

NFPA®

122

Standard for
Fire Prevention and Control
in Metal/Nonmetal Mining and
Metal Mineral Processing Facilities

2020



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NFPA® 122

Standard for

Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities

2020 Edition

This edition of NFPA 122, *Standard for Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities*, was prepared by the Technical Committee on Mining Facilities. It was issued by the Standards Council on November 4, 2019, with an effective date of November 24, 2019, and supersedes all previous editions.

This edition of NFPA 122 was approved as an American National Standard on November 24, 2019.

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.

The 1995 edition was a complete revision that focused 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 edition incorporated 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in NFPA 124, *Standard for Fire Protection of Diesel Fuel and Diesel Equipment in Underground Mines*, which was withdrawn.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 included editorial corrections and revisions that provided consistency with other NFPA mining-related standards.

The 2000 edition of the standard was reconfirmed by the technical committee. There were no technical changes made. The fire risk assessment material in Appendix A was editorially moved to Appendix B.

In 2004, the Technical Committee reorganized the mining standards and combined NFPA 121, *Standard on Fire Protection for Self-Propelled and Mobile Surface Mining Equipment*, with NFPA 122. The committee also added a new Chapter 13, Fire Protection of Surface Metal Mineral Processing Plants. The committee incorporated the concept of conducting a fire risk assessment throughout the standard.

For the 2010 edition, the technical committee assigned a task group the responsibility of revising NFPA 122 to update the existing fire protection requirements that were included in portions of existing Sections 4.3 and 7.4 to improve operator safety and the reliability of the required suppression systems. Similarly, Chapter 12, Fire Prevention and Fire Protection of Surface Mining Equipment, was completely revised to make it consistent with fire protection industry practices and the updated provisions in NFPA 120, *Standard for Fire Prevention and Control in Coal Mines*.

Concurrently, another task group was assigned the responsibility of revising NFPA 122 to include fire protection requirements for hydro-metallurgical solvent extraction (SX) plants. This resulted in two new sections being added into Chapter 13, Section 13.18 for new and existing hydro-metallurgical SX plants and Section 13.19 for new hydro-metallurgical SX plants. Sections 13.18 and 13.19 include a fire risk assessment of the facility and requirements for fixed fire suppression systems. To support these new sections on hydro-metallurgical SX plants, additional references and definitions were added to Chapters 2 and 3, respectively.

The Metal/Nonmetal Mining Task Group for the 2010 edition consisted of the following members: Larry Moore, Chair, FM Global; Steve Behrens, Swiss Re; Dennis Brohmer, Tyco Fire Suppression & Building Products; J. J. Kenny, Marsh; L. Harvey Kirk, MSHA; Mario Orozco, Zurich; Pierre Tousignant, QIT Quebec; and Mark Yarbro, Freeport MacMoran Mining.

The 2014 edition of NFPA included various technical and editorial updates. The committee established a common definition and a protection scheme for *self-propelled*, *mobile equipment* and *portable equipment*.

In the 2020 edition, the technical committee added new fire safety material to Chapter 13 related to the use of combustible concentrators in gravimetric ore concentrator facilities. Direction has been provided to the stakeholder regarding best practices for fire suppression and steps to be taken during welding and cutting operations within the vicinity of combustible concentrators. In addition, associated Annex A material has been added for further guidance on fire suppression and welding and cutting operations near combustible concentrators.

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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.

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

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1* Scope.

1.1.1 This standard covers minimum requirements for safeguarding life and property against fire and related hazards associated with metal and nonmetal underground and surface mining and metal mineral processing plants.

1.1.2 As applies to underground mining, this standard shall cover only the following:

- (1) Diesel-powered equipment
- (2) Storage and handling of flammable and combustible liquids

1.1.3 As applies to underground mining, this standard shall not cover flammable and combustible liquids produced in underground mines, such as shale oil mines.

1.1.4 As applies to surface mining, this standard shall cover only the following:

- (1) Mobile equipment in use without its own motive power train and normally moved by self-propelled equipment
- (2) Self-propelled equipment that contains a motive power train as an integral part of the unit and is not rail-mounted

1.1.5 This standard shall not cover buildings or employee housing and support facilities for a mining operation, or preparation or use of explosives.

1.1.6* As applies to metal mineral processing, this standard shall cover fire and related hazards associated with metal mineral processing plants — whether underground or on the surface — including but not limited to conveying, crushing, fine milling, beneficiation, flotation, hydro-metallurgical solvent extraction, drying, filtering, ore and concentrate storage, and support facilities for the mineral processing activity.

1.1.7* As applies to surface metal mineral processing plants, this standard shall not cover the following:

- (1) Solvent extraction plants
- (2) Pressure-leaching processes
- (3) Alumina refineries
- (4) Nonmetal mineral processing plants
- (5) Metal smelters including roasting, sintering, and calcining
- (6) Metal refineries such as electrowinning or electrorefining processes
- (7) Gas, liquid, or solid waste handling or storage systems

1.1.8 Nothing in this standard is intended to prohibit the use of new methods or devices, provided sufficient technical data are submitted to the authority having jurisdiction to demonstrate that the new method or device is equivalent in quality, effectiveness, durability, and safety to that specified by this standard.

1.2 Purpose. This standard shall be intended for use by those charged with fire prevention and fire protection or with responsibility for purchasing, designing, installing, testing, inspecting, approving, listing, operating, or maintaining the following:

- (1) Facilities and equipment for the storage and handling of flammable and combustible liquids within underground metal and nonmetal mines
- (2) Diesel-powered equipment in underground metal and nonmetal mines, mobile and self-propelled surface mining equipment in metal and nonmetal mines, and metal mineral processing plants

1.3 Application. Only those skilled in fire protection shall be permitted to design and supervise the installation of fire protection systems.

1.4 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2016 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2018 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2019 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2017 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2019 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2017 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2019 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2020 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.

NFPA 51, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 2018 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2019 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2020 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2020 edition.

NFPA 70®, *National Electrical Code*®, 2020 edition.

NFPA 72®, *National Fire Alarm and Signaling Code*®, 2019 edition.

NFPA 85, *Boiler and Combustion Systems Hazards Code*, 2019 edition.

NFPA 101®, *Life Safety Code*®, 2018 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2019 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2020 edition.

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, 2017 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2018 edition.

NFPA 2010, *Standard for Fixed Aerosol Fire-Extinguishing Systems*, 2020 edition.

2.3 Other Publications.

▲ **2.3.1 ASME Publications.** American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

Boiler and Pressure Vessel Code, 2017.

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

ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*, 2015a.

● **2.3.3 NETA Publications.** InterNational Electrical Testing Association, 3050 Old Centre Avenue, Suite 101, Portage, MI 49024.

ANSI/NETA MTS, *Standard for Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*, 2015.

2.3.4 Other Publications.

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

▲ 2.4 References for Extracts in Mandatory Sections.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2019 edition.

NFPA 52, *Vehicular Gaseous Fuel Systems Code*, 2019 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2019 edition.

NFPA 120, *Standard for Fire Prevention and Control in Coal Mines*, 2020 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

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

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

3.2.5 Shall. Indicates a mandatory requirement.

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

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Boiling Point. The temperature at which the vapor pressure of a liquid equals the surrounding atmospheric pressure. [30, 2018]

▲ **3.3.2 Closed Container.** A container as herein defined, so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures. [30, 2018]

3.3.3 Combustible. Capable of undergoing combustion.

3.3.4 Combustible Liquid Storage Area.

3.3.4.1 Combustible Liquid Storage Area — Fixed. An area used for storage of Class II and Class III combustible liquids that is infrequently moved, and where the aggregate quantity present shall not exceed 18,925 L (5000 gal). Handling of liquids incidental to transfer can take place within a storage area. [120, 2020]

3.3.4.2 Small Combustible Liquid Storage Area — Portable. An area used for storage of Class II and Class III combustible liquids that is periodically moved, and where the aggregate quantity present does not exceed 3785 L (1000 gal). Handling of liquids incidental to transfer can take place within a storage area. [120, 2020]

3.3.5 Combustion. A chemical process of oxidation that occurs at a rate fast enough to produce heat and usually light in the form of either a glow or flame. [5000, 2018]

3.3.6 Container. Any vessel of 450 L (119 gal) or less capacity used for transporting or storing liquids. [30, 2018]

3.3.7 Cutoff Room. A room within a building and having at least one exterior wall.

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

3.3.9* Emergency Egress.

3.3.10 Equipment Operator. The authorized person who starts, controls, or stops mining equipment.

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

3.3.12 Fire Risk Assessment. The evaluation of the relative danger of the start and spread of fire; the 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.

3.3.13 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 2498 L (660 gal), from which tanks or containers are not moved or transported within the mine.

3.3.14 Fixed Fire-Suppression System. An engineered or pre-engineered 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.

3.3.14.1 Engineered Systems. Those systems requiring individual calculation and design to determine the flow rates, nozzle pressures, pipe size, area, volume protected by each nozzle, quantity of suppression agent, number and types of nozzles, and their placement in a specific system.

3.3.14.2 Pre-Engineered Systems. Those systems having predetermined flow rates, nozzle pressures, and quantities of extinguishing agent and having specific pipe size, maximum and minimum pipe lengths, flexible-hose specifications, number of fittings, and number and types of nozzles. [17, 2017]

3.3.15 Flammable Liquid Storage Area. Area used for storage of Class I liquids. [120, 2020]

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

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

3.3.16* Flash Point. The minimum temperature of a liquid at which sufficient vapor is given off to form an ignitable mixture with the air, near the surface of the liquid or within the vessel used, as determined by the appropriate test procedure and apparatus specified in Section 4.4 of NFPA 30. [30, 2018]

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

3.3.18 Hot Work. Work involving burning, welding, or a similar operation that is capable of initiating fires or explosions. [51B, 2019]

3.3.19 Inherent Safety. A protection layer that relies on the reduction or elimination of hazardous conditions, materials, or processes through changes in the chemistry, physics, and physical design of a process.

3.3.20 Liquid.

3.3.20.1 Combustible Liquid. Any liquid that has a closed-cup flash point at or above 37.8°C (100°F), as determined by the test procedures and apparatus set forth in Section 4.4 of NFPA 30. Combustible liquids are classified according to Section 4.3 of NFPA 30. [30, 2018]

△ **3.3.20.2 Flammable Liquid.** Any liquid that has a closed-cup flash point below 37.8°C (100°F), as determined by the test procedures and apparatus set forth in Section 4.4 of NFPA 30, and a Reid vapor pressure that does not exceed an absolute pressure of 276 kPa (40 psi) at 37.8°C (100°F), as determined by ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*. Flammable liquids are classified according to Section 4.3 of NFPA 30. [30, 2018]

3.3.21 Metal and Nonmetal. Minerals other than coal.

3.3.22 Metal Mineral. Belonging to the class of inorganic metal compounds occurring in the earth's crust that are transformed into pure metals by metallurgical refining, including gold, silver, lead, zinc, nickel, and copper.

3.3.23* Metal Mineral Processing Plant. A surface processing facility used to size, separate, and concentrate valuable metals from raw ore.

3.3.24 Mine Operator. Any owner, lessee, or other person who operates, controls, or supervises a mine.

3.3.25* Mineral. A naturally formed inorganic substance occurring in the earth's crust and having a consistent and distinct set of physical properties and a composition that can be expressed by a chemical formula.

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

3.3.27* Noncombustible Material. Material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

3.3.28 Nonmetal Mineral. Belonging to the class of inorganic structural and industrial minerals that do not become metals through metallurgical refining, such as potash, asbestos, sulfur, granite, and rock aggregates.

3.3.29 Ore. A mixture of valuable metal mineral and waste rock.

3.3.30 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.

3.3.31 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.

△ **3.3.32 Pressure Vessel.** A container or other component designed in accordance with the ASME *Boiler and Pressure Vessel Code*. [52, 2019]

3.3.33* Safe Area. An area where hot work such as cutting and welding, burning, or grinding is done routinely and frequently and has been identified, inspected, and designated as being safe for hot work operations.

△ **3.3.34 Safety Can.** A listed container of not more than 20 L (5.3 gal) capacity having a screen or strainer in each fill and pour opening and having a spring-closing lid and spout cover designed to safely relieve internal pressure when exposed to fire. [30, 2018]

3.3.35 Self-Closing Doors. Doors that, when opened and released, return to the closed position. [80, 2019]

3.3.36 Self-Igniting Ore. See 3.3.37, Self-Igniting Rock.

3.3.37* 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.

3.3.38 Self-Propelled Equipment. Any unit that contains a motive power train as an integral part of the unit.

3.3.39* Solvent Extraction (SX) Facility. Within this standard, a solvent extraction (SX) facility is a hydro-metallurgical processing facility associated with a mining or mineral refining facility that uses organic or alcohol-based solvents to extract desirable metals.

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

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

3.3.41.1 Atmospheric Tank. A storage tank that has been designed to operate at pressures from atmospheric through a gauge pressure of 6.9 kPa (1.0 psi) (i.e., 760 mm Hg through 812 mm Hg) measured at the top of the tank. [30, 2018]

3.3.41.2 Low Pressure Tank. A storage tank designed to withstand an internal gauge pressure above 3.5 kPa (0.5 psi) but not more than 103.4 kPa (15 psi).

3.3.41.3 Portable Tank. Any closed vessel having a liquid capacity over 230 L (60 gal) intended for storing liquids and not intended for fixed installation. [30, 2018]

Chapter 4 General

4.1 General. Provisions in Chapter 4 shall apply to all underground and surface metal and nonmetal mines and to surface metal mineral processing plants, subject to scope limitations.

4.2 Housekeeping.

4.2.1 Combustible materials shall not be allowed to accumulate in quantities that could create a fire hazard, as determined by a fire risk assessment.

4.2.2 Approved metal receptacles shall be provided where oil-soaked wastes or rubbish are not immediately removed to a safe place for disposal.

4.2.3 Maintenance operations shall include written procedures and practices to identify and prevent leakage and accidental escape of flammable or combustible liquids.

4.2.4 Spillage of flammable or combustible liquids shall be cleaned up.

4.2.5 Where flammable or combustible liquids are used or handled, means shall be provided to dispose of leakage or spills.

4.2.6 Access routes shall be kept clear of obstructions to allow access and use of fire protection equipment.

4.3 Ignition Source Control.

4.3.1 Smoking and open flames shall be prohibited in areas or locations where fire or explosion hazards exist.

4.3.2 Signs warning against smoking and open flames shall be posted conspicuously.

4.4 Hot Work.

4.4.1 Hot work shall be in accordance with NFPA 51B.

4.4.2 Compressed gases used for hot work shall be stored in accordance with Chapter 4 of NFPA 51.

4.4.3 A hot work permit system shall be developed for all areas of the mine and surface metal processing facilities where hot work is conducted outside of designated safe areas.

4.4.4 Hot work shall be performed only by personnel who have been trained in precautions and procedures for safety in these operations.

4.4.5 Before hot work is performed, prior approval shall be granted by the plant/mine superintendent or designated agent.

4.4.6 All hot work equipment shall be maintained to ensure it is in proper condition.

4.4.7 A flashback arrester shall be installed at the outlet of each pressure regulator on compressed flammable gas cylinders.

4.4.8 When not in use, the compressed gas cylinder valve shall be closed.

4.4.9 Appropriate personal protective equipment, including gloves, goggles, and welding hoods, shall be worn by personnel during hot work operations.

4.4.10 All combustibles shall be relocated at least 11 m (35 ft) in all directions from the work site.

4.4.11 Hot work shall not be performed within 15.24 m (50 ft) of explosives, blasting agents, or mine fuel storage areas, unless separated by a suitable noncombustible barrier.

4.4.12 Open gear cases or other exposed machinery components containing lubricants located within 4.6 m (15 ft) of hot work shall be covered in accordance with 4.4.13.

N 4.4.13 Where relocation of combustible materials per 4.4.10, 4.4.11, and 4.4.12 is impractical, the materials shall be protected

by a listed welding curtain, welding blanket, welding pad, or equivalent.

4.4.14 Noncombustible barriers shall be installed below hot work operations that are being performed in or over shafts, silos, or bins, and similar openings that are constructed of or contain combustible materials or flammable gases.

4.4.15 Openings or cracks in walls, partitions, floor decks, or ducts shall be covered tightly to prevent the passage of sparks to adjacent areas.

4.4.16 Where hot work is done on a metal wall, partition, ceiling, or roof, precautions shall be taken to prevent ignition of combustibles on the other side due to conduction or radiation.

4.4.17 Noncombustible barriers shall be installed below hot work operations that are being performed over empty open-topped tanks or process equipment that are lined with rubber, plastic, or other combustible linings.

4.4.18 As an alternative to providing barriers over open-topped lined equipment in 4.4.17, the equipment shall be filled with water or an ore-water slurry (pulp).

4.4.19 Rubber or plastic lined or constructed vessels, process equipment, or piping shall be clearly labeled using placards or stencils warning of hot work fire hazard.

4.4.20 The hot work permit system shall include explicit wording warning of rubber and plastic lined or constructed equipment hazards and special precautions to be taken.

4.4.21 Hot work shall not be performed in the presence of atmospheres containing flammable mixtures of gases, vapors, or liquids with air, or combustible mixtures of dust in suspension with air.

4.4.22* Hot work shall not be performed on or within containers that have contained combustible or flammable materials until such containers or tanks have been thoroughly purged and cleaned or inerted.

4.4.23 A charged water hose line or a multipurpose dry chemical portable extinguisher having a minimum nominal capacity of 9.1 kg (20 lb) shall be available at the work site before hot work is started.

4.4.24 Inspection for sparks, smoldering material, and fire shall be made during hot work operations.

4.4.25 Where hot work is performed near combustible materials that cannot be removed or protected, a trained fire watch person equipped with extinguishing devices shall be present to guard against fire during and after hot work operations.

4.4.26 Where a fire watch is required, a search of the area, including all levels or floors above and below, shall be made and the fire watch shall be maintained for a minimum of 1 hour after completion of hot work operations to detect and extinguish smoldering combustibles.

4.4.27 Fire watchers shall be familiar with alarm location and procedures for sounding an alarm in the event of a fire.

4.4.28 Tests for methane and other flammable gases shall be made before hot work in any area where flammable gas could be present.

4.4.29 Cutting or welding shall not be allowed to begin or continue unless the concentration of flammable gas is less than 25 percent of the lower explosive limit.

4.5 Maintenance.

4.5.1 The operator shall establish a maintenance program that ensures that equipment is in proper working order.

4.5.2 All ore handling and concentrating equipment and machinery shall be maintained in accordance with the manufacturers' recommendations.

4.6 Fire Protection Equipment Inspection, Maintenance, and Testing.

4.6.1 Portable extinguishers shall be inspected, tested, and maintained in accordance with NFPA 10.

4.6.2 Any fire suppression system shall be inspected, tested, and maintained in accordance with the manufacturer's listed installation and maintenance manual or owner's manual (inspection) and the applicable NFPA standard for the type of system.

4.6.2.1 A fire suppression system, approved for use on diesel-powered, mobile, and self-propelled equipment, shall be inspected on a monthly basis or more frequently as required by the manufacturer.

4.6.2.2 Inspections shall be in accordance with the fire suppression system manufacturer's listed installation and maintenance manual or owner's manual.

4.7 Training.

4.7.1 All site personnel shall receive annual instruction on the different classes of fires and types of fire-fighting equipment, fire prevention, and emergency procedures to be followed during a fire.

4.7.2 All site personnel shall receive annual training in the use or operation of fire suppression and detection devices in their work areas or on the equipment they operate, supervise, or maintain.

4.7.3 All site personnel who inspect, test, and maintain a fire suppression system shall be trained to perform their intended tasks.

4.7.4 All site personnel shall receive annual instruction on emergency evacuation procedures.

4.8 Flammable and Combustible Liquid Handling and Storage.

4.8.1 For surface operations, flammable and combustible liquid handling and storage shall be in compliance with NFPA 30.

4.8.2 For underground operations, flammable and combustible liquid handling and storage shall be in compliance with Chapters 9, 10, and 11 of this standard.

4.8.3 Flammable or combustible liquids shall not be stored or processed underneath cable trays or inside cable-spreading rooms or tunnels.

4.8.4 Ignition.

4.8.4.1 Precautions shall be taken to prevent the ignition of flammable and combustible liquid vapors.

4.8.4.2 Possible sources of ignition shall include, but are not limited to, the following:

- (1) Open flames
- (2) Smoking
- (3) Cutting and welding
- (4) Hot surfaces
- (5) Frictional heat
- (6) Static, electrical, and mechanical sparks
- (7) Spontaneous ignition, including heat-producing chemical reactions
- (8) Radiant heat

4.8.5 Where a fire risk assessment determines the need, ventilation air volume and velocity shall be designed to dilute and carry away flammable or explosive concentrations of vapors before they reach 25 percent of the lower explosive limit.

4.9 Vehicle Refueling.

4.9.1 Vehicles using liquid fuels shall be refueled from approved dispensing pumps and nozzles only at locations designated for that purpose or evaluated for risks in accordance with Chapter 5.

4.9.2 While fueling, vehicles, regardless of fuel type, shall be constantly attended.

4.9.3 Engines, except diesel engines, shall be shut off during refueling.

Chapter 5 Fire Risk Assessment and Risk Reduction

5.1* Fire Risk Assessment.

5.1.1 A documented fire risk assessment shall be performed for all diesel-powered underground mining equipment, all self-propelled and mobile surface mining equipment, storage and handling of flammable and combustible liquids, and surface metal mineral processing facilities.

5.1.2* Only those skilled in fire risk assessment techniques shall be permitted to conduct a fire risk assessment.

5.1.3 The fire risk assessment shall be kept on file at the mine site.

5.1.4* The fire risk assessment shall determine whether mobile or other equipment, fuel depots, and surface buildings and metal mineral processing facilities require a fixed fire suppression system.

5.1.5 The fire risk assessment shall determine whether an on-site fire-fighting organization is required, based on the distance to the nearest local public fire department and response time.

5.1.6 Where required by the authority having jurisdiction, fixed fire protection systems shall be provided.

5.1.7 The fire risk assessment 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 damage to property.

5.1.8 A separate fire risk assessment for each piece of mobile or self-propelled mining equipment — whether underground or on the surface — shall be required when variations in design, use, condition, and environment could change the fire potential.

5.1.9 If the fire risk assessment identifies unacceptable risks, further assessment shall include an evaluation of each of the following:

- (1) Methods for reducing or eliminating existing hazardous fire conditions
- (2) Use of detection and early fire-warning devices
- (3) Use of fixed fire suppression systems
- (4) Requirements for on-site fire water availability and capacity
- (5) Normal and emergency means of egress from equipment or workplaces and evacuation to a safe location, such location to be determined by the fire risk assessment
- (6) Compartmentalization of equipment, isolation of areas, or provision of barriers or enclosures to prevent or contain the spread of fire
- (7) Availability of fire-fighting personnel and fire suppression equipment
- (8) Spread of fire to combustible materials in proximity
- (9) Ventilation control structures to contain or redirect products of combustion (underground mines only)
- (10) Any other devices or procedures necessary to protect life and property

5.1.10 Modifications affecting the fire risk of mobile, self-propelled, or other mining equipment or buildings shall be analyzed to determine whether such modifications decrease or increase fire risks.

5.1.11 Working plans for fixed fire protection systems shall be submitted for approval to the authority having jurisdiction.

5.2 Risk Reduction.

5.2.1 Risk reduction practices shall follow the principles of minimizing ignition sources, reducing exposure of combustible materials to ignition sources, and control or suppression of fire spread.

5.2.2 For purposes of this standard, fire protection shall include fire prevention, fire detection, and fire suppression.

Chapter 6 Fire Detection and Suppression Equipment

6.1 Portable Fire Extinguishers.

6.1.1 General Requirements. All areas or process equipment in underground and surface mines and metal mineral processing plants where combustible materials are present, processed, or handled shall be provided with approved portable multipurpose fire extinguishers that comply with NFPA 10.

6.1.2 The number of such extinguishers, their type, size, and distribution shall be in accordance with NFPA 10, except that the extinguishers shall have a nominal capacity of 4.5 kg (10 lb) or greater of agent and a minimum rating of 4-A:10-B:C.

6.1.3 Extinguishers employing agents having a B:C rating shall be permitted to be used on electrical hazards.

6.1.4 At least one hand-portable fire extinguisher having a nominal capacity of 9.1 kg (20 lb) or greater and a minimum rating of 10-A:60-B:C shall be located outside of, but not more than 3 m (10 ft) from, the opening into each flammable and combustible liquid storage or dispensing area and maintenance shop.

6.1.5 Where portable fire extinguishers are provided within flammable and combustible liquid storage or dispensing areas and maintenance shops, travel distance to a portable extinguisher shall not exceed 9.1 m (30 ft).

6.2 Hand Hose Line Systems.

6.2.1 All areas or process equipment in underground and surface mines and metal mineral processing plants where combustible materials, liquids, or other fire hazards exist, as determined by the fire risk assessment, shall be provided with approved hand hose line systems.

6.2.2 Hand hose line systems shall be installed in accordance with NFPA 14 and shall be a minimum of either 38 mm (1½ in.) lined or 25 mm (1 in.) hard rubber.

6.2.3 When automatic sprinkler systems are supplied through the hand hose line standpipe system, hydraulic calculations shall be used to ensure that the piping and water supply will supply the hose and automatic sprinkler demands simultaneously.

6.2.4 Hose stations in conveyor galleries shall be provided with hoses that are of length equal to the distance between water supply connections.

6.3 Fire Detection.

6.3.1 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.

6.3.2 Fire detection systems and applicable equipment in surface mineral concentrating plants shall be installed and tested in accordance with NFPA 72.

6.3.3 Fire detection systems in underground mines, on underground diesel-powered equipment, and on surface mobile and self-propelled equipment shall be tested in accordance with NFPA 72 or the manufacturer's recommendations, whichever is more stringent.

6.3.4 Fire detectors shall be listed for their application.

6.3.5 Equipment compartment and room sizes and contours, airflow patterns, obstructions, and other characteristics of the protected area shall determine the placement, type, sensitivity, durability, and, where applicable, the number of detectors.

6.3.6 Detector testing shall not require the discharge of the fire suppression system on underground diesel-powered or surface mobile or self-propelled equipment.

6.3.7 Any equipment found deficient shall be repaired or replaced and the system retested for operation in accordance with the manufacturer's instructions.

6.3.8 The mine operator, plant superintendent, or a designee shall have a copy of the manufacturer's installation and maintenance manual or owner's manual that describes detection system operation and required maintenance.

6.4 Fire Suppression Equipment.

6.4.1 Fire suppression systems shall be designed, installed, and tested in accordance with the following NFPA standards:

- (1) NFPA 11
- (2) NFPA 12
- (3) NFPA 12A
- (4) NFPA 13

- (5) NFPA 16
- (6) NFPA 17
- (7) NFPA 17A
- (8) NFPA 25
- (9) NFPA 750
- (10) NFPA 2001
- (11) NFPA 2010

6.4.1.1 A pre-engineered fire suppression system shall be approved for use and shall be designed, installed, and tested in accordance with the fire suppression system manufacturer's listed installation and maintenance manual.

6.4.2 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.

6.4.3 The mine operator, plant superintendent, or a designee shall have a copy of the manufacturer's installation and maintenance manual or owner's manual that describes suppression system operation, required maintenance, and recharging.

6.4.4 Where inadvertent discharge of the fire suppression system during servicing could result in injury to personnel, provisions shall be made to safeguard against accidental actuation of the system.

Chapter 7 Fire Protection for Diesel-Powered Equipment in Underground Mines

7.1 Equipment Modification.

7.1.1* All diesel-powered mining equipment shall be analyzed to determine whether fire risks can be reduced through equipment modification.

7.1.2* Modifications affecting the fire risk of diesel-powered mining equipment shall be analyzed to determine whether such modifications decrease or increase the fire risk.

7.2 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 accordance with the diesel-powered equipment manufacturers' recommendations.

7.3 Portable Fire Extinguishers.

7.3.1 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 4.6 kg (10 lb) of extinguishing agent and a minimum rating of 4-A:10-B:C.

7.3.2 The risk assessment shall determine whether larger or additional extinguishers are needed.

7.4 Fixed Suppression Systems. Diesel-powered equipment shall be protected by a fixed fire suppression system to suppress the largest anticipated fires in the protected areas, and that system shall have the following characteristics:

- (1) Be listed or approved for the purpose
- (2) Be automatically actuated by a fire detection system
- (3)* Have one manual actuator in the operator's compartment and at least one additional actuator accessible from the ground
- (4) Be provided with an agent container and a network of agent distribution hoses or pipes with discharge nozzles

- (5) Be provided with discharge nozzle blowoff caps or other suitable devices or materials to prevent the entrance of moisture, dirt, or other material into the piping
- (6) Have all system components secured and protected against damage, including abrasion and corrosion
- (7) Be installed so that the system actuation causes shutdown of the protected equipment
- (8) Permit up to a 30-second agent discharge delay
- (9) Include a standby source of power if electrical power is the only means of actuation
- (10) Have an installation and maintenance manual or owner's manual

7.4.1 Post-installation testing shall be in accordance with the manufacturer's or designer's recommendations.

7.4.2 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.

Chapter 8 Transfer of Flammable or Combustible Liquids in Underground Mines

8.1 Fire Risk Assessment. The fire risk assessment for surface flammable or combustible liquid storage areas located near underground mines shall include the following:

- (1) The potential for the generation of smoke, gases, or toxic fumes that could contaminate the mine intake air
- (2) The topography and relative elevation of storage tanks and mine openings
- (3) Air currents
- (4) Vegetation

8.2 Proximity of Surface Flammable and Combustible Liquid Storage to Underground Openings.

8.2.1 Surface flammable or combustible liquid storage areas shall be located away from any mine opening to prevent contamination of mine intake air, but in no case shall they be closer than 30.5 m (100 ft) unless the boreholes are drilled specifically for the transfer of combustible liquids to the underground mine.

8.2.2 Drainage from flammable or combustible liquid storage areas shall be designed and maintained to prevent liquid flow toward any mine opening.

8.3 Surface-to-Underground Transfer.

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

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

8.3.3 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.

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

8.3.5 Piping, valves, and fittings used for flammable or combustible liquid transfer shall be suitable for the expected working pressures and structural stresses.