§ 1910.152 [Reserved]

Subpart L—Fire Protection

Authority: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, and 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), 6-96 (62 FR 111), 3-2000 (65 FR 50017), 5-2002 (67 FR 65008), or 5-2007 (72 FR 31160), as applicable, and 29 CFR part 1911.

§ 1910.155 Scope, application and definitions applicable to this subpart.

(a) ***Scope.*** This subpart contains requirements for fire brigades, and all portable and fixed fire suppression equipment, fire detection systems, and fire or employee alarm systems installed to meet the fire protection requirements of 29 CFR part 1910.

(b) ***Application.*** This subpart applies to all employments except for maritime, construction, and agriculture.

(c) ***Definitions applicable to this subpart —***

(1) ***After-flame*** means the time a test specimen continues to flame after the flame source has been removed.

(2) ***Aqueous film forming foam (AFFF)*** means a fluorinated surfactant with a foam stabilizer which is diluted with water to act as a temporary barrier to exclude air from mixing with the fuel vapor by developing an aqueous film on the fuel surface of some hydrocarbons which is capable of suppressing the generation of fuel vapors.

(3) ***Approved*** means acceptable to the Assistant Secretary under the following criteria:

(i) If it is accepted, or certified, or listed, or labeled or otherwise determined to be safe by a nationally recognized testing laboratory; or

(ii) With respect to an installation or equipment of a kind which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, if it is inspected or tested by another Federal agency and found in compliance with the provisions of the applicable National Fire Protection Association Fire Code; or

(iii) With respect to custom-made equipment or related installations which are designed, fabricated for, and intended for use by its manufacturer on the basis of test data which the employer keeps and makes available for inspection to the Assistant Secretary.

(iv) For the purposes of paragraph (c)(3) of this section:

(A) Equipment is listed if it is of a kind mentioned in a list which is published by a nationally recognized testing laboratory which makes periodic inspections of the production of such equipment and which states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner;

(B) Equipment is labeled if there is attached to it a label, symbol, or other identifying mark of a nationally recognized testing laboratory which makes periodic inspections of the production of such equipment, and whose labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner;

(C) Equipment is accepted if it has been inspected and found by a nationally recognized testing laboratory to conform to specified plans or to procedures of applicable codes; and

(D) Equipment is certified if it has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner or is of a kind whose production is periodically inspected by a nationally recognized testing laboratory, and if it bears a label, tag, or other record of certification.

(E) Refer to § 1910.7 for definition of nationally recognized testing laboratory.

(4) ***Assistant Secretary*** means the Assistant Secretary of Labor for Occupational Safety and Health or designee.

(5) ***Automatic fire detection device*** means a device designed to automatically detect the presence of fire by heat, flame, light, smoke or other products of combustion.

(6) ***Buddy-breathing device*** means an accessory to self-contained breathing apparatus which permits a second person to share the same air supply as that of the wearer of the apparatus.

(7) ***Carbon dioxide*** means a colorless, odorless, electrically nonconductive inert gas (chemical formula CO_2) that is a medium for extinguishing fires by reducing the concentration of oxygen or fuel vapor in the air to the point where conbustion is impossible.

(8) ***Class A fire*** means a fire involving ordinary combustible materials such as paper, wood, cloth, and some rubber and plastic materials.

(9) ***Class B fire*** means a fire involving flammable or combustible liquids, flammable gases, greases and similar materials, and some rubber and plastic materials.

(10) ***Class C fire*** means a fire involving energized electrical equipment where safety to the employee requires the use of electrically nonconductive extinguishing media.

(11) ***Class D fire*** means a fire involving combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium.

(12) ***Dry chemical*** means an extinguishing agent composed of very small particles of chemicals such as, but not limited to, sodium bicarbonate, potassium bicarbonate, urea-based potassium bicarbonate, potassium chloride, or monoammonium phosphate supplemented by special treatment to provide resistance to packing and moisture absorption (caking) as well as to provide proper flow capabilities. Dry chemical does not include dry powders.

(13) ***Dry powder*** means a compound used to extinguish or control Class D fires.

(14) ***Education*** means the process of imparting knowledge or skill through systematic instruction. It does not require formal classroom instruction.

(15) ***Enclosed structure*** means a structure with a roof or ceiling and at least two walls which may present fire hazards to employees, such as accumulations of smoke, toxic gases and heat, similar to those found in buildings.

(16) ***Extinguisher classification*** means the letter classification given an extinguisher to designate the class or classes of fire on which an extinguisher will be effective.

(17) ***Extinguisher rating*** means the numerical rating given to an extinguisher which indicates the extinguishing potential of the unit based on standardized tests developed by Underwriters' Laboratories, Inc.

(18) ***Fire brigade*** (private fire department, industrial fire department) means an organized group of employees who are knowledgeable, trained, and skilled in at least basic fire fighting operations.

(19) ***Fixed extinguishing system*** means a permanently installed system that either extinguishes or controls a fire at the location of the system.

(20) ***Flame resistance*** is the property of materials, or combinations of component materials, to retard ignition and restrict the spread of flame.

(21) ***Foam*** means a stable aggregation of small bubbles which flow freely over a burning liquid surface and form a coherent blanket which seals combustible vapors and thereby extinguishes the fire.

(22) ***Gaseous agent*** is a fire extinguishing agent which is in the gaseous state at normal room temperature and pressure. It has low viscosity, can expand or contract with changes in pressure and temperature, and has the ability to diffuse readily and to distribute itself uniformly throughout an enclosure.

(23) ***Halon 1211*** means a colorless, faintly sweet smelling, electrically nonconductive liquefied gas (chemical formula $CBrC1F_2$) which is a medium for extinguishing fires by inhibiting the chemical chain reaction of fuel and oxygen. It is also known as bromochlorodifluoromethane.

(24) ***Halon 1301*** means a colorless, odorless, electrically nonconductive gas (chemical formula $CBrF_3$) which is a medium for extinguishing fires by inhibiting the chemical chain reaction of fuel and oxygen. It is also known as bromotrifluoromethane.

(25) ***Helmet*** is a head protective device consisting of a rigid shell, energy absorption system, and chin strap intended to be worn to provide protection for the head or portions thereof, against impact, flying or falling objects, electric shock, penetration, heat and flame.

(26) ***Incipient stage fire*** means a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class II standpipe or small hose systems without the need for protective clothing or breathing apparatus.

(27) ***Inspection*** means a visual check of fire protection systems and equipment to ensure that they are in place, charged, and ready for use in the event of a fire.

(28) ***Interior structural fire fighting*** means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage.

(29) ***Lining*** means a material permanently attached to the inside of the outer shell of a garment for the purpose of thermal protection and padding.

(30) ***Local application system*** means a fixed fire suppression system which has a supply of extinguishing agent, with nozzles arranged to automatically discharge extinguishing agent directly on the burning material to extinguish or control a fire.

(31) ***Maintenance*** means the performance of services on fire protection equipment and systems to assure that they will perform as expected in the event of a fire. Maintenance differs from inspection in that maintenance requires the checking of internal fittings, devices and agent supplies.

(32) ***Multipurpose dry chemical*** means a dry chemical which is approved for use on Class A, Class B and Class C fires.

(33) ***Outer shell*** is the exterior layer of material on the fire coat and protective trousers which forms the outermost barrier between the fire fighter and the environment. It is attached to the vapor barrier and liner and is usually constructed with a storm flap, suitable closures, and pockets.

(34) ***Positive-pressure breathing apparatus*** means self-contained breathing apparatus in which the pressure in the breathing zone is positive in relation to the immediate environment during inhalation and exhalation.

(35) ***Pre-discharge employee alarm*** means an alarm which will sound at a set time prior to actual discharge of an extinguishing system so that employees may evacuate the discharge area prior to system discharge.

(36) ***Quick disconnect valve*** means a device which starts the flow of air by inserting of the hose (which leads from the facepiece) into the regulator of self-contained breathing apparatus, and stops the flow of air by disconnection of the hose from the regulator.

(37) ***Sprinkler alarm*** means an approved device installed so that any waterflow from a sprinkler system equal to or greater than that from single automatic sprinkler will result in an audible alarm signal on the premises.

(38) ***Sprinkler system*** means a system of piping designed in accordance with fire protection engineering standards and installed to control or extinguish fires. The system includes an adequate and reliable water supply, and a network of specially sized piping and sprinklers which are interconnected. The system also includes a control valve and a device for actuating an alarm when the system is in operation.

(39) ***Standpipe systems.***

(i) ***Class I standpipe system*** means a $2^{1}/_{2}$" (6.3 cm) hose connection for use by fire departments and those trained in handling heavy fire streams.

(ii) ***Class II standpipe system*** means a $1^{1}/_{2}$" (3.8 cm) hose system which provides a means for the control or extinguishment of incipient stage fires.

(iii) ***Class III standpipe system*** means a combined system of hose which is for the use of employees trained in the use of hose operations and which is capable of furnishing effective water discharge during the more advanced stages of fire (beyond the incipient stage) in the interior of workplaces. Hose outlets are available for both $1^{1}/_{2}$" (3.8 cm) and $2^{1}/_{2}$" (6.3 cm) hose.

(iv) ***Small hose system*** means a system of hose ranging in diameter from $^{5}/_{8}$" (1.6 cm up to $1^{1}/_{2}$" (3.8 cm) which is for the use of employees and which provides a means for the control and extinguishment of incipient stage fires.

(40) ***Total flooding system*** means a fixed suppression system which is arranged to automatically discharge a predetermined concentration of agent into an enclosed space for the purpose of fire extinguishment or control.

(41) ***Training*** means the process of making proficient through instruction and hands-on practice in the operation of equipment, including respiratory protection equipment, that is expected to be used and in the performance of assigned duties.

(42) ***Vapor barrier*** means that material used to prevent or substantially inhibit the transfer of water, corrosive liquids and steam or other hot vapors from the outside of a garment to the wearer's body.

[45 FR 60704, Sept. 12, 1980, as amended at 53 FR 12122, Apr. 12, 1988]

§ 1910.156 Fire brigades.

(a) ***Scope and application —***

(1) ***Scope.*** This section contains requirements for the organization, training, and personal protective equipment of fire brigades whenever they are established by an employer.

(2) ***Application.*** The requirements of this section apply to fire brigades, industrial fire departments and private or contractual type fire departments. Personal protective equipment requirements apply only to members of fire brigades performing interior structural fire fighting. The requirements of this section do not apply to airport crash rescue or forest fire fighting operations.

(b) ***Organization —***

(1) ***Organizational statement.*** The employer shall prepare and maintain a statement or written policy which establishes the existence of a fire brigade; the basic organizational structure; the type, amount, and frequency of training to be provided to fire brigade members; the expected number of members in the fire brigade; and the functions that the fire brigade is to perform at the workplace. The organizational statement shall be available for inspection by the Assistant Secretary and by employees or their designated representatives.

(2) ***Personnel.*** The employer shall assure that employees who are expected to do interior structural fire fighting are physically capable of performing duties which may be assigned to them during emergencies. The employer shall not permit employees with known heart disease, epilepsy, or emphysema, to participate in fire brigade emergency activities unless a physician's certificate of the employees' fitness to participate in such activities is provided. For employees assigned to fire brigades before September 15, 1980, this paragraph is effective on September 15, 1990. For employees assigned to fire brigades on or after September 15, 1980, this paragraph is effective December 15, 1980.

(c) ***Training and education.***

(1) The employer shall provide training and education for all fire brigade members commensurate with those duties and functions that fire brigade members are expected to perform. Such training and education shall be provided to fire brigade members before they perform fire brigade emergency activities. Fire brigade leaders and training instructors shall be provided with training and education which is more comprehensive than that provided to the general membership of the fire brigade.

(2) The employer shall assure that training and education is conducted frequently enough to assure that each member of the fire brigade is able to perform the member's assigned duties and functions satisfactorily and in a safe manner so as not to endanger fire brigade members or other employees.

All fire brigade members shall be provided with training at least annually. In addition, fire brigade members who are expected to perform interior structural fire fighting shall be provided with an education session or training at least quarterly.

(3) The quality of the training and education program for fire brigade members shall be similar to those conducted by such fire training schools as the Maryland Fire and Rescue Institute; Iowa Fire Service Extension; West Virginia Fire Service Extension; Georgia Fire Academy, New York State Department, Fire Prevention and Control; Louisiana State University Firemen Training Program, or Washington State's Fire Service Training Commission for Vocational Education. (For example, for the oil refinery industry, with its unique hazards, the training and education program for those fire brigade members shall be similar to those conducted by Texas A & M University, Lamar University, Reno Fire School, or the Delaware State Fire School.)

(4) The employer shall inform fire brigade members about special hazards such as storage and use of flammable liquids and gases, toxic chemicals, radioactive sources, and water reactive substances, to which they may be exposed during fire and other emergencies. The fire brigade members shall also be advised of any changes that occur in relation to the special hazards. The employer shall develop and make available for inspection by fire brigade members, written procedures that describe the actions to be taken in situations involving the special hazards and shall include these in the training and education program.

(d) ***Fire fighting equipment.*** The employer shall maintain and inspect, at least annually, fire fighting equipment to assure the safe operational condition of the equipment. Portable fire extinguishers and respirators shall be inspected at least monthly. Fire fighting equipment that is in damaged or unserviceable condition shall be removed from service and replaced.

(e) ***Protective clothing.*** The following requirements apply to those employees who perform interior structural fire fighting. The requirements do not apply to employees who use fire extinguishers or standpipe systems to control or extinguish fires only in the incipient stage.

(1) ***General.***

(i) The employer shall provide at no cost to the employee and assure the use of protective clothing which complies with the requirements of this paragraph. The employer shall assure that protective clothing ordered or purchased after July 1, 1981, meets the requirements contained in this paragraph. As the new equipment is provided, the employer shall assure that all fire brigade members wear the equipment when performing interior structural fire fighting. After July 1, 1985, the employer shall assure that all fire brigade members wear protective clothing meeting the requirements of this paragraph when performing interior structural fire fighting.

(ii) The employer shall assure that protective clothing protects the head, body, and extremities, and consists of at least the following components: foot and leg protection; hand protection; body protection; eye, face and head protection.

(2) ***Foot and leg protection.***

(i) Foot and leg protection shall meet the requirements of paragraphs (e)(2)(ii) and (e)(2)(iii) of this section, and may be achieved by either of the following methods:

(A) Fully extended boots which provide protection for the legs; or

(B) Protective shoes or boots worn in combination with protective trousers that meet the requirements of paragraph (e)(3) of this section.

(ii) Protective footwear shall meet the requirements of § 1910.136 for Class 75 footwear. In addition, protective footwear shall be water-resistant for at least 5 inches (12.7 cm) above the bottom of the heel and shall be equipped with slip-resistant outer soles.

(iii) Protective footwear shall be tested in accordance with paragraph (1) of appendix E, and shall provide protection against penetration of the midsole by a size 8D common nail when at least 300 pounds (1330 N) of static force is applied to the nail.

(3) *Body protection.*

(i) Body protection shall be coordinated with foot and leg protection to ensure full body protection for the wearer. This shall be achieved by one of the following methods:

(A) Wearing of a fire-resistive coat meeting the requirements of paragraph (e)(3)(ii) of this section in combination with fully extended boots meeting the requirements of paragraphs (e)(2)(ii) and (e)(2)(iii) of this section; or

(B) Wearing of a fire-resistive coat in combination with protective trousers both of which meet the requirements of paragraph (e)(3)(ii) of this section.

(ii) The performance, construction, and testing of fire-resistive coats and protective trousers shall be at least equivalent to the requirements of the National Fire Protection Association (NFPA) standard NFPA No. 1971-1975, "Protective Clothing for Structural Fire Fighting," which is incorporated by reference as specified in § 1910.6, (See appendix D to subpart L) with the following permissible variations from those requirements:

(A) Tearing strength of the outer shell shall be a minimum of 8 pounds (35.6 N) in any direction when tested in accordance with paragraph (2) of appendix E; and

(B) The outer shell may discolor but shall not separate or melt when placed in a forced air laboratory oven at a temperature of 500 °F (260 °C) for a period of five minutes. After cooling to ambient temperature and using the test method specified in paragraph (3) of appendix E, char length shall not exceed 4.0 inches (10.2 cm) and after-flame shall not exceed 2.0 seconds.

(4) *Hand protection.*

(i) Hand protection shall consist of protective gloves or glove system which will provide protection against cut, puncture, and heat penetration. Gloves or glove system shall be tested in accordance with the test methods contained in the National Institute for Occupational Safety and Health (NIOSH) 1976 publication, "The Development of Criteria for Fire Fighter's Gloves; Vol. II, Part II: Test Methods," which is incorporated by reference as specified in § 1910.6, (See appendix D to subpart L) and shall meet the following criteria for cut, puncture, and heat penetration:

(A) Materials used for gloves shall resist surface cut by a blade with an edge having a 60° included angle and a .001 inch (.0025 cm.) radius, under an applied force of 16 lbf (72N), and at a slicing velocity of greater or equal to 60 in/min (2.5 cm./sec);

(B) Materials used for the palm and palm side of the fingers shall resist puncture by a penetrometer (simulating a 4d lath nail), under an applied force of 13.2 lbf (60N), and at a velocity greater or equal to 20 in/min (.85 cm./sec); and

(C) The temperature inside the palm and gripping surface of the fingers of gloves shall not exceed 135 °F (57 °C) when gloves or glove system are exposed to 932 °F (500 °C) for five seconds at 4 psi (28 kPa) pressure.

(ii) Exterior materials of gloves shall be flame resistant and shall be tested in accordance with paragraph (3) of appendix E. Maximum allowable afterflame shall be 2.0 seconds, and the maximum char length shall be 4.0 inches (10.2 cm).

(iii) When design of the fire-resistive coat does not otherwise provide protection for the wrists, protective gloves shall have wristlets of at least 4.0 inches (10.2 cm) in length to protect the wrist area when the arms are extended upward and outward from the body.

(5) *Head, eye and face protection.*

(i) Head protection shall consist of a protective head device with ear flaps and chin strap which meet the performance, construction, and testing requirements of the National Fire Safety and Research Office of the National Fire Prevention and Control Administration, U.S. Department of Commerce (now known as the U.S. Fire Administration), which are contained in "Model Performance Criteria for Structural Firefighters' Helmets" (August 1977) which is incorporated by reference as specified in § 1910.6, (See appendix D to subpart L).

(ii) Protective eye and face devices which comply with § 1910.133 shall be used by fire brigade members when performing operations where the hazards of flying or falling materials which may cause eye and face injuries are present. Protective eye and face devices provided as accessories to protective head devices (face shields) are permitted when such devices meet the requirements of § 1910.133.

(iii) Full facepieces, helmets, or hoods of breathing apparatus which meet the requirements of § 1910.134 and paragraph (f) of this section, shall be acceptable as meeting the eye and face protection requirements of paragraph (e)(5)(ii) of this section.

(f) *Respiratory protection devices —*

(1) *General requirements.*

(i) The employer must ensure that respirators are provided to, and used by, each fire brigade member, and that the respirators meet the requirements of 29 CFR 1910.134 for each employee required by this section to use a respirator.

(ii) Approved self-contained breathing apparatus with full-facepiece, or with approved helmet or hood configuration, shall be provided to and worn by fire brigade members while working inside buildings or confined spaces where toxic products of combustion or an oxygen deficiency may be present.

Such apparatus shall also be worn during emergency situations involving toxic substances.

(iii) Approved self-contained breathing apparatus may be equipped with either a "buddy-breathing" device or a quick disconnect valve, even if these devices are not certified by NIOSH. If these accessories are used, they shall not cause damage to the apparatus, or restrict the air flow of the apparatus, or obstruct the normal operation of the apparatus.

(iv) Approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus shall meet DOT and NIOSH criteria.

(v) Self-contained breathing apparatuses must have a minimum service-life rating of 30 minutes in accordance with the methods and requirements specified by NIOSH under 42 CFR part 84, except for escape self-contained breathing apparatus (ESCBAs) used only for emergency escape purposes.

(vi) Self-contained breathing apparatus shall be provided with an indicator which automatically sounds an audible alarm when the remaining service life of the apparatus is reduced to within a range of 20 to 25 percent of its rated service time.

(2) ***Positive-pressure breathing apparatus.***

(i) The employer shall assure that self-contained breathing apparatus ordered or purchased after July 1, 1981, for use by fire brigade members performing interior structural fire fighting operations, are of the pressure-demand or other positive-pressure type. Effective July 1, 1983, only pressure-demand or other positive-pressure self-contained breathing apparatus shall be worn by fire brigade members performing interior structural fire fighting.

(ii) This paragraph does not prohibit the use of a self-contained breathing apparatus where the apparatus can be switched from a demand to a positive-pressure mode. However, such apparatus shall be in the positive-pressure mode when fire brigade members are performing interior structural fire fighting operations.

[45 FR 60706, Sept. 12, 1980; 46 FR 24557, May 1, 1981; 49 FR 18295, Apr. 30, 1984; 61 FR 9239, Mar. 7, 1996; 63 FR 1284, Jan. 8, 1998; 63 FR 33467, June 18, 1998; 73 FR 75584, Dec. 12, 2008]

PORTABLE FIRE SUPPRESSION EQUIPMENT

§ 1910.157 Portable fire extinguishers.

(a) ***Scope and application.*** The requirements of this section apply to the placement, use, maintenance, and testing of portable fire extinguishers provided for the use of employees. Paragraph (d) of this section does not apply to extinguishers provided for employee use on the outside of workplace buildings or structures. Where extinguishers are provided but are not intended for employee use and the employer has an emergency action plan and a fire prevention plan that meet the requirements of 29 CFR 1910.38 and 29 CFR 1910.39 respectively, then only the requirements of paragraphs (e) and (f) of this section apply.

(b) ***Exemptions.***

(1) Where the employer has established and implemented a written fire safety policy which requires the immediate and total evacuation of employees from the workplace upon the sounding of a fire alarm signal and which includes an emergency action plan and a fire prevention plan which meet the requirements of 29 CFR 1910.38 and 29 CFR 1910.39 respectively, and when extinguishers are not available in the workplace, the employer is exempt from all requirements of this section unless a specific standard in part 1910 requires that a portable fire extinguisher be provided.

(2) Where the employer has an emergency action plan meeting the requirements of § 1910.38 which designates certain employees to be the only employees authorized to use the available portable fire extinguishers, and which requires all other employees in the fire area to immediately evacuate the affected work area upon the sounding of the fire alarm, the employer is exempt from the distribution requirements in paragraph (d) of this section.

(c) *General requirements.*

(1) The employer shall provide portable fire extinguishers and shall mount, locate and identify them so that they are readily accessible to employees without subjecting the employees to possible injury.

(2) Only approved portable fire extinguishers shall be used to meet the requirements of this section.

(3) The employer shall not provide or make available in the workplace portable fire extinguishers using carbon tetrachloride or chlorobromomethane extinguishing agents.

(4) The employer shall assure that portable fire extinguishers are maintained in a fully charged and operable condition and kept in their designated places at all times except during use.

(5) The employer shall remove from service all soldered or riveted shell self-generating soda acid or self-generating foam or gas cartridge water type portable fire extinguishers which are operated by inverting the extinguisher to rupture the cartridge or to initiate an uncontrollable pressure generating chemical reaction to expel the agent.

(d) *Selection and distribution.*

(1) Portable fire extinguishers shall be provided for employee use and selected and distributed based on the classes of anticipated workplace fires and on the size and degree of hazard which would affect their use.

(2) The employer shall distribute portable fire extinguishers for use by employees on Class A fires so that the travel distance for employees to any extinguisher is 75 feet (22.9 m) or less.

(3) The employer may use uniformly spaced standpipe systems or hose stations connected to a sprinkler system installed for emergency use by employees instead of Class A portable fire extinguishers, provided that such systems meet the respective requirements of § 1910.158 or § 1910.159, that they provide total coverage of the area to be protected, and that employees are trained at least annually in their use.

(4) The employer shall distribute portable fire extinguishers for use by employees on Class B fires so that the travel distance from the Class B hazard area to any extinguisher is 50 feet (15.2 m) or less.

(5) The employer shall distribute portable fire extinguishers used for Class C hazards on the basis of the appropriate pattern for the existing Class A or Class B hazards.

(6) The employer shall distribute portable fire extinguishers or other containers of Class D extinguishing agent for use by employees so that the travel distance from the combustible metal working area to any extinguishing agent is 75 feet (22.9 m) or less. Portable fire extinguishers for Class D hazards are required in those combustible metal working areas where combustible metal powders, flakes, shavings, or similarly sized products are generated at least once every two weeks.

(e) *Inspection, maintenance and testing.*

(1) The employer shall be responsible for the inspection, maintenance and testing of all portable fire extinguishers in the workplace.

(2) Portable extinguishers or hose used in lieu thereof under paragraph (d)(3) of this section shall be visually inspected monthly.

(3) The employer shall assure that portable fire extinguishers are subjected to an annual maintenance check. Stored pressure extinguishers do not require an internal examination. The employer shall record the annual maintenance date and retain this record for one year after the last entry or the life of the shell, whichever is less. The record shall be available to the Assistant Secretary upon request.

(4) The employer shall assure that stored pressure dry chemical extinguishers that require a 12-year hydrostatic test are emptied and subjected to applicable maintenance procedures every 6 years. Dry chemical extinguishers having non-refillable disposable containers are exempt from this requirement. When recharging or hydrostatic testing is performed, the 6-year requirement begins from that date.

(5) The employer shall assure that alternate equivalent protection is provided when portable fire extinguishers are removed from service for maintenance and recharging.

(f) *Hydrostatic testing.*

(1) The employer shall assure that hydrostatic testing is performed by trained persons with suitable testing equipment and facilities.

(2) The employer shall assure that portable extinguishers are hydrostatically tested at the intervals listed in Table L-1 of this section, except under any of the following conditions:

(i) When the unit has been repaired by soldering, welding, brazing, or use of patching compounds;

(ii) When the cylinder or shell threads are damaged;

(iii) When there is corrosion that has caused pitting, including corrosion under removable name plate assemblies;

(iv) When the extinguisher has been burned in a fire; or

(v) When a calcium chloride extinguishing agent has been used in a stainless steel shell.

(3) In addition to an external visual examination, the employer shall assure that an internal examination of cylinders and shells to be tested is made prior to the hydrostatic tests.

TABLE L-1

Type of extinguishers	Test interval (years)
Soda acid (soldered brass shells) (until 1/1/82)	([1])
Soda acid (stainless steel shell)	5
Cartridge operated water and/or antifreeze	5
Stored pressure water and/or antifreeze	5

[1] *Extinguishers having shells constructed of copper or brass joined by soft solder or rivets shall not be hydrostatically tested and shall be removed from service by January 1, 1982. (Not permitted)*

Type of extinguishers	Test interval (years)
Wetting agent	5
Foam (soldered brass shells) (until 1/1/82)	([1])
Foam (stainless steel shell)	5
Aqueous Film Forming foam (AFFF)	5
Loaded stream	5
Dry chemical with stainless steel	5
Carbon dioxide	5
Dry chemical, stored pressure, with mild steel, brazed brass or aluminum shells	12
Dry chemical, cartridge or cylinder operated, with mild steel shells	12
Halon 1211	12
Halon 1301	12
Dry powder, cartridge or cylinder operated with mild steel shells	12

[1] *Extinguishers having shells constructed of copper or brass joined by soft solder or rivets shall not be hydrostatically tested and shall be removed from service by January 1, 1982. (Not permitted)*

(4) The employer shall assure that portable fire extinguishers are hydrostatically tested whenever they show new evidence of corrosion or mechanical injury, except under the conditions listed in paragraphs (f)(2)(i)-(v) of this section.

(5) The employer shall assure that hydrostatic tests are performed on extinguisher hose assemblies which are equipped with a shut-off nozzle at the discharge end of the hose. The test interval shall be the same as specified for the extinguisher on which the hose is installed.

(6) The employer shall assure that carbon dioxide hose assemblies with a shut-off nozzle are hydrostatically tested at 1,250 psi (8,620 kPa).

(7) The employer shall assure that dry chemical and dry powder hose assemblies with a shut-off nozzle are hydrostatically tested at 300 psi (2,070 kPa).

(8) Hose assemblies passing a hydrostatic test do not require any type of recording or stamping.

(9) The employer shall assure that hose assemblies for carbon dioxide extinguishers that require a hydrostatic test are tested within a protective cage device.

(10) The employer shall assure that carbon dioxide extinguishers and nitrogen or carbon dioxide cylinders used with wheeled extinguishers are tested every 5 years at 5/3 of the service pressure as stamped into the cylinder. Nitrogen cylinders which comply with 49 CFR 173.34(e)(15) may be hydrostatically tested every 10 years.

(11) The employer shall assure that all stored pressure and Halon 1211 types of extinguishers are hydrostatically tested at the factory test pressure not to exceed two times the service pressure.

(12) The employer shall assure that acceptable self-generating type soda acid and foam extinguishers are tested at 350 psi (2,410 kPa).

(13) Air or gas pressure may not be used for hydrostatic testing.

(14) Extinguisher shells, cylinders, or cartridges which fail a hydrostatic pressure test, or which are not fit for testing shall be removed from service and from the workplace.

(15)

(i) The equipment for testing compressed gas type cylinders shall be of the water jacket type. The equipment shall be provided with an expansion indicator which operates with an accuracy within one percent of the total expansion or .1cc (.1mL) of liquid.

(ii) The equipment for testing non-compressed gas type cylinders shall consist of the following:

(A) A hydrostatic test pump, hand or power operated, capable of producing not less than 150 percent of the test pressure, which shall include appropriate check valves and fittings;

(B) A flexible connection for attachment to fittings to test through the extinguisher nozzle, test bonnet, or hose outlet, as is applicable; and

(C) A protective cage or barrier for personal protection of the tester, designed to provide visual observation of the extinguisher under test.

(16) The employer shall maintain and provide upon request to the Assistant Secretary evidence that the required hydrostatic testing of fire extinguishers has been performed at the time intervals shown in Table L-1. Such evidence shall be in the form of a certification record which includes the date of the test, the signature of the person who performed the test and the serial number, or other identifier, of the fire extinguisher that was tested. Such records shall be kept until the extinguisher is hydrostatically retested at the time interval specified in Table L-1 or until the extinguisher is taken out of service, whichever comes first.

(g) *Training and education.*

(1) Where the employer has provided portable fire extinguishers for employee use in the workplace, the employer shall also provide an educational program to familiarize employees with the general principles of fire extinguisher use and the hazards involved with incipient stage fire fighting.

(2) The employer shall provide the education required in paragraph (g)(1) of this section upon initial employment and at least annually thereafter.

(3) The employer shall provide employees who have been designated to use fire fighting equipment as part of an emergency action plan with training in the use of the appropriate equipment.

(4) The employer shall provide the training required in paragraph (g)(3) of this section upon initial assignment to the designated group of employees and at least annually thereafter.

[45 FR 60708, Sept. 12, 1980; 46 FR 24557, May 1, 1981, as amended at 51 FR 34560, Sept. 29, 1986; 61 FR 9239, Mar. 7, 1996; 67 FR 67964, Nov. 7, 2002]

§ 1910.158 Standpipe and hose systems.

(a) *Scope and application —*

(1) *Scope.* This section applies to all small hose, Class II, and Class III standpipe systems installed to meet the requirements of a particular OSHA standard.

(2) ***Exception.*** This section does not apply to Class I standpipe systems.

(b) ***Protection of standpipes.*** The employer shall assure that standpipes are located or otherwise protected against mechanical damage. Damaged standpipes shall be repaired promptly.

(c) ***Equipment —***

(1) ***Reels and cabinets.*** Where reels or cabinets are provided to contain fire hose, the employer shall assure that they are designed to facilitate prompt use of the hose valves, the hose, and other equipment at the time of a fire or other emergency. The employer shall assure that the reels and cabinets are conspicuously identified and used only for fire equipment.

(2) ***Hose outlets and connections.***

(i) The employer shall assure that hose outlets and connections are located high enough above the floor to avoid being obstructed and to be accessible to employees.

(ii) The employer shall standardize screw threads or provide appropriate adapters throughout the system and assure that the hose connections are compatible with those used on the supporting fire equipment.

(3) ***Hose.***

(i) The employer shall assure that every $1^{1}/_{2}$" (3.8 cm) or smaller hose outlet used to meet this standard is equipped with hose connected and ready for use. In extremely cold climates where such installation may result in damaged equipment, the hose may be stored in another location provided it is readily available and can be connected when needed.

(ii) Standpipe systems installed after January 1, 1981, for use by employees, shall be equipped with lined hose. Unlined hose may remain in use on existing systems. However, after the effective date of this standard, unlined hose which becomes unserviceable shall be replaced with lined hose.

(iii) The employer shall provide hose of such length that friction loss resulting from water flowing through the hose will not decrease the pressure at the nozzle below 30 psi (210 kPa). The dynamic pressure at the nozzle shall be within the range of 30 psi (210 kPa) to 125 psi (860 kPa).

(4) ***Nozzles.*** The employer shall assure that standpipe hose is equipped with shut-off type nozzles.

(d) ***Water supply.*** The minimum water supply for standpipe and hose systems, which are provided for the use of employees, shall be sufficient to provide 100 gallons per minute (6.3 l/s) for a period of at least thirty minutes.

(e) ***Tests and maintenance —***

(1) ***Acceptance tests.***

(i) The employer shall assure that the piping of Class II and Class III systems installed after January 1, 1981, including yard piping, is hydrostatically tested for a period of at least 2 hours at not less than 200 psi (1380 kPa), or at least 50 psi (340 kPa) in excess of normal pressure when such pressure is greater than 150 psi (1030 kPa).

(ii) The employer shall assure that hose on all standpipe systems installed after January 1, 1981, is hydrostatically tested with couplings in place, at a pressure of not less than 200 psi (1380 kPa), before it is placed in service. This pressure shall be maintained for at least 15 seconds and not more than one minute during which time the hose shall not leak nor shall any jacket thread break during the test.

(2) *Maintenance.*

(i) The employer shall assure that water supply tanks are kept filled to the proper level except during repairs. When pressure tanks are used, the employer shall assure that proper pressure is maintained at all times except during repairs.

(ii) The employer shall assure that valves in the main piping connections to the automatic sources of water supply are kept fully open at all times except during repair.

(iii) The employer shall assure that hose systems are inspected at least annually and after each use to assure that all of the equipment and hose are in place, available for use, and in serviceable condition.

(iv) When the system or any portion thereof is found not to be serviceable, the employer shall remove it from service immediately and replace it with equivalent protection such as extinguishers and fire watches.

(v) The employer shall assure that hemp or linen hose on existing systems is unracked, physically inspected for deterioration, and reracked using a different fold pattern at least annually. The employer shall assure that defective hose is replaced in accordance with paragraph (c)(3)(ii) of this section.

(vi) The employer shall designate trained persons to conduct all inspections required under this section.

[45 FR 60710, Sept. 12, 1980, as amended at 61 FR 9239, Mar. 7, 1996]

Fixed Fire Suppression Equipment

§ 1910.159 Automatic sprinkler systems.

(a) *Scope and application.*

(1) The requirements of this section apply to all automatic sprinkler systems installed to meet a particular OSHA standard.

(2) For automatic sprinkler systems used to meet OSHA requirements and installed prior to the effective date of this standard, compliance with the National Fire Protection Association (NFPA) or the National Board of Fire Underwriters (NBFU) standard in effect at the time of the system's installation will be acceptable as compliance with this section.

(b) *Exemptions.* Automatic sprinkler systems installed in workplaces, but not required by OSHA, are exempt from the requirements of this section.

(c) *General requirements —*

(1) *Design.*

(i) All automatic sprinkler designs used to comply with this standard shall provide the necessary discharge patterns, densities, and water flow characteristics for complete coverage in a particular workplace or zoned subdivision of the workplace.

(ii) The employer shall assure that only approved equipment and devices are used in the design and installation of automatic sprinkler systems used to comply with this standard.

(2) ***Maintenance.*** The employer shall properly maintain an automatic sprinkler system installed to comply with this section. The employer shall assure that a main drain flow test is performed on each system annually. The inspector's test valve shall be opened at least every two years to assure that the sprinkler system operates properly.

(3) ***Acceptance tests.*** The employer shall conduct proper acceptance tests on sprinkler systems installed for employee protection after January 1, 1981, and record the dates of such tests. Proper acceptance tests include the following:

(i) Flushing of underground connections;

(ii) Hydrostatic tests of piping in system;

(iii) Air tests in dry-pipe systems;

(iv) Dry-pipe valve operation; and

(v) Test of drainage facilities.

(4) ***Water supplies.*** The employer shall assure that every automatic sprinkler system is provided with at least one automatic water supply capable of providing design water flow for at least 30 minutes. An auxiliary water supply or equivalent protection shall be provided when the automatic water supply is out of service, except for systems of 20 or fewer sprinklers.

(5) ***Hose connections for fire fighting use.*** The employer may attach hose connections for fire fighting use to wet pipe sprinkler systems provided that the water supply satisfies the combined design demand for sprinklers and standpipes.

(6) ***Protection of piping.*** The employer shall assure that automatic sprinkler system piping is protected against freezing and exterior surface corrosion.

(7) ***Drainage.*** The employer shall assure that all dry sprinkler pipes and fittings are installed so that the system may be totally drained.

(8) ***Sprinklers.***

(i) The employer shall assure that only approved sprinklers are used on systems.

(ii) The employer may not use older style sprinklers to replace standard sprinklers without a complete engineering review of the altered part of the system.

(iii) The employer shall assure that sprinklers are protected from mechanical damage.

(9) ***Sprinkler alarms.*** On all sprinkler systems having more than twenty (20) sprinklers, the employer shall assure that a local waterflow alarm is provided which sounds an audible signal on the premises upon water flow through the system equal to the flow from a single sprinkler.

(10) *Sprinkler spacing.* The employer shall assure that sprinklers are spaced to provide a maximum protection area per sprinkler, a minimum of interference to the discharge pattern by building or structural members or building contents and suitable sensitivity to possible fire hazards. The minimum vertical clearance between sprinklers and material below shall be 18 inches (45.7 cm).

(11) *Hydraulically designed systems.* The employer shall assure that hydraulically designed automatic sprinkler systems or portions thereof are identified and that the location, number of sprinklers in the hydraulically designed section, and the basis of the design is indicated. Central records may be used in lieu of signs at sprinkler valves provided the records are available for inspection and copying by the Assistant Secretary.

[45 FR 60710, Sept. 12, 1980; 46 FR 24557, May 1, 1981]

§ 1910.160 Fixed extinguishing systems, general.

(a) *Scope and application.*

(1) This section applies to all fixed extinguishing systems installed to meet a particular OSHA standard except for automatic sprinkler systems which are covered by § 1910.159.

(2) This section also applies to fixed systems not installed to meet a particular OSHA standard, but which, by means of their operation, may expose employees to possible injury, death, or adverse health consequences caused by the extinguishing agent. Such systems are only subject to the requirements of paragraphs (b)(4) through (b)(7) and (c) of this section.

(3) Systems otherwise covered in paragraph (a)(2) of this section which are installed in areas with no employee exposure are exempted from the requirements of this section.

(b) *General requirements.*

(1) Fixed extinguishing system components and agents shall be designed and approved for use on the specific fire hazards they are expected to control or extinguish.

(2) If for any reason a fixed extinguishing system becomes inoperable, the employer shall notify employees and take the necessary temporary precautions to assure their safety until the system is restored to operating order. Any defects or impairments shall be properly corrected by trained personnel.

(3) The employer shall provide a distinctive alarm or signaling system which complies with § 1910.165 and is capable of being perceived above ambient noise or light levels, on all extinguishing systems in those portions of the workplace covered by the extinguishing system to indicate when the extinguishing system is discharging. Discharge alarms are not required on systems where discharge is immediately recognizable.

(4) The employer shall provide effective safeguards to warn employees against entry into discharge areas where the atmosphere remains hazardous to employee safety or health.

(5) The employer shall post hazard warning or caution signs at the entrance to, and inside of, areas protected by fixed extinguishing systems which use agents in concentrations known to be hazardous to employee safety and health.

(6) The employer shall assure that fixed systems are inspected annually by a person knowledgeable in the design and function of the system to assure that the system is maintained in good operating condition.

(7) The employer shall assure that the weight and pressure of refillable containers is checked at least semi-annually. If the container shows a loss in net content or weight of more than 5 percent, or a loss in pressure of more than 10 percent, it shall be subjected to maintenance.

(8) The employer shall assure that factory charged nonrefillable containers which have no means of pressure indication are weighed at least semi-annually. If a container shows a loss in net weight or more than 5 percent it shall be replaced.

(9) The employer shall assure that inspection and maintenance dates are recorded on the container, on a tag attached to the container, or in a central location. A record of the last semi-annual check shall be maintained until the container is checked again or for the life of the container, whichever is less.

(10) The employer shall train employees designated to inspect, maintain, operate, or repair fixed extinguishing systems and annually review their training to keep them up-to-date in the functions they are to perform.

(11) The employer shall not use chlorobromomethane or carbon tetrachloride as an extinguishing agent where employees may be exposed.

(12) The employer shall assure that systems installed in the presence of corrosive atmospheres are constructed of non-corrosive material or otherwise protected against corrosion.

(13) Automatic detection equipment shall be approved, installed and maintained in accordance with § 1910.164.

(14) The employer shall assure that all systems designed for and installed in areas with climatic extremes shall operate effectively at the expected extreme temperatures.

(15) The employer shall assure that at least one manual station is provided for discharge activation of each fixed extinguishing system.

(16) The employer shall assure that manual operating devices are identified as to the hazard against which they will provide protection.

(17) The employer shall provide and assure the use of the personal protective equipment needed for immediate rescue of employees trapped in hazardous atmospheres created by an agent discharge.

(c) ***Total flooding systems with potential health and safety hazards to employees.***

(1) The employer shall provide an emergency action plan in accordance with § 1910.38 for each area within a workplace that is protected by a total flooding system which provides agent concentrations exceeding the maximum safe levels set forth in paragraphs (b)(5) and (b)(6) of § 1910.162.

(2) Systems installed in areas where employees cannot enter during or after the system's operation are exempt from the requirements of paragraph (c) of this section.

(3) On all total flooding systems the employer shall provide a pre-discharge employee alarm which complies with § 1910.165, and is capable of being perceived above ambient light or noise levels before the system discharges, which will give employees time to safely exit from the discharge area prior to system discharge.

(4) The employer shall provide automatic actuation of total flooding systems by means of an approved fire detection device installed and interconnected with a pre-discharge employee alarm system to give employees time to safely exit from the discharge area prior to system discharge.

[45 FR 60711, Sept. 12, 1980]

§ 1910.161 Fixed extinguishing systems, dry chemical.

(a) ***Scope and application.*** This section applies to all fixed extinguishing systems, using dry chemical as the extinguishing agent, installed to meet a particular OSHA standard. These systems shall also comply with § 1910.160.

(b) ***Specific requirements.***

(1) The employer shall assure that dry chemical agents are compatible with any foams or wetting agents with which they are used.

(2) The employer may not mix together dry chemical extinguishing agents of different compositions. The employer shall assure that dry chemical systems are refilled with the chemical stated on the approval nameplate or an equivalent compatible material.

(3) When dry chemical discharge may obscure vision, the employer shall provide a pre-discharge employee alarm which complies with § 1910.165 and which will give employees time to safely exit from the discharge area prior to system discharge.

(4) The employer shall sample the dry chemical supply of all but stored pressure systems at least annually to assure that the dry chemical supply is free of moisture which may cause the supply to cake or form lumps.

(5) The employer shall assure that the rate of application of dry chemicals is such that the designed concentration of the system will be reached within 30 seconds of initial discharge.

[45 FR 60712, Sept. 12, 1980]

§ 1910.162 Fixed extinguishing systems, gaseous agent.

(a) ***Scope and application —***

(1) ***Scope.*** This section applies to all fixed extinguishing systems, using a gas as the extinguishing agent, installed to meet a particular OSHA standard. These systems shall also comply with § 1910.160. In some cases, the gas may be in a liquid state during storage.

(2) ***Application.*** The requirements of paragraphs (b)(2) and (b)(4) through (b)(6) shall apply only to total flooding systems.

(b) ***Specific requirements.***

(1) Agents used for initial supply and replenishment shall be of the type approved for the system's application. Carbon dioxide obtained by dry ice conversion to liquid is not acceptable unless it is processed to remove excess water and oil.

(2) Except during overhaul, the employer shall assure that the designed concentration of gaseous agents is maintained until the fire has been extinguished or is under control.

(3) The employer shall assure that employees are not exposed to toxic levels of gaseous agent or its decomposition products.

(4) The employer shall assure that the designed extinguishing concentration is reached within 30 seconds of initial discharge except for Halon systems which must achieve design concentration within 10 seconds.

(5) The employer shall provide a distinctive pre-discharge employee alarm capable of being perceived above ambient light or noise levels when agent design concentrations exceed the maximum safe level for employee exposure. A pre-discharge employee alarm for alerting employees before system discharge shall be provided on Halon 1211 and carbon dioxide systems with a design concentration of 4 percent or greater and for Halon 1301 systems with a design concentration of 10 percent or greater. The pre-discharge employee alarm shall provide employees time to safely exit the discharge area prior to system discharge.

(6)

(i) Where egress from an area cannot be accomplished within one minute, the employer shall not use Halon 1301 in concentrations greater than 7 percent.

(ii) Where egress takes greater than 30 seconds but less than one minute, the employer shall not use Halon 1301 in a concentration greater than 10 percent.

(iii) Halon 1301 concentrations greater than 10 percent are only permitted in areas not normally occupied by employees provided that any employee in the area can escape within 30 seconds. The employer shall assure that no unprotected employees enter the area during agent discharge.

[45 FR 60712, Sept. 12, 1980; 46 FR 24557, May 1, 1981]

§ 1910.163 Fixed extinguishing systems, water spray and foam.

(a) ***Scope and application.*** This section applies to all fixed extinguishing systems, using water or foam solution as the extinguishing agent, installed to meet a particular OSHA standard. These systems shall also comply with § 1910.160. This section does not apply to automatic sprinkler systems which are covered under § 1910.159.

(b) ***Specific requirements.***

(1) The employer shall assure that foam and water spray systems are designed to be effective in at least controlling fire in the protected area or on protected equipment.

(2) The employer shall assure that drainage of water spray systems is directed away from areas where employees are working and that no emergency egress is permitted through the drainage path.

[45 FR 60712, Sept. 12, 1980]

OTHER FIRE PROTECTION SYSTEMS

§ 1910.164 Fire detection systems.

(a) *Scope and application.* This section applies to all automatic fire detection systems installed to meet the requirements of a particular OSHA standard.

(b) *Installation and restoration.*

(1) The employer shall assure that all devices and equipment constructed and installed to comply with this standard are approved for the purpose for which they are intended.

(2) The employer shall restore all fire detection systems and components to normal operating condition as promptly as possible after each test or alarm. Spare detection devices and components which are normally destroyed in the process of detecting fires shall be available on the premises or from a local supplier in sufficient quantities and locations for prompt restoration of the system.

(c) *Maintenance and testing.*

(1) The employer shall maintain all systems in an operable condition except during repairs or maintenance.

(2) The employer shall assure that fire detectors and fire detection systems are tested and adjusted as often as needed to maintain proper reliability and operating condition except that factory calibrated detectors need not be adjusted after installation.

(3) The employer shall assure that pneumatic and hydraulic operated detection systems installed after January 1, 1981, are equipped with supervised systems.

(4) The employer shall assure that the servicing, maintenance and testing of fire detection systems, including cleaning and necessary sensitivity adjustments are performed by a trained person knowledgeable in the operations and functions of the system.

(5) The employer shall also assure that fire detectors that need to be cleaned of dirt, dust, or other particulates in order to be fully operational are cleaned at regular periodic intervals.

(d) *Protection of fire detectors.*

(1) The employer shall assure that fire detection equipment installed outdoors or in the presence of corrosive atmospheres be protected from corrosion. The employer shall provide a canopy, hood, or other suitable protection for detection equipment requiring protection from the weather.

(2) The employer shall locate or otherwise protect detection equipment so that it is protected from mechanical or physical impact which might render it inoperable.

(3) The employer shall assure that detectors are supported independently of their attachment to wires or tubing.

(e) *Response time.*

(1) The employer shall assure that fire detection systems installed for the purpose of actuating fire extinguishment or suppression systems shall be designed to operate in time to control or extinguish a fire.

(2) The employer shall assure that fire detection systems installed for the purpose of employee alarm and evacuation be designed and installed to provide a warning for emergency action and safe escape of employees.

(3) The employer shall not delay alarms or devices initiated by fire detector actuation for more than 30 seconds unless such delay is necessary for the immediate safety of employees. When such delay is necessary, it shall be addressed in an emergency action plan meeting the requirements of § 1910.38.

(f) ***Number, location and spacing of detecting devices.*** The employer shall assure that the number, spacing and location of fire detectors is based upon design data obtained from field experience, or tests, engineering surveys, the manufacturer's recommendations, or a recognized testing laboratory listing.

[45 FR 60713, Sept. 12, 1980]

§ 1910.165 Employee alarm systems.

(a) ***Scope and application.***

(1) This section applies to all emergency employee alarms installed to meet a particular OSHA standard. This section does not apply to those discharge or supervisory alarms required on various fixed extinguishing systems or to supervisory alarms on fire suppression, alarm or detection systems unless they are intended to be employee alarm systems.

(2) The requirements in this section that pertain to maintenance, testing and inspection shall apply to all local fire alarm signaling systems used for alerting employees regardless of the other functions of the system.

(3) All pre-discharge employee alarms installed to meet a particular OSHA standard shall meet the requirements of paragraphs (b)(1) through (4), (c), and (d)(1) of this section.

(b) ***General requirements.***

(1) The employee alarm system shall provide warning for necessary emergency action as called for in the emergency action plan, or for reaction time for safe escape of employees from the workplace or the immediate work area, or both.

(2) The employee alarm shall be capable of being perceived above ambient noise or light levels by all employees in the affected portions of the workplace. Tactile devices may be used to alert those employees who would not otherwise be able to recognize the audible or visual alarm.

(3) The employee alarm shall be distinctive and recognizable as a signal to evacuate the work area or to perform actions designated under the emergency action plan.

(4) The employer shall explain to each employee the preferred means of reporting emergencies, such as manual pull box alarms, public address systems, radio or telephones. The employer shall post emergency telephone numbers near telephones, or employee notice boards, and other conspicuous locations when telephones serve as a means of reporting emergencies. Where a communication system also serves as the employee alarm system, all emergency messages shall have priority over all non-emergency messages.

(5) The employer shall establish procedures for sounding emergency alarms in the workplace. For those employers with 10 or fewer employees in a particular workplace, direct voice communication is an acceptable procedure for sounding the alarm provided all employees can hear the alarm. Such workplaces need not have a back-up system.

(c) ***Installation and restoration.***

(1) The employer shall assure that all devices, components, combinations of devices or systems constructed and installed to comply with this standard are approved. Steam whistles, air horns, strobe lights or similar lighting devices, or tactile devices meeting the requirements of this section are considered to meet this requirement for approval.

(2) The employer shall assure that all employee alarm systems are restored to normal operating condition as promptly as possible after each test or alarm. Spare alarm devices and components subject to wear or destruction shall be available in sufficient quantities and locations for prompt restoration of the system.

(d) *Maintenance and testing.*

(1) The employer shall assure that all employee alarm systems are maintained in operating condition except when undergoing repairs or maintenance.

(2) The employer shall assure that a test of the reliability and adequacy of non-supervised employee alarm systems is made every two months. A different actuation device shall be used in each test of a multi-actuation device system so that no individual device is used for two consecutive tests.

(3) The employer shall maintain or replace power supplies as often as is necessary to assure a fully operational condition. Back-up means of alarm, such as employee runners or telephones, shall be provided when systems are out of service.

(4) The employer shall assure that employee alarm circuitry installed after January 1, 1981, which is capable of being supervised is supervised and that it will provide positive notification to assigned personnel whenever a deficiency exists in the system. The employer shall assure that all supervised employee alarm systems are tested at least annually for reliability and adequacy.

(5) The employer shall assure that the servicing, maintenance and testing of employee alarms are done by persons trained in the designed operation and functions necessary for reliable and safe operation of the system.

(e) *Manual operation.* The employer shall assure that manually operated actuation devices for use in conjunction with employee alarms are unobstructed, conspicuous and readily accessible.

[45 FR 60713, Sept. 12, 1980]

Appendixes to Subpart L of Part 1910—Note

Note: The following appendices to subpart L, except appendix E, serve as nonmandatory guidelines to assist employers in complying with the appropriate requirements of subpart L.

Appendix A to Subpart L of Part 1910—Fire Protection

§ 1910.156 Fire brigades.

1. *Scope.* This section does not require an employer to organize a fire brigade. However, if an employer does decide to organize a fire brigade, the requirements of this section apply.

2. *Pre-fire planning.* It is suggested that pre-fire planning be conducted by the local fire department and/or the workplace fire brigade in order for them to be familiar with the workplace and process hazards. Involvement with the local fire department or fire prevention bureau is encouraged to facilitate coordination and cooperation between members of the fire brigade and those who might be called upon for assistance during a fire emergency.

3. *Organizational statement.* In addition to the information required in the organizational statement, paragraph 1910.156(b)(1), it is suggested that the organizational statement also contain the following information: a description of the duties that the fire brigade members are expected to perform; the line authority of each fire brigade officer; the number of the fire brigade officers and number of training instructors; and a list and description of the types of awards or recognition that brigade members may be eligible to receive.

4. *Physical capability.* The physical capability requirement applies only to those fire brigade members who perform interior structural fire fighting. Employees who cannot meet the physical capability requirement may still be members of the fire brigade as long as such employees do not perform interior structural fire fighting. It is suggested that fire brigade members who are unable to perform interior structural fire fighting be assigned less stressful and physically demanding fire brigade duties, e.g., certain types of training, recordkeeping, fire prevention inspection and maintenance, and fire pump operations.

   Physically capable can be defined as being able to perform those duties specified in the training requirements of section 1910.156(c). Physically capable can also be determined by physical performance tests or by a physical examination when the examining physician is aware of the duties that the fire brigade member is expected to perform.

   It is also recommended that fire brigade members participate in a physical fitness program. There are many benefits which can be attributed to being physically fit. It is believed that physical fitness may help to reduce the number of sprain and strain injuries as well as contributing to the improvement of the cardiovascular system.

5. *Training and education.* The paragraph on training and education does not contain specific training and education requirements because the type, amount, and frequency of training and education will be as varied as are the purposes for which fire brigades are organized. However, the paragraph does require that training and education be commensurate with those functions that the fire brigade is expected to perform; i.e., those functions specified in the organizational statement. Such a performance requirement provides the necessary flexibility to design a training program which meets the needs of individual fire brigades.

   At a minimum, hands-on training is required to be conducted annually for all fire brigade members. However, for those fire brigade members who are expected to perform interior structural fire fighting, some type of training or education session must be provided at least quarterly.

   In addition to the required hands-on training, it is strongly recommended that fire brigade members receive other types of training and education such as: classroom instruction, review of emergency action procedures, pre-fire planning, review of special hazards in the workplace, and practice in the use of self-contained breathing apparatus.

   It is not necessary for the employer to duplicate the same training or education that a fire brigade member receives as a member of a community volunteer fire department, rescue squad, or similar organization. However, such training or education must have been provided to the fire brigade member within the past year and it must be documented that the fire brigade member has received

the training or education. For example: there is no need for a fire brigade member to receive another training class in the use of positive-pressure self-contained breathing apparatus if the fire brigade member has recently completed such training as a member of a community fire department. Instead, the fire brigade member should receive training or education covering other important equipment or duties of the fire brigade as they relate to the workplace hazards, facilities and processes.

It is generally recognized that the effectiveness of fire brigade training and education depends upon the expertise of those providing the training and education as well as the motivation of the fire brigade members. Fire brigade training instructors must receive a higher level of training and education than the fire brigade members they will be teaching. This includes being more knowledgeable about the functions to be performed by the fire brigade and the hazards involved. The instructors should be qualified to train fire brigade members and demonstrate skills in communication, methods of teaching, and motivation. It is important for instructors and fire brigade members alike to be motivated toward the goals of the fire brigade and be aware of the importance of the service that they are providing for the protection of other employees and the workplace.

It is suggested that publications from the International Fire Service Training Association, the National Fire Protection Association (NFPA-1041), the International Society of Fire Service Instructors and other fire training sources be consulted for recommended qualifications of fire brigade training instructors.

In order to be effective, fire brigades must have competent leadership and supervision. It is important for those who supervise the fire brigade during emergency situations, e.g., fire brigade chiefs, leaders, etc., to receive the necessary training and education for supervising fire brigade activities during these hazardous and stressful situations. These fire brigade members with leadership responsibilities should demonstrate skills in strategy and tactics, fire suppression and prevention techniques, leadership principles, pre-fire planning, and safety practices. It is again suggested that fire service training sources be consulted for determining the kinds of training and education which are necessary for those with fire brigade leadership responsibilities.

It is further suggested that fire brigade leaders and fire brigade instructors receive more formalized training and education on a continuing basis by attending classes provided by such training sources as universities and university fire extension services.

The following recommendations should not be considered to be all of the necessary elements of a complete comprehensive training program, but the information may be helpful as a guide in developing a fire brigade training program.

All fire brigade members should be familiar with exit facilities and their location, emergency escape routes for handicapped workers, and the workplace “emergency action plan.”

In addition, fire brigade members who are expected to control and extinguish fires in the incipient stage should, at a minimum, be trained in the use of fire extinguishers, standpipes, and other fire equipment they are assigned to use. They should also be aware of first aid medical procedures and procedures for dealing with special hazards to which they may be exposed. Training and education should include both classroom instruction and actual operation of the equipment under simulated emergency conditions. Hands-on type training must be conducted at least annually but some functions should be reviewed more often.

In addition to the above training, fire brigade members who are expected to perform emergency rescue and interior structural fire fighting should, at a minimum, be familiar with the proper techniques in rescue and fire suppression procedures. Training and education should include fire protection courses, classroom training, simulated fire situations including “wet drills” and, when feasible, extinguishment of actual mock fires. Frequency of training or education must be at least quarterly, but some drills or classroom training should be conducted as often as monthly or even weekly to maintain the proficiency of fire brigade members.

There are many excellent sources of training and education that the employer may want to use in developing a training program for the workplace fire brigade. These sources include publications, seminars, and courses offered by universities.

There are also excellent fire school courses by such facilities as Texas A and M University, Delaware State Fire School, Lamar University, and Reno Fire School, that deal with those unique hazards which may be encountered by fire brigades in the oil and chemical industry. These schools, and others, also offer excellent training courses which would be beneficial to fire brigades in other types of industries. These courses should be a continuing part of the training program, and employers are strongly encouraged to take advantage of these excellent resources.

It is also important that fire brigade members be informed about special hazards to which they may be exposed during fire and other emergencies. Such hazards as storage and use areas of flammable liquids and gases, toxic chemicals, water-reactive substances, etc., can pose difficult problems. There must be written procedures developed that describe the actions to be taken in situations involving special hazards. Fire brigade members must be trained in handling these special hazards as well as keeping abreast of any changes that occur in relation to these special hazards.

6. ***Fire fighting equipment.*** It is important that fire fighting equipment that is in damaged or unserviceable condition be removed from service and replaced. This will prevent fire brigade members from using unsafe equipment by mistake.

   Fire fighting equipment, except portable fire extinguishers and respirators, must be inspected at least annually. Portable fire extinguishers and respirators are required to be inspected at least monthly.

7. ***Protective clothing.***

   (A) ***General.*** Paragraph (e) of § 1910.156 does not require all fire brigade members to wear protective clothing. It is not the intention of these standards to require employers to provide a full ensemble of protective clothing for every fire brigade member without consideration given to the types of hazardous environments to which the fire brigade member might be exposed. It is the intention of these standards to require adequate protection for those fire brigade members who might be exposed to fires in an advanced stage, smoke, toxic gases, and high temperatures. Therefore, the protective clothing requirements only apply to those fire brigade members who perform interior structural fire fighting operations.

   Additionally, the protective clothing requirements do not apply to the protective clothing worn during outside fire fighting operations (brush and forest fires, crash crew operations) or other special fire fighting activities. It is important that the protective clothing to be worn during these types of fire fighting operations reflect the hazards which are expected to be encountered by fire brigade members.

   (B) ***Foot and leg protection.*** Section 1910.156 permits an option to achieve foot and leg protection.

The section recognizes the interdependence of protective clothing to cover one or more parts of the body. Therefore, an option is given so that fire brigade members may meet the foot and leg requirements by either wearing long fire-resistive coats in combination with fully extended boots, or by wearing shorter fire-resistive costs in combination with protective trousers and protective shoes or shorter boots.

(C) ***Body protection.*** Paragraph (e)(3) of § 1910.156 provides an option for fire brigade members to achieve body protection. Fire brigade members may wear a fire-resistive coat in combination with fully extended boots, or they may wear a fire-resistive coat in combination with protective trousers.

Fire-resistive coats and protective trousers meeting all of the requirements contained in NFPA 1971-1975 "Protective Clothing for Structural Fire Fighters," are acceptable as meeting the requirements of this standard.

The lining is required to be permanently attached to the outer shell. However, it is permissible to attach the lining to the outer shell material by stitching in one area such as at the neck. Fastener tape or snap fasteners may be used to secure the rest of the lining to the outer shell to facilitate cleaning. Reference to permanent lining does not refer to a winter liner which is a detachable extra lining used to give added protection to the wearer against the effects of cold weather and wind.

(D) ***Hand protection.*** The requirements of the paragraph on hand protection may be met by protective gloves or a glove system. A glove system consists of a combination of different gloves. The usual components of a glove system consist of a pair of gloves, which provide thermal insulation to the hands, worn in combination with a second pair of gloves which provide protection against flame, cut, and puncture.

It is suggested that protective gloves provide dexterity and a sense of feel for objects. Criteria and test methods for dexterity are contained in the NIOSH publications, "The Development of Criteria for Firefighters' Gloves; Vol. I: Glove Requirements" and "Vol. II: Glove Criteria and Test Methods." These NIOSH publications also contain a permissible modified version of Federal Test Method 191, Method 5903, (paragraph (3) of appendix E) for flame resistance when gloves, rather than glove material, are tested for flame resistance.

(E) ***Head, eye, and face protection.*** Head protective devices which meet the requirements contained in NFPA No. 1972 are acceptable as meeting the requirements of this standard for head protection.

Head protective devices are required to be provided with ear flaps so that the ear flaps will be available if needed. It is recommended that ear protection always be used while fighting interior structural fires.

Many head protective devices are equipped with face shields to protect the eyes and face. These face shields are permissible as meeting the eye and face protection requirements of this paragraph as long as such face shields meet the requirements of § 1910.133 of the General Industry Standards.

Additionally, full facepieces, helmets or hoods of approved breathing apparatus which meet the requirements of § 1910.134 and paragraph (f) of § 1910.156 are also acceptable as meeting the eye and face protection requirements.

It is recommended that a flame resistant protective head covering such as a hood or snood, which will not adversely affect the seal of a respirator facepiece, be worn during interior structural fire fighting operations to protect the sides of the face and hair.

8. ***Respiratory protective devices.*** Respiratory protection is required to be worn by fire brigade members while working inside buildings or confined spaces where toxic products of combustion or an oxygen deficiency is likely to be present; respirators are also to be worn during emergency situations involving toxic substances. When fire brigade members respond to emergency situations, they may be exposed to unknown contaminants in unknown concentrations. Therefore, it is imperative that fire brigade members wear proper respiratory protective devices during these situations. Additionally, there are many instances where toxic products of combustion are still present during mop-up and overhaul operations. Therefore, fire brigade members should continue to wear respirators during these types of operations.

Self-contained breathing apparatus are not required to be equipped with either a buddy-breathing device or a quick-disconnect valve. However, these accessories may be very useful and are acceptable as long as such accessories do not cause damage to the apparatus, restrict the air flow of the apparatus, or obstruct the normal operation of the apparatus.

Buddy-breathing devices are useful for emergency situations where a victim or another fire brigade member can share the same air supply with the wearer of the apparatus for emergency escape purposes.

The employer is encouraged to provide fire brigade members with an alternative means of respiratory protection to be used only for emergency escape purposes if the self-contained breathing apparatus becomes inoperative. Such alternative means of respiratory protection may be either a buddy-breathing device or an escape self-contained breathing apparatus (ESCBA). The ESCBA is a short-duration respiratory protective device which is approved for only emergency escape purposes. It is suggested that if ESCBA units are used, that they be of at least 5 minutes service life.

Quick-disconnect valves are devices which start the flow of air by insertion of the hose (which leads to the facepiece) into the regulator of self-contained breathing apparatus, and stop the flow of air by disconnecting the hose from the regulator. These devices are particularly useful for those positive-pressure self-contained breathing apparatus which do not have the capability of being switched from the demand to the positive-pressure mode.

The use of a self-contained breathing apparatus where the apparatus can be switched from a demand to a positive-pressure mode is acceptable as long as the apparatus is in the positive-pressure mode when performing interior structural fire fighting operations. Also acceptable are approved respiratory protective devices which have been converted to the positive-pressure type when such modification is accomplished by trained and experienced persons using kits or parts approved by NIOSH and provided by the manufacturer and by following the manufacturer's instructions.

There are situations which require the use of respirators which have a duration of 2 hours or more. Presently, there are no approved positive-pressure apparatus with a rated service life of more than 2 hours. Consequently, negative-pressure self-contained breathing apparatus with a rated service life of more than 2 hours and which have a minimum protection factor of 5,000 as determined by an acceptable quantitative fit test performed on each individual, will be acceptable for use during situations which require long duration apparatus. Long duration apparatus may be needed in such instances as working in tunnels, subway systems, etc. Such negative-pressure breathing apparatus

will continue to be acceptable for a maximum of 18 months after a positive-pressure apparatus with the same or longer rated service life of more than 2 hours is certified by NIOSH/MSHA. After this 18 month phase-in period, all self-contained breathing apparatus used for these long duration situations will have to be of the positive-pressure type.

Protection factor (sometimes called fit factor) is defined as the ratio of the contaminant concentrations outside of the respirator to the contaminant concentrations inside the facepiece of the respirator.

$$PF = \frac{\text{Concentration outside respirator}}{\text{Concentration inside facepiece}}$$

Protection factors are determined by quantitative fit tests. An acceptable quantitative fit test should include the following elements:

1. A fire brigade member who is physically and medically capable of wearing respirators, and who is trained in the use of respirators, dons a self-contained breathing apparatus equipped with a device that will monitor the concentration of a contaminant inside the facepiece.
2. The fire brigade member then performs a qualitative fit test to assure the best face to facepiece seal as possible. A qualitative fit test can consist of a negative-pressure test, positive-pressure test, isoamyl acetate vapor (banana oil) test, or an irritant smoke test. For more details on respirator fitting see the NIOSH booklet entitled “A Guide to Industrial Respiratory Protection” June, 1976, and HEW publication No. (NIOSH) 76-189.
3. The wearer should then perform physical activity which reflects the level of work activity which would be expected during fire fighting activities. The physical activity should include simulated fire-ground work activity or physical exercise such as running-in-place, a step test, etc.
4. Without readjusting the apparatus, the wearer is placed in a test atmosphere containing a non-toxic contaminant with a known, constant, concentration.

The protection factor is then determined by dividing the known concentration of the contaminant in the test atmosphere by the concentration of the contaminant inside the facepiece when the following exercises are performed:

(a) Normal breathing with head motionless for one minute;

(b) Deep breathing with head motionless for 30 seconds;

(c) Turning head slowly from side to side while breathing normally, pausing for at least two breaths before changing direction. Continue for at least one minute;

(d) Moving head slowly up and down while breathing normally, pausing for at least two breaths before changing direction. Continue for at least two minutes;

(e) Reading from a prepared text, slowly and clearly, and loudly enough to be heard and understood. Continue for one minute; and

(f) Normal breathing with head motionless for at least one minute.

The protection factor which is determined must be at least 5,000. The quantitative fit test should be conducted at least three times. It is acceptable to conduct all three tests on the same day. However, there should be at least one hour between tests to reflect the protection afforded by the apparatus during different times of the day.

The above elements are not meant to be a comprehensive, technical description of a quantitative fit test protocol. However, quantitative fit test procedures which include these elements are acceptable for determining protection factors. Procedures for a quantitative fit test are required to be available for inspection by the Assistant Secretary or authorized representative.

Organizations such as Los Alamos Scientific Laboratory, Lawrence Livermore Laboratory, NIOSH, and American National Standards Institute (ANSI) are excellent sources for additional information concerning qualitative and quantitative fit testing.

§ 1910.157 Portable fire extinguishers.

1. ***Scope and application.*** The scope and application of this section is written to apply to three basic types of workplaces. First, there are those workplaces where the employer has chosen to evacuate all employees from the workplace at the time of a fire emergency. Second, there are those workplaces where the employer has chosen to permit certain employees to fight fires and to evacuate all other non-essential employees at the time of a fire emergency. Third, there are those workplaces where the employer has chosen to permit all employees in the workplace to use portable fire extinguishers to fight fires.

The section also addresses two kinds of work areas. The entire workplace can be divided into outside (exterior) work areas and inside (interior) work areas. This division of the workplace into two areas is done in recognition of the different types of hazards employees may be exposed to during fire fighting operations. Fires in interior workplaces, pose a greater hazard to employees; they can produce greater exposure to quantities of smoke, toxic gases, and heat because of the capability of a building or structure to contain or entrap these products of combustion until the building can be ventilated. Exterior work areas, normally open to the environment, are somewhat less hazardous, because the products of combustion are generally carried away by the thermal column of the fire. Employees also have a greater selection of evacuation routes if it is necessary to abandon fire fighting efforts.

In recognition of the degree of hazard present in the two types of work areas, the standards for exterior work areas are somewhat less restrictive in regards to extinguisher distribution. Paragraph (a) explains this by specifying which paragraphs in the section apply.

2. ***Portable fire extinguisher exemptions.*** In recognition of the three options given to employers in regard to the amount of employee evacuation to be carried out, the standards permit certain exemptions based on the number of employees expected to use fire extinguishers.

Where the employer has chosen to totally evacuate the workplace at the time of a fire emergency and when fire extinguishers are not provided, the requirements of this section do not apply to that workplace.

Where the employer has chosen to partially evacuate the workplace or the effected area at the time of a fire emergency and has permitted certain designated employees to remain behind to operate critical plant operations or to fight fires with extinguishers, then the employer is exempt from the distribution requirements of this section. Employees who will be remaining behind to perform incipient fire fighting or members of a fire brigade must be trained in their duties. The training must result in the employees becoming familiar with the locations of fire extinguishers. Therefore, the employer must locate the extinguishers in convenient locations where the employees know they can be found. For example, they could be mounted in the fire truck or cart that the fire brigade uses when it responds to a fire emergency. They can also be distributed as set forth in the National Fire Protection Association's Standard No. 10, “Portable Fire Extinguishers.”

Where the employer has decided to permit all employees in the workforce to use fire extinguishers, then the entire OSHA section applies.

3. ***Portable fire extinguisher mounting.*** Previous standards for mounting fire extinguishers have been criticized for requiring specific mounting locations. In recognition of this criticism, the standard has been rewritten to permit as much flexibility in extinguisher mounting as is acceptable to assure that fire extinguishers are available when needed and that employees are not subjected to injury hazards when they try to obtain an extinguisher.

It is the intent of OSHA to permit the mounting of extinguishers in any location that is accessible to employees without the use of portable devices such as a ladder. This limitation is necessary because portable devices can be moved or taken from the place where they are needed and, therefore, might not be available at the time of an emergency.

Employers are given as much flexibility as possible to assure that employees can obtain extinguishers as fast as possible. For example, an acceptable method of mounting extinguishers in areas where fork lift trucks or tow-motors are used is to mount the units on retractable boards which, by means of counterweighting, can be raised above the level where they could be struck by vehicular traffic. When needed, they can be lowered quickly for use. This method of mounting can also reduce vandalism and unauthorized use of extinguishers. The extinguishers may also be mounted as outlined in the National Fire Protection Association's Standard No. 10, “Portable Fire Extinguishers.”

4. ***Selection and distribution.*** The employer is responsible for the proper selection and distribution of fire extinguishers and the determination of the necessary degree of protection. The selection and distribution of fire extinguishers must reflect the type and class of fire hazards associated with a particular workplace.

Extinguishers for protecting Class A hazards may be selected from the following types: water, foam, loaded stream, or multipurpose dry chemical. Extinguishers for protecting Class B hazards may be selected from the following types: Halon 1301, Halon 1211, carbon dioxide, dry chemicals, foam, or loaded stream. Extinguishers for Class C hazards may be selected from the following types: Halon 1301, Halon 1211, carbon dioxide, or dry chemical.

Combustible metal (Class D hazards) fires pose a different type of fire problem in the workplace. Extinguishers using water, gas, or certain dry chemicals cannot extinguish or control this type of fire. Therefore, certain metals have specific dry powder extinguishing agents which can extinguish or control this type of fire. Those agents which have been specifically approved for use on certain metal fires provide the best protection; however, there are also

some “universal” type agents which can be used effectively on a variety of combustible metal fires if necessary. The “universal” type agents include: Foundry flux, Lith-X powder, TMB liquid, pyromet powder, TEC powder, dry talc, dry graphite powder, dry sand, dry sodium chloride, dry soda ash, lithium chloride, zirconium silicate, and dry dolomite.

Water is not generally accepted as an effective extinguishing agent for metal fires. When applied to hot burning metal, water will break down into its basic atoms of oxygen and hydrogen. This chemical breakdown contributes to the combustion of the metal. However, water is also a good universal coolant and can be used on some combustible metals, but only under proper conditions and application, to reduce the temperature of the burning metal below the ignition point. For example, automatic deluge systems in magnesium plants can discharge such large quantities of water on burning magnesium that the fire will be extinguished. The National Fire Protection Association has specific standards for this type of automatic sprinkler system. Further information on the control of metal fires with water can be found in the National Fire Protection Association's *Fire Protection Handbook*.

An excellent source of selection and distribution criteria is found in the National Fire Protection Association's Standard No. 10. Other sources of information include the National Safety Council and the employer's fire insurance carrier.

5. ***Substitution of standpipe systems for portable fire extinguishers.*** The employer is permitted to substitute acceptable standpipe systems for portable fire extinguishers under certain circumstances. It is necessary to assure that any substitution will provide the same coverage that portable units provide. This means that fire hoses, because of their limited portability, must be spaced throughout the protected area so that they can reach around obstructions such as columns, machinery, etc. and so that they can reach into closets and other enclosed areas.

6. ***Inspection, maintenance and testing.*** The ultimate responsibility for the inspection, maintenance and testing of portable fire extinguishers lies with the employer. The actual inspection, maintenance, and testing may, however, be conducted by outside contractors with whom the employer has arranged to do the work. When contracting for such work, the employer should assure that the contractor is capable of performing the work that is needed to comply with this standard.

If the employer should elect to perform the inspection, maintenance, and testing requirements of this section in-house, then the employer must make sure that those persons doing the work have been trained to do the work and to recognize problem areas which could cause an extinguisher to be inoperable. The National Fire Protection Association provides excellent guidelines in its standard for portable fire extinguishers. The employer may also check with the manufacturer of the unit that has been purchased and obtain guidelines on inspection, maintenance, and testing. Hydrostatic testing is a process that should be left to contractors or individuals using suitable facilities and having the training necessary to perform the work.

Anytime the employer has removed an extinguisher from service to be checked or repaired, alternate equivalent protection must be provided. Alternate equivalent protection could include replacing the extinguisher with one or more units having equivalent or equal ratings, posting a fire watch, restricting the unprotected area from employee exposure, or providing a hose system ready to operate.

7. ***Hydrostatic testing.*** As stated before, the employer may contract for hydrostatic testing. However, if the employer wishes to provide the testing service, certain equipment and facilities must be available. Employees should be made aware of the hazards associated with hydrostatic testing and the importance of using proper guards and water pressures. Severe injury can result if extinguisher shells fail violently under hydrostatic pressure.

Employers are encouraged to use contractors who can perform adequate and reliable service. Firms which have been certified by the Materials Transportation Board (MTB) of the U.S. Department of Transportation (DOT) or State licensed extinguisher servicing firms or recognized by the National Association of Fire Equipment Distributors in Chicago, Illinois, are generally acceptable for performing this service.

8. *Training and education.* This part of the standard is of the utmost importance to employers and employees if the risk of injury or death due to extinguisher use is to be reduced. If an employer is going to permit an employee to fight a workplace fire of any size, the employer must make sure that the employee knows everything necessary to assure the employee's safety.

Training and education can be obtained through many channels. Often, local fire departments in larger cities have fire prevention bureaus or similar organizations which can provide basic fire prevention training programs. Fire insurance companies will have data and information available. The National Fire Protection Association and the National Safety Council will provide, at a small cost, publications that can be used in a fire prevention program.

Actual fire fighting training can be obtained from various sources in the country. The Texas A & M University, the University of Maryland's Fire and Rescue Institute, West Virginia University's Fire Service Extension, Iowa State University's Fire Service Extension and other State training schools and land grant colleges have fire fighting programs directed to industrial applications. Some manufacturers of extinguishers, such as the Ansul Company and Safety First, conduct fire schools for customers in the proper use of extinguishers. Several large corporations have taken time to develop their own on-site training programs which expose employees to the actual “feeling” of fire fighting. Simulated fires for training of employees in the proper use of extinguishers are also an acceptable part of a training program.

In meeting the requirements of this section, the employer may also provide educational materials, without classroom instruction, through the use of employee notice campaigns using instruction sheets or flyers or similar types of informal programs. The employer must make sure that employees are trained and educated to recognize not only what type of fire is being fought and how to fight it, but also when it is time to get away from it and leave fire suppression to more experienced fire fighters.

§ 1910.158 Standpipe and hose systems.

1. *Scope and application.* This section has been written to provide adequate coverage of those standpipe and hose systems that an employer may install in the workplace to meet the requirements of a particular OSHA standard. For example, OSHA permits the substitution of hose systems for portable fire extinguishers in § 1910.157. If an employer chooses to provide hose systems instead of portable Class A fire extinguishers, then those hose systems used for substitution would have to meet the applicable requirements of § 1910.157. All other standpipe and hose systems not used as a substitute would be exempt from these requirements.

The section specifically exempts Class I large hose systems. By large hose systems, OSHA means those $2^{1}/_{2}$" (6.3 cm) hose lines that are usually associated with fire departments of the size that provide their own water supply through fire apparatus. When the fire gets to the size that outside protection of that degree is necessary, OSHA believes that in most industries employees will have been evacuated from the fire area and the “professional” fire fighters will take control.

2. ***Protection of standpipes.*** Employers must make sure that standpipes are protected so that they can be relied upon during a fire emergency. This means protecting the pipes from mechanical and physical damage. There are various means for protecting the equipment such as, but not limited to, enclosing the supply piping in the construction of the building, locating the standpipe in an area which is inaccessible to vehicles, or locating the standpipe in a stairwell.

3. ***Hose covers and cabinets.*** The employer should keep fire protection hose equipment in cabinets or inside protective covers which will protect it from the weather elements, dirt or other damaging sources. The use of protective covers must be easily removed or opened to assure that hose and nozzle are accessible. When the employer places hose in a cabinet, the employer must make sure that the hose and nozzle are accessible to employees without subjecting them to injury. In order to make sure that the equipment is readily accessible, the employer must also make sure that the cabinets used to store equipment are kept free of obstructions and other equipment which may interfere with the fast distribution of the fire hose stored in the cabinet.

4. ***Hose outlets and connections.*** The employer must assure that employees who use standpipe and hose systems can reach the hose rack and hose valve without the use of portable equipment such as ladders. Hose reels are encouraged for use because one employee can retrieve the hose, charge it, and place it into service without much difficulty.

5. ***Hose.*** When the employer elects to provide small hose in lieu of portable fire extinguishers, those hose stations being used for the substitution must have hose attached and ready for service. However, if more than the necessary amount of small hose outlets are provided, hose does not have to be attached to those outlets that would provide redundant coverage. Further, where the installation of hose on outlets may expose the hose to extremely cold climates, the employer may store the hose in houses or similar protective areas and connect it to the outlet when needed.

There is approved lined hose available that can be used to replace unlined hose which is stored on racks in cabinets. The lined hose is constructed so that it can be folded and placed in cabinets in the same manner as unlined hose.

Hose is considered to be unserviceable when it deteriorates to the extent that it can no longer carry water at the required pressure and flow rates. Dry rotted linen or hemp hose, cross threaded couplings, and punctured hose are examples of unserviceable hose.

6. ***Nozzles.*** Variable stream nozzles can provide useful variations in water flow and spray patterns during fire fighting operations and they are recommended for employee use. It is recommended that 100 psi (700kPa) nozzle pressure be used to provide good flow patterns for variable stream nozzles. The most desirable attribute for nozzles is the ability of the nozzle person to shut off the water flow at the nozzle when it is necessary. This can be accomplished in many ways. For example, a shut-off nozzle with a lever or rotation of the nozzle to stop flow would be effective, but in other cases a simple globe valve placed between a straight stream nozzle and the hose could serve the same purpose. For straight stream nozzles 50 psi nozzle pressure is recommended. The intent of this standard is to protect the employee from “run-away” hoses if it becomes necessary to drop a pressurized hose line and retreat from the fire front and other related hazards.

7. ***Design and installation.*** Standpipe and hose systems designed and installed in accordance with NFPA Standard No. 14, “Standpipe and Hose Systems,” are considered to be in compliance with this standard.

§ 1910.159 Automatic sprinkler systems.

1. *Scope and application.* This section contains the minimum requirements for design, installation and maintenance of sprinkler systems that are needed for employee safety. The Occupational Safety and Health Administration is aware of the fact that the National Board of Fire Underwriters is no longer an active organization, however, sprinkler systems still exist that were designed and installed in accordance with that organization's standards. Therefore, OSHA will recognize sprinkler systems designed to, and maintained in accordance with, NBFU and earlier NFPA standards.

2. *Exemptions.* In an effort to assure that employers will continue to use automatic sprinkler systems as the primary fire protection system in workplaces, OSHA is exempting from coverage those systems not required by a particular OSHA standard and which have been installed in workplaces solely for the purpose of protecting property. Many of these types of systems are installed in areas or buildings with little or no employee exposure. An example is those warehouses where employees may enter occasionally to take inventory or move stock. Some employers may choose to shut down those systems which are not specifically required by OSHA rather than upgrade them to comply with the standards. OSHA does not intend to regulate such systems. OSHA only intends to regulate those systems which are installed to comply with a particular OSHA standard.

3. *Design.* There are two basic types of sprinkler system design. Pipe schedule designed systems are based on pipe schedule tables developed to protect hazards with standard sized pipe, number of sprinklers, and pipe lengths. Hydraulic designed systems are based on an engineered design of pipe size which will produce a given water density or flow rate at any particular point in the system. Either design can be used to comply with this standard.

The National Fire Protection Association's Standard No. 13, “Automatic Sprinkler Systems,” contains the tables needed to design and install either type of system. Minimum water supplies, densities, and pipe sizes are given for all types of occupancies.

The employer may check with a reputable fire protection engineering consultant or sprinkler design company when evaluating existing systems or designing a new installation.

With the advent of new construction materials for the manufacuture of sprinkler pipe, materials, other than steel have been approved for use as sprinkler pipe. Selection of pipe material should be made on the basis of the type of installation and the acceptability of the material to local fire and building officials where such systems may serve more than one purpose.

Before new sprinkler systems are placed into service, an acceptance test is to be conducted. The employer should invite the installer, designer, insurance representative, and a local fire official to witness the test. Problems found during the test are to be corrected before the system is placed into service.

4. *Maintenance.* It is important that any sprinkler system maintenance be done only when there is minimal employee exposure to the fire hazard. For example, if repairs or changes to the system are to be made, they should be made during those hours when employees are not working or are not occupying that portion of the workplace protected by the portion of the system which has been shut down.

The procedures for performing a flow test via a main drain test or by the use of an inspector's test valve can be obtained from the employer's fire insurance company or from the National Fire Protection Association's Standard No. 13A, “Sprinkler System, Maintenance.”

5. ***Water supplies.*** The water supply to a sprinkler system is one of the most important factors an employer should consider when evaluationg a system. Obviously, if there is no water supply, the system is useless. Water supplies can be lost for various reasons such as improperly closed valves, excessive demand, broken water mains, and broken fire pumps. The employer must be able to determine if or when this type of condition exists either by performing a main drain test or visual inspection. Another problem may be an inadequate water supply. For example, a light hazard occupancy may, through rehabilitation or change in tenants, become an ordinary or high hazard occupancy. In such cases, the existing water supply may not be able to provide the pressure or duration necessary for proper protection. Employers must assure that proper design and tests have been made to assure an adequate water supply. These tests can be arranged through the employer's fire insurance carrier or through a local sprinkler maintenance company or through the local fire prevention organization.

Anytime the employer must shut down the primary water supply for a sprinkler system, the standard requires that equivalent protection be provided. Equivalent protection may include a fire watch with extinguishers or hose lines in place and manned, or a secondary water supply such as a tank truck and pump, or a tank or fire pond with fire pumps, to protect the areas where the primary water supply is limited or shut down. The employer may also require evacuation of the workplace and have an emergency action plan which specifies such action.

6. ***Protection of piping.*** Piping which is exposed to corrosive atmospheres, either chemical or natural, can become defective to the extent that it is useless. Employers must assure that piping is protected from corrosion by its material of construction, e.g., stainless steel, or by a protective coating, e.g., paint.

7. ***Sprinklers.*** When an employer finds it necessary to replace sprinkler system components or otherwise change a sprinkler's design, employer should make a complete fire protection engineering survey of that part of the system being changed. This review should assure that the changes to the system will not alter the effectiveness of the system as it is presently designed. Water supplies, densities and flow characteristics should be maintained.

8. ***Protection of sprinklers.*** All components of the system must be protected from mechanical impact damage. This can be achieved with the use of mechanical guards or screens or by locating components in areas where physical contact is impossible or limited.

9. ***Sprinkler alarms.*** The most recognized sprinkler alarm is the water motor gong or bell that sounds when water begins to flow through the system. This is not however, the only type of acceptable water flow alarm. Any alarm that gives an indication that water is flowing through the system is acceptable. For example, a siren, a whistle, a flashing light, or similar alerting device which can transmit a signal to the necessary persons would be acceptable. The purpose of the alarm is to alert persons that the system is operating, and that some type of planned action is necessary.

10. *Sprinkler spacing.* For a sprinkler system to be effective there must be an adequate discharge of water spray from the sprinkler head. Any obstructions which hinder the designed density or spray pattern of the water may create unprotected areas which can cause fire to spread. There are some sprinklers that, because of the system's design, are deflected to specific areas. This type of obstruction is acceptable if the system's design takes it into consideration in providing adequate coverage.

§ 1910.160 Fixed extinguishing systems, general.

1. *Scope and application.* This section contains the general requirements that are applicable to all fixed extinguishing systems installed to meet OSHA standards. It also applies to those fixed extinguishing systems, generally total flooding, which are not required by OSHA, but which, because of the agent's discharge, may expose employees to hazardous concentrations of extinguishing agents or combustion by-products. Employees who work around fixed extinguishing systems must be warned of the possible hazards associated with the system and its agent. For example, fixed dry chemical extinguishing systems may generate a large enough cloud of dry chemical particles that employees may become visually disoriented. Certain gaseous agents can expose employees to hazardous by-products of combustion when the agent comes into contact with hot metal or other hot surface. Some gaseous agents may be present in hazardous concentrations when the system has totally discharged because an extra rich concentration is necessary to extinguish deep-seated fires. Certain local application systems may be designed to discharge onto the flaming surface of a liquid, and it is possible that the liquid can splatter when hit with the discharging agent. All of these hazards must be determined before the system is placed into operation, and must be discussed with employees.

Based on the known toxicological effects of agents such as carbon tetrachloride and chlorobromomethane, OSHA is not permitting the use of these agents in areas where employees can be exposed to the agent or its side effects. However, chlorobromomethane has been accepted and may be used as an explosion suppression agent in unoccupied spaces. OSHA is permitting the use of this agent only in areas where employees will not be exposed.

2. *Distinctive alarm signals.* A distinctive alarm signal is required to indicate that a fixed system is discharging. Such a signal is necessary on those systems where it is not immediately apparent that the system is discharging. For example, certain gaseous agents make a loud noise when they discharge. In this case no alarm signal is necessary. However, where systems are located in remote locations or away from the general work area and where it is possible that a system could discharge without anyone knowing that it is doing so, then a distinctive alarm is necessary to warn employees of the hazards that may exist. The alarm can be a bell, gong, whistle, horn, flashing light, or any combination of signals as long as it is identifiable as a discharge alarm.

3. *Maintenance.* The employer is responsible for the maintenance of all fixed systems, but this responsibility does not preclude the use of outside contractors to do such work. New systems should be subjected to an acceptance test before placed in service. The employer should invite the installer, designer, insurance representative and others to witness the test. Problems found during the test need to be corrected before the system is considered operational.

4. *Manual discharge stations.* There are instances, such as for mechanical reasons and others, where the standards call for a manual back-up activation device. While the location of this device is not specified in the standard, the employer should assume that the device should be located where employees can easily reach it. It could, for example, be located along the main means of egress from the protected area so that employees could activate the system as they evacuate the work area.

5. *Personal protective equipment.* The employer is required to provide the necessary personal protective equipment to rescue employees who may be trapped in a totally flooded environment which may be hazardous to their health. This equipment would normally include a positive-pressure self-contained breathing apparatus and any necessary first aid equipment. In cases where the employer can assure the prompt arrival of the local fire department or plant emergency personnel which can provide the equipment, this can be considered as complying with the standards.

§ 1910.161 Fixed extinguishing systems, dry chemical.

1. *Scope and application.* The requirements of this section apply only to dry chemical systems. These requirements are to be used in conjunction with the requirements of § 1910.160.

2. *Maintenance.* The employer is responsible for assuring that dry chemical systems will operate effectively. To do this, periodic maintenance is necessary. One test that must be conducted during the maintenance check is one which will determine if the agent has remained free of moisture. If an agent absorbs any moisture, it may tend to cake and thereby clog the system. An easy test for acceptable moisture content is to take a lump of dry chemical from the container and drop it from a height of four inches. If the lump crumbles into fine particles, the agent is acceptable.

§ 1910.162 Fixed extinguishing systems, gaseous agent.

1. *Scope and application.* This section applies only to those systems which use gaseous agents. The requirements of § 1910.160 also apply to the gaseous agent systems covered in this section.

2. *Design concentrations.* Total flooding gaseous systems are based on the volume of gas which must be discharged in order to produce a certain designed concentration of gas in an enclosed area. The concentration needed to extinguish a fire depends on several factors including the type of fire hazard and the amount of gas expected to leak away from the area during discharge. At times it is necessary to “super-saturate” a work area to provide for expected leakage from the enclosed area. In such cases, employers must assure that the flooded area has been ventilated before employees are permitted to reenter the work area without protective clothing and respirators.

3. *Toxic decomposition.* Certain halogenated hydrocarbons will break down or decompose when they are combined with high temperatures found in the fire environment. The products of the decomposition can include toxic elements or compounds. For example, when Halon 1211 is placed into contact with hot metal it will break down and form bromide or fluoride fumes. The employer must find out which toxic products may result from decomposition of a particular agent from the manufacturer, and take the necessary precautions to prevent employee exposure to the hazard.

§ 1910.163 Fixed extinguishing systems, water spray and foam.

1. *Scope and application.* This section applies to those systems that use water spray or foam. The requirements of § 1910.160 also apply to this type of system.

2. *Characteristics of foams.* When selecting the type of foam for a specific hazard, the employer should consider the following limitations of some foams.

   a. Some foams are not acceptable for use on fires involving flammable gases and liquefied gases with boiling points below ambient workplace temperatures. Other foams are not effective when used on fires involving polar solvent liquids.

   b. Any agent using water as part of the mixture should not be used on fire involving combustible metals unless it is applied under proper conditions to reduce the temperature of burning metal below the ignition temperature. The employer should use only those foams that have been tested and accepted for this application by a recognized independent testing laboratory.

   c. Certain types of foams may be incompatible and break down when they are mixed together.

   d. For fires involving water miscible solvents, employers should use only those foams tested and approved for such use. Regular protein foams may not be effective on such solvents.

Whenever employers provide a foam or water spray system, drainage facilities must be provided to carry contaminated water or foam overflow away from the employee work areas and egress routes. This drainage system should drain to a central impounding area where it can be collected and disposed of properly. Other government agencies may have regulations concerning environmental considerations.

§ 1910.164 Fire detection systems.

1. *Installation and restoration.* Fire detection systems must be designed by knowledgeable engineers or other professionals, with expertise in fire detection systems and when the systems are installed, there should be an acceptance test performed on the system to insure it operates properly. The manufacturer's recommendations for system design should be consulted. While entire systems may not be approved, each component used in the system is required to be approved. Custom fire detection systems should be designed by knowledgeable fire protection or electrical engineers who are familiar with the workplace hazards and conditions. Some systems may only have one or two individual detectors for a small workplace, but good design and installation is still important. An acceptance test should be performed on all systems, including these smaller systems.

OSHA has a requirement that spare components used to replace those which may be destroyed during an alarm situation be available in sufficient quantities and locations for prompt restoration of the system. This does not mean that the parts or components have to be stored at the workplace. If the employer can assure that the supply of parts is available in the local community or the general metropolitan area of the workplace, then the requirements for storage and availability have been met. The intent is to make sure that the alarm system is fully operational when employees are occupying the workplace, and that when the system operates it can be returned to full service the next day or sooner.

2. *Supervision.* Fire detection systems should be supervised. The object of supervision is detection of any failure of the circuitry, and the employer should use any method that will assure that the system's circuits are operational. Electrically operated sensors for air pressure, fluid pressure, or electrical circuits, can provide effective monitoring and are the typical types of supervision.

3. *Protection of fire detectors.* Fire detectors must be protected from corrosion either by protective coatings, by being manufactured from non-corrosive materials or by location. Detectors must also be protected from mechanical impact damage, either by suitable cages or metal guards where such hazards are present, or by locating them above or out of contact with materials or equipment which may cause damage.

4. *Number, location, and spacing of detectors.* This information can be obtained from the approval listing for detectors or NFPA standards. It can also be obtained from fire protection engineers or consultants or manufacturers of equipment who have access to approval listings and design methods.

§ 1910.165 Employee alarm systems.

1. *Scope and application.* This section is intended to apply to employee alarm systems used for all types of employee emergencies except those which occur so quickly and at such a rapid rate (e.g., explosions) that any action by the employee is extremely limited following detection.

In small workplaces with 10 or less employees the alarm system can be by direct voice communication (shouting) where any one individual can quickly alert all other employees. Radio may be used to transmit alarms from remote workplaces where telephone service is not available, provided that radio messages will be monitored by emergency services, such as fire, police or others, to insure alarms are transmitted and received.

2. *Alarm signal alternatives.* In recognition of physically impaired individuals, OSHA is accepting various methods of giving alarm signals. For example, visual, tactile or audible alarm signals are acceptable methods for giving alarms to employees. Flashing lights or vibrating devices can be used in areas where the employer has hired employees with hearing or vision impairments. Vibrating devices, air fans, or other tactile devices can be used where visually and hearing impaired employees work. Employers are cautioned that certain frequencies of flashing lights have been claimed to initiate epileptic seizures in some employees and that this fact should be considered when selecting an alarm device. Two way radio communications would be most appropriate for transmitting emergency alarms in such workplaces which may be remote or where telephones may not be available.

3. *Reporting alarms.* Employee alarms may require different means of reporting, depending on the workplace involved. For example, in small workplaces, a simple shout throughout the workplace may be sufficient to warn employees of a fire or other emergency. In larger workplaces, more sophisticated equipment is necessary so that entire plants or high-rise buildings are not evacuated for one small emergency. In remote areas, such as pumping plants, radio communication with a central base station may be necessary. The goal of this standard is to assure that all employees who need to know that an emergency exists can be notified of the emergency. The method of transmitting the alarm should reflect the situation found at the workplace.

Personal radio transmitters, worn by an individual, can be used where the individual may be working such as in a remote location. Such personal radio transmitters shall send a distinct signal and should clearly indicate who is having an emergency, the location, and the nature of the emergency. All radio transmitters need a feedback system to assure that the emergency alarm is sent to the people who can provide assistance.

For multi-story buildings or single story buildings with interior walls for subdivisions, the more traditional alarm systems are recommended for these types of workplaces. Supervised telephone or manual fire alarm or pull box stations with paging systems to transmit messages throughout the building is the recommended alarm system. The alarm box stations should be available within a travel distance of 200 feet. Water flow detection on a sprinkler system, fire detection systems (guard's supervisory station) or tour signal (watchman's service), or other related systems may be part of the overall system. The paging system may be used for nonemergency operations provided the emergency messages and uses will have precedence over all other uses of the system.

4. ***Supervision.*** The requirements for supervising the employee alarm system circuitry and power supply may be accomplished in a variety of ways. Typically, electrically operated sensors for air pressure, fluid pressure, steam pressure, or electrical continuity of circuitry may be used to continuously monitor the system to assure it is operational and to identify trouble in the system and give a warning signal.

[45 FR 60715, Sept. 12, 1980; 46 FR 24557, May 1, 1981]

Appendix B to Subpart L of Part 1910—National Consensus Standards

The following table contains a cross-reference listing of those current national consensus standards which contains information and guidelines that would be considered acceptable in complying with requirements in the specific sections of subpart L.

Subpart L section	National consensus standard
1910.156	ANSI/NFPA No. 1972; Structural Fire Fighter's Helmets.
	ANSI Z88.5 American National Standard, Practice for Respirator Protection for the Fire Service.
	ANSI/NFPA No. 1971, Protective Clothing for Structural Fire Fighters.
	NFPA No. 1041, Fire Service Instructor Professional Qualifications.
1910.157	ANSI/NFPA No. 10, Portable Fire Extinguishers.
1910.158	ANSI/NFPA No. 18, Wetting Agents.
	ANSI/NFPA No. 20, Centrifugal Fire Pumps.
	NFPA No. 21, Steam Fire Pumps.
	ANSI/NFPA No. 22, Water Tanks.
	NFPA No. 24, Outside Protection.

NFPA standards are available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

ANSI Standards are available from the American National Standards Institute, 1430 Broadway, New York, NY 10018.