

# NFPA 1991

## Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies

### 2005 Edition



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An International Codes and Standards Organization

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## NFPA 1991

### Standard on

## Vapor-Protective Ensembles for Hazardous Materials Emergencies

### 2005 Edition

This edition of NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*, was prepared by the Technical Committee on Hazardous Materials Protective Clothing and Equipment, released by the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment, and acted on by NFPA at its November Association Technical Meeting held November 13–17, 2004, in Miami Beach, FL. It was issued by the Standards Council on January 14, 2005, with an effective date of February 7, 2005, and supersedes all previous editions.

This edition of NFPA 1991 was approved as an American National Standard on February 7, 2005.

### Origin and Development of NFPA 1991

In 1985, the National Transportation Safety Board (NTSB) issued report I-004-5 on a hazardous material incident that occurred in Benicia, California. In that report, the NTSB recommended that standards be developed for protective clothing for protection from hazardous chemicals. The United States Department of Transportation (DOT) issued a position that requested private sector standards development to undertake the project of writing the standards on hazardous chemical protective clothing and asked other governmental agencies to assist and participate in the private sector standards development system. The DOT at this time also directly requested that the NFPA develop documents on hazardous chemical protective clothing. The Environmental Protection Agency (EPA), the United States Coast Guard (USCG), the Federal Emergency Management Agency (FEMA), and the Occupational Safety and Health Administration (OSHA) either adopted position statements modeled after the DOT position or endorsed the DOT position.

During 1985, the NFPA Standards Council approved a project for development of these standards and assigned the project to the Technical Committee on Fire Service Protective Clothing and Equipment. That committee established a standing Subcommittee on Hazardous Chemicals Protective Clothing, and they began their work in Phoenix, AZ, in March 1986. Representatives from the USCG, FEMA, and OSHA participated on the subcommittee.

At the same time, ASTM was developing a document on a selection of chemicals for evaluating protective clothing materials that would serve as one of several ASTM testing criteria that would be referenced in the NFPA standards.

The subcommittee met several times over a 2½-year period at different locations across the country and developed two standards, one for vapor-protection and one for liquid splash-protection.

NFPA 1991 addresses vapor-protective ensembles designed to protect emergency response personnel against exposure to specified chemicals in vapor and liquid splash environments during hazardous materials emergencies. Chemical permeation resistance documentation is required for primary suit materials (garment, visor, gloves, and boots) against each chemical in the NFPA battery of chemicals and any additional chemicals or specific chemical mixtures for which the manufacturer is certifying the suit. The NFPA battery of chemicals consists of 21 chemicals: those specified in ASTM F 1001, *Standard Guide for Chemicals to Evaluate Protective Clothing Materials*. These chemicals were selected because they are representative of the classes of chemicals that are encountered during hazardous chemical emergencies.

The standard includes performance requirements that were established to reflect simulated use conditions. A suit pressurization test is used to check the airtight integrity of each protective suit. Also, an overall suit water penetration test is designed to ensure the suit provides full body protection against liquid splashes. Primary suit materials must resist permeation for one hour or more by each chemical in the NFPA battery. Manufacturers may certify protective suits for additional chemicals when the same permeation performance is met. Also included are penetration resistance testing of closures and leak and cracking pressure tests for exhaust valves. These tests allow determination of adequate suit component performance in hazardous chemical environments.

Material testing for burst strength, tear strength, abrasion resistance, flammability resistance, cold temperature performance, and flexural fatigue are required so that materials used for vapor-protective suits will afford adequate protection in the environment where they will be used.

The other standard for hazardous materials emergency responders is NFPA 1992. It addresses liquid splash-protective ensembles and clothing designed to protect against exposure to specified chemicals in liquid splash environments during hazardous materials emergencies. Chemical penetration resistance documentation of garment material against an NFPA battery of test chemicals and any additional chemicals or specific chemical mixtures for which the manufacturer is certifying the suit is required. These do not include liquid chemicals with known or suspected carcinogenicity or skin toxicity because these garments deal with skin exposure and not inhalation.

The first edition of NFPA 1991 was voted on by the Association at the 1989 Fall Meeting in Seattle, Washington, on November 15, 1989, and had an effective date of February 5, 1990.

The Subcommittee on Hazardous Chemicals Protective Clothing began an early revision (4-year cycle) of the 1990 edition of NFPA 1991 in December 1991. During 1993, the NFPA restructured the manner in which committees were organized, and all standing subcommittees were eliminated. Within the Technical Committee on Fire Service Protective Clothing and Equipment, the former standing subcommittees were reorganized as task groups to address specific technical issues, and the technical committee assumed the entire responsibility for NFPA 1991.

The second edition of NFPA 1991 encompassed revised scope and purpose sections to include optional components for enhanced protection and replacement items. Test methods were updated and refined to better ensure repeatability of testing results. Extensive changes were made to the product labels to better accommodate the optional and replacement items.

The second edition was acted on by the membership of the Association at the NFPA Annual Meeting in San Francisco, California, on May 18, 1994, and was issued with an effective date of August 5, 1994.

In January 1995, the entire project for fire service protective clothing and equipment was reorganized by the Standards Council. The new project has a Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment and seven technical committees operating within the project. The former standing Subcommittee on Hazardous Chemicals Protective Clothing was established as the new Technical Committee on Hazardous Materials Protective Clothing and Equipment and has responsibility for NFPA 1991.

The third edition, with the new title of *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*, represented a complete revision to the second edition and addressed the protection as an ensemble rather than as separate items, but did provide for replacement elements for gloves and footwear. The third edition was presented to the Association membership at the 1999 November Meeting in New Orleans, Louisiana, on November 17, 1999, and issued by the Standards Council with an effective date of February 11, 2000.

This 2005 edition (the fourth edition) is once again a complete revision of NFPA 1991 and is now reformatted according to the new style for all NFPA codes and standards. As a result, chapter titles and numbering, as well as paragraph numbering, have changed. While this edition's content is in a different order than previous editions', all the material is here and the table of contents will quickly direct users of the document to the appropriate chapters and sections. The Committee has included in Chapter 4 new requirements for manufacturers' quality assurance programs, and for situations where 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 new requirements apply to all fire and emergency services product standards that are the responsibility of this Project. The formerly optional requirements for protection from chemical and biological terrorism agents are no longer optional and are now incorporated into the base requirements for all vapor-protective ensembles. The change provides this additional protection from CBR(N) exposures for the hazardous materials protective ensemble that offers the highest level of protection for emergency responders: the vapor-protective ensemble. The other two optional requirements, chemical flash fire protection for escape only and liquefied gas protection, remain as optional features that the purchasers can specify in purchase specifications. All labeling, design, performance, and testing requirements have been reviewed and refined as necessary.

#### **In Memoriam, 11 September 2001**

We pay tribute to the 343 members of FDNY who gave their lives to save civilian victims on 11 September 2001, at the World Trade Center. They are true American heroes in death, but they were also American heroes in life. We will keep them in our memory and in our hearts. They are the embodiment of courage, bravery, and dedication. May they rest in peace.

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

**Committee Scope:** This Committee shall have primary responsibility for documents on the design, performance, testing, and certification of protective clothing and protective equipment manufactured for fire and emergency services organizations and personnel, to protect against exposures encountered during emergency incident operations. This Committee shall also have the primary responsibility for documents on the selection, care, and maintenance of such protective clothing and protective equipment by fire and emergency services organizations and personnel.

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*This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.*

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**Committee Scope:** This Committee shall have primary responsibility for documents on protective clothing and protective equipment, except respiratory protective equipment, that provides hand, foot, torso, limb, and head protection for fire fighters and other emergency services responders during incidents that involve hazardous materials operations. These operations involve the activities of rescue; hazardous material confinement, containment, and mitigation; and property conservation where exposure to substances that present an unusual danger to responders are present or could occur due to toxicity, chemical reactivity, decomposition, corrosiveness, or similar reactions.

Additionally, this committee shall have primary responsibility for documents on the selection, care, and maintenance of hazardous materials protective clothing and protective equipment by fire and emergency services organizations and personnel.

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

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 specify minimum requirements for the design, performance, testing, documentation, and certification of vapor-protective ensembles and ensemble elements used by emergency response personnel during hazardous materials incidents and chemical, biological, or radiological terrorism incidents.

**1.1.2** This standard shall also specify criteria for chemical agents, biological agents, and radioactive particulates encountered during terrorism incidents.

**1.1.3\*** This standard shall also specify additional *optional* criteria for vapor-protective ensembles that provide escape protection from chemical flash fires encountered during hazardous materials incidents.

**1.1.4** This standard shall specify requirements for new vapor-protective ensembles and new ensemble elements.

**1.1.5** This standard alone shall not specify requirements for protective clothing for any fire fighting applications.

**1.1.6** This standard alone shall not specify requirements for protection against ionizing radiation, cryogenic liquid hazards, or explosive atmospheres.

**1.1.7\*** This standard shall not specify requirements for the respiratory protection that is necessary for proper protection with the protective ensemble.

**1.1.8** Certification of compliant vapor-protective ensembles and compliant elements to the requirements of this standard shall not preclude certification to additional appropriate standards where the ensemble or ensemble elements meet all the applicable requirements of each standard.

**1.1.9** This standard shall not be construed as addressing all of the safety concerns, if any, associated with its use for the designing, manufacturing, testing, or certifying of product to meet the

requirements of this standard. It shall be the responsibility of the persons and organizations that use this standard to establish safety and health practices and determine the applicability of regulatory limitations prior to use of this standard.

**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 a minimum level of protection for emergency response personnel against adverse vapor, liquid-splash, and particulate environments during hazardous materials incidents, and from specified chemical and biological terrorism agents in vapor, liquid splash, and particulate environments during chemical and biological terrorism incidents.

**1.2.1.1** The purpose of this standard shall also be to establish a minimum level of liquefied gas protection as an *option* for compliant vapor-protective ensembles and compliant ensemble elements.

**1.2.1.2** The purpose of this standard shall also be to 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 vapor-protective ensembles and compliant ensemble elements.

**1.2.1.3** The purpose of these options shall be to provide emergency response organizations the flexibility to specify neither, one, or both of these options in their purchase specifications according to the anticipated exposure and expected needs of the emergency response organization.

**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** This standard shall apply to the design, manufacturing, testing, documentation and certification of new vapor-protective ensembles and new ensemble elements. This edition of NFPA 1991 shall not apply to vapor-protective ensembles and ensemble elements manufactured to previous editions of NFPA 1991, *Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies*.

**1.3.2\*** This standard alone shall not apply to protective clothing for any fire-fighting applications.

**1.3.3** This standard alone shall not apply to protective clothing for protection against ionizing radiation, cryogenic liquid hazards, or explosive atmospheres.

**1.3.4** This standard shall not apply to use requirements for vapor-protective ensembles or ensemble elements as these requirements are specified in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*.

**1.3.5\*** The requirements of this standard shall not apply to any accessories that could be attached to the product but are not necessary for the product to meet the requirements of this standard.

### 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 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2002 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*, 2002 edition.

### 2.3 Other Publications.

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

ANSI Z41, *Standard for Personal Protection — Protective Footwear*, 1999.

ANSI Z89.1, *Standard for Industrial Head Protection*, 1997.

**2.3.2 ASTM Publications.** American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 747, *Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam*, 2002.

ASTM D 751, *Standard Methods of Testing Coated Fabrics*, 2000.

ASTM D 1630, *Standard Test Method for Rubber Property — Abrasion Resistance (NBS Abrader)*, 2000.

ASTM D 2136, *Standard Test Method for Coated Fabrics — Low Temperature Bend Test*, 2002.

ASTM D 2582, *Standard Test Method for Puncture Propagation Tear Resistance of Plastic Film and Thin Sheeting*, 2003.

ASTM D 4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, 2002.

ASTM F 392, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, 2004.

ASTM F 489, *Standard Test Method for Static Coefficient of Friction of Shoe Sole and Heel Materials as Measured by the James Machine*, 1996.

ASTM F 739, *Standard Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases Under Conditions of Continuous Contact*, 1999a.

ASTM F 903, *Standard Test Method for Resistance of Protective Clothing Materials to Penetration by Liquids*, 2003.

ASTM F 1052, *Standard Test Method for Pressure Testing of Vapor-Protective Ensembles*, 2002.

ASTM F 1154, *Standard Practice for Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical Protective Suit Ensembles*, 2004.

ASTM F 1301, *Standard Practice for Labeling Chemical Protective Clothing*, 2001.

ASTM F 1342, *Standard Test Method for Resistance of Protective Clothing Materials to Puncture*, 1996.

ASTM F 1358, *Standard Test Method for Resistance of Protective Clothing Materials to Flame Impingement*, 2000.

ASTM F 1359, *Standard Test Method for Measuring the Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Using a Shower Spray While on a Mannequin*, 2004.

ASTM F 1790, *Standard Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing*, 1997.

ASTM F 2010, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test*, 2000.

**2.3.3 FIA Publication.** Footwear Industries of America, 1420 K Street, NW, Washington, DC 20005.

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

**2.3.4 ISO Publications.** International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland.

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

ISO 65, *General requirements for bodies operating product certification systems*, 1996.

ISO 9001, *Quality Management Systems — Requirements*, 2000.

ISO 17011, *General requirements for accreditation bodies accrediting conformity assessment bodies*, 2003.

ISO 17025, *General requirements for the competence of testing and calibration laboratories*, 1999.

ISO 17492, *Clothing for protection against heat and flame — Determination of heat transmission on exposure to both flame and radiant heat*, 2003.

**2.3.5 U.S. Government Publication.** U.S. Government Printing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.132, “Personal Protective Equipment,” 1994.

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

### 3.3\* General Definitions.

**3.3.1 Afterflame Time.** The length of time for which a material, component, or chemical-protective suit continues to burn after the simulated chemical flash fire has ended.

**3.3.2 Biological Agents.** Biological materials that are capable of causing an acute disease or long-term damage to the human body.

**3.3.3 Biological Warfare Agent.** A biological substance intended to kill, seriously injure, or incapacitate humans through physiological effects.

**3.3.4 Boot.** See 3.3.69, Vapor-Protective Footwear.

**3.3.5 Bootie.** A sock-like extension of the garment or suit leg that covers the entire foot.

**3.3.6 Care.** Procedures for cleaning, decontamination, and storage of protective clothing and equipment.

**3.3.7 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 requirements 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 of labeled and listed products with the requirements of this standard.

**3.3.8 Certification Organization.** An independent, third-party organization that determines product compliance with the requirements of this standard with a labeling/listing/follow-up program.

**3.3.9 Chemical and Biological Terrorism Incidents.** Situations involving the release of chemical or biological warfare agents in civilian areas by terrorists.

**3.3.10 Chemical and Biological Terrorism Vapor-Protective Ensemble.** See 3.3.65, Vapor-Protective Ensemble.

**3.3.11\* Chemical Flash Fire.** The ignition of a flammable and ignitable vapor or gas that produces an outward expanding flame front as those vapors or gases burn. This burning and expanding flame front, a fireball, will release both thermal and kinetic energy to the environment.

**3.3.12 Chemical-Protective Elements.** See 3.3.24, Ensemble Elements.

**3.3.13\* Chemical-Protective Layer.** The material or composite used in an ensemble or clothing for the purpose of providing protection from chemical hazards.

**3.3.14 Chemical Warfare Agent.** A chemical substance intended to kill, seriously injure, or incapacitate humans through physiological effects.

**3.3.15 Compliance/Compliant.** Meeting or exceeding all applicable requirements of this standard.

**3.3.16\* Component(s).** Any material, part, or subassembly used in the construction of the compliant product.

**3.3.17 Component Part(s).** Any material(s) or part(s) used in the construction of a vapor-protective ensemble or ensemble elements.

**3.3.18 Composite.** The layer or layers of materials or components.

**3.3.19 Cracking Pressure.** The pressure at which the suit exhaust valve begins to open, releasing exhaust air to the outside suit environment.

**3.3.20\* Cryogenic Liquid.** A refrigerated liquefied gas having a boiling point below  $-90^{\circ}\text{C}$  ( $-130^{\circ}\text{F}$ ) at atmospheric pressure.

**3.3.21 Element(s).** See 3.3.24, Ensemble Elements.

**3.3.22 Emergency Response Personnel.** Personnel assigned to organizations that have the responsibility for responding to hazardous materials emergencies.

**3.3.23 Ensemble.** See 3.3.65, Vapor-Protective Ensemble.

**3.3.24\* Ensemble Elements.** The compliant products that provide protection to the upper and lower torso, arms, legs, head, hands, and feet.

**3.3.25 Exhaust Valve.** One-way vent that releases exhaust to the outside environment and prevents entry of outside environment.

**3.3.26\* External Fittings.** Any component that allows the passage of gases, liquids, or electrical current from the outside to the inside of the element or item. 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.

**3.3.27 Flammable or Explosive Atmospheres.** Atmospheres containing solids, liquids, vapors, or gases at concentrations that will burn or explode if ignited.

**3.3.28 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.

**3.3.29 Footwear.** See 3.3.69, Vapor-Protective Footwear.

**3.3.30 Footwear Upper.** That portion of the footwear element above the sole, heel, and insole.

**3.3.31 Garment.** See 3.3.71, Vapor-Protective Suit.

**3.3.32 Glove.** See 3.3.70, Vapor-Protective Gloves.

**3.3.33\* Hazardous Materials.** A substance (solid, liquid, or gas) that when released is capable of creating harm to people, the environment, and property.

**3.3.34\* Hazardous Materials Emergencies.** Incidents involving the release or potential release of hazardous materials.

**3.3.35 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.

**3.3.36 Ladder Shank.** See 3.3.58, Shank.

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

**3.3.38 Liquid Splash-Protective Ensemble.** Multiple elements of compliant protective clothing and equipment products that when worn together provide protection from some risks, but not all risks, of hazardous materials emergency incident operations involving liquids.

**3.3.39 Maintenance.** Procedures for inspection, repair, and removal from service of vapor-protective ensembles.

**3.3.40 Manufacturer.** The entity that assumes the liability, provides the warranty for the compliant product, or obtains the product certification.

**3.3.41 Model.** The collective term used to identify a group of individual vapor-protective ensembles or 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.

**3.3.42 Normalized Breakthrough Detection Time.** The time at which the permeation rate of a chemical through a material reaches 0.1 µg/cm<sup>2</sup>/min.

**3.3.43 Outer Boot.** A secondary boot worn over the footwear ensemble element or bootie for the purpose of providing physical protection in order to meet the requirements of this standard.

**3.3.44 Outer Garment.** A secondary garment worn over the suit ensemble element for the purpose of providing physical protection in order to meet the requirements of this standard.

**3.3.45 Outer Glove.** A secondary glove worn over the glove ensemble element for the purpose of providing physical protection in order to meet the requirements of this standard.

**3.3.46 Particulates.** Solid matter that is dispersed in air as a mixture. For the purpose of this standard, particulates do not include aerosol, or suspended liquid droplets in air. Aerosols are considered liquids.

**3.3.47\* Primary Materials.** Vapor-protective ensemble and element materials limited to the suit material, hood and visor material, glove material, and footwear material that provide protection from chemical and physical hazards.

**3.3.48 Product Label.** A label or marking affixed to each compliant vapor-protective ensemble and compliant ensemble element by the manufacturer. Such labels contain

compliance statements, certification statements, general information, care, maintenance, or similar data. The product label is not the certification organization's label, symbol, or identifying mark; however, the certification organization's label, symbol, or identifying mark is attached to or a part of the product label.

**3.3.49 Protective Ensemble.** See 3.3.65, Vapor-Protective Ensemble.

**3.3.50 Protective Footwear.** See 3.3.69, Vapor-Protective Footwear.

**3.3.51 Protective Glove.** See 3.3.70, Vapor-Protective Gloves.

**3.3.52 Protective Suit.** See 3.3.71, Vapor-Protective Suit.

**3.3.53\* Radioactive Particulate.** Finely divided solids, such as powders and dusts, which emit ionizing radiation in excess of background radiation levels.

**3.3.54 Recall System.** The action taken by which a manufacturer identifies an element, provides notice to the users, withdraws an element from the marketplace and distribution sites, and returns the element to the manufacturer or other acceptable location for corrective action.

**3.3.55 Respiratory Equipment.** A positive pressure, self-contained breathing apparatus (SCBA) or combination SCBA/supplied-air breathing apparatus certified by the National Institute for Occupational Safety and Health (NIOSH) and certified as compliant with NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*.

**3.3.56 Sample.** An amount of the material, product, or assembly to be tested that is representative of the item as a whole.

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

**3.3.58 Shank.** The component of footwear that provides additional support to the instep.

**3.3.59 Specimen.** The conditioned element, item, component, or composite that is subjected to testing. Specimens are taken from samples. In some tests, the specimen and sample can also be the same element, item, component, or composite.

**3.3.60 Storage Life.** The date to remove from service a vapor-protective ensemble or individual element that has undergone proper care and maintenance in accordance with manufacturer's instructions but has not been used either in training or at actual incidents.

**3.3.61 Suit.** See 3.3.71, Vapor-Protective Suit.

**3.3.62 Suit Closure.** The component that allows the wearer to enter (don) and exit (doff) the vapor-protective suit element.

**3.3.63 Suit Closure Assembly.** The combination of the suit closure and the seam attaching the suit closure to the suit garment, excluding any protective flap or cover.

**3.3.64 Suit Material.** The principal material used in the construction of the vapor-protective suit.

**3.3.65\* Vapor-Protective Ensemble.** Multiple elements of compliant protective clothing and equipment that when worn together provide protection from some risks, but not all risks, of vapor, liquid-splash, and particulate environments during hazardous materials incidents and from chemical and biological terrorism agents in vapor, gas, liquid, or particulate forms.

**3.3.66 Vapor-Protective Ensemble with Optional Chemical Flash Fire Escape and Liquefied Gas Protection.** A compliant vapor-protective ensemble that is also certified as compliant with the optional requirements for both *limited* protection against chemical flash fire *for escape only* and for protection against liquefied gases.

**3.3.67\* Vapor-Protective Ensemble with Optional Chemical Flash Fire Escape Protection.** A compliant vapor-protective ensemble that is also certified as compliant with the optional requirements for *limited* protection against chemical flash fire *for escape only*.

**3.3.68\* Vapor-Protective Ensemble with Optional Liquefied Gas Protection.** A compliant vapor-protective ensemble that is also certified as compliant with the optional requirements for protection against liquefied gases.

**3.3.69\* Vapor-Protective Footwear.** The ensemble element of the protective ensemble that provides chemical protection and physical protection to the feet, ankles, and lower legs.

**3.3.70 Vapor-Protective Gloves.** The ensemble element of the protective ensemble that provides chemical protection to the hands and wrists.

**3.3.71 Vapor-Protective Suit.** The ensemble garment element of the protective ensemble that provides chemical protection to the upper and lower torso, head, arms, and legs.

**3.3.72 Visor Material.** The transparent chemical-protective material that allows the wearer to see outside the protective ensemble hood.

## Chapter 4 Certification

### 4.1 General.

**4.1.1** The process of certification for protective ensembles and ensemble elements as being compliant with NFPA 1991 shall meet the requirements of Section 4.1, General; Section 4.2, Certification Program; Section 4.3, Inspection and Testing; Section 4.4, Annual Verification of Product Compliance; 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 ensembles and ensemble elements that are labeled as being compliant with this standard shall meet or exceed all applicable requirements specified in this standard and shall be certified.

**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 65, *General requirements for bodies operating product certification systems*. The accreditation shall be issued by an accreditation body operating in accordance with ISO 17011, *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 1991, in any statements about their respective product(s) unless the product(s) is certified as compliant to this standard.

**4.1.5** All compliant protective ensembles and ensemble elements shall be labeled and listed.

**4.1.6** All compliant ensembles and ensemble elements shall also have a product label that meets the requirements specified in Section 5.1, Product Label Requirements.

**4.1.7\*** The certification organization's label, symbol, or identifying mark shall be attached to the product label, or shall be part of 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 2000 edition of this standard on or after the NFPA effective date for the 2005 edition, which is 7 February 2005.

**4.1.9** The certification organization shall not permit any manufacturer to continue to label any ensembles or ensemble elements that are certified as compliant with the 2000 edition of this standard on or after 1 September 2005.

**4.1.10** The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2000 edition of this standard from all ensembles and ensemble elements that are under the control of the manufacturer on 1 September 2005, 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.

**4.2.3** The certification organization shall be accredited for personal protective equipment in accordance with ISO 65, *General requirements for bodies operating product certification systems*. The accreditation shall be issued by an accreditation body operating in accordance with ISO 17011, *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.

**4.2.6\*** The certification organization shall have laboratory facilities and equipment available 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 as 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 report(s) of situation(s) 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 protective ensembles and ensemble elements, 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 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 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 17011, *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 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 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 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 for the ensemble and ensemble elements in Section 5.1, Product Label 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 by 5.1.1.5, 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 and evaluation 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 protective ensemble and ensemble element.

**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 to 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 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\*** 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.

**4.3.17** 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.

#### **4.4 Annual Verification of Product Compliance.**

**4.4.1** All vapor-protective ensemble models and all individual element models that are labeled as being compliant with this standard shall undergo recertification on an annual basis. This recertification shall include inspection and evaluation to

all design requirements and testing to all performance requirements as required by this standard on all manufacturer's models and components as required by 4.4.3.

**4.4.1.1** Any change that affects the ensemble or element performance under design or performance requirements of this standard shall constitute a different model.

**4.4.1.2** For the purpose of this standard, models shall include each unique pattern, style, or design of the individual element.

**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 inspection program. For recertification, the certification organization shall acquire at least one complete vapor-protective ensemble sample outfitted with all manufacturer-provided external fittings. The certification organization shall also acquire a sufficient quantity of component samples to be tested for recertification as required by 4.4.3.

**4.4.3** Sample vapor-protective ensembles and components shall be inspected, evaluated, and tested as follows.

**4.4.3.1** Each vapor-protective ensemble shall be inspected and evaluated to each of the design requirements specified in Chapter 6.

**4.4.3.2** Each vapor-protective ensemble specimen shall be tested for overall performance as specified in Section 7.1 using the following sequence of tests:

- (1) The vapor-protective ensemble specimen shall be tested for gastight integrity in accordance with Section 8.2, Gastight Integrity Test.
- (2) The vapor-protective ensemble specimen shall then be tested for liquidtight integrity as specified in Section 8.3, Liquidtight Integrity Test.
- (3) The vapor-protective ensemble specimen shall then be tested for overall function and integrity as specified in Section 8.4, Overall Ensemble Function and Integrity Test.
- (4) The vapor-protective ensemble specimen shall then be tested for airflow capacity as specified in Section 8.5, Maximum Suit Ventilation Rate Test.
- (5) If certified for optional chemical flash fire protection, the vapor-protective ensemble shall then be tested for overall ensemble flash protection as specified in Section 8.27, Overall Ensemble Flash Test.

**4.4.3.3** All suit material, visor, glove, footwear, optional chemical flash fire protection, and optional liquefied gas protection performance requirements shall be evaluated as specified in Chapter 5 with the following modifications:

- (1) Permeation and penetration resistance testing specified in 7.2.1, 7.2.6, 7.2.8, 7.3.1, 7.3.6, 7.4.1, and 7.5.1 shall be performed against each of the following chemicals:
  - (a) Carbon disulfide
  - (b) Dichloromethane
  - (c) Diethylamine
  - (d) Methanol
  - (e) Tetrahydrofuran
- (2) A total of two specimens shall be permitted for 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, upon request, to the purchaser or 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 manufacturer shall be registered to ISO 9001, *Quality management systems — requirements*.

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

#### **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. These procedures shall comply with the provisions of ISO 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 product 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) Removal of the mark of certification from the product.
- (4) Where a hazardous condition exists and it is not practical to implement (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 hazardous 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 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 conduct a product recall.