Recommended Practice for

RESPONDING TO HAZARDOUS MATERIALS INCIDENTS

ANSI/NFPA 471
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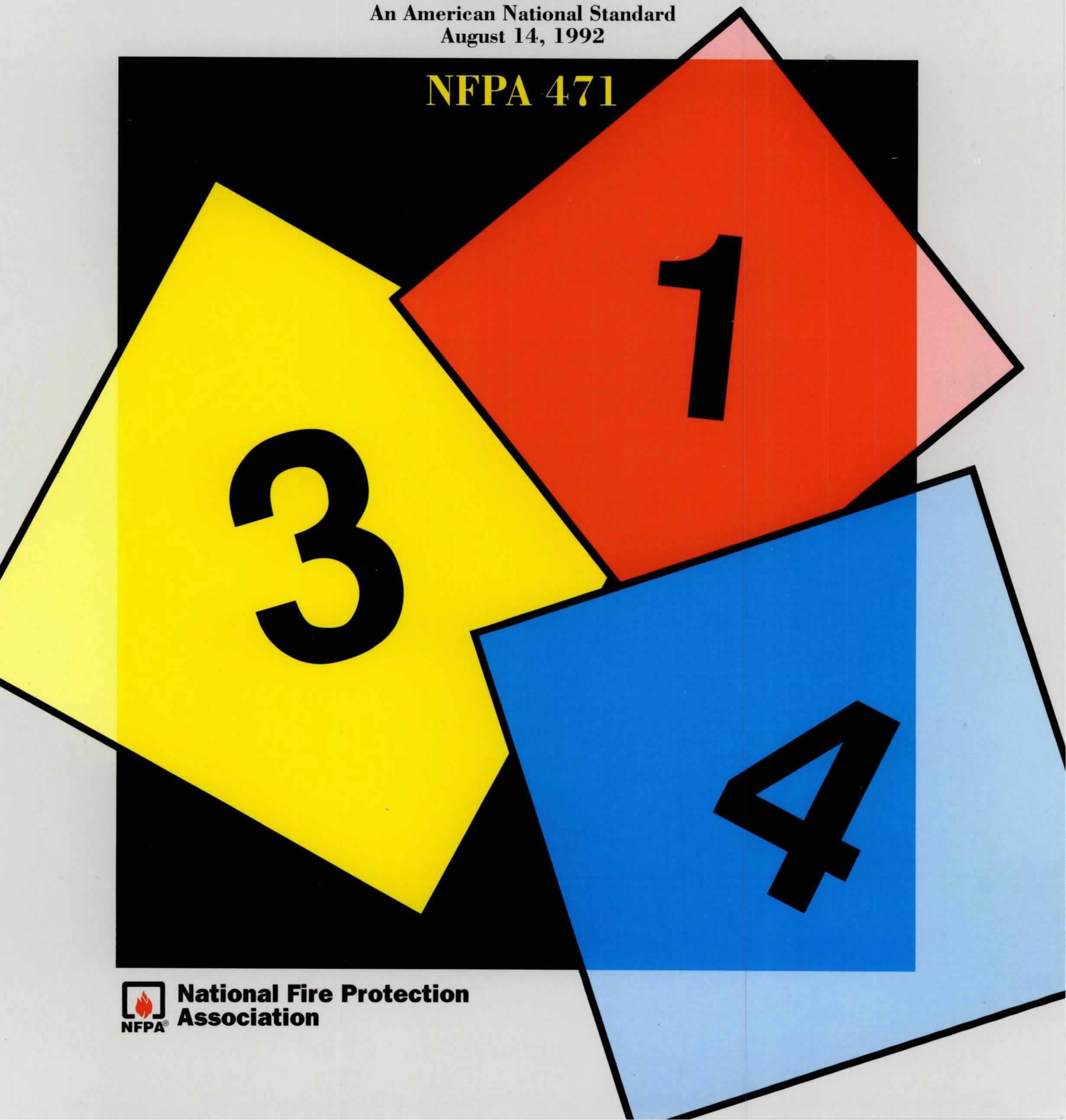
August 14, 1992

NFPA 471



National Fire Protection Association

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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NFPA 471

Recommended Practice for

Responding to Hazardous Materials Incidents

1992 Edition

This edition of NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents*, was prepared by the Technical Committee on Hazardous Materials Response Personnel and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 18-21, 1992 in New Orleans, LA. It was issued by the Standards Council on July 17, 1992, with an effective date of August 14, 1992, and supersedes all previous editions.

The 1992 edition of this document has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 471

In 1984, two separate requests to NFPA expressed a perceived need for documents relating to response to hazardous materials incidents. One came from the International Society of Fire Service Instructors, the other from the International Fire Service Training Association. NFPA sought public support for the idea and received many letters indicating agreement with the requests.

At the July 1985 NFPA Standards Council meeting, approval was given to the concept of a new project on Hazardous Materials Response Personnel. The Council directed that a proposed scope and start-up roster for the new Committee be prepared, taking into account the need to expand the Committee membership beyond the fire service and the application beyond "professional qualifications."

When establishment of the Committee was formally announced, many requests for membership were received, and similar requests continued to arrive during the first year of its existence. The first meeting of the Committee took place in October 1986 at the Fairfax County Fire and Rescue Training Center. Since that opening session, five additional meetings were held to complete work on this document.

Interest in the subject of hazardous materials, especially as it relates to the emergency responder, continues at a high level. Some of this is due to an increased awareness of the magnitude of the problem; much of it can be credited to federal regulations that will have an impact on all responders.

In 1990 the Committee began reviewing this document for the purpose of revising it. The Committee has made several changes to this 1992 edition in order to ensure that the document remains consistent with NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents.*

The gratitude of the Committee is extended to all who participated in the development process, and especially to the non-Committee members who helped so much.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

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Recommended Practice for

Responding to Hazardous Materials Incidents

1992 Edition

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

Information on referenced publications can be found in Chapter 8 and Appendix B.

Chapter 1 Administration

1-1* Scope. This practice applies to all organizations that have responsibilities when responding to hazardous materials incidents and recommends standard operating guidelines for responding to such incidents. It specifically covers planning procedures, policies, and application of procedures for incident levels, personal protective equipment, decontamination, safety, and communications.

1-2 Purpose. The purpose of this document is to outline the minimum requirements that should be considered when dealing with responses to hazardous materials incidents and to specify operating guidelines for responding to hazardous materials incidents. It is not the intent of this recommended practice to restrict any jurisdiction from using more stringent guidelines.

1-3 Application. The recommendations contained in this document should be followed by organizations that respond to hazardous materials incidents and by incident commanders responsible for managing hazardous materials incidents.

1-4 Definitions.

Authority Having Jurisdiction.* The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

Confinement. Those procedures taken to keep a material in a defined or local area.

Containment. The actions taken to keep a material in its container (e.g., stop a release of the material or reduce the amount being released).

Contaminant. A hazardous material that physically remains on or in people, animals, the environment, or equipment, thereby creating a continuing risk of direct injury or a risk of exposure outside of the hot zone.

Contamination. The process of transferring a hazardous material from its source to people, animals, the environment, or equipment, which may act as a carrier.

Control. The defensive or offensive procedures, techniques, and methods used in the mitigation of a hazardous materials incident, including containment, extinguishment, and confinement.

Control Zones. The designation of areas at a hazardous materials incident based upon safety and the degree of hazard. Many terms are used to describe the zones involved in a hazardous materials incident. For purposes of this document, these zones are defined as the hot, warm, and cold zones.

Decontamination (Contamination Reduction). The physical and/or chemical process of reducing and preventing the spread of contamination from persons and equipment used at a hazardous materials incident.

Degradation. (a) A chemical action involving the molecular breakdown of a protective clothing material or equipment due to contact with a chemical. (b) The molecular breakdown of the spilled or released material to render it less hazardous during control operations.

Emergency. A sudden and unexpected event calling for immediate action.

Environmental Hazard. A condition capable of posing an unreasonable risk to air, water, or soil quality and to plants or wildlife.

Hazard/Hazardous. Capable of posing an unreasonable risk to health, safety, or the environment; capable of causing harm.

Hazard Sector. That function within an overall incident management system that deals with the mitigation of a hazardous materials incident. It is directed by a sector officer and principally deals with the technical aspects of the incident.

Hazard Sector Officer. The person responsible for the management of the hazard sector.

Hazardous Material.* A substance (gas, liquid, or solid) capable of creating harm to people, the environment, and property. See specific regulatory definitions in Appendix A.

Incident. An emergency involving the release or potential release of a hazardous material, with or without fire.

Incident Commander. The person responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident site. This is equivalent to the on-scene incident commander as defined by 29 CFR 1910.120.

Incident Management System. An organized system of roles, responsibilities, and standard operating procedures used to manage and direct emergency operations. Such systems are sometimes referred to as incident command systems (ICS).

Mitigation. Actions taken to prevent or reduce product loss, human injury or death, environmental damage, and property damage due to the release or potential release of hazardous materials.

Monitoring Equipment. Instruments and devices used to identify and quantify contaminants.

National Contingency Plan.* Policies and procedures of the federal agency members of the National Oil and Hazardous Materials Response Team. This document provides guidance for responses, remedial action, enforcement, and funding mechanisms for hazardous materials incident responses.

Penetration. The movement of a material through a suit's closures, such as zippers, buttonholes, seams, flaps, or other design features of chemical-protective clothing, and through punctures, cuts, and tears.

Permeation. A chemical action involving the movement of chemicals, on a molecular level, through intact material.

Protective Clothing. Equipment designed to protect the wearer from heat and/or hazardous materials contacting the skin or eyes. Protective clothing is divided into four types:

(a) Structural fire fighting protective clothing;

(b) Liquid splash-protective clothing;

(c) Vapor-protective clothing; and

(d) High temperature-protective clothing.

Response. That portion of incident management in which personnel are involved in controlling (defensively or offensively) a ,hazardous materials incident. The activities in the response portion of a hazardous materials incident include analyzing the incident, planning the response, implementing the planned response, and evaluating progress.

Sampling. Sampling is the process of collecting a representative amount of gas, liquid, or solid for analytical purposes.

Stabilization. The point in an incident at which the adverse behavior of the hazardous material is controlled.

Waste Minimization. Treatment of hazardous spills by procedures or chemicals designed to reduce the hazardous nature of the material and/or to minimize the quantity of waste produced.

Chapter 2 Incident Response Planning

2-1 Planning is an essential part of emergency preparedness. The development of both facility response plans and community emergency plans is required by numerous state and federal laws, including SARA, Title III, "The Emergency Planning and Community Right to Know Act of 1986." Planning guides and reference materials are listed in Appendix B-2.4.

2-2 A planning team is necessary for developing the hazardous materials emergency plan. Local, state, and federal planning guidelines should be reviewed and consulted by the planning team when preparing plans for hazardous materials incidents.

2-3 As a minimum, an annual review and update of the hazardous materials emergency plan is necessary.

2-4 As a minimum, a training exercise should be conducted annually to determine the adequacy and effectiveness of the hazardous materials emergency plan.

Chapter 3 Response Levels

3-1* Table 3-1 is a planning guide intended to provide the user with assistance in determining incident levels for response and training. Potential applications to a jurisdiction's response activities may include development of standard operating procedures; implementation of a training program using the competency levels of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*; acquisition of necessary equipment; and development of community emergency response plans. When consulting this table, the user should refer to all of the incident condition criteria to determine the appropriate incident level.

Chapter 4 Site Safety

4-1 Emergency Incident Operations.

4-1.1 Emergency incident operations should be conducted in compliance with Chapter 6 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, or 29 CFR 1910.120 or EPA.

4-1.2* An incident management system should be implemented at all hazardous materials incidents. Operations should be directed by a designated incident commander and follow established written standard operating procedures.

4-1.3 An emergency response plan describing the general safety procedures that are to be followed at an incident should be prepared in accordance with 29 CFR 1910.120. These procedures should be thoroughly reviewed and tested.

4-2 Ignition Sources. Ignition sources should be eliminated whenever possible at incidents involving releases, or probable releases, of ignitable materials. Whenever possible, electrical devices used within the hot zone should be certified as intrinsically safe by recognized organizations.

4-3 Control Zones. Control zone names have not been consistently applied at incidents. The intent of this section is to show areas of responder control. The various zones or areas at a typical emergency response site are shown in Figure 4-3.

4-3.1* Hot Zone. Area immediately surrounding a hazardous materials incident, extending far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone. This zone is also referred to as the exclusion zone or restricted zone in other documents.

Table 3-1 Planning Guide for Determining Incident Levels, Response, and Training

	Incident Level		
Incident Conditions	**One**	**Two**	**Three**
Product Identifications	Placard not required, NFPA 0 or 1 all categories, all Class 9 and ORM-D.	DOT placarded, NFPA 2 for any categories, PCBs without fire, EPA regulated waste.	Class 2, Division 2.3—poisonous gases, Class 1, Division 1.1 and 1.2—explosives, organic peroxide, flammable solid, materials dangerous when wet, chlorine, fluorine, anhydrous ammonia, radioactive materials, NFPA 3 & 4 for any categories including special hazards, PCBs & fire, DOT inhalation hazard, EPA extremely hazardous substances, and cryogenics.
Container Size	Small (e.g., pail, drums, cylinders except 1-ton, packages, bags).	Medium (e.g., 1-ton cylinder, portable containers, nurse tanks, multiple small packages).	Large (e.g., tank cars, tank trucks, stationary tanks, hopper cars/trucks, multiple medium containers).
Fire/Explosion Potential	Low.	Medium.	High.
Leak Severity	No release or small release contained or confined with readily available resources.	Release may not be controllable without special resources.	Release may not be controllable even with special resources.
Life Safety	No life-threatening situation from materials involved.	Localized area, limited evacuation area.	Large area, mass evacuation area.
Environmental Impact (Potential)	Minimal.	Moderate.	Severe.
Container Integrity	Not damaged.	Damaged but able to contain the contents to allow handling or transfer of product.	Damaged to such an extent that catastrophic rupture is possible.

4-3.2 Warm Zone. The area where personnel and equipment decontamination and hot zone support takes place. It includes control points for the access corridor and thus assists in reducing the spread of contamination. This is also referred to as the decontamination, contamination reduction, or limited access zone in other documents.

4-3.3 Cold Zone. This area contains the command post and such other support functions as are deemed necessary to control the incident. This is also referred to as the clean zone or support zone in other documents.

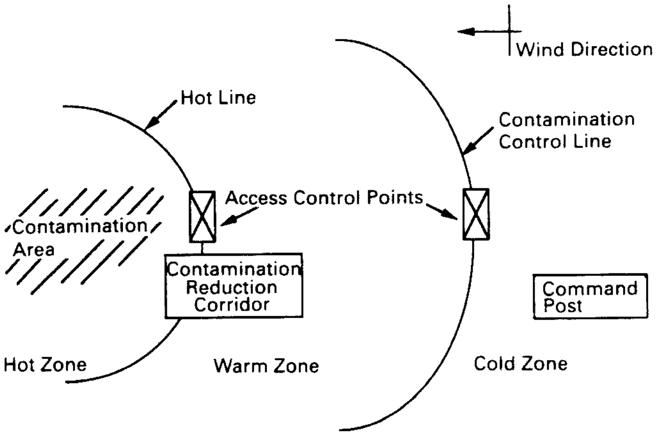

Figure 4-3 Diagram of control zones.

4-4 Communications.

4-4.1 When personal protective clothing or remote operations inhibit communications, an effective means of communications, such as radios, should be established.

4-4.2 The frequencies employed in these radios should be "dedicated" and not used or shared with other local agencies.

4-4.3 Communication should be supplemented by a prearranged set of hand signals and hand-light signals to be used when primary communication methods fail. Handlights employed for this purpose should be in accordance with NFPA 70, *National Electrical Code*®, for use in hazardous environments.

4-5 Monitoring Equipment.

4-5.1 Monitoring equipment operates on several different principles and measures different aspects of hazardous materials releases. Examples of this equipment are:

(a) Oxygen meters

(b) Combustible gas indicator (explosimeter)

(c) Carbon monoxide meter

(d) pH meter

(e) Radiation detection instruments

(f) Colorimetric detector tubes

(g) Organic vapor analyzer

(h) Photoionization meter

(i) Air sampling devices

(j) Other meters to measure specific products such as chlorine, hydrogen sulfide, or ethylene oxide

(k) pH paper or strips

(l) Organic vapor badge or film strip

(m) Mercury badge

(n) Formaldehyde badge or strip.

4-5.2 All monitoring equipment should be operationally checked prior to use and periodically calibrated as per manufacturers' specifications.

Chapter 5 Personal Protective Equipment

5-1 General. It is essential that personal protective equipment meeting appropriate NFPA and OSHA standards be provided, maintained, and used. Protection against physical, chemical, and thermal hazards must be considered when selecting personal protective equipment.

5-1.1 A written personal protective equipment program should be established in accordance with 29 CFR Part 1910.120. Elements of the program should include personal protective equipment selection and use; storage, maintenance, and inspection procedures; and training considerations. The selection of personal protective clothing should be based on the hazardous materials and/or conditions present and be appropriate for the hazards encountered.

5-1.2 Protective clothing and equipment used to perform fire suppression operations, beyond the incipient stage, should meet the requirements of Chapter 5 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*. Structural fire fighting protective clothing is not intended to provide chemical protection to the user.

5-2 Respiratory Protective Equipment.

5-2.1 Self-contained breathing apparatus (SCBA) should meet the requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*.

5-2.2 Personal alert safety systems should meet the requirements of NFPA 1982, *Standard on Personal Alert Safety Systems (PASS) for Fire Fighters*.

5-2.3 Air Purifying Respirators. These devices are worn to filter particulates and contaminants from the air. They should only be worn in atmospheres where the type and quantity of the contaminants are known and sufficient oxygen is known to be present.

5-3 Chemical-Protective Clothing.

5-3.1 Chemical-protective clothing (CPC) is made from special materials and is designed to prevent the contact of chemicals with the body. Chemical-protective clothing is of two types: totally encapsulating and nonencapsulating.

5-3.2 A variety of materials are used to make the fabric from which clothing is manufactured. Each material will provide protection against certain specified chemicals or mixtures of chemicals. It may afford little or no protection against certain other chemicals. It is most important to note that there is no material that provides satisfactory protection from all chemicals. Protective clothing material must be compatible with the chemical substances involved, consistent with manufacturers' instructions.

5-3.3 Performance requirements must be considered in selecting the appropriate chemical-protective material. These would include chemical resistance, permeation, penetration, flexibility, abrasion, temperature resistance, shelf life, and sizing criteria.

5-3.3.1 Chemical resistance is the ability of the material from which the protective garment is made to prevent or reduce degradation and permeation of the fabric by the attack chemical. Degradation is a chemical action involving the molecular breakdown of the material due to contact with a chemical. The action may cause the fabric to swell, shrink, blister, or discolor; become brittle, sticky, or soft; or deteriorate. These changes permit chemicals to penetrate the suit more rapidly or increase the probability of permeation.

5-3.3.2 Permeation is a chemical action involving the movement of chemicals, on a molecular level, through intact material. There is usually no indication that this process is occurring. Permeation is defined by two terms, permeation rate and breakthrough time. Permeation rate is the quantity of chemical that will move through an area of protective garment in a given period of time, usually expressed as micrograms of chemical per square centimeter per minute. Breakthrough time is the time required for the chemical to be measured on the inside surface of the fabric. The most desirable protective fabric is one that has the longest breakthrough time and a very low permeation rate. Breakthrough times and permeation rates are not available for all the common suit materials and the variety of chemicals that exist. Manufacturers' data and reference sources should be consulted. Generally, if a material degrades rapidly permeation will occur rapidly.

5-3.3.3 Penetration is the movement of material through a suit's closures, such as zippers, buttonholes, seams, flaps, or other design features. Torn or ripped suits will also allow penetration.

5-4 Thermal Protection.

5-4.1 Proximity Suits. These suits provide short duration and close proximity protection at radiant heat temperatures as high as 2,000°F (1093°C) and may withstand some exposure to water and steam. Respiratory protection must be provided with proximity suits.

5-4.2 Fire Entry Suits. This type of suit provides protection for brief entry into total flame environment at temperatures as high as 2,000°F (1093°C). This suit is not effective or meant to be used for rescue operations. Respiratory protection must be provided with fire entry suits.

5-4.3 Overprotection Garments. These garments are worn in conjunction with chemical-protective encapsulating suits.

5-4.3.1 Flash Cover Protective Suit. Flash cover suits are neither proximity nor fire entry suits. They provide limited overprotection against flashback only. They are worn outside of other protective suits and are used only when the risks require them.

5-4.3.2 Low Temperature Suits. Low temperature suits provide some degree of protection of the encapsulating chemical-protective clothing from contact with low temperature gases and liquids. They are worn outside of the encapsulating chemical-protective clothing and are used only when the risk requires them.

5-5 Levels of Protection. Personal protective equipment is divided into four categories based on the degree of protection afforded.

NOTE: An asterisk (*) after the description indicates optional, as applicable.

5-5.1 Level A. To be selected when the greatest level of skin, respiratory, and eye protection is required. The following constitute Level A equipment; it may be used as appropriate.

5-5.1.1 Pressure-demand, full facepiece, self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA, approved by the National Institute of Occupational Safety and Health (NIOSH).

5-5.1.2 Vapor-protective suits: totally encapsulating chemical-protective suits (TECP suits) constructed of protective clothing materials; covering the wearer's torso, head, arms, and legs; having boots and gloves that may be an integral part of the suit, or separate and tightly attached; and completely enclosing the wearer by itself or in combination with the wearer's respiratory equipment, gloves, and boots. All components of a TECP suit, such as relief valves, seams, and closure assemblies, should provide equivalent chemical resistance protection. Vapor-protective suits should meet the requirements in NFPA 1991, *Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies.*

5-5.1.3 Coveralls.*

5-5.1.4 Long underwear.*

5-5.1.5 Gloves, outer, chemical-resistant.

5-5.1.6 Gloves, inner, chemical-resistant.

5-5.1.7 Boots, chemical-resistant, steel toe and shank.

5-5.1.8 Hard hat (under suit).*

5-5.1.9 Disposable protective suit, gloves, and boots (depending on suit construction, may be worn over totally encapsulating suit).

5-5.1.10 Two-way radios (worn inside encapsulating suit).

5-5.2 Level B. The highest level of respiratory protection is necessary but a lesser level of skin protection is needed. The following constitutes Level B equipment; it may be used as appropriate.

5-5.2.1 Pressure-demand, full facepiece, self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA, NIOSH approved.

5-5.2.2 Hooded chemical-resistant clothing that meet the requirements of NFPA 1992, *Standard on Liquid Splash-Protective Suits for Chemical Emergencies* (overalls and long-sleeved jacket, coveralls, one- or two-piece chemical-splash suit, disposable chemical-resistant overalls).

5-5.2.3 Coveralls.*

5-5.2.4 Gloves, outer, chemical-resistant.

5-5.2.5 Gloves, inner, chemical-resistant.

5-5.2.6 Boots, outer, chemical-resistant, steel toe and shank.

5-5.2.7 Boot covers, outer, chemical-resistant (disposable).*

5-5.2.8 Hard hat.

5-5.2.9 Two-way radios (worn inside encapsulating suit).

5-5.2.10 Face shield.*

5-5.3* Level C. The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met. The following constitute Level C equipment; it may be used as appropriate.

5-5.3.1 Full-face or half-mask, air purifying respirators, self-contained positive pressure breathing apparatus (NIOSH approved).

5-5.3.2 Hooded chemical-resistant clothing that meets the requirements of NFPA 1993, *Standard on Support Function Protective Garments for Hazardous Chemical Operations* (overalls, two-piece chemical-splash suit, disposable chemical-resistant overalls).

5-5.3.3 Coveralls.*

5-5.3.4 Gloves, outer, chemical-resistant.

5-5.3.5 Gloves, inner, chemical-resistant.

5-5.3.6 Boots, outer, chemical-resistant, steel toe and shank.

5-5.3.7 Boot covers, outer, chemical-resistant (disposable).*

5-5.3.8 Hard hat.

5-5.3.9 Escape mask.*

5-5.3.10 Two-way radios (worn under outside protective clothing).

5-5.3.11 Face shield.*

5-5.4 Level D. A work uniform affording minimal protection, used for nuisance contamination only. The following constitute Level D equipment; it may be used as appropriate.

5-5.4.1 Coveralls.

5-5.4.2 Gloves.*

5-5.4.3 Boots/shoes, chemical-resistant, steel toe and shank.

5-5.4.4 Boots, outer, chemical-resistant (disposable).*

5-5.4.5 Safety glasses or chemical-splash goggles.

5-5.4.6 Hard hat.

5-5.4.7 Escape mask.*

5-5.4.8 Face shield.*

5-6 Types of Hazards. The types of hazards for which levels A, B, C, and D protection are appropriate are described below.

5-6.1 Level A protection should be used when:

5-6.1.1 The hazardous material has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of material that are harmful to skin or capable of being absorbed through the intact skin;

5-6.1.2 Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible; or

5-6.1.3 Operations must be conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A have not yet been determined.

5-6.2 Level B protection should be used when:

5-6.2.1* The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection;

5-6.2.2 The atmosphere contains less than 19.5 percent oxygen;

5-6.2.3 The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but the vapors and gases are known not to contain high levels of chemicals harmful to skin or capable of being absorbed through the intact skin; or

5-6.2.4 The presence of liquids or particulates is indicated, but they are known not to contain high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

5-6.3 Level C protection should be used when:

5-6.3.1 The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;

5-6.3.2 The types of air contaminants have been identified, concentrations measured, and an air purifying respirator is available that can remove the contaminants; and

5-6.3.3 All criteria for the use of air purifying respirators are met.

5-6.3.4* Atmospheric concentration of chemicals must not exceed IDLH levels. The atmosphere must contain at least 19.5 percent oxygen.

5-6.4 Level D protection should be used when:

5-6.4.1 The atmosphere contains no known hazard; and

5-6.4.2* Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Chapter 6 Incident Mitigation

6-1 Control. This chapter will address those actions necessary to ensure confinement and containment (the first line of defense) in a manner that will minimize risk to both life and the environment in the early, critical stages of a spill or leak. Both natural and synthetic methods can be employed to limit the releases of hazardous materials so that effective recovery and treatment can be accomplished with minimum additional risk to the environment or to life.

6-2 Types of Hazardous Materials.

6-2.1 Chemical Materials. Those materials that pose a hazard based upon their chemical and physical properties.

6-2.2 Biological Materials. Those organisms that have a pathogenic effect to life and the environment and can exist in normal ambient environments.

6-2.3 Radioactive Materials. Those materials that emit ionizing radiation.

6-3 Physical States of Hazardous Materials. Hazardous materials may be classified into three states, namely gases, solids, and liquids. They can be stored or contained at a high or low pressure. All three states may be affected by the environment in which the incident occurs. The emergency responder must take into account conditions such as heat, cold, rain, or wind, which can have a significant effect on the methods used to accomplish a safe operation.

6-4 Methods of Mitigation. There are two basic methods for mitigation of hazardous materials incidents, physical and chemical. Table 6-4.1 lists many physical methods and

Table 6-4.1 Physical Methods of Mitigation[5]

Method	Chemical				Biological				Radiological			
	Gases		Liq.	Sol.	Gases		Liq.	Sol.	Gases		Liq.	Sol.
	LVP*	HVP**			LVP	HVP			LVP	HVP		
Absorption	yes	yes	yes	no	no	no	yes[4]	no	no	no	yes	no
Covering	no	no	yes	yes	no	no	yes	yes	no	no	yes[3]	yes[3]
Dikes, Dams, Diversions & Retention	yes	yes[6]	yes	yes	no	no	yes	yes	no	no	yes	yes
Dilution	yes	yes	yes	yes	no	no	no	no	yes	no	yes	yes
Overpack	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes
Plug/Patch	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Transfer	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes
Vapor Suppression (Blanketing)	no	no	yes	yes	no	no	yes	yes	no	no	no	no
Vacuuming	no	no	yes	yes	no	no	yes	yes	no	no	yes	yes
Venting[1]	yes	yes	yes	no	yes	no	no	no	yes[2]	no	no	no

*Low Vapor Pressure

**High Vapor Pressure

1. Venting of low-vapor-pressure gases is recommended only when an understanding of the biological system is known. Venting is allowed when the bacteriological system is known to be nonpathogenic, or if methods can be employed to make the environment hostile to pathogenic bacteria.
2. Venting of low-vapor-pressure radiological gases is allowed when the gas(es) is/are known to be alpha or beta emitters with short half-lives. Further, this venting is only to be allowed after careful consultation with a certified health physicist.
3. Covering should be done only after consultation with appropriate experts.
4. Absorption of liquids containing bacteria is permitted where the absorption bacteria or environment is hostile to the bacteria.
5. For substances involving more than one type, the most restrictive control measure should be used.
6. Water dispersion on certain vapors and gases only.

Table 6-4.2 lists many chemical methods that may be acceptable for mitigation of hazardous materials incidents. Recommended practices should be implemented only by personnel appropriately prepared by training, education, or experience.

6-4.1* Physical Methods. Physical methods of control involve any of several processes or procedures to reduce the area of the spill, leak, or other release mechanism. In all cases, methods used should be acceptable to the incident commander. The selection of personal protective clothing should be based on the hazardous materials and/or conditions present and should be appropriate for the hazards encountered. Refer to Table 6-4.1.

6-4.1.1* Absorption. Absorption is the process in which materials hold liquids through the process of wetting. Absorption is accompanied by an increase in the volume of the sorbate/sorbent system through the process of swelling. Some of the materials typically used as absorbents are sawdust, clays, charcoal, and polyolefin-type fibers. These materials can be used for confinement, but it should be noted that the sorbed liquid can be desorbed under mechanical or thermal stress. When absorbents become contaminated, they retain the properties of the absorbed hazardous liquid, and they are, therefore, considered to be hazardous materials and must be treated and disposed of accordingly. See ASTM F716, *Method of Testing Sorbent Performance of Absorbents*, for further information.

6-4.1.2 Covering. Refers to a temporary form of mitigation for radioactive, biological, and some chemical substances such as magnesium. It should be done after consultation with a certified health physicist (in the case of radioactive materials) or other appropriate experts.

6-4.1.3 Dikes, Dams, Diversions, and Retention. These refer to the use of physical barriers to prevent or reduce the quantity of liquid flowing into the environment. Dikes or dams usually refer to concrete, earth, and other barriers temporarily or permanently constructed to hold back the spill or leak. Diversion refers to the methods used to physically change the direction of flow of the liquid. Vapors from certain materials, such as liquefied petroleum gas (LPG), can be dispersed by means of a water spray.

6-4.1.4 Dilution. Refers to the application of water to water-miscible hazardous materials. The goal is to reduce the hazard to safe levels.

6-4.1.5 Overpacking. The most common form of overpacking is accomplished by the use of an oversized container. Overpack containers should be compatible with the hazards of the materials involved. If the material is to be shipped, DOT specification overpack containers must be used. (The spilled materials still should be treated or properly disposed of.)

6-4.1.6 Plug and Patch. Plugging and patching refers to the use of compatible plugs and patches to reduce or temporarily stop the flow of materials from small holes, rips, tears, or gashes in containers. The repaired container may not be reused without proper inspection and certification.

6-4.1.7 Transfer. Transfer refers to the process of moving a liquid, gas, or some forms of solids, either manually, by pump, or by pressure transfer, from a leaking or damaged container or tank. Care must be taken to ensure the pump, transfer hoses and fittings, and container selectedare compatible with the hazardous material. When flammable liquids are transferred, proper concern for electrical continuity (such as bonding/grounding) must be observed.

6-4.1.8 Vacuuming. Many hazardous materials may be placed in a containment simply by vacuuming them up. This has the advantage of not causing an increase in volume. Care must be taken to ensure compatibility of materials. The exhaust air may be filtered, scrubbed, or treated as needed. The method of vacuuming will depend on the nature of the hazardous material.

6-4.1.9 Vapor Dispersion. Vapors from certain materials can be dispersed or moved by means of a water spray. With other products, such as liquefied petroleum gas (LPG), the gas concentration may be reduced below the lower flammable limit through rapid mixing of the gas with air, using the turbulence created by a fine water spray. Reducing the concentration of the material through the use of water spray may bring the material into its flammable range.

6-4.1.10* Vapor Suppression (Blanketing). Vapor suppression refers to the reduction or elimination of vapors emanating from a spilled or released material through the most efficient method or application of specially designed agents. A recommended vapor suppression agent is an aqueous foam blanket.

6-4.1.11 Venting. Venting is a process that is used to deal with liquids or liquefied compressed gases where a danger, such as an explosion or mechanical rupture of the container or vessel, is considered likely. The method of venting will depend on the nature of the hazardous material. In general, it involves the controlled release of the material to reduce and contain the pressure and diminish the probability of an explosion.

6-4.2* Chemical Methods. Chemical methods of control involve the application of chemicals to treat spills of hazardous materials. Chemical methods may involve any one of several actions to reduce the involved area affected by the release of a hazardous material. In all cases, methods used should be acceptable to the incident commander. The selection of personal protective clothing should be based on the hazardous materials and/or conditions present and be appropriate for the hazards encountered. Refer to Table 6-4.2.

6-4.2.1* Adsorption. Adsorption is the process in which a sorbate (hazardous liquid) interacts with a solid sorbent surface. See ASTM F726, *Method of Testing Sorbent Performance of Adsorbents*, for further information. The principal characteristics of this interaction are:

(a) The sorbent surface is rigid and no volume increase occurs as is the case with absorbents.

(b) The adsorption process is accompanied by heat of adsorption whereas absorption is not.

(c) Adsorption occurs only with activated surfaces, e.g., activated carbon, alumina, etc.

6-4.2.2 Controlled Burning. For purposes of this practice, controlled combustion is considered a chemical method of control. However, it should only be used by qualified personnel trained specifically in this procedure.

In some emergency situations where extinguishing a fire will result in large, uncontained volumes of contaminated water, or threaten the safety of responders or the public, controlled burning is used as a technique. It is advised that consultation be made with the appropriate environmental authorities when this method is used.

6-4.2.3 Dispersion, Surface Active Agents, and Biological Additives. Certain chemical and biological agents can be used to disperse or break up the materials involved in liquid spills. The use of these agents results in a lack of containment and generally results in spreading the liquid over a much larger area. Dispersants are most often applied to spills of liquids on water. The dispersant breaks down a liquid spill into many fine droplets, thereby diluting the material to acceptable levels. Use of this method may require the prior approval of the appropriate environmental authority. See ASTM STP 659, *Chemical Dispersants for the Control of Oil Spills*, and ASTM STP 840, *Oil Spill Chemical Dispersants: Research, Experience, and Recommendations*, for further information.

Table 6-4.2 Chemical Methods of Mitigation

Method	Chemical				Biological				Radiological			
	Gases		Liq.	Sol.	Gases		Liq.	Sol.	Gases		Liq.	Sol.
	LVP*	HVP**			LVP	HVP			LVP	HVP		
Adsorption	yes	yes	yes	no	yes[3]	yes	yes[3]	no	no	no	no	no
Burn	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no
Dispersion/Emulsification	no	no	yes	yes	no	no	yes[3]	no	no	no	no	no
Flare	yes	yes	yes	no	yes	yes	yes	no	no	no	no	no
Gelatin	yes	no	yes	yes	yes[3]	no	yes[3]	yes[3]	no	no	no	no
Neutralization	yes[1]	yes[4]	yes	yes[2]	no	no	no	no	no	no	no	no
Polymerization	yes	no	yes	yes	no	no	no	no	no	no	no	no
Solidification	no	no	yes	no	no	no	yes[3]	no	no	no	yes	no
Vapor Suppression	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Vent/Burn	yes	yes	yes	no	yes	yes	yes	no	no	no	no	no

*Low Vapor Pressure

**High Vapor Pressure

[1] Technique may be possible as a liquid or solid neutralizing agent, and water can be applied.

[2] When solid neutralizing agents are used, they must be used simultaneously with water.

[3] Technique is permitted only if resulting material is hostile to the bacteria.

[4] The use of this procedure requires special expertise and technique.

6-4.2.4 Flaring. Flaring is a process that is used with high-vapor-pressure liquids or liquefied compressed gases for the safe disposal of the product. Flaring is the controlled burning of material in order to reduce or control pressure and/or dispose of a product.

6-4.2.5 Gelation. Gelation is the process of forming a gel. A gel is a colloidal system consisting of two phases, a solid and a liquid. The resulting gel is considered to be a hazardous material and must be disposed of properly.

6-4.2.6 Neutralization. Neutralization is the process of applying acids or bases to a spill to form a neutral salt. The application of solids for neutralizing can often result in confinement of the spilled material. Special formulations are available that do not result in violent reactions or local heat generation during the neutralization process. In cases where special neutralizing formulations are not available, special considerations should be given to protecting persons applying the neutralizing agent, as heat is generated and violent reactions may occur. One of the advantages of neutralization is that a hazardous material may be rendered nonhazardous.

6-4.2.7 Polymerization. A process in which a hazardous material is reacted in the presence of a catalyst, of heat or light, or with itself or another material to form a polymeric system.

6-4.2.8 Solidification. Solidification is the process whereby a hazardous liquid is treated chemically so that a solid material results. Adsorbents can be considered an example of a solidification process. There are other materials that can be used to convert hazardous liquids into nonhazardous solids. Examples are applications of special formulations designed to form a neutral salt in the case of spills of acids or caustics. The advantage of the solidification process is that a spill of small scale can be confined relatively quickly and treatment effected immediately.

6-4.2.9 Vapor Suppression. The use of solid activated materials to treat hazardous materials so as to effect suppression of the vapor off-gasing from the materials. This process results in the formation of a solid that affords easier handling but that may result in a hazardous solid that must be disposed of properly.

6-4.2.10 Venting and Burning. This involves the use of shaped charges to vent the high vapor pressure at the top of the container and then with additional charges to release and burn the remaining liquid in the container in a controlled fashion.

Chapter 7 Decontamination

7-1 Decontamination Plan. At every incident involving hazardous materials there is a possibility that response personnel and their equipment will become contaminated. The contaminant poses a threat, not only to the persons contaminated, but to other personnel who may subsequently have contact with them or the equipment.

7-1.1 Incident responders should have an established procedure to minimize contamination or contact, to limit migration of contaminants, and to properly dispose of contaminated materials. Decontamination procedures should begin upon arrival at the scene, should provide for an adequate number of decontamination personnel, and should continue until the incident commander determines that decontamination procedures are no longer required. Decontamination of victims may be required.

7-1.2 The following methods of decontamination are available for personnel and/or equipment:

(a) Absorption
(b) Adsorption
(c) Chemical degradation
(d) Dilution
(e) Disposal
(f) Isolation
(g) Neutralization
(h) Solidification.

7-2 Personal Protective Equipment. Before personal protective equipment is removed it should be decontaminated. During doffing of personal protective equipment, the clothing should be removed in a manner such that the outside surfaces do not touch or make contact with the wearer. A log of personal protective equipment used during the incident should be maintained. Personnel wearing disposable protective equipment should go through the decontamination process, and the disposable protective equipment should be disposed of in accordance with established procedures.

7-3 Decontamination. Decontamination consists of removing the contaminants by chemical or physical processes. The conservative action is always to assume contamination has occurred and to implement a thorough, technically sound decontamination procedure until it is determined or judged to be unnecessary.

7-3.1 Procedures for all phases of decontamination must be developed and implemented to reduce the possibility of contamination to personnel and equipment. Reference guides for the development of decontamination procedures can be found in Appendix C-2.4(d) and C-2.4(f). Assuming protective equipment is grossly contaminated, use appropriate decontamination methods for the chemicals encountered.

7-3.2 Outer clothing should be decontaminated prior to removal. The outer articles of clothing, after removal, should be placed in plastic bags for later additional decontamination, cleaning, and/or inspection. In some cases, they may have to be overpacked into containers for proper disposal. Water or other solutions used for washing or rinsing may have to be contained, collected, containerized, and analyzed prior to disposal.

7-3.3 Initial procedures should be upgraded or downgraded as additional information is obtained concerning the type of hazardous materials involved, the degree of hazard, and the probability of exposure of response personnel.

7-3.4 Using solutions containing chemicals to alter or change contaminants to less hazardous materials should only be done after consultation with persons experienced and familiar with the hazards involved. The use of detergent-water washing solutions is more prevalent, but its effectiveness against certain contaminants may be low. It is less risky, however, than using chemical solutions.

7-3.5 Many types of equipment are very difficult to decontaminate and may have to be discarded as hazardous wastes. Whenever possible, other pieces of small equipment should be disposable or made of nonporous material. Monitoring instruments and some types of sampling equipment can be placed in plastic bags (with only the detecting element exposed) to minimize potential contamination problems.

7-3.6 Large items of equipment, such as vehicles and trucks, should be subjected to decontamination by high pressure water washes, steam, or special solutions. Water or other solutions used for washing or rinsing may have to be contained, collected, containerized, and analyzed prior to disposal. Consultation with appropriate sources should be utilized to determine proper decontamination procedures.

7-3.7 Personnel assigned to the decontamination team should wear an appropriate level of personal protective equipment and may require decontamination themselves.

Chapter 8 Referenced Publications

8-1 The following documents or portions thereof are referenced within this recommended practice and should be considered part of the recommendations of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

8-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 70, *National Electrical Code*, 1993 edition

NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*, 1992 edition

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1992 edition

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, 1992 edition

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS) for Fire Fighters*, 1988 edition

NFPA 1991, *Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies*, 1990 edition

NFPA 1992, *Standard on Liquid Splash-Protective Suits for Chemical Emergencies*, 1990 edition

NFPA 1993, *Standard on Support Function Protective Garments for Hazardous Chemical Operations*, 1990 edition.

8-1.2 Other Publications.

8-1.2.1 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM F716-82, *Method of Testing Sorbent Performance of Absorbents*

ASTM F726-81, *Method of Testing Sorbent Performance of Adsorbents*

ASTM STP 659, *Chemical Dispersants for the Control of Oil Spills*

ASTM STP 840, *Oil Spill Chemical Dispersants: Research, Experience, and Recommendations*.

8-1.2.2 U.S. Government Publication. U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402.

Title 29 CFR Part 1910.120.

Appendix A

This Appendix is not a part of the recommendations of this NFPA document, but is included for information purposes only.

A-1-1 Many of the recommendations in this document are based on U.S. federal laws and regulations that were in effect at the time of adoption. Users should carefully review laws and regulations that may have been added or amended or that may be required by other authorities. Users outside the jurisdiction of the U.S. should determine what requirements may be in force at the time of application of this document.

A-1-4 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

A-1-4 Hazardous Material. There are many definitions and descriptive names being used for the term hazardous material, each of which depends on the nature of the problem being addressed.

Unfortunately, there is no one list or definition that covers everything. The U.S. agencies involved, as well as state and local governments, have different purposes for regulating hazardous materials that, under certain circumstances, pose a risk to the public or the environment.

(a) *Hazardous Materials.* The U.S. Department of Transportation (DOT) uses the term *hazardous materials*, which covers eleven hazard classes, some of which have subcategories called divisions. DOT includes in its regulations hazardous substances and hazardous wastes as Class 9 Miscellaneous Hazardous Materials, both of which are regulated by the U.S. Environmental Protection Agency (EPA), if their inherent properties would not otherwise be covered.

(b) *Hazardous Substances.* EPA uses the term *hazardous substance* for the chemicals that, if released into the environment above a certain amount, must be reported, and, depending on the threat to the environment, federal involvement in handling the incident can be authorized. A list of the hazardous substances is published in 40 CFR Part 302, Table 302.4. The U.S. Occupational Safety and Health Administration (OSHA) uses the term hazardous substance in 29 CFR Part 1910.120, which resulted from Title I of SARA and covers emergency response. OSHA uses the term differently than EPA. Hazardous substances, as used by OSHA, cover every chemical regulated by both DOT and EPA.

(c) *Extremely Hazardous Substances.* EPA uses the term *extremely hazardous substance* for the chemical that must be reported to the appropriate authorities if released above the threshold reporting quantity. Each substance has a threshold reporting quantity. The list of extremely hazardous substances is identified in Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 (40 CFR Part 355).

(d) *Toxic Chemicals.* EPA uses the term *toxic chemical* for chemicals whose total emissions or releases must be reported annually by owners and operators of certain facilities that manufacture, process, or otherwise use a listed toxic chemical. The list of toxic chemicals is identified in Title III of SARA.

(e) *Hazardous Wastes.* EPA uses the term *hazardous wastes* for chemicals that are regulated under the Resource, Conservation, and Recovery Act (40 CFR Part 261.33). Hazardous wastes in transportation are regulated by DOT (49 CFR Parts 170-179).

(f) *Hazardous Chemicals.* OSHA uses the term *hazardous chemical* to denote any chemical that would be a risk to employees if exposed in the workplace. Hazardous chemicals cover a broader group of chemicals than the other chemical lists.

(g) *Dangerous Goods.* In Canadian transportation, hazardous materials are called dangerous goods.

Class 1 (Explosives)

Explosive means any substance or article, including a device, that is designed to function by explosion (i.e., an extremely rapid release of gas and heat) or that, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion. Explosives in Class 1 are divided into six divisions. Each division will have a letter designation.

Division 1.1 consists of explosives that have a mass explosion hazard. A mass explosion is one that affects almost the entire load instantaneously.

Examples of Division 1.1 explosives include black powder, dynamite, and TNT.

Division 1.2 consists of explosives that have a projection hazard but not a mass explosion hazard.

Examples of Division 1.2 explosives include aerial flares, detonating cord, and power device cartridges.

Division 1.3 consists of explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

Examples of Division 1.3 explosives include liquid-fueled rocket motors and propellant explosives.

Division 1.4 consists of explosive devices that present a minor explosion hazard. No device in the division may contain more than 25 g (0.9 oz) of a detonating material. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

Examples of Division 1.4 explosives include line-throwing rockets, practice ammunition, and signal cartridges.

Division 1.5 consists of very insensitive explosives. This division is comprised of substances that have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Examples of Division 1.5 explosives include prilled ammonium nitrate fertilizer-fuel oil mixtures (blasting agents).

Division 1.6 consists of extremely insensitive articles that do not have a mass explosive hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and that demonstrate a negligible probability of accidental initiation or propagation.

Class 2

Division 2.1 (Flammable Gas) means any material that is a gas at 20°C (68°F) or less and 101.3 kPa (14.7 psi) of pressure, a material that has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psi) and that:

(a) Is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13 percent or less by volume with air; or

(b) Has a flammable range at 101.3 kPa (14.7 psi) with air of at least 12 percent regardless of the lower limit.

Examples of Division 2.1 gases include inhibited butadienes, methyl chloride, and propane.

Division 2.2 (Nonflammable, Nonpoisonous Compressed Gas, Including Compressed Gas, Liquefied Gas, Pressurized Cryogenic Gas, and Compressed Gas in Solution) A nonflammable, nonpoisonous compressed gas means any material (or mixture) that exerts in the packaging an absolute pressure of 280 kPa (41 psia) at 20°C (68°F).

A cryogenic liquid means a refrigerated liquefied gas having a boiling point colder than -90°C (-130°F) at 101.3 kPa (14.7 psi) absolute.

Examples of Division 2.2 gases include anhydrous ammonia, cryogenic argon, carbon dioxide, and compressed nitrogen.

Division 2.3 (Poisonous Gas) means a material that is a gas at 20°C (68°F) or less and a pressure of 101.3 kPa (14.7 psi or 1 atm), a material that has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psi), and that:

(a) Is known to be so toxic to humans as to pose a hazard to health during transportation, or;

(b) In the absence of adequate data on human toxicity, is presumed to be toxic to humans because, when tested on laboratory animals, it has an LC_{50} value of not more than 5,000 ppm.

Examples of Division 2.3 gases include anhydrous hydrogen fluoride, arsine, chlorine, and methyl bromide.

Hazard zones are associated with Division 2.3 materials:

Hazard zone A — LC_{50} less than or equal to 200 ppm.

Hazard zone B — LC_{50} greater than 200 ppm and less than or equal to 1,000 ppm.

Hazard zone C — LC_{50} greater than 1,000 ppm and less than or equal to 3,000 ppm.

Hazard zone D — LC_{50} greater than 3,000 ppm and less than or equal to 5,000 ppm.

Class 3 (Flammable Liquid)

Flammable liquid means any liquid having a flash point of not more than 60.5°C (141°F).

Examples of Class 3 liquids include acetone, amyl acetate, gasoline, methyl alcohol, and toluene.

Hazard zones are associated with Class 3 materials:

Hazard zone A — LC_{50} less than or equal to 200 ppm.

Hazard zone B — LC_{50} greater than 200 ppm and less than or equal to 1,000 ppm.

Combustible Liquid

Combustible liquid means any liquid that does not meet the definition of any other hazard class and has a flash point above 60°C (140°F) and below 93°C (200°F). Flammable liquids with a flash point above 38°C (100°F) may be reclassified as a combustible liquid.

Examples of combustible liquids include mineral oil, peanut oil, and No. 6 fuel oil.

Class 4

Division 4.1 (Flammable Solid) means any of the following three types of materials:

(a) Wetted explosives — explosives wetted with sufficient water, alcohol, or plasticizers to suppress explosive properties.

(b) Self-reactive materials — materials that are liable to undergo, at normal or elevated temperatures, a strongly exothermic decomposition caused by excessively high transport temperatures or by contamination.

(c) Readily combustible solids — solids that may cause a fire through friction and any metal powders that can be ignited.

Examples of Division 4.1 materials include magnesium (pellets, turnings, or ribbons) and nitrocellulose.

Division 4.2 (Spontaneously Combustible Material) means any of the following materials:

(a) Pyrophoric material — a liquid or solid that, even in small quantities and without an external ignition source, can ignite within 5 minutes after coming in contact with air.

(b) Self-heating material — a material that, when in contact with air and without an energy supply, is liable to self-heat.

Examples of Division 4.2 materials include aluminum alkyls, charcoal briquettes, magnesium alkyls, and phosphorus.

Division 4.3 (Dangerous When Wet Material) means a material that, by contact with water, is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 L per kg of the material, per hour.

Examples of Division 4.3 materials include calcium carbide, magnesium powder, potassium metal alloys, and sodium hydride.

Class 5

Division 5.1 (Oxidizer) means a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials.

Examples of Division 5.1 materials include ammonium nitrate, bromine trifluoride, and calcium hypochlorite.

Division 5.2 (Organic Peroxide) means any organic compound containing oxygen (O) in the bivalent -O-O- structure that may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.

Division 5.2 (Organic Peroxide) materials are assigned to one of seven types:

Type A — organic peroxide that can detonate or deflagrate rapidly as packaged for transport. Transportation of type A organic peroxides is forbidden.

Type B — organic peroxide that neither detonates nor deflagrates rapidly, but that can undergo a thermal explosion.

Type C — organic peroxide that neither detonates nor deflagrates rapidly and cannot undergo a thermal explosion.

Type D — organic peroxide that detonates only partially or deflagrates slowly, with medium to no effect when heated under confinement.

Type E — organic peroxide that neither detonates nor deflagrates and shows low, or no, effect when heated under confinement.

Type F — organic peroxide that will not detonate, does not deflagrate, shows only a low, or no, effect if heated when confined, and has low or no explosive power.

Type G — organic peroxide that will not detonate, does not deflagrate, shows no effect if heated when confined, and has no explosive power, is thermally stable, and is desensitized.

Examples of Division 5.2 materials include dibenzoyl peroxide, methyl, ethyl ketone peroxide, and peroxyacetic acid.

Class 6

Division 6.1 (Poisonous Material) means a material, other than a gas, that is either known to be so toxic to humans as to afford a hazard to health during transportation, or in the absence of adequate data on human toxicity, is presumed to be toxic to humans, including irritating materials that cause irritation.

Examples of Division 6.1 materials include aniline, arsenic compounds, carbon tetrachloride, hydrocyanic acid, and tear gas.

Division 6.2 (Infectious Substance) means a viable microorganism, or its toxin, that causes or may cause disease in humans or animals. Infectious substance and etiologic agent are synonymous.

Examples of Division 6.2 materials include anthrax, botulism, rabies, and tetanus.

Class 7

Radioactive material means any material having a specific activity greater than 0.002 microcuries per gram (μCi/g).

Examples of Class 7 materials include cobalt, uranium hexafluoride, and "yellow cake."

Class 8

Corrosive material means a liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum.

Examples of Class 8 materials include nitric acid, phosphorus trichloride, sodium hydroxide, and sulfuric acid.

Class 9

Miscellaneous hazardous material means a material that presents a hazard during transport, but that is not included in another hazard class, including:

(1) Any material that has an anesthetic, noxious, or other similar property that could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties; and

(2) Any material that is not included in any other hazard class, but is subject to the DOT requirements (a hazardous substance or a hazardous waste).

Examples of Class 9 materials include adipic acid, hazardous substances (e.g., PCBs), and molten sulfur.

ORM-D Material

An ORM-D material means a material that presents a limited hazard during transportation due to its form, quantity, and packaging.

Examples of ORM-D materials include consumer commodities and small arms ammunition.

Forbidden

Forbidden means prohibited from being offered or accepted for transportation. Prohibition does not apply if these materials are diluted, stabilized, or incorporated in devices.

A-1-4 National Contingency Plan. See *Code of Federal Regulations*: 40 CFR, Part 300, Subchapters A through J.

A-3-1 These incidents can be considered as requiring either offensive operations or defensive operations.

Offensive operations include actions taken by a hazardous materials responder, in appropriate chemical-protective clothing, to handle an incident in such a manner that contact with the released material may result. This includes: patching or plugging to slow or stop a leak; containing a material in its own package or container; and cleanup operations that may require overpacking or transfer of a product to another container.

Defensive operations include actions taken during an incident where there is no intentional contact with the material involved. This includes: elimination of ignition sources, vapor suppression, and diking or diverting to keep a release in a confined area. It requires notification and possible evacuation, but does not involve plugging, patching, or cleanup of spilled or leaking materials.

Jurisdictions have the responsibility to develop standard operating procedures that equate levels of response to levels of training indicated in NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*. Depending on the capabilities and training of personnel, first responder operational level may equate to incident level one and the technician level may equate to incident level two.

Response personnel should operate only at that incident level that matches their knowledge, training, and equipment. If conditions indicate a need for a higher response level, then additional personnel, appropriate training, and equipment should be summoned.

A-4-1.2 Though in the following text 29 CFR 1910.120 is cited, it should be understood that some states will adopt these regulations under state OSHA plans and others will adopt these regulations through adoption of a similar regulation established by EPA and appropriate state agencies.

A-4-3.1 Access into the hot zone is to be limited to those persons necessary to control the incident. A log is to be maintained at the access control point to record entry and exit time of all personnel in the hot zone.

A-5-5.3 Refer to OSHA 29 CFR 1910.134.

A-5-6.2.1 This involves atmospheres with IDLH (immediately dangerous to life and health) concentrations of specific substances that do not represent a severe skin hazard, or that do not meet the criteria for use of air purifying respirators.

A-5-6.3.4 Refer to OSHA 29 CFR 1910.134.

A-5-6.4.2 Combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

A-6-4.1 Procedures described in 6-4.1.1 through 6-4.1.11 should be completed only by personnel trained in those procedures.

A-6-4.1.1 Absorbents saturated with volatile liquid chemicals can create a more severe vapor hazard than the spill alone because of severely enlarged surface area for vapor release.

A-6-4.1.10 One technique available for handling a spill of a hazardous liquid is the application of foams to suppress the vapor emanating from the liquid. This technique is ideally suited for liquid spills that are contained, i.e., diked. It can also be used where the spill is not confined. In all cases this technique should only be undertaken by personnel who have been trained in the use of foam concentrate for vapor suppression. Training in the use of foam as a fire extinguishing agent is not sufficient to qualify an individual for applying foam application as a vapor-suppressing agent.

Vapor-suppressing foam concentrates vary in their effectiveness depending on a number of factors. These factors can include the type of foam, the 25 percent drainage time of the foam, the rate of application of the foam, and the depth of the foam blanket. These variables serve to emphasize the need for training of the person selecting this technique for applying foam as a vapor-suppressing medium.

Foams are produced by mechanically mixing a dilute solution of the foam concentrate and water with air, producing an expanded foam. Foams have been developed basically as fire extinguishing agents. Data has also been developed on their capability to suppress vapor release from water-immiscible flammable or combustible hydrocarbon liquids.

Foam and specific foam concentrates for each category, along with the definitions of appropriate terms, can be obtained by consulting NFPA 11, *Standard for Low Expansion Foam and Combined Agent Systems*; NFPA 11A, *Medium- and High-Expansion Foam Systems*; NFPA 16, *Foam-Water Sprinklers*; and ASTM Standard Guide F1129, *Using Aqueous Foams to Control the Vapor Hazard from Immiscible Volatile Liquids*.

The use of fire fighting foam as a vapor suppressant involves some considerations that are different from those required for fire extinguishing agents. It should be noted that fire fighting foams are predominantly restricted to use on water-immiscible hydrocarbon liquids or polar compounds. They are not usually effective on inorganic acids or bases, nor on liquefied gases, including the hydrocarbon gases such as methane and propane, in controlling vapor release. One of the obvious issues of concern is the stability of the foam blanket as a function of time. This can be approached by looking at what is referred to as the foam quality.

Foam quality is generally measured in terms of foam expansion ratio and foam 25 percent drainage time. Foam expansion ratio refers to the volume of foam solution. AFFF is often used in nonaspirating equipment such as water fog nozzles. Nonaspirated AFFF solutions have significantly limited effectiveness in comparison with aspirated foam solutions in vapor suppression.

The 25 percent drainage time is that time which is required for 25 percent of the foam solution to drain from the foam. This is the property that is generally used to measure the stability of the foam. The slower the drainage of any expanded foam, regardless of expansion, the more effective and longer lasting is the foam blanket. This assumes weather conditions are ideal.

An important factor is the vapor pressure of the liquid that is being suppressed. Liquid vapor pressures can vary widely. The higher the vapor pressure, the slower the control time. The key to effective use of foam as a vapor-suppressing agent is to have a continuous foam blanket on the fuel surface. Films from AFFF/FFFP are no guarantee of effective vapor control.

It is important to recognize that there are some limitations in the use of foam fire extinguishing agents in vapor suppression. As indicated, these materials are basically designed for flammable hydrocarbon liquids. They have severe shortcomings for inorganic acids or bases or liquefied gases. They should not be used for vapor suppression of these categories of volatile hazardous chemicals without consultation with the manufacturer of the specific foam agent being considered.

Most fire fighting foam concentrates have a limited range of pH tolerance. pH is a measure of the acidity or alkalinity of inorganic acids or bases. pH tolerance is the level that the bubble wall of the foam can tolerate before collapsing catastrophically. A few surfactant foams and the polar compound-type foams have good pH tolerance. Most of the protein, fluoroprotein, AFFFs, and high-expansion foams are not suitable for inorganic acids or bases.

Liquefied gas spills may be controlled by the application of high-expansion foam blankets. Low-expansion foams are not effective for liquefied gas spill control. Because of the large temperature differential between the liquefied gas and the foam, the drainage from the foam initially exaggerates boiloff from the spill. The higher the expansion, the lesser the effect of the drainage. For liquefied gases and all water-reactive inorganic materials, the foam should exhibit the best chemical resistance and expansion ratios to ensure maximum water retention consistent with the condition of the spill site. Since each spilled material can have unique properties, the manufacturer of the foam concentrate should be consulted for directions.

The great differences in the chemistry of flammable hydrocarbon liquids and the water-reactive inorganic materials have resulted in the development of foam concentrates specifically applicable to the inorganic chemicals. Few fire fighting foams have capabilities of vapor suppression of the inorganic acids and bases. For effective control, special foam concentrates should be employed.

Some special foam concentrates are specific for either acids or alkalis but not both. Further, they are not applicable to all inorganic materials nor are they effective in fire suppression. In many cases, their effectiveness is limited, and intermittent foam make-up may be required to maintain the foam blanket. Others, usually containing a polymer modification, can cover a wide range of materials, both acids and bases, and may possess some degree of fire resistance. This is important for those inorganic materials that may also pose a fire hazard.

At present, there is no single foam concentrate that is truly effective against all categories of volatile hazardous chemicals. A few possess limited capabilities in most categories, but they are compromise materials sacrificing in one category to provide some capability in other categories. These may, however, be the best choice for first responders where an overall capability is essential.

In all cases, however, the foam manufacturer or the manufacturer's literature should be consulted to provide specific guidance for the chemical to be treated.

NOTE: Vapor suppression can also be considered a chemical method of mitigation.

A-6-4.2 The procedures described in 6-4.2.1 through 6-4.2.10 should only be used by personnel trained in those procedures.

A-6-4.2.1 Spontaneous ignition can occur through the heat of adsorption of flammable materials, and caution should be exercised.

NOTE: Adsorbents saturated with volatile liquid chemicals can create a more severe vapor hazard than the spill alone because of the severely enlarged surface area for vapor release.

Appendix B Referenced Publications

B-1 The following documents or portions thereof are referenced within this recommended practice for informational purposes only and thus are not considered part of the recommendations of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

B-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 11, *Standard for Low Expansion Foam and Combined Agent Systems*, 1988 edition

NFPA 11A, *Standard for Medium- and High-Expansion Foam Systems*, 1988 edition

NFPA 16, *Standard on the Installation of Deluge Foam-Water Sprinkler and Foam-Water Spray Systems*, 1991 edition

NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*, 1992 edition.

B-1.2 Other Publications.

B-1.2.1 ASTM Publication. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM F1129-88, *Using Aqueous Foams to Control the Vapor Hazard from Immiscible Volatile Liquids*.

B-1.2.2 U.S. Government Publications. U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402.

Title 29 CFR Parts 1910.120, 1910.134

Title 40 CFR Parts 261.33, 300, 302, and 355

Title 49 CFR Parts 170-179.

Appendix C Suggested Reading List

This Appendix is not a part of the recommendations of this NFPA document, but is included for information purposes only.

C-1 Introduction.

This list provides the titles of references and organizations that may be of value to those responding to hazardous materials incidents. This list can be expanded based on personal preferences and requirements.

The references are categorized by subject. The title, author, publisher, and place of publication are given for each. The year of publication is not always given because many are revised annually. The user should attempt to obtain the most recent edition.

The last section lists sources of these references as well as other information that might be useful. Usually, these agencies or associations will provide a catalog on request. Where available, phone numbers are also listed.

C-2 References.

C-2.1 Industrial Hygiene (Air Sampling and Monitoring, Respiratory Protection, Toxicology).

(a) *Air Sampling Instruments for Evaluation of Atmospheric Contaminants*, American Conference of Governmental Industrial Hygienists, Cincinnati, OH.

(b) *Direct Reading Colorimetric Indicator Tubes Manual*, American Industrial Hygiene Association, Akron, OH.

(c) *Fundamentals of Industrial Hygiene*, National Safety Council, Chicago, IL.

(d) *Industrial Hygiene and Toxicology*, Frank A. Patty, John Wiley and Sons, Inc., New York, NY.

(e) *Manual of Recommended Practice for Combustible Gas Indicators and Portable, Direct Reading Hydrocarbon Detectors*, American Industrial Hygiene Association, Akron, OH.

(f) *NIOSH/OSHA Pocket Guide to Chemical Hazards*, DHHS No. 85-114, NIOSH, Department of Health and Human Services, Cincinnati, OH.

(g) *Occupational Health Guidelines for Chemical Hazards*, DHHS No. 81-123, NIOSH, Department of Health and Human Services, Cincinnati, OH.

(h) *Occupational Safety and Health Standards*, Title 29, *Code of Federal Regulations*, Part 1910.120, "Hazardous Waste Operations and Emergency Response Final Rule," U.S. Government Printing Office, Washington, DC.

(i) *TLVs Threshold Limit Values and Biological Exposure Indices (Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment)*, American Conference of Governmental Industrial Hygienists, Cincinnati, OH.

C-2.2 Chemical Data.

(a) *Chemical Hazard Response Information System (CHRIS)*, U.S. Coast Guard, Washington, DC, Commandant Instruction M.16565.12A.

(b) *CHRIS — A Condensed Guide to Chemical Hazards*, U.S. Coast Guard, Commandant Instruction M16565.11a.

(c) *The Condensed Chemical Dictionary*, G. Hawley, Van Nostrand Reinhold Co., New York, NY.

(d) *CRC Handbook of Chemistry and Physics*, CRC Press, Boca Raton, FL.

(e) *Dangerous Properties of Industrial Materials*, N. Irving Sax, Van Nostrand Reinhold Co., New York, NY.

(f) *Effects of Exposure to Toxic Gases*, Matheson.

(g) *Emergency Handling of Hazardous Materials in Surface Transportation*, Association of American Railroads, Washington, DC.

(h) *Farm Chemicals Handbook*, Farm Chemicals Magazine, Willoughby, OH.

(i) *Firefighter's Handbook of Hazardous Materials*, Baker, Charles J., Maltese Enterprises, Indianapolis, IN.

(j) *Fire Protection Guide to Hazardous Materials*, National Fire Protection Association, Quincy, MA.

(k) *Hazardous Materials Handbook*, Meidl, J. H., Glencoe Press, Encino, CA.

(l) *The Merck Index*, Merck and Co., Inc., Rahway, NJ.

(m) *Emergency Action Guides*, Association of American Railroads, Washington, DC.

C-2.3 Safety and Personnel Protection.

(a) *A Guide to the Safe Handling of Hazardous Materials Accidents*, ASTM STP 825, American Society for Testing and Materials, Philadelphia, PA.

(b) *Fire Protection Handbook*, National Fire Protection Association, Quincy, MA.

(c) *Guidelines for Decontamination of Firefighters and Their Equipment Following Hazardous Materials Incidents*, Canadian Association of Fire Chiefs, Ottawa (May 1987).

(d) *Guidelines for the Selection of Chemical Protective Clothing*. Volume 1: Field Guide, A. D. Schwope, P. P. Costas, J. O. Jackson, D. J. Weitzman; Arthur D. Little, Inc., Cambridge, MA (March 1983).

(e) *Guidelines for the Selection of Chemical Protective Clothing*. Volume 2: Technical and Reference Manual, A. D. Schwope, P. P. Costas, J.O. Jackson, D.J. Weitzman, J. O. Stull; Arthur D. Little, Inc., Cambridge, MA, 3rd edition (February 1987).

(f) *Hazardous Materials*, Warren Isman and Gene Carlson, Glencoe Press, Encino, CA, 1981.

(g) *Hazardous Materials Emergencies Response and Control*, John R. Cashman, Technomic Publishing Company, Lancaster, PA (June 1983).

(h) *Hazardous Materials for the First Responser*, International Fire Service Training Association, Stillwater, OK (1988).

(i) *Hazardous Materials: Managing the Incident*, Gregory Noll, Michael Hildebrand, and James Yvorra, Fire Service Publications, Stillwater, OK (1988).

(j) *Handling Radiation Emergencies*, Purington and Patterson, National Fire Protection Association, Quincy, MA.

(k) *Hazardous Materials Injuries, A Handbook for Pre-Hospital Care*, Douglas R. Stutz, Robert C. Ricks, Michael F. Olsen, Bradford Communications Corp., Greenbelt, MD.

(l) *National Safety Council Safety Sheets*, National Safety Council, Chicago, IL.

(m) *Radiological Health — Preparedness and Response in Radiation Accidents*, U.S. Department of Health and Human Services, Washington, DC.

(n) *Standard First Aid and Personal Safety*, American Red Cross.

C-2.4 Planning Guides.

(a) *A Fire Department's Guide to Implementing Title III and the OSHA Hazardous Materials Standard* (August 1987), William H. Stringfield, International Society of Fire Service Instructors, Ashland, MA.

(b) *Federal Motor Carrier Safety Regulations Pocketbook*, U.S. Department of Transportation, J. J. Keller and Associates, Inc.

(c) *Hazardous Chemical Spill Cleanup*, Noyes Data Corporation, Ridge Park, New Jersey.

(d) *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH/OSHA/USCG/EPA, U.S. Department of Health and Human Services, NIOSH.

(e) *Hazardous Materials Emergency Planning Guide*, (March 1987), National Response Team.

(f) *Standard Operating Safety Guides*, Environmental Response Branch, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency.

C-3 Agencies and Associations.

Agency for Toxic Substances Disease Registry
Shamlee 28 S., Room 9
Centers for Disease Control
Atlanta, GA 30333
404/452-4100

American Conference of Governmental Industrial Hygienists
6500 Glenway Avenue — Building D-5
Cincinnati, OH 45211
513/661-7881

American Industrial Hygiene Association
475 Wolf Ledges Parkway
Akron, OH 44311-1087
216/762-7294

American National Standards Institute, Inc.
1430 Broadway
New York, NY 10018
212/354-3300

American Petroleum Institute (API)
1220 L Street N.W. 9th Floor
Washington, DC 20005
202/682-8000

Association of American Railroads
50 F Street N.W.
Washington, DC 20001
202/639-2100

Chemical Manufacturers' Association
2501 M Street N.W.
Washington, DC 20037
202/877-1100

CHEMTREC
Washington, DC
800/424-9300

The Chlorine Institute
2001 L Street N.W.
Washington, DC 20001
202/639-2100

Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, VA 22202
703/979-0900

The Fertilizer Institute (TFI)
1015 18th Street N.W.
Washington, DC 20036
202/861-4900

International Society of Fire Service Instructors
30 Main Street
Ashland, MA 01721
617/881-5800

National Fire Protection Association
1 Batterymarch Park, P.O. Box 9101
Quincy, MA 02269-9101
617/770-3000

Spill Control Association of America
Suite 1575
100 Renaissance Center
Detroit, MI 48243-1075

U.S. Department of Transportation
Materials Transportation Bureau
DHM 51
RS PA
Washington, DC 20590
202/366-4555

U.S. EPA Office of Research & Development
Publications — CERI
Cincinnati, OH 45268
513/684-7562

U.S. EPA Office of Solid Waste (WH-562)
Superfund Hotline
401 M Street S.W.
Washington, DC 20460
800/424-9346

U.S. Mine Safety and Health Administration
Department of Labor
4015 Wilson Boulevard, Room 600
Arlington, VA 22203
703/235-1452

U.S. National Oceanic and Atmospheric Administration
Hazardous Materials Response Branch N/CMS 34
7600 Sand Point Way NE
Seattle, WA 98115

C-4 Computer Data Base Systems.

Hazardous Materials Information Exchange (HMIX)
Federal Emergency Management Agency
State and Local Programs Support Directory
Technological Hazards Division
500 C Street S.W.
Washington, DC 20472

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The NFPA Codes and Standards Development Process

Since 1896, one of the primary purposes of the NFPA has been to develop and update the standards covering all areas of fire safety.

Calls for Proposals

The code adoption process takes place twice each year and begins with a call for proposals from the public to amend existing codes and standards or to develop the content of new fire safety documents.

Report on Proposals

Upon receipt of public proposals, the technical committee members meet to review, consider, and act on the proposals. The public proposals – together with the committee action on each proposal and committee-generated proposals – are published in the NFPA's Report on Proposals (ROP). The ROP is then subject to public review and comment.

Report on Comments

These public comments are considered and acted upon by the appropriate technical committees. All public comments – together with the committee action on each comment – are published as the Committee's supplementary report in the NFPA's Report on Comments (ROC).

The committee's report and supplementary report are then presented for adoption and open debate at either of NFPA's semi-annual meetings held throughout the United States and Canada.

Association Action

The Association meeting may, subject to review and issuance by the NFPA Standards Council, (a) adopt a report as published, (b) adopt a report as amended, contingent upon subsequent approval by the committee, (c) return a report to committee for further study, and (d) return a portion of a report to committee.

Standards Council Action

The Standards Council will make a judgement on whether or not to issue an NFPA document based upon the entire record before the Council, including the vote taken at the Association meeting on the technical committee's report.

Voting Procedures

Voting at an NFPA Annual or Fall Meeting is restricted to members of record for 180 days prior to the opening of the first general session of the meeting, except that individuals who join the Association at an Annual or Fall Meeting are entitled to vote at the next Fall or Annual Meeting.

"Members" are defined by Article 3.2 of the Bylaws as individuals, firms, corporations, trade or professional associations, institutes, fire departments, fire brigades, and other public or private agencies desiring to advance the purposes of the Association. Each member shall have one vote in the affairs of the Association. Under Article 4.5 of the Bylaws, the vote of such a member shall be cast by that member individually or by an employee designated in writing by the member of record who has registered for the meeting. Such a designated person shall not be eligible to represent more than one voting privilege on each issue, nor cast more than one vote on each issue.

Any member who wishes to designate an employee to cast that member's vote at an Association meeting in place of that member must provide that employee with written authorization to represent the member at the meeting. The authorization must be on company letterhead signed by the member of record, with the membership number indicated, and the authorization must be recorded with the President of NFPA or his designee before the start of the opening general session of the Meeting. That employee, irrespective of his or her own personal membership status, shall be privileged to cast only one vote on each issue before the Association.