cracks, holes, or fractures	
Materials	Flammability resistance	ASTM F1358 (Section 8.28)	Afterflame time of ≤ 2.0 s and does not melt and drip	

(continues)

N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
Material seams	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥67 N/25 mm (≥15 lbf/1 in.)	
Elastomeric Interface Materials				
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Elongation at rupture ≥125%	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥7 N (≥1.6 lbf)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Ultimate tensile strength of ≥4 MPa (≥580 psi)	
Class 1 Glove Elements				
	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥15 N (≥3.8 lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤0.057 N·m (≤0.5 in.·lbf) at an angular deflection of 60°at −25°C (−13°F)	
	Flammability resistance	ASTM F1358 (Section 8.28)	Afterflame time of ≤2.0 s and does not melt and drip	
	Glove hand function	ASTM F2010/F2010M (Section 8.16)	Average % increase over barehanded control <300%	
Class 1 Footwear Elements				
	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Slip resistance	ISO 13287 (Section 8.19)	Coefficient of friction ≥0.40	
	Flammability resistance	ASTM F1358 (Section 8.28)	Afterflame time of ≤2.0 s and does not melt and drip	
Upper materials	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥36 N (≥8 lbf)	
Soles and heels	Abrasion resistance	ISO 4649 (Section 8.17)	Relative volume loss not >250 mm ³ (>0.015 in. ³)	
Footwear covers			Meet the requirements specified in 7.1.4.1, 7.1.4.2, 7.1.4.3, 7.1.4.4, 7.1.4.6, and 7.1.4.7	
	Abrasion resistance	ASTM D3884 (Section 8.23)	Show no wear-through after 3000 cycles	
Socks			Outer boot of the footwear element meets the minimum height requirement specified in 6.4.3 and the cut resistance performance requirement in 7.1.4.3	
Class 2 Ensembles				
	Liquidtight integrity	Procedure A of ASTM F1359/F1359M (Section 8.4)	No liquid penetration	

(continues)

Shaded text = Revisions.  = Text deletions and figure/table revisions. • = Section deletions. **N** = New material



N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
	Overall inward leakage (MIST)	Section 8.2	$PPDF_i \geq 481$	
	Overall ensemble function and integrity	Procedures A and B in ASTM F1154 (Section 8.3)	$PPDF_{sys} \geq 328$ Test subject completes task ≤ 20 minutes Accommodates head protection devices meeting ANSI/ISEA Z89.1 (Type 1, Class G) Protective flap remains closed over closure system Test subject has visual acuity through facepiece lens and visor 20/35 or better	
External fittings intended for tethered applications	Fitting pull out strength	Section 8.6	Strength ≥ 1000 N (≥ 225 lbf)	
External fittings not intended for tethered applications	Fitting pull out strength	Section 8.6	Strength ≥ 135 N (≥ 30 lbf)	
Exhaust valves	Exhaust valve mounting strength	Section 8.24	Strength ≥ 135 N (≥ 30 lbf)	
	Exhaust valve inward leakage	Section 8.25	Leakage rate ≤ 30 mL/min (≤ 1.83 in. ³ /min)	
Class 2 Garment Elements				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
Garment materials	Burst strength	Section 8.9	Strength ≥ 156 N (≥ 35 lbf)	
Garment materials	Puncture propagation tear resistance	ASTM D2582 (Section 8.10)	Tear resistance ≥ 31 N (≥ 7 lbf)	
Garment materials	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	
Seams and closure assemblies	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 34 N/25 mm (≥ 7.5 lbf/1 in.)	
Class 2 Garment Visors				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
Materials	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
	Visor high-mass impact resistance	Section 9.11 of ANSI/ISEA Z87.1 (Section 8.13)	No full-thickness punctures, cracks, holes, or fractures	
Material seams	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 34 N/25 mm (≥ 7.5 lbf/1 in.)	
Class 2 Elastomeric Interface Materials				
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Elongation at rupture $\geq 125\%$	
	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 7 N (≥ 1.6 lbf)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Ultimate tensile strength of ≥ 4 MPa (≥ 580 psi)	

(continues)

N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
<i>Class 2 Glove Elements</i>				
	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 15 N (≥ 3.8 lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	
	Glove hand function	ASTM F2010/F2010M (Section 8.16)	Average % increase over barehanded control $< 300\%$	
Materials and seams	Viral penetration resistance	ASTM F1671 (Section 8.21)	No penetration for ≥ 1 hr	
<i>Class 2 Footwear Elements</i>				
Upper materials	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Slip resistance	ISO 13287 (Section 8.19)	Coefficient of friction ≥ 0.40	
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 36 N (≥ 8 lbf)	
	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
Soles and heels	Abrasion resistance	ISO 4649 (Section 8.17)	Relative volume loss will not be > 250 mm ³ (> 0.015 in. ³)	
Footwear covers			Meet the requirements specified in 7.2.4.1, 7.2.4.2, 7.2.4.3, 7.2.4.4, 7.2.4.6, and 7.2.4.7	
Socks	Abrasion resistance	ASTM D3884 (Section 8.23)	Show no wear-through after 3000 cycles	
			Outer boot of the footwear element meets the minimum height requirement specified in 6.4.3 and the cut resistance performance requirement in 7.2.4.3	
<i>Class 2R Ensembles</i>				
	Liquidtight integrity	Procedure A of ASTM F1359/F1359M (Section 8.4)	No liquid penetration	
	Overall inward leakage (MIST)	Section 8.2	$PPDF_i \geq 481$	
	Overall ensemble function and integrity	Procedures A and B, in ASTM F1154 (Section 8.3)	$PPDF_{sys} \geq 328$ Test subject completes task ≤ 20 minutes	
			Accommodates head protection devices meeting ANSI/ISEA Z89.1 (Type 1, Class G) Protective flap remains closed over closure system Test subject has visual acuity through facepiece lens and visor 20/35 or better	
External fittings intended for tethered applications	Fitting pull out strength	Section 8.6	Strength ≥ 1000 N (≥ 225 lbf)	

(continues)

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N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
External fittings not intended for tethered applications	Fitting pull out strength	Section 8.6	Strength ≥ 135 N (≥ 30 lbf)	
Exhaust valves	Exhaust valve mounting strength	Section 8.24	Strength ≥ 135 N (≥ 30 lbf)	
	Exhaust valve inward leakage	Section 8.25	Leakage rate ≤ 30 mL/min (≤ 1.83 in. ³ /min)	
Class 2R Garment Elements				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
Garment materials	Burst strength	Section 8.9	Strength ≥ 200 N (≥ 45 lbf)	
Sock materials	Burst strength	Section 8.9	Strength ≥ 156 N (≥ 35 lbf)	
Garment materials	Puncture propagation tear resistance	ASTM D2582 (Section 8.10)	Tear resistance ≥ 49 N (≥ 11 lbf)	
Sock materials	Puncture propagation tear resistance	ASTM D2582 (Section 8.10)	Tear resistance ≥ 31 N (≥ 7 lbf)	
Garment materials	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	
Seams and closure assemblies	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 67 N/25 mm (≥ 15 lbf/1 in.)	
Class 2R Garment Visors				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
Materials	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
	Visor high-mass impact resistance	Section 9.11 of ANSI/ISEA Z87.1 (Section 8.13)	No full-thickness punctures, cracks, holes, or fractures	
Material seams	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 67 N/25 mm (≥ 15 lbf/1 in.)	
Class 2R Elastomeric Interface Materials				
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Elongation at rupture $\geq 125\%$	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342 (Section 8.15)	Puncture resistance of ≥ 7 N (≥ 1.6 lbf)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Ultimate tensile strength of ≥ 4 MPa (≥ 580 psi)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	
Class 2R Glove Elements				
	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 15 N (≥ 3.8 lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	

(continues)

N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
Materials and seams	Glove hand function	ASTM F2010/F2010M (Section 8.16)	Average % increase over barehanded control <300%	
	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥1 hr	
Class 2R Footwear Elements				
Upper materials	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Slip resistance	ISO 13287 (Section 8.19) ASTM F2412	Coefficient of friction ≥0.40 Meets ASTM F2413, for impact-, compression-, and puncture-resistant footwear with the exception of flex resistance to cracking	
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥36 N (≥8 lbf)	
Soles and heels	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥1 hr	
	Abrasion resistance	ISO 4649 (Section 8.17)	Relative volume loss not >250 mm ³ (0.015 in ³)	
Footwear covers			Meet the requirements specified in 7.3.4.1, 7.3.4.2, 7.3.4.3, 7.3.4.4, 7.3.4.6, and 7.3.4.7, excluding 7.3.4.5	
Socks	Abrasion resistance	ASTM D3884 (Section 8.23)	Show no wear-through after 3000 cycles Outer boot of the footwear element meets the minimum height requirement specified in 6.4.3 and the cut resistance performance requirement in 7.3.4.3	
	Class 3 Ensembles			
External fittings intended for tethered applications	Liquidtight integrity	Procedure A of ASTM F1359/F1359M (Section 8.4)	No liquid penetration	
	Overall inward leakage (MIST)	Section 8.2	PPDF _i ≥ 160 PPDF _{sys} ≥ 69	
	Overall ensemble function and integrity	Procedures A and B, in ASTM F1154 (Section 8.3)	Test subject completes task ≤20 minutes Accommodates head protection devices meeting ANSI/ISEA Z89.1 (Type 1, Class G) Protective flap remains closed over closure system Test subject has visual acuity through facepiece lens and visor 20/35 or better	
	Fitting pull out strength	Section 8.6	Strength ≥1000 N (≥225 lbf)	
	Fitting pull out strength	Section 8.6	Strength ≥135 N (≥30 lbf)	
Exhaust valves	Exhaust valve mounting strength	Section 8.24	Strength ≥135 N (≥30 lbf)	
	Exhaust valve inward leakage	Section 8.25	Leakage rate ≤30 mL/min (≤1.83 in. ³ /min)	

Shaded text = Revisions.  = Text deletions and figure/table revisions. • = Section deletions.  = New material

N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
Class 3 Garment Elements				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥1 hr	
Garment materials	Burst strength	Section 8.9	Strength ≥135 N (≥30 lbf)	
	Puncture propagation tear resistance	ASTM D2582 (Section 8.10)	Tear resistance ≥25 N (≤5 ⅓ lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤0.057 N·m (≤0.5 in.·lbf) at an angular deflection of 60°at −25°C (−13°F)	
	Total heat loss	Section 8.8	≥200 W/m²	
Seams and closure assemblies	Evaporative resistance	ISO 11092 (Section 8.20)	≤30 Pa m²/W	
	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥34 N/25 mm (≥7.5 lbf/1 in.)	
Class 3 Garment Visors				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
Materials	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥1 hr	
	Visor high-mass impact resistance	Section 9.11 of ANSI/ISEA Z87.1		
		Section 8.13	No full-thickness punctures, cracks, holes, or fractures	
Material seams	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥34 N/25 mm (≥7.5 lbf/1 in.)	
Class 3 Elastomeric Interface Materials				
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Elongation at rupture ≥125%	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥7 N (≥1.6 lbf)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Ultimate tensile strength of ≥4 MPa (≥580 psi)	
Class 3 Glove Elements				
	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥9 N (≥2 lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤0.057 N·m (≤½ in. lbf) at an angular deflection of 60°at −25°C (−13°F)	
	Glove hand function	ASTM F2010/F2010M (Section 8.16)	Average % increase over barehanded control <200%	
Materials and seams	Viral penetration resistance	ASTM F1671 (Section 8.21)	No penetration for ≥1 hr	
Class 3 Footwear Elements				
	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	
	Slip resistance	ISO 13287 (Section 8.19)	Coefficient of friction ≥0.40	

(continues)

N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
Upper materials	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥36 N (≥8 lbf)	
	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥1 hr	
Soles and heels	Abrasion resistance	ISO 4649 (Section 8.17)	Relative volume loss not >250 mm ³ >250 mm ³ (>0.015 in ³)	
Footwear covers			Meet the requirements specified in 7.4.4.1, 7.4.4.2, 7.4.4.3, 7.4.4.4, 7.4.4.6, and 7.4.4.7	
	Abrasion resistance	ASTM D3884 (Section 8.23)	Show no wear-through after 3000 cycles	
Footwear designed and configured according to 6.4.10			(1) Booties sock meets the requirements specified in 7.4.4.2 and 7.4.4.3	
			(2) Outer boot meets the requirements specified in 7.4.4.4 and 7.4.4.5	
			(3) Integrity cover meets the requirements in 7.4.4.1, 7.4.4.7, and 7.4.4.9	
Socks			Outer boot of the footwear element meets the minimum height requirement specified in 6.4.3 and the cut resistance performance requirement specified in 7.4.4.3	
Class 3 Hood Elements				
Elastomeric interface material	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Meet all of the applicable requirements specified in 7.4.1	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7	Elongation at rupture ≥125%	
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥7 N (≥1.6 lbf)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Ultimate tensile strength of ≥4 MPa (≥580 psi)	
Class 3R Ensembles				
	Liquidtight integrity	Procedure A of ASTM F1359/F1359M (Section 8.4)	No liquid penetration	
	Overall inward leakage (MIST)	Section 8.2	PPDF _i ≥ 160	
	Overall ensemble function and integrity	Procedures A and B, in ASTM F1154 (Section 8.3)	PPDF _{sys} ≥ 69 Test subject completes task ≤20 minutes	
			Accommodates head protection devices meeting ANSI/ISEA Z89.1 (Type 1, Class G)	
			Protective flap remains closed over closure system	
			Test subject has visual acuity through facepiece lens and visor 20/35 or better	
External fittings intended for tethered applications	Fitting pull out strength	Section 8.6	Strength ≥1000 N (≥225 lbf)	

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Shaded text = Revisions. Δ = Text deletions and figure/table revisions. • = Section deletions. N = New material

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N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
External fittings not intended for tethered applications	Fitting pull out strength	Section 8.6	Strength ≥ 135 N (≥ 30 lbf)	
Exhaust valves	Exhaust valve mounting strength	Section 8.24	Strength ≥ 135 N (≥ 30 lbf)	
	Exhaust valve inward leakage	Section 8.25	Leakage rate ≤ 30 mL/min (≤ 1.83 in. ³ /min)	
Class 3R Garment Elements				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
Garment materials	Burst strength	Section 8.9	Strength ≥ 156 N (≥ 35 lbf)	
	Puncture propagation tear resistance	ASTM D2582 (Section 8.10)	Tear resistance ≥ 31 N (≥ 7 lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	
	Total heat loss	Section 8.8	≥ 200 W/m ²	
	Evaporative resistance	ISO 11092 (Section 8.20)	≤ 30 Pa m ² /W	
Seams and closure assemblies	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 34 N/25 mm (≥ 7.5 lbf/1 in.)	
Class 3R Garment Visors				
Materials and seams	Chemical permeation resistance	Section 8.7		See Table 5.3.2(b).
Materials	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr.	
	Visor high-mass impact resistance	Section 9.11 of ANSI/ISEA Z87.1 (Section 8.13)	No full-thickness punctures, cracks, holes, or fractures	
Material seams	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 34 N/25 mm (≥ 7.5 lbf/1 in.)	
Class 3R Elastomeric Interface Materials				
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Elongation at rupture $\geq 125\%$	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 7 N (≥ 1.6 lbf)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Ultimate tensile strength of ≥ 4 MPa (≥ 580 psi)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m ($\leq \frac{1}{2}$ in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	
Class 3R Glove Elements				
	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 15 N (≥ 3.8 lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in.·lbf) at an angular deflection of 60° at -25°C (-13°F)	

(continues)

N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
Materials and seams	Glove hand function	ASTM F2010/F2010M (Section 8.16)	Average % increase over barehanded control <200%	See Table 5.3.2(b).
	Viral penetration resistance	ASTM F1671 (Section 8.21)	No penetration for ≥1 hr	
Class 3R Footwear Elements				
Upper materials	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	See Table 5.3.2(b).
	Slip resistance	ISO 13287 (Section 8.19)	Coefficient of friction ≥0.40	
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥36 N (≥8 lbf)	
Soles and heels	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥1 hr	
	Abrasion resistance	ISO 4649 (Section 8.17)	Relative volume loss not >250 mm ³ Meet the requirements specified in 7.5.4.1, 7.5.4.2, 7.5.4.3, 7.5.4.4, 7.5.4.5, and 7.5.4.7, excluding 7.5.4.6	
Footwear covers	Abrasion resistance	ASTM D3884 (Section 8.23)	Show no wear-through after 3000 cycles (1) Booties sock meets the requirements specified in 7.5.4.2 and 7.5.4.3 (2) Outer boot meets the requirements specified in 7.5.4.4 and 7.5.4.5 (3) Integrity cover meets the requirements in 7.5.4.1, 7.5.4.7, and 7.5.4.9 Outer boot of the footwear element meets the minimum height requirement specified in 6.4.3 and the cut resistance performance requirement specified in 7.5.4.4	
Footwear designed and configured according to 6.4.10				
Socks				
Class 3R Hood Elements				
Elastomeric interface material	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Meet all of the applicable requirements specified in 7.5.1 Elongation at rupture ≥125%	See Table 5.3.2(b).
	Chemical permeation resistance	Section 8.7		
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥20 mm (≥0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥7 N (≥1.6 lbf)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Ultimate tensile strength of ≥4 MPa (≥580 psi)	
Class 4 Ensembles				
	Overall particulate inward leakage	Section 8.5	No visual particulate inward leakage	
	Overall ensemble function and integrity	Procedures A and B, in ASTM F1154 (Section 8.3)	Test subject completes task ≤15 min.	
			Accommodates head protection devices meeting ANSI/ISEA Z89.1 (Type 1, Class G) Protective flap remains closed over closure system	

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N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
External fittings intended for tethered applications	Fitting pull out strength	Section 8.6	Test subject has visual acuity through facepiece lens and visor 20/35 or better Strength ≥ 1000 N (≥ 225 lbf)	
External fittings (not intended for tethered applications)	Fitting pull out strength	Section 8.6	Strength ≥ 135 N (≥ 30 lbf)	
Exhaust valves	Exhaust valve mounting strength	Section 8.24	Strength ≥ 135 N (≥ 30 lbf)	
	Exhaust valve inward leakage	Section 8.25	Leakage rate ≤ 30 mL/min (1.83 in ³ /min)	
Class 4 Garment Elements				
Garment materials	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
	Burst strength	Section 8.9	Strength ≥ 135 N (≥ 30 lbf)	
	Puncture propagation tear resistance	ASTM D2582 (Section 8.10)	Tear resistance ≥ 25 N ($\geq 5\frac{3}{8}$ lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in·lbf) at an angular deflection of 60° at -25°C (-13°F)	
Seams and closure assemblies	Total heat loss	Section 8.8	≥ 450 W/m ²	
	Evaporative resistance	ISO 11092 (Section 8.20)	≤ 30 Pa m ² /W	
	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 34 N/25 mm (≥ 7.5 lbf/1 in.)	
Class 4 Garment Visors				
Materials	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
Material seams	Visor high-mass impact resistance	Section 9.11 of ANSI/ISEA Z87.1 (Section 8.13)	No full-thickness punctures, cracks, holes, or fractures	
	Seam/closure breaking strength	ASTM D751 (Section 8.12)	Breaking strength ≥ 34 N/25 mm (≥ 7.5 lbf/1 in.)	
Class 4 Elastomeric Interface Materials				
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Elongation at rupture $\geq 125\%$	
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 7 N (≥ 1.6 lbf)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Ultimate tensile strength of ≥ 4 MPa (≥ 580 psi)	
Class 4 Glove Elements				
	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 9 N (≥ 2 lbf)	
	Cold temperature performance	ASTM D747 (Section 8.11)	Bending moment of ≤ 0.057 N·m (≤ 0.5 in·lbf) at an angular deflection of 60° at -25°C (-13°F)	
	Glove hand function	ASTM F2010/F2010M (Section 8.16)	Average % increase over barehanded control $< 200\%$	
Materials and seams	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	

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N Table 5.3.2(a) *Continued*

Ensemble or Element	Performance Requirement	Test Method	Requirement	Result
Class 4 Footwear Elements				
Upper materials	Liquidtight integrity	ASTM D5151 with modifications (Section 8.22)	No liquid penetration	
	Slip resistance	ISO 13287 (Section 8.19)	Coefficient of friction ≥ 0.40	
	Cut resistance	ASTM F1790 (Section 8.14)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Puncture resistance of ≥ 36 N (≥ 8 lbf)	
Soles and heels	Viral penetration resistance	ASTM F1671/F1671M (Section 8.21)	No penetration for ≥ 1 hr	
	Abrasion resistance	ISO 4649 (Section 8.17)	Relative volume loss not > 250 mm ³ (> 0.015 in ³)	
Footwear covers			Meet the requirements specified in 7.6.4.1, 7.6.4.2, 7.6.4.3, 7.6.4.4, 7.6.4.6, and 7.6.4.7, excluding 7.6.4.5	
Footwear designed and configured according to 6.4.10	Abrasion resistance	ASTM D3884 (Section 8.23)	Show no wear-through after 3000 cycles	
			(1) Socks meet the requirements specified in 7.6.4.2	
			(2) Outer boot meets the requirements specified in 7.6.4.3 and 7.6.4.4	
Socks			(3) Integrity cover meets the requirements in 7.6.4.1, 7.6.4.7, and 7.6.4.8	
			Outer boot of the footwear element meets the minimum height requirement specified in 6.4.3 and the cut resistance performance requirement in 7.6.4.3	
Class 4 Hood Elements				
Elastomeric interface material	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Meet all the applicable requirements specified in 7.6.1	
	Cut resistance	ASTM F1790 (Section 8.14)	Elongation at rupture $\geq 125\%$	
	Puncture resistance	ASTM F1342/F1342M (Section 8.15)	Blade travel distance of ≥ 20 mm (≥ 0.8 in.)	
	Ultimate tensile strength	Method A of ASTM D412 (Section 8.29)	Puncture resistance of ≥ 7 N (≥ 1.6 lbf)	
Class 4R Ensembles				
	Overall particulate inward leakage	Section 8.5	No visual particulate inward leakage	
	Overall ensemble function and integrity	Procedures A and B, in ASTM F1154 (Section 8.3)	Test subject completes task ≤ 15 min	
			Accommodates head protection devices meeting ANSI/ISEA Z89.1 (Type 1, Class G)	
External fittings intended for tethered applications			Protective flap remains closed over closure system	
	Fitting pull out strength	Section 8.6	Test subject has visual acuity through facepiece lens and visor 20/35 or better	
			Strength ≥ 1000 N (≥ 225 lbf)	

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