NFPA 122
Standard for Fire Prevention and Control in Underground Metal and Nonmetal Mines

1995 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 122

Standard for

Fire Prevention and Control in Underground Metal and Nonmetal Mines

1995 Edition

This edition of NFPA 122, *Standard for Fire Prevention and Control in Underground Metal and Nonmetal Mines*, was prepared by the Technical Committee on Mining Facilities and acted on by the National Fire Protection Association, Inc., at its Fall Meeting held November 14–16, 1994, in Toronto, Ontario, Canada. It was issued by the Standards Council on January 13, 1995, with an effective date of February 7, 1995, and supersedes all previous editions.

The 1995 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 122

In 1978 the Technical Committee on Mining Facilities through its membership and current Mine Safety and Health Administration regulations identified the need for guidance in storage and handling of flammable and combustible liquids in underground nonmetal mines. The first edition of NFPA 122 was approved in 1986 as a result and was titled NFPA 122, *Storage of Flammable and Combustible Liquids Within Underground Metal and Nonmetal Mines (Other than Coal)*. The second edition was issued in 1990 and included a variety of minor editorial changes to provide consistency with the other NFPA Mining Facilities documents.

This latest edition is a complete revision that focuses the document on the overall fire protection of metal and nonmetal mines, as indicated by the document's new title: NFPA 122, *Standard for Fire Prevention and Control in Underground Metal and Nonmetal Mines*. Furthermore, this latest edition incorporates the requirements that were previously included in NFPA 124, *Standard for Fire Protection of Diesel Fuel and Diesel Equipment in Underground Mines*, which was withdrawn. Further changes include editorial corrections and revisions that provide consistency with other NFPA mining-related standards.

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

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

Committee Scope: This Committee shall have primary responsibility for documents on safeguarding life and property against fire, explosion, and related hazards associated with underground and surface coal and metal and nonmetal mining facilities and equipment.

Contents

NFPA 122

Standard for

Fire Prevention and Control in Underground Metal and Nonmetal Mines

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

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

Chapter 1 Introduction

1-1 Scope.

1-1.1 This standard covers minimum requirements for reducing loss of life and property from fire in underground metal and nonmetal mines. This standard applies only to:

(a) Diesel-powered equipment; and

(b) Storage and handling of flammable and combustible liquids.

1-1.2 This standard does not apply to the following:

(a) Diesel fuel that has been modified with additives that reduce the flash point to less than 100°F (37.8°C);

(b) Modified or unmodified diesel fuel used at altitudes where the flash point drops to less than 100°F (37.8°C);

(c) Explosion hazards;

(d) Storage of flammable and combustible liquids produced in underground mines, such as shale oil mines; or

(e) Flammable and combustible liquids in use, other than those used in diesel-powered equipment.

1-2 Purpose. This standard is intended for use by those charged with mine fire prevention and fire protection or with responsibility for purchasing, designing, installing, testing, inspecting, approving, listing, operating, or maintaining the following:

(a) Facilities and equipment for the storage and handling of flammable and combustible liquids within underground metal and nonmetal mines; and

(b) Diesel-powered equipment in underground metal and nonmetal mines.

1-3 General.

1-3.1 Because of the uniqueness of underground metal and nonmetal mines, provisions in this standard might differ from commonly accepted fire protection standards and guides devised for other types of occupancies.

1-3.2 Only those skilled in fire protection are competent to design and supervise the installation of mine fire protection systems. It might be necessary for those responsible for the storage of flammable and combustible liquids and the use of diesel-powered equipment within underground metal and nonmetal mines to consult an experienced fire protection specialist.

1-3.3 No provisions of this standard are intended to prevent the use of systems, methods, and devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety to those prescribed by this standard. Technical justification or demonstration of equivalency shall be provided to the authority having jurisdiction.

1-3.4 The provisions of this document are considered necessary to provide a reasonable level of protection from loss of life and property from fire and explosions. They reflect situations and the state of the art at the time the standard was issued.

1-3.5 Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document, except in those cases where it is determined by the authority having jurisdiction that the existing situation involves an imminent hazard to life or adjacent property.

1-4 Definitions.

Approved. Acceptable to the authority having jurisdiction.

NOTE: The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations that is in a position to determine compliance with appropriate standards for the current production of listed items.

Atmospheric Tank. A storage tank that has been designed to operate at pressures that range from atmospheric through 0.5 psig (a gauge pressure of 3.5).

Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

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

Boiling Point. The boiling point of liquid at a pressure of 14.7 psia (760 mm). Where an accurate boiling point is unavailable for the material in question, or for mixtures that do not have a constant boiling point, for the purposes of this standard, the 10 percent point of a distillation performed in accordance with ASTM D86, *Standard Method of Test for Distillation of Petroleum Products*, shall be permitted to be used as the boiling point of the liquid.

Closed Container. A container sealed by means of a lid or other device so that neither liquid nor vapor can escape from it at ambient temperatures.

Combustible. Capable of undergoing combustion.

Combustible Liquid. A liquid having a flash point at or above 100°F (37.8°C).

Combustible liquids shall be subdivided as follows:

Class II liquids shall include those having flash points at or above 100°F (37.8°C) and below 140°F (60°C).

Class IIIA liquids shall include those having flash points at or above 140°F (60°C) and below 200°F (93.4°C).

Class IIIB liquids shall include those having flash points at or above 200°F (93.4°C).

Combustible Liquid Storage Area — Large. An area used for storage of Class II and Class III combustible liquids where the aggregate quantity present is greater than 1,000 gal (3.,785 L). Handling of liquids incidental to transfer can take place within a storage area.

Combustible Liquid Storage Area — Small. An area used for storage of Class II and Class III combustible liquids where the aggregate quantity present is from 60 gal to 1,000 gal (227 L to 3,785 L). Handling of liquids incidental to transfer can take place within a storage area.

Container. Any vessel of 60 gal (227 L) capacity or less.

Diesel-Powered Equipment. Any device powered by a diesel engine.

Fire Detector. An automatic device designed to detect the presence of fire and initiate action.

Fire Risk Assessment. The evaluation of the relative danger of the start and spread of fire; generation of smoke, gases, or toxic fumes; and the possibility of explosion or other occurrence endangering the lives and safety of personnel or causing significant damage to property.

Fixed Diesel Fuel Storage Area. A designated location used to facilitate fuel dispensing for the storage of diesel fuel in containers, tanks, or both, exceeding an aggregate quantity of 660 gal (2498 L), from which tanks or containers are not moved or transported within the mine.

Fixed Fire-Suppression System. A total flooding or local application system consisting of a fixed supply of extinguishing agent permanently connected for fixed agent distribution to fixed nozzles that are arranged to discharge an extinguishing agent into an enclosure (total flooding), directly onto a hazard (local application), or a combination of both; or an automatic sprinkler system.

Flammable Liquid. A liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 psia (276 kPa) at 100°F (37.8°C) and classified as Class I liquid.

Class I liquids shall be subdivided as follows:

Class IA shall include those having flash points below 73°F (22.8°C) and a boiling point below 100°F (37.8°C).

Class IB shall include those having flash points below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C).

Class IC shall include those having flash points at or above 73°F (22.8°C) and below 100°F (37.8°C).

Flammable Liquid Storage Area — Large. An area used for storage of Class I liquids where the aggregate quantity present is greater than 10 gal (37.8 L).

Flammable Liquid Storage Area — Small. An area used for storage of Class I liquids where the aggregate quantity present is 10 gal (37.8 L) or less.

Flash Point of a Liquid. The minimum temperature at which a liquid emits vapor in sufficient concentration to form an ignitible mixture with air near the surface of the liquid, with the container as specified by appropriate test procedure and apparatus as follows:

The flash point of a liquid having a viscosity less than 45 SUS at 100°F (37.8°C) or a flash point of 200°F (93.4°C) or higher shall be determined in accordance with ASTM D56, *Standard Method of Test for Flash Point by the Tag Closed Cup Tester.*

The flash point of a liquid having a viscosity of 45 SUS or more at 100°F (37.8°C) or a flash point of 200°F (93.4°C) or higher shall be determined in accordance with ASTM D93, *Standard Method of Test for Flash Point by the Pensky-Martens Closed Tester.*

As an alternative, ASTM D3243, *Standard Method of Tests for Flash Point of Aviation Turbine Fuels by Setaflash Closed Tester*, shall be permitted to be used for testing aviation turbine fuels within the scope of this procedure.

As an alternative, ASTM D3278, *Standard Method of Tests for Flash Point of Liquids by Setaflash Closed Tester*, shall be permitted to be used for paints, enamels, lacquers, varnishes, and related products and their components having flash points between 32°F to 230°F (0°C to 110°C), and having a viscosity lower than 150 stokes at 77°F (25°C).

Hand Hose Line System. A hose and nozzle assembly connected by fixed piping or connected directly to a supply of extinguishing agent.

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

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

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

Low Pressure Tank. A storage tank designed to withstand an internal pressure above 0.5 psig (3.5 kPa) but not more than 15 psig (102.4 kPa).

Metal and Nonmetal. Minerals other than coal.

Mine Operator. The highest-ranking person responsible for conduct of work at a mine.

Mobile Equipment. Wheeled, skid-mounted, track-mounted, or rail-mounted equipment capable of moving or being moved.

Noncombustible. Material that, in the form in which it is used under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials reported as noncombustible when tested in accordance with ASTM E 136, *Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C*, shall be considered noncombustible materials.

Pipeline System. An arrangement of piping, valves, connections, and allied equipment installed in a mine for the purpose of transporting, transferring, or dispensing flammable or combustible liquids.

Portable Extinguisher. An extinguisher of the hand-held or wheeled type that is capable of being carried or moved about; or a transportable system consisting of a hose reel or rack, hose, and discharge nozzle assembly connected to a supply of suppressant.

Portable Tank. Any closed vessel having a liquid capacity in excess of 60 gal (227 L), but less than 1,000 gal (3,785 L) and not intended for fixed installation.

Pressure Vessel. Any fired or unfired vessel within the scope of the applicable section of the ASME *Boiler and Pressure Vessel Code.*

Safety Can. An approved container, of not more than 5 gal (18.9 L) capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

Self-Closing Door. A door that, when opened and released, returns to the closed position.

Self-Igniting Ore. See Self-Igniting Rock.

Self-Igniting Rock. Rock containing minerals prone to self-heating and ignition due to chemical oxidation and spontaneous combustion, if such minerals are present in sufficient amounts and occur in a form known to present a spontaneous combustion hazard.

Shall. Indicates a mandatory requirement.

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

Suitable. That which is appropriate and has the qualities or qualifications to meet a given purpose, occasion, condition, function, or circumstance.

Tank. A closed vessel having a liquid capacity in excess of 60 U.S. gal (227 L).

Chapter 2 General

2-1 Housekeeping.

2-1.1 Maintenance and operating practices shall minimize leakage and prevent the accidental escape of flammable or combustible liquids. Spillage shall not be allowed to accumulate in quantities that could create a fire hazard and shall be cleaned up promptly.

2-1.2 Where flammable or combustible liquids are used or handled, means shall be provided to dispose of leakage or spills safely.

2-1.3 Combustible material shall not be allowed to accumulate in quantities sufficient to create a fire hazard within a flammable or combustible liquids storage area.

2-1.4 Access routes shall be kept clear of obstruction to allow ready access and use of fire protection equipment.

2-1.5 Air volume and velocity shall be sufficient to dilute, render harmless, and carry away flammable or explosive concentrations of vapors.

2-2 Cutting and Welding.

2-2.1 Cutting and welding in the vicinity of diesel fuel shall be performed only by personnel who have been instructed in precautions and procedures for safety.

2-2.2 Cutting and welding equipment shall be maintained in good operating condition with all necessary safeguards in place and functioning.

2-2.3 Prior to cutting or welding, combustibles in proximity to the area shall be relocated or protected with a fire retardant cover or fire retardant barrier, or other precautions shall be taken to prevent ignition of combustibles.

2-2.4 Portable fire extinguishers, either a single unit having a nominal capacity of 20 lb (9.1 kg) with a minimum rating of 10-A:60-B:C, or two units, each having a nominal capacity of 10 lb (4.5 kg) with a minimum rating of 4-A:40-B:C, shall be available immediately at the cutting or welding site.

2-2.5 Cutting or welding on equipment or within enclosed areas of the equipment shall not be performed in the presence of atmospheres containing flammable mixtures of gases, vapors or liquids, or combustible mixtures of dust in suspension.

2-2.6 Tests for methane gas (CH_4) shall be made before cutting or welding in any area where methane gas is likely to be present. Cutting or welding shall not be allowed to begin or continue unless the concentration is less than 1 percent by volume.

2-2.7 Cutting or welding shall not be performed on or within containers or tanks that have stored combustible or flammable materials until such containers or tanks have been purged and cleaned thoroughly or have been inerted.

NOTE: For additional information, see NFPA 327, *Standard Procedures for Cleaning or Safeguarding Small Tanks and Containers Without Entry*, and AWS F4.1, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers that Have Held Hazardous Substances.*

2-2.8 Cutting or welding shall not be performed within 50 ft (15.2 m), measured horizontally, of explosives, blasting agents, or mine fuel storage areas, unless separated by a suitable noncombustible barrier.

2-2.9 Where a fire watch is required, it shall be maintained for a minimum of 30 minutes after completion of cutting or welding operations to detect and extinguish smoldering combustibles.

2-2.9.1 Fire watchers shall have fire extinguishing equipment readily available and shall be trained in its use.

2-2.9.2 Fire watchers shall be familiar with the facilities and the procedures for sounding an alarm in the event of a fire.

2-3 Flammable Vapors. Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include, but are not limited to:

(a) Open flames;

(b) Smoking;

(c) Cutting and welding;

(d) Hot surfaces;

(e) Frictional heat;

(f) Static, electrical, and mechanical sparks;

(g) Spontaneous ignition, including heat-producing chemical reactions; and

(h) Radiant heat.

2-4 Proximity of Surface Storage to Underground Openings.

2-4.1 Surface flammable or combustible liquid storage areas shall be located a sufficient distance from any mine opening to prevent contamination of mine intake-air, but in no case shall they be closer than 100 ft (30.5 m). The intended location for installation of surface flammable or combustible liquid storage areas shall bed etermined by a fire risk assessment. This assessment shall include:

(a) The potential for the generation of smoke, gases, or toxic fumes that could contaminate the mine intake air;

(b) The topography and relative elevation of storage tanks and mine openings;

(c) Air currents;

(d) Vegetation; and

(e) The ability to control a fire in storage areas.

Exception: Combustible liquid storage areas shall be permitted to be located closer than 100 ft (30.5 m) to boreholes drilled specifically for the transfer of combustible liquids to the underground mine.

2-4.2 Fixed, unburied flammable or combustible liquid storage tanks shall be provided with containment or drainage in accordance with NFPA 30, *Flammable and Combustible Liquids Code*. Drainage from flammable or combustible liquid storage areas shall be designed and maintained to prevent liquid flow toward any mine opening.

Chapter 3 Transfer of Flammable or Combustible Liquids

3-1 Surface to Underground Transfer.

3-1.1 Flammable or combustible liquid shall be permitted to be transferred into the mine by pipeline, portable tank, closed container, or safety can.

3-1.2 Persons shall not be transported on conveyances with flammable or combustible liquids unless the items are secured or small and can be carried safely by hand.

3-1.3 Where flammable or combustible liquid is transferred into the mine, it shall be transferred directly to a storage area or a location where it will be used.

3-1.4* Pipeline systems used for flammable or combustible liquid transfer shall be permitted to be either wet or dry pipe installations.

3-1.4.1 Piping, valves, and fittings used for flammable or combustible liquid transfer shall be suitable for the expected working pressures and structural stresses. Piping, valve, and fitting burst strengths shall be at least four times the static pressure. The mechanical and thermal stresses of the pipeline caused by exposure to fire shall be considered in the selection of components and the design of the pipeline system.

3-1.4.2 A manual shutoff valve shall be installed in the pipeline at the surface storage tank and at the point of underground discharge. An additional shutoff valve shall be installed in each branch line where the branch line joins the main line.

3-1.4.3 The pipeline system shall be guarded so as to be protected against physical damage. Guarding by location shall be considered an acceptable practice.

3-1.4.4 Flammable or combustible liquid pipeline transfer systems shall be maintained in good working order.

3-1.4.5 A fire risk assessment shall be conducted for the location(s) intended for installation of flammable or combustible liquid pipeline systems.

3-2 Underground Transfer.

3-2.1 Persons shall not be transported on conveyances with flammable or combustible liquids unless the items are secured or small and can be carried safely by hand.

3-2.2 Flammable or combustible liquid containers or tanks loaded on rail or trackless vehicles shall be secured against shifting and damage during transit.

3-2.3 Flammable or combustible liquid containers or tanks shall be at least 12 in. (305 mm) below energized trolley wires or protected from contacting the wire by insulation while being transported by trolley wire-powered systems.

3-2.4 Vehicles transporting flammable or combustible liquids shall be kept clear of accumulations of oil, grease, and other combustible material.

3-2.5 Vehicles transporting flammable or combustible liquids shall not be stored under an energized trolley wire.

3-2.6 The quantity of flammable or combustible liquids in containers or tanks off-loaded from transport vehicles and stored in an operating area shall not exceed a three-day supply for equipment normally operating in that area.

Exception: A single tank or container with a capacity exceeding a three-day supply shall be permitted.

Chapter 4 Flammable Liquid Storage

4-1 General.

4-1.1 Wherever possible, the underground storage of flammable liquids shall be avoided, as such liquids are inherently hazardous.

4-1.2 Electrical equipment in large flammable liquid storage areas shall be Class I, Division 1, as specified in NFPA 70, *National Electrical Code®*, or shall be classified as "permissible" electrical equipment.

NOTE: Electrical equipment classified as "permissible" is certified as meeting the requirements of *Code of Federal Regulations*, Title 30, Chapter 1, Part 18.

4-1.3 Flammable liquids in storage shall be kept in closed containers. (*See Section 4-5.*)

4-1.4 Flammable liquids shall be permitted to be used only where there are no open flames or other sources of ignition within the possible path of vapor travel in flammable concentrations.

4-1.5 Flammable liquid containers shall be returned to a flammable liquid storage area after use.

4-1.6 Flammable liquids with flash points below 0°F (–18°C), such as gasoline, shall not be permitted.

Exception: Low flash point Class IA flammable liquids in aerosol cans shall be permitted.

4-2 Flammable Liquid Containers.

4-2.1 Safety cans or containers for flammable liquids authorized by the U.S. Department of Transportation shall be acceptable as storage containers.

4-2.2 Containers for flammable liquids shall conform to the capacity limitations specified in Table 4-2.2.

Table 4-2.2 Maximum Allowable Size of Containers for Flammable Liquids

Container Type	Class IA (gal)	Class IB (gal)	Class IC (gal)
Original metal containers (other than DOT containers) or approved plastic containers	1	5	5
Safety cans	2	5	5
Containers, other than safety cans,complying with 4-2.1	Not allowed	60	60

For SI units: 1 gal = 3.785 L.

4-2.3 All flammable liquid containers shall be labeled clearly with the word "flammable."

4-2.4 Flammable liquid containers shall be stored in a stable manner.

4-3 Small Flammable Liquid Storage Areas.

4-3.1 Small flammable liquid storage areas shall be separated from other small flammable or combustible liquid storage areas by at least 50 ft (14.2 m) or from large flammable liquid storage areas by a distance of at least 100 ft (30.5 m), or they shall be separated by unexcavated rock or masonry bulkheads.

4-3.2 Storage of flammable liquids in small flammable liquid storage areas shall be in cabinets specifically designed and constructed for such purpose.

4-4 Large Flammable Liquid Storage Areas.

4-4.1 The total aggregate quantity of flammable liquids to be stored in any one storage area shall not exceed 165 gal (624 L).

4-4.2 Large flammable liquid storage areas shall be separated from other flammable or combustible liquid storage areas by at least 100 ft (30.5 m) or separated by an unexcavated rock or masonry bulkhead and shall be located a minimum of 100 ft (30.5 m) from any shaft station or explosives magazine or electrical substation and transformers. Electrical equipment within 50 ft (15.2 m) from the storage area shall be Class I, Division 1, as specified in NFPA 70, *National Electrical Code*, or shall be classified as "permissible" electrical equipment.

NOTE: Electrical equipment classified as "permissible" is certified as meeting the requirements of *Code of Federal Regulations*, Title 30, Chapter 1, Part 18.

4-4.2.1 Large flammable liquid storage areas shall be located a minimum of 100 ft (30.5 m) from any working face and out of the line of sight of blasting, or they shall be located a minimum of 500 ft (152.4 m) within the line of sight of any working face.

4-4.2.2 Large flammable liquid storage areas shall not be constructed in an area bounded at any point by self-igniting rock.

4-4.3 Large flammable liquid storage areas shall be enclosed and of noncombustible construction. Combustible rock shall be covered with noncombustible material, such as gunite, shotcrete, or preformed masonry units.

4-4.3.1 The enclosure shall be tightly sealed and have a minimum 2-hr fire resistance rating.

4-4.3.2 Each opening into a large flammable liquid storage area shall be limited to a maximum area of 100 ft^2 (9.2 m^2).

4-4.3.3 Openings shall be equipped with self-closing fire doors with a minimum $1^1/_2$-hr fire resistance rating.

4-4.3.4 The entire storage area below the sill shall be capable of containing the total amount of flammable liquids stored, or means shall be provided to remove the spilled flammable liquid safely.

4-4.3.5 Large flammable liquid storage areas shall have exhaust directed to an exhaust ventilating system with air movement that has a velocity sufficient to maintain flammable vapors at less than 25 percent of the lower explosive limit.

4-4.4 Noncombustible storage cabinets meeting the requirements specified in NFPA 30, *Flammable and Combustible Liquids Code*, Section 4-3, shall be considered as complying with the construction requirements for large flammable liquid storage areas.

4-5 Dispensing Flammable Liquids.

4-5.1 Flammable liquids shall be drawn from or transferred into containers within a storage area using only the following methods:

(a) From safety cans;

(b) From a container by means of a device drawn through an opening in the top of the container; or

(c) By gravity through a listed or approved self-closing valve or self-closing faucet.

4-5.2 Transfer of flammable liquids by means of pressurizing a container with air shall be prohibited. Transfer of flammable liquids by pressure of inert gas shall be permitted only if controls, including pressure-relief devices, are provided to limit the pressure so it cannot exceed the design pressure of the container.

4-5.3 Where electrically powered pumps are used to transfer flammable liquids, a clearly identified and accessible switch or circuit breaker shall be provided at a location remote from dispensing devices, including remote pumping systems, to shut off the power to all dispensing devices in the event of an emergency.

4-5.4 Where flammable liquids are dispensed from containers, the containers shall be provided with approved vents, bonding, and flame arresters.

4-5.5 At least one portable fire extinguisher having a nominal capacity of 20 lb (9.1 kg) with a minimum rating of 10-A:60-B:C shall be located not more than 40 ft (12.2 m) from any area where flammable liquid is dispensed.

Chapter 5 Combustible Liquid Storage

5-1 General.

5-1.1 This chapter shall apply to the storage and handling of combustible liquids in containers, portable tanks, and tanks intended for fixed installations. Combustible liquids in use are not covered in this chapter.

5-1.2 Combustible liquids in approved tanks or containers meeting the requirements of 5-1.2(a) and (b) shall not require any special consideration and shall be permitted to be exempt from the requirements for storage areas if the containers or tanks are located at least 50 ft (15.2 m) from a working face, explosives magazines, electrical substations, shafts, other exempt containers or tanks, or any storage area, and if they are located out of the line of sight of blasting and out of the way of vehicular traffic:

(a) Class II combustible liquids stored in containers meeting the requirements of this chapter and not exceeding an aggregate of 60 gal (227 L) in any single location; or

(b) Class III combustible liquids stored in containers or approved tanks as specified in this chapter and not exceeding an aggregate of 660 gal (2498 L) in any single location.

5-1.3 Ventilation shall be provided to prevent the accumulation of ignitible vapors.

5-2 Combustible Liquid Containers and Tanks.

5-2.1 Shipping containers and portable tanks of combustible liquids authorized by the U.S. Department of Transportation or conforming to the requirements of NFPA 386, *Standard for Portable Shipping Tanks for Flammable and Combustible Liquids*, shall be acceptable as storage containers.

5-2.1.1 Shipping containers larger than 5 gal (18.9 L) shall be provided with vacuum and pressure relief.

5-2.1.2 Containers and portable tanks for combustible liquids shall conform to the capacity limitations defined in Section 1-4.

5-2.2 Combustible liquid storage tanks intended for fixed installation and engineered portable tanks shall be of materials compatible with the liquid stored and shall be designed and built in accordance with good engineering practices.

5-2.3 Atmospheric Tanks.

5-2.3.1 Atmospheric tanks shall be built in accordance with good engineering practices.

NOTE 1: Information on the design and construction of atmospheric tanks can be found in API 650, *Standard for Welded Steel Tanks for Oil Storage;* UL 80, *Standard for Steel Inside Tanks for Oil Burner Fuel;* or UL 142, *Standard for Steel Above-Ground Tanks for Flammable and Combustible Liquids.*

NOTE 2: Low-pressure tanks and pressure vessels can be permitted to be used as atmospheric tanks.

5-2.3.2 Atmospheric tanks shall not be used for storage of a combustible liquid at a temperature above its boiling point.

5-2.4 Low-Pressure Tanks.

5-2.4.1 The operating pressure of the tanks shall not exceed the design working pressure.

5-2.4.2 Low-pressure tanks shall be built in accordance with good engineering practices.

NOTE: Information on the design and construction of atmospheric tanks can be found in API 620, *Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks,* or *Code for Unfired Pressure Vessels,* Section VIII, Division I, of the ASME *Boiler and Pressure Vessel Code.*

5-2.5 Pressure Vessels.

5-2.5.1 The operating pressure of the vessel shall not exceed the design working pressure.

5-2.5.2 Pressure vessels shall be built in accordance with good engineering practices.

NOTE: Information on the design and construction of pressure vessels can be found in the *Code for Unfired Pressure Vessels,* Section VIII, Division I, of the *ASME Boiler and Pressure Vessel Code.*

5-2.6 Venting Atmospheric and Low-Pressure Combustible Liquid Storage Tanks.

5-2.6.1 Storage tanks shall be vented to prevent the development of a vacuum or pressure sufficient to distort the shell or roof of the tank as a result of filling or emptying and atmospheric temperature changes. Protection also shall be provided to prevent overpressure from any filling source exceeding the design pressure of the tank.

5-2.6.2 Vents shall be at least as large as the filling or withdrawing lines but not less than $1^1/_4$ in. (21.8 mm) nominal inside diameter. If more than one fill or withdraw line can be used simultaneously, the vent capacity shall be based on the maximum anticipated simultaneous flow.

NOTE: Information on venting can be found in API 2000, *Standard for Venting Atmospheric and Low-Pressure Storage Tanks.*

5-2.6.3 Vent pipes shall be constructed to drain toward the tank without sags or traps to collect liquid.

5-2.7 Additional Considerations.

5-2.7.1 Connections for all tank openings shall be liquid tight.

5-2.7.2 Each connection to a tank through which liquid normally can flow shall be provided with an internal or external valve located as close as practicable to the shell of the tank.

5-2.7.3 Tanks containing combustible liquids shall be provided with a means for quick cutoff of flow in the event of fire in the vicinity of the tank.

5-2.7.4 Openings for manual gauging, if independent of the fill pipe, shall be kept closed when not gauging. Each such opening for any liquid shall be protected against liquid overflow and possible vapor release by means of a spring-loaded check valve or other appropriate device. Substitutes for manual gauging are acceptable.

5-3 Small Combustible Liquid Storage Areas.

5-3.1 Small combustible liquid storage areas shall be located a minimum of 100 ft (30.5 m) from explosives magazines, electrical substations, working faces, or other combustible liquid storage areas or shall be separated by unexcavated rock or masonry bulkheads. The storage area, unless equipped with an approved fire protection system, shall be located a minimum of 100 ft (30.5 m) from any shaft station.

5-3.2 A small combustible liquid storage area shall be recessed or otherwise located and protected from accidental damage by mobile equipment or blasting.

5-3.3 Small combustible liquid storage areas shall not be constructed in an area bounded at any point by self-igniting ore.

5-3.4 Where small combustible liquid storage areas are constructed of combustible materials or are located where there is rock capable of self-propagating combustion, the material or rock shall be covered with noncombustible material such as gunite, shotcrete, or preformed masonry units.

5-3.5 Where tanks are used, a safe means shall be provided to confine within or remove from the small combustible liquid storage area the contents of the largest tank in the event of a tank rupture.

5-4 Large Combustible Liquid Storage Areas.

5-4.1 The total quantity of combustible liquids in storage tanks intended for fixed installation shall not be restricted.

5-4.2 In areas not protected by automatic fire suppression systems, the total quantity of combustible liquids in containers and portable tanks shall be restricted in accordance with Table 5-4.2(a), but in no case shall the aggregate quantity exceed 50,000 gal (189 250 L) in any single storage area. The use of racks shall not be permitted in unprotected areas.

5-4.3 Where combustible liquid storage areas are protected by automatic fire suppression systems, the total quantity of combustible liquids in containers and portable tanks shall not be restricted. Within a combustible liquid storage area, the quantity stored in a single pile shall be in accordance with Table 5-4.2(b). Where racks are used, the heights and quantities per rack shall be in accordance with Table 5-4.2(c).

5-4.4 For mixed storage of Class II and Class III liquids in a single pile or rack, the maximum quantity and maximum height in that pile or rack shall be as specified for Class II liquids [*see Tables 5-4.2(b) and 5-4.2(c)*], as applicable.

5-4.5 Individual piles [*see Tables 5-4.2(a) and5-4.2(b)*] shall be arranged so that piles are separated from each other by at least 4 ft (1.22 m).

5-4.6 Single-row or double-row rack storage [*see Table 5-4.2(c)*] shall be separated by minimum 8-ft (2.45-m) aisles from other rows of rack storage or other pile storage.

Table 5-4.2(a) Unprotected Storage of Combustible Liquids in Containers and Portable Tanks

	Container Storage			Portable Tank Storage		
Class	Maximum Pile Height (ft)	Maximum Quantity per Pile (gal)	Maximum Total Quantity (gal)	Maximum Pile Height (ft)	Maximum Quantity per Pile (gal)	Maximum Total Quantity (gal)
II	7	2,000	4,000	10	3,000	6,000
IIIA	7	7,000	14,000	10	11,000	22,000
IIIB	7	7,000	28,000	10	11,000	44,000

For SI units: 1 ft = 0.3045 m; 1 gal = 3.785 L.

Table 5-4.2(b) Storage Arrangements for Protected Palletized or Solid Pile Storage of Combustible Liquids in Containers and Portable Tanks

	Maximum Storage Height (ft)		Maximum Quantity per Pile (gal)	
Class	Containers	Portable Tanks	Containers	Portable Tanks
II	7	10	7,500	20,000
III	10	15	10,000	20,000

For SI units: 1 ft = 0.3045 m; 1 gal = 3.785 L.

Table 5-4.2(c) Storage Arrangements for Protected Rack Storage of Combustible Liquids in Containers

Class	Type Rack	Maximum Storage Height (ft)	Maximum Quantity per Rack (gal)
II	Double row or single row	15	9,000
III	Multirow, double row, or single row	20	24,000

For SI units: 1 ft = 0.3045 m; 1 gal = 3.785 L.

5-4.7 Empty or idle combustible pallet storage within the combustible liquid storage area shall be limited to a maximum pile size of 250 ft^2 (23.2 m^2) and a maximum storage height of 7 ft (2.13 m). Idle pallet storage shall be separated from combustible liquids by at least 4 ft (1.22 m).

5-4.8 Large combustible liquid storage areas shall be located a minimum of 100 ft (30.5 m) from explosives magazines or electrical substations.

5-4.9 Large combustible liquid storage areas shall be located a minimum of 100 ft (30.5 m) from any shaft station, unless equipped with an approved fire protection system.

5-4.10 Large combustible liquid storage areas shall be located a minimum of 100 ft (30.5 m) from any working face and out of the line of sight of blasting, or they shall be located a minimum of 500 ft (152 m) within the line of sight of any working face to avoid damage from fly rock.

5-4.11 Large combustible liquid storage areas shall be separated from other flammable or combustible liquid storage areas by a distance of at least 100 ft (30.5 m), or they shall be separated by unexcavated rock or masonry bulkheads. The masonry bulkhead shall have a minimum thickness of 4 in. (102 mm) of block or 2 in. (51 mm) of reinforced gunite.

5-4.12 Large combustible liquid storage areas that are enclosed shall be built of noncombustible materials. Combustible rock within all large combustible liquid storage areas shall be covered with noncombustible material such as gunite, shotcrete, or preformed masonry. No storage areas shall be constructed in a location bounded at any point by self-igniting ore.

5-4.13 If enclosed, each opening into a large combustible liquid storage area shall be equipped with a self-closing metal door.

5-4.14 Bulkheads, if used, shall be sealed tightly and shall be built or covered with noncombustible materials.

5-4.15 Tanks shall rest on the ground or on foundations made of concrete, masonry, piling, or steel. Tank foundations shall be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation.

NOTE: Information on tank foundations can be found in API 620, *Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks*, Appendix B, and API 650, *Standard for Welded Steel Tanks for Oil Storage*, Appendix E.

5-4.16 The entire large combustible liquid storage area below the door sill shall be capable of containing the total amount of combustible liquid, or means shall be provided to remove the combustible liquid safely.

5-4.17 All piping, valves, and fittings shall be suitable for the expected working pressures and structural stresses.

5-4.18 Large combustible liquid storage areas shall have exhaust directed to an exhaust ventilating system.

Exception: This requirement shall not apply to buried tanks or areas equipped with automatic fire protection systems.

5-5* Dispensing Combustible Liquids.

5-5.1 Dispensing combustible liquid from containers or tanks shall be permitted to be accomplished by transfer pump or gravity flow. Means shall be provided to control the flow and prevent leakage and accidental discharge. Manual dispensing valves, if used, shall be of the self-closing type.

5-5.2 Combustible liquids shall be permitted to be dispensed through the application of positive pressure to containers or tanks only if they are certified as pressure vessels.

5-5.3 Where electrically powered pumps are used to dispense combustible liquids, a clearly identified and accessible switch or circuit breaker shall be provided at a location away from dispensing devices, including remote pumping systems, to shut off the power to all dispensing devices in the event of an emergency.

5-5.4 Dispensing nozzles shall be of the self-closing type without a latch-open device.

5-5.5 Combustible liquids shall not be dispensed within 50 ft (15.2 m) of cutting or welding operations.

5-5.6 At least one portable fire extinguisher having a nominal capacity of 20 lb (9.1 kg) with a minimum rating of 10-A:60-B:C shall be located not more than 40 ft (12.2 m) from any area where combustible liquid is dispensed.

5-5.7 Spillage shall be cleaned up promptly.

Chapter 6 Fire Suppression for Flammable or Combustible Liquid Storage Areas

6-1 Portable Fire Extinguishers.

6-1.1 At least one hand portable fire extinguisher having a nominal capacity of 20 lb (9.1 kg) with a minimum rating of 10-A:60-B:C shall be located outside of, but not more than 10 ft (3.0 m) from, the opening into each storage area. The installation of manual or automatic fire suppression systems shall not exempt the requirements for a portable fire extinguisher.

6-1.2 Where portable fire extinguishers are provided within storage areas, travel distance to a portable extinguisher shall not exceed 40 ft (12.2 m).

6-2 Hand Hose Line Systems.

6-2.1 Hand hose line systems, if used, shall be installed in accordance with NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, and shall be a minimum of either $1^1/_2$-in. (38-mm) lined or 1-in. (25-mm) hard rubber.

6-2.2 Hand hose lines designated for fire fighting and accessible to storage areas shall be equipped to discharge a foam-water solution and shall be in accordance with NFPA 11, *Standard for Low-Expansion Foam.*

6-3 Fire Suppression Systems.

6-3.1* Where provided, automatic sprinkler systems installed for the protection of flammable liquid or diesel fuel storage areas shall be of the foam-water type.

NOTE: See NFPA 16A, *Standard for the Installation of Closed-Head Foam-Water Sprinkler Systems.*

6-3.2 Where provided, automatic sprinkler systems used for the protection of other combustible liquid storage areas shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

6-3.3 Where the fire suppression requirements of this standard are met by means other than an automatic sprinkler system but an automatic sprinkler system is installed to supplement such means, the water supply provisions for automatic sprinkler systems of NFPA 13, *Standard for the Installation of Sprinkler Systems*, shall not be required.

6-3.4 Fire suppression systems other than automatic foam-water sprinkler systems installed for protection of storage areas shall be in accordance with NFPA 11, *Standard for Low-Expansion Foam;* NFPA 11A, *Standard for Medium- and High-Expansion Foam Systems;* NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems;* NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems;* NFPA 16, *Standard on the Installation of Deluge Foam-Water Sprinkler and Foam-Water Spray Systems;* NFPA 17, *Standard for Dry Chemical Extinguishing Systems;* and NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems.*

6-3.5 Fire suppression systems installed under the requirements of this standard shall be maintained in accordance with the manufacturer's instructions or designer's recommendations.

6-3.6 All persons who inspect, test, operate, or maintain fire suppression systems shall be trained thoroughly. Annual refresher training shall be provided.

6-4 Inspection, Maintenance, and Training.

6-4.1 Portable extinguishers shall be maintained in accordance with NFPA 10, *Standard for Portable Fire Extinguishers.*

6-4.2 Any fire suppression system installed to satisfy the requirements of this standard shall be properly maintained in accordance with the applicable standards for the system.

6-4.3 All persons who might be expected to inspect, test, operate, or maintain fire suppression systems shall be trained thoroughly in the functions they are expected to perform and shall receive periodic refresher instructions.

Chapter 7 Fire Protection for Diesel-Powered Equipment

7-1* General. For purposes of this standard, fire protection is defined in the broad sense to include fire prevention, fire detection, and fire suppression. Section 7-2 addresses these three components within the context of a fire risk assessment.

7-2* Fire Risk Assessment.

7-2.1 A fire risk assessment shall be performed for all diesel-powered underground mining equipment by the mine operator or the mine operator's designee. This analysis shall include evaluation of the risk potential for the start and spread of a fire and the generation of smoke, gases, or toxic fumes that could endanger the lives and safety of personnel or cause unacceptable damage to property.

7-2.2 A separate fire risk assessment for each piece of underground mining equipment is required only where variations in design, use, condition, and environment could change the fire potential.

7-2.3 If the assessment identifies unacceptable risks, further assessment shall include an evaluation of each of the following:

(a) Methods for minimizing or eliminating existing hazardous fire conditions;

(b) Use of detection and early fire-warning devices;

(c) Normal and emergency means of egress from the equipment and evacuation to a safe location;

(d) Compartmentalization of the equipment or isolation of areas to prevent or contain the spread of fire;

(e) Availability of fire-fighting personnel and existing fire suppression equipment;

(f) Spread of equipment fire to combustible materials in proximity;

(g) Ventilation control structures to contain or redirect products of combustion to the return; and

(h) Any other devices or procedures necessary to protect life and property.

7-3 Fire Risk Reduction. Fire risk-reduction practices for diesel-powered underground mining equipment shall follow the principles of minimizing ignition sources and reducing exposures of combustible materials to ignition sources. The following sections delineate risk-reduction practices.

7-4 Equipment Modification.

7-4.1 All diesel-powered underground mining equipment shall be analyzed to determine whether fire risks can be reduced through equipment modification. Some examples include physical barriers between fuel and ignition sources, thermal shields over hot surfaces, hydraulic hose and electrical wiring harness rerouting, and power shutoffs.

NOTE: Modifications might affect the life expectancy and certification of diesel-powered equipment and diesel-powered equipment components. Such a modified machine might not be covered by the manufacturer's warranty or certification. Questions concerning the effect of a proposed modification should be discussed with the diesel-powered equipment manufacturer or the manufacturer's representative.

7-4.2 Modifications affecting the fire risk of diesel-powered underground mining equipment shall be analyzed to determine whether such modifications decrease or increase fire risks.

7-5 Equipment Inspection and Maintenance. Hydraulic fluid, coolant, lubrication and fuel lines, electrical wiring, mechanical components, and fire prevention devices shall be inspected and maintained in proper condition in accordance with the manufacturer's recommendations.

7-6 Portable Fire Extinguishers on Diesel-Powered Equipment.

7-6.1 All self-propelled, diesel-powered underground equipment shall be equipped with at least one portable multipurpose (ABC) dry chemical extinguisher having a nominal capacity of 5 lb (2.3 kg) of extinguishing agent and a minimum rating of 2-A:10-B:C. The risk assessment shall determine whether larger or additional extinguishers are needed.

7-6.2 Portable extinguishers shall be maintained in a fully charged and operable condition and kept in their designated locations at all times when not in use.

7-6.3 Extinguishers shall be conspicuously located for easy access and immediate use in the event of fire.

Exception: In areas where obstruction to visual observation cannot be avoided completely, visible markings shall be provided on the equipment to indicate the extinguisher's location.

7-6.4 Extinguishers on diesel-powered equipment shall be protected against physical damage.

7-6.5 The installation of an automatic or manually operated fire suppression system shall not exempt the portable fire extinguisher requirement.

7-6.6 Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, *Standard for Portable Fire Extinguishers*, and as follows:

(a) The visual inspection shall occur at least monthly;

(b) The visual inspection shall ensure that the extinguisher is in its designated location, the tamper seals are intact, the extinguisher gauge is in the operable range (if the extinguisher is a stored-pressure type), and that there is no obvious physical damage or condition that can prevent proper operation. Extinguishers evidencing any such irregularity shall be repaired or shall be removed from service and replaced;

NOTE: For additional stored-pressure extinguisher maintenance requirements, see NFPA 10, *Standard for Portable Fire Extinguishers.*

(c) Extinguishers shall be subjected to a maintenance examination at least once every 12 months;

(d) Maintenance procedures shall include a thorough examination of the extinguishers, including mechanical parts, extinguishing agent, and expellant. Any irregularities shall be corrected by competent personnel;

(e) All extinguishers shall be recharged after use in accordance with the manufacturer's recommendations; and

(f) A record shall be maintained indicating the date and initials of the person performing the maintenance services. The same record tag or label shall indicate if recharging also was performed.

7-6.7 Portable extinguishers shall be hydrostatically tested at intervals as required by NFPA 10, *Standard for Portable Fire Extinguishers.*

7-7 Fire Detection on Diesel-Powered Equipment.

7-7.1 Fire detectors shall be permitted to be used to initiate audible or visual warning, automatic actuation of a fire suppression system, equipment shutdown, or any combination thereof.

7-7.2 Fire detectors shall be listed for their application.

7-7.3 Compartment sizes and contours, airflow patterns, obstructions, and other characteristics of the protected area shall determine the location, type, sensitivity, and, where applicable, the number of detectors.

7-7.4 All fire detection systems and associated equipment shall be tested after installation in accordance with the manufacturer's or designer's instruction manual. Testing shall not require the discharge of any associated fire suppression system.

7-7.5 The detection system shall be inspected visually by competent personnel in accordance with an approved schedule necessitated by conditions as determined by the mine operator.

7-7.6 At least every 12 months, all fire detection systems, including alarms, shutdowns, and other associated equipment, shall be examined and checked thoroughly for proper operation by competent personnel in accordance with the manufacturer's or designer's instruction manual. Deficiencies shall be corrected, and the system shall be retested for proper operation.

7-8 Fixed Suppression Systems on Diesel-Powered Equipment.

7-8.1 The risk assessment shall determine whether diesel-powered equipment requires a fixed fire suppression system.

7-8.2 Diesel-powered equipment requiring a fixed fire suppression system shall be protected by a system of sufficient capacity to suppress the largest anticipated fires in the protected areas and shall:

(a) Be listed or approved for the purpose;

(b) Be suitably located or guarded to be protected against physical damage;

(c) Be either automatically or manually actuated. Automatically actuated systems also shall have a manual actuator capable of being activated from the operator's compartment or other accessible location;

NOTE: Depending upon the size of the equipment, additional manual actuators might be needed to provide quick access for activation of the system.

(d) Provide agent distribution hose or pipe secured and protected against damage, including abrasion and corrosion; and

(e) Be provided with discharge nozzle blow-off caps or other suitable devices or materials to prevent the entrance of moisture, dirt, or other material into the piping. The discharge nozzle protective device shall blow off, blow out, or open upon agent discharge.

Exception: The requirements of 7-8.2 (c) and (e) shall not apply to automatic water-based sprinkler systems.

7-8.3 All fire suppression systems shall be tested after installation in accordance with the manufacturer's or designer's instruction manual. Testing shall not require the discharge of suppressant unless there is no other satisfactory manner in which the reliability and integrity of the system can be verified.

7-8.4 During the period between regular maintenance examinations or tests, the fire suppression system shall be inspected visually by competent personnel according to a schedule determined by the mine operator.

7-8.5 At least every 12 months, all fire suppression systems, including alarms, shutdowns, and other associated equipment, shall be examined and checked thoroughly for proper operation by competent personnel in accordance with the manufacturer's or designer's instruction manual. Deficiencies shall be corrected, and the system or affected portion of the system shall be retested for proper operation.

7-8.6 The mine operator or the mine operator's designee shall be provided with a copy of the manufacturer's installation and maintenance manual or owner's manual that describes system operation, required maintenance, and recharging.

7-9 Training.

7-9.1 All diesel-powered equipment operators, supervisors, and maintenance personnel shall be trained in the proper use of fire suppression devices provided on the equipment they operate, supervise, or maintain. Annual refresher training shall be provided.

7-9.2 All persons who inspect, test, and maintain a fire suppression system shall be trained to perform their intended tasks. Annual refresher training shall be provided.

Chapter 8 Referenced Publications

8-1 The following documents of portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

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

NFPA 10, *Standard for Portable Fire Extinguishers*, 1994 edition.

NFPA 11, *Standard for Low-Expansion Foam*, 1994 edition.

NFPA 11A, *Standard for Medium- and High-Expansion Foam Systems*, 1994 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 1993 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 1992 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1994 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 1993 edition.

NFPA 16, *Standard on the Installation of Deluge Foam-Water Sprinkler and Foam-Water Spray Systems*, 1995 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 1994 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 1993 edition.

NFPA 70, *National Electrical Code*, 1993 edition.

NFPA 386, *Standard for Portable Shipping Tanks for Flammable and Combustible Liquids*, 1990 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 1994 edition.

8-1.2 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D56, *Standard Method of Test for Flash Point by the Tag Closed Cup Tester*, 1993 edition.

ASTM D86, *Standard Method of Test for Distillation of Petroleum Products*, 1993 edition.

ASTM D93, *Standard Method of Test for Flash Point by the Pensky-Martens Closed Tester*, 1990 edition.

ASTM D3243, *Standard Method of Tests for Flash Point of Aviation Turbine Fuels by Setaflash Closed Tester*, 1977 edition.

ASTM D3278, *Standard Method of Tests for Flash Point of Liquids by Setaflash Closed Tester*, 1989 edition.

ASTM E136, *Standard Method of Test for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C*, 1993 edition.

Appendix A Explanatory Material

This Appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

A-3-1.4 Where pressurized pipeline systems are used for combustible liquid transfer, consideration should be given to providing a pressure-sensing interlock downstream of the transfer pump discharge. This interlock should be suitable for Class I, Division 2 locations and should be arranged to shut down the pump immediately upon loss of line pressure.

A-5-5 No requirements for bonding or grounding to dissipate static electricity are included in this standard for combustible liquids, based upon the fact that NFPA 30, *Flammable and Combustible Liquids Code*, does not require bonding or grounding for combustible liquids handled at temperatures below their flash points.

However, it is recognized that certain conditions can exist that might necessitate bonding or grounding, such as temperature and altitude, which can reduce the flash point of diesel fuel.

For additional information on static electricity see NFPA 77, *Recommended Practice on Static Electricity*.

A-6-3.1 Automatic Foam-Water Sprinkler Systems.

Underground shaft mines that use diesel-powered equipment generally employ underground diesel fuel storage areas to facilitate equipment refueling. Adit-type mines in the western United States might initially locate diesel fuel storage and refueling facilities on the surface; however, as the active mine workings progress further from the adit portal(s), these facilities usually are moved underground.

A common means of fire protection currently found in many underground diesel fuel storage areas is a fixed water sprinkler system. The federal Mine Safety and Health Administration (MSHA) currently approves such systems for this application. The consensus of the committee is that this situation represents a significant safety hazard. According to the NFPA *Fire Protection Handbook*, water sprinklers can be used on diesel fuel for control but not for extinguishment.

"The Health and Safety Implications of the Use of Diesel-Powered Equipment in Underground Mines," a report by an interagency task group prepared for MSHA in 1985, concludes that "water spray or fog usually will not extinguish diesel fuel fires."

In an underground mine, fire control is not sufficient; fire extinguishment is essential for the following reasons:

(a) As long as a fire burns, even if it does not grow in intensity or area and appears to be responsive to fire control, toxic smoke and fire gases are produced that can endanger persons in the mine.

(b) According to the NFPA *Fire Protection Handbook*, overpressure failure of containers when exposed to fire is considered the principal hazard of closed-container flammable and combustible liquid storage.

(c) Even a "controlled" fire can cause container failure, producing a fire so intense that the sprinkler system is unable to control it, much less extinguish it.

(d) Water sprays are not effective in extinguishing pressure fires, running fuel fires, and obstructed spill fires, all of which can occur in a diesel refueling area.

(e) Water supplies are limited in many underground mines. Fire control, therefore, should be considered temporary, because the fire will grow immediately to maximum intensity when the water supply is depleted.

(f) The vapor pressure of diesel fuel increases with elevation due to reduced barometric pressure. As a result, even fuels without flash point-reducing additives can become flammable, depending on the altitude at which they are used. This reduction in flash point could result in reclassification of the diesel fuel to a Class 1C flammable liquid. There is no clear consensus in the literature and industry practice as to the effectiveness of fixed water sprays in controlling and extinguishing fires involving Class 1C flammable liquids. Although industry practice strongly favors fixed water sprays for such applications, the literature and available research results clearly indicate the ineffectiveness of fixed sprays on Class 1C liquids, especially on pressure fires, running fuel fires, and obstructed spill fires.

Therefore, it is the opinion of the committee that water sprinkler systems installed for the protection of diesel fuel storage areas are inadequate; foam-water systems should be utilized.

A-7-1 The diesel engine was developed in the 1890s by Rudolf Diesel and has proven itself a reliable workhorse of industry. Today, diesel equipment is used safely and productively in all types of underground mines worldwide. Many years of experience in the use of diesel equipment have demonstrated that the technology exists to reduce fire hazards associated with diesel equipment to acceptable levels.

Diesel fuel is a combustible liquid. As with any combustible liquid, it can safely be transferred, transported, stored, and used if its physical, chemical, and hazardous properties are fully understood and the necessary precautions and safeguards are observed.

The risk of starting a fire associated with diesel equipment and the control methods used to reduce this risk are essentially the same for both underground and surface operations. The confining environment found in underground mines, however, can compound the consequences of a fire and might necessitate separate evaluations to determine the degree of safeguards needed.

In addition to the recognized differences between surface and underground mines, there are also differences in their physical environments, such as those created by product combustibility within underground mines.

Such differences might require individual evaluations to determine the appropriate fire prevention and fire protection safeguards.

A-7-2 Fire Risk Assessment. Fire risk assessment for underground mining operations consists of four phases:

(a) Identification of the fire potential;

(b) Assessment of the consequences of fire;

(c) Determination of the need for fire protection; and

(d) Selection of appropriate fire protection option(s).

The following fire risk assessment outline is a suggested procedure for the identification of elements in phases A-7-2(a) through (d):

Additional guidance in performing risk assessment is provided in several of the publications referenced in Appendix B.

I. Identify the Fire Potential.

A. Ignition Sources.

1. *High Temperatures.* High temperatures usually are found in the vicinity of an engine, exhaust system, turbochargers, and malfunctioning devices such as bearings, brakes, and gears.

2. *Electrical.* Batteries, generators, instrument panels, motors, pumps, switches, transformers, and wiring.

3. *Cutting and Welding.*

4. *Other.* Smoking materials and spontaneous ignition sources are examples of other sources.

B. Fuel Sources.

1. *Class A.* Class A sources include combustible debris, wood, rags, electrical insulation, combustible minerals, upholstery, hoselines, and tires.

2. *Class B.* Class B sources include flammable and combustible liquids such as diesel fuel, starting fluids, some hydraulic fluids, coolants, grease, oil, and cleaning solvents.

C. Probability of the Coexistence of Fuel and Ignition Sources.

1. *Proximity of Fuel to Ignition Sources.* An analysis of equipment design can indicate areas where lubrication, hydraulic oil, or fuel lines are in proximity to ignition sources. In identifying fire risk areas, note that a combustible liquid can spray or drip onto a hot surface that is remote from the rupture or leak point. Sparks from a battery or an electrical short can ignite combustibles in another area of the machine.

Typical areas where a potential fire risk can exist include the engine compartment, exhaust system, transmission area, vehicle articulation points, parking brakes, engine pan area, and battery compartments.

Thermal shields, spray shields, water-cooled exhaust compartments, hydraulic fuel and electrical line routing, and electrical harnesses can affect the potential for fire.

2. *Fire Incident Experience.* Previous fire experience on similar machines can indicate that special risks exist.

3. *Quality of Maintenance.* The quality and frequency of equipment maintenance can affect the number and severity of equipment fires. A maintenance program should consider the manufacturer's recommended guidelines, the quality of replacement parts, the competence and training of maintenance personnel, the frequency of preventive maintenance, and operating conditions.

4. *Housekeeping.* Accumulations of combustible materials such as oil-soaked waste, fuel spillage, excess lubricant, and combustible minerals represent potential fire risks.

5. *Operational Damage.* Physical impact from external material at a chute or face, which can roll or slide onto equipment, can cause leaks in fuel or hydraulic lines as well as damage to electrical components and wiring.

II. Assess the Consequences of Fire.

A. Personnel Exposure. Determine whether personnel can be exposed to the effects of a fire. These effects could include:

1. Direct exposure of the operator or nearby personnel to heat, smoke, and toxic fire gases from the burning equipment.

2. Exposure of personnel located away from the equipment fire site to products of combustion by the mine ventilation.

3. Equipment fire spread to other combustibles such as timber supports, combustible minerals, explosives, and lubricants. Such fires can grow in intensity, producing increased quantities of toxic combustion products, complicating firefighting efforts, and interfering with evacuation and rescue operations.

4. The possibility of the equipment fire or secondary fires causing ventilation disturbances such as throttling or reversals, contaminating escapeways in an unpredictable manner.

B. Economic Risks. Determine the economic loss resulting from a fire on a piece of equipment, including both property damage and business interruption costs, and consider the following factors:

1. Fire involving a single piece of equipment could cause property damage and loss of production until the fire is extinguished and the equipment is repaired or replaced.

2. Fire spread to nearby combustible material, including combustible mineral seams, can have greater economic effects than the initial fire.

III. Determine the Need for Fire Protection. If the risk analysis discloses unacceptable personnel risks, economic risks, or both, appropriate fire protection options should be determined.

IV. Select Appropriate Fire Protection Option(s).

A. Hazard Reduction.

1. *Equipment Design.* Evaluate equipment to determine if the risk from the start or the spread of a fire can be reduced.

2. *Operating Procedures.* Mine operators, through implementation of company policies and procedures, can reduce the threat of fire. Examples include effec- tive equipment maintenance programs, adequate housekeeping procedures, proper employee training, development of emergency plans, and strategies that deal directly with fire.

3. *Evaluation.* Determine whether fire-risk reduction practices reduce risks to acceptable levels. If risks are acceptable, no further action is necessary. If unacceptable risks still exist, action is needed either to reduce risks further or to install fire detection/suppression equipment, or a combination of both.

B. Fire Detection and Suppression Equipment. Identify available fire detection and suppression equipment alternatives.

1. *Portable Protection.* Options include portable hand extinguishers, hose reels and lines, wheeled extinguishers, and skid-mounted extinguishers.

For difficult fires, larger capacity extinguishers that provide more agent, greater range, and longer discharge time are recommended. See Section IV C for agent selection.

2. *Detection.* Fire detection devices can be used to provide early warning of fires, actuate a fire suppression system, shut down equipment, and operate other fire control systems such as ventilation devices and fire doors.

For a discussion of detector and control options, selection, and placement, see Section IV C.

3. *Fixed Fire Suppression Systems.*

a. Fixed system protection can be accomplished by local application, total flooding, a combination of both, or automatic sprinklers. See Paragraph IV C 1 for agent selection. See Paragraph IV C 2(b) for fixed fire suppression options.

b. Compare capability with need. Identified needs should be matched with the most cost-effective approach to fire detection, fire suppression, or both.

c. Select equipment. The selection of all equipment used for all detection and suppression of fires in mining equipment should be based on consideration of the environment in which the equipment functions.

d. Evaluate fixed fire suppression systems. Determine whether fire risk reduction complies with mandatory requirements and reduces risks to acceptable levels. If risks are within acceptable levels, no further action is necessary. If not, additional action is needed either to reduce fire risks or to install fire detection/suppression equipment, or a combination of both.

C. Fire Protection Agents and Equipment.

1. *Fire Suppression Agents.* The following extinguishing agents commonly are used in the mining industry:

a. Class A:

(i) Dry chemicals (ABC) with ammonium phosphate as the basic ingredient;

(ii) Foams such as protein, fluoroprotein, aqueous film-forming, medium- and high-expansion;

(iii) Water;

(iv) Water-based antifreeze solution.

b. Class B:

(i) Dry chemicals (BC) with sodium bicarbonate, ammonium phosphate, potassium bicarbonate, urea-based potassium bicarbonate, or potassium chloride as the basic composition;

(ii) Foams such as protein, fluoroprotein, aqueous film-forming, medium- and high-expansion;

(iii) Carbon dioxide;

(iv) Halons (halon substitutes);

(v) Water spray or fog;

(vi) Water-based antifreeze solution.