NFPA 430

Code for the Storage of Liquid and Solid Oxidizers

2004 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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NFPA 430

Code for the

Storage of Liquid and Solid Oxidizers

2004 Edition

This edition of NFPA 430, *Code for the Storage of Liquid and Solid Oxidizers*, was prepared by the Technical Committee on Hazardous Chemicals and acted on by NFPA at its May Association Technical Meeting held May 23–26, 2004, in Salt Lake City, UT. It was issued by the Standards Council on July 16, 2004, with an effective date of August 5, 2004, and supersedes all previous editions.

This edition of NFPA 430 was approved as an American National Standard on August 5, 2004.

Origin and Development of NFPA 430

At the 1969 NFPA Annual Meeting, the Sectional Committee on Storage, Handling and Transportation of Hazardous Chemicals obtained tentative adoption of a Code for the Storage and Transportation of Oxidizing Materials and Organic Peroxides, No. 499-T. Subsequently, the Sectional Committee decided to replace No. 499-T with two codes, one for the storage of liquid and solid oxidizers and the other for organic peroxides.

The text printed here contains those requirements that the Sectional Committee believes to be essential for the safe storage of liquid and solid oxidizers. It was processed in accordance with the NFPA Regulations Governing Committee Projects. A draft was adopted as a Tentative Code in 1971. In 1972, an amended version of the 1971 edition was adopted as a Tentative Code. The 1972 edition, with further revisions, was officially adopted by the Association in 1973. Amendments were adopted in 1974, 1975, and 1980.

For the 1990 edition of NFPA 43A, the Committee initiated a complete revision of the document that incorporated revised limits for the quantities of oxidizers stored in buildings, whether they are sprinklered or nonsprinklered. The limits were revised in consideration of the burning characteristics and loss experience this class of chemicals had demonstrated over the previous few years. In that edition, the Committee provided enhanced requirements for the storage of oxidizers in retail establishments. The Committee also included an enhanced list of typical oxidizers covered by this code in the appendix as a guide to users of the document.

The 1995 edition of NFPA 430 was a renumbering and revision of the former code NFPA 43A. It represented a complete revision of the document to update the requirements for the safe handling, fire prevention, and storage provisions for liquid and solid oxidizers. The edition incorporated new material into the document to reflect changes in protection technology, particularly in the requirements for sprinkler protection of oxidizers stored in rack storage configurations. The Committee completely revised the document to make it compatible with industry practices and to incorporate enhanced provisions for the safe handling and storage of liquid and solid oxidizers.

The 2000 edition of NFPA 430 contained new requirements for the storage and display of oxidizing materials in retail occupancies. These requirements, located in Chapter 7 of the document, addressed quantities of materials stored, location and arrangement of materials, and fire protection.

The 2004 edition of NFPA 430 contains new requirements for mercantile and industrial storage of oxidizers and new requirements for sprinkler control of storage in buildings that are required to have sprinkler protection. The 2004 edition also includes new annex material that provides more information on the behavior of oxidizers and emergency response and incident procedures.

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Committee Scope: This Committee shall have primary responsibility for documents on, and maintain current codes for, classes of hazardous chemicals and codes for specific chemicals where these are warranted by virtue of widespread distribution or special hazards.

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

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

Chapter 1 Administration

1.1 Scope.

1.1.1 This code shall apply to the storage and handling of oxidizers that are liquid or solid at ambient conditions.

1.1.1.1 This code shall not apply to the storage of solid and liquid oxidizers for normal use on the premises of one- and two-family dwellings.

1.1.1.2 Separate chapters shall specify requirements for storage of oxidizers by class where the quantities stored are greater than the stated minimums.

1.1.1.3* For quantities of a class of oxidizer that are less than the minimum covered by the separate chapter for that class, those parts of that chapter pertaining to fire prevention and compatibility as well as all of Chapter 4 of this code shall be used as requirements.

1.1.2 This code shall not apply to explosives or blasting agents, which are covered by NFPA 495, *Explosive Materials Code*; to ammonium nitrate, which is covered in NFPA 490, *Code for the Storage of Ammonium Nitrate*; or to organic peroxides, which are covered in NFPA 432, *Code for the Storage of Organic Peroxide Formulations*.

1.1.3 The quantity and arrangement limits in this code shall not apply to the storage of oxidizers in process areas at plants where oxidizers are manufactured.

1.1.3.1 This code shall not apply to the storage of solid and liquid oxidizers in existing buildings used for the storage of oxidizers at manufacturing plants.

1.1.4 The quantity and arrangement limits in this code shall not apply to facilities that use ammonium perchlorate in the commercial manufacture of large-scale rocket motors.

1.2* Purpose. The purpose of this code shall be to provide requirements for the safe storage of commercially available strengths of liquid and solid oxidizers.

1.3 Application. The requirements of NFPA 1, *Uniform Fire Code*, NFPA 13, *Standard for the Installation of Sprinkler Systems*, NFPA 30, *Flammable and Combustible Liquids Code*, and *NFPA 5000, Building Construction and Safety Code*, shall apply where applicable and where they are more restrictive than this code.

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

1.4.1 Unless otherwise specified, the provisions of this code 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 code. Where specified, the provisions of this code 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 code deemed appropriate.

1.4.3 The retroactive requirements of this code 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.

1.5 Equivalency.

1.5.1 Nothing in this code is intended to prevent the use of systems, methods, or devices equivalent to those prescribed by this code, provided that technical documentation is submitted to the authority having jurisdiction that demonstrates equivalency, and provided that the system, method, or device is approved for the intended purpose.

1.5.2 The arrangement and quantity of oxidizers in storage shall be permitted to deviate from the requirements of succeeding chapters where specially engineered fire prevention or fire protection systems that are equivalent to or exceed the requirements of this code are used and are acceptable to the authority having jurisdiction.

1.6 Enforcement. This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. *(See Annex E for sample wording for enabling legislation.)*

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code 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 1, *Uniform Fire Code™*, 2003 edition.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2002 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2002 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2003 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 2002 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2002 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2003 edition.

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NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work,* 2003 edition.

NFPA 70, *National Electrical Code®,* 2005 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids,* 2004 edition.

NFPA 432, *Code for the Storage of Organic Peroxide Formulations,* 2002 edition.

NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents,* 2002 edition.

NFPA 490, *Code for the Storage of Ammonium Nitrate,* 2002 edition.

NFPA 495, *Explosive Materials Code,* 2001 edition.

NFPA 5000®, Building Construction and Safety Code®, 2003 edition.

2.3 Other Publications.

2.3.1 Canadian Government Publication. Transport Canada, 330 Sparks Street, Ottawa, K1A 0N5, Canada.

Canadian Ministry of Transport Regulations.

2.3.2 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.120, "Hazardous Waste Operations and Emergency Response," Occupational Safety and Health Administration.

Title 29, Code of Federal Regulations, Part 1910.1200, "Hazardous Communication," Occupational Safety and Health Organization.

Title 49, Code of Federal Regulations, Parts 100 to end.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this code. Where terms are not included, common usage of the terms shall apply.

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* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

3.2.4 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.

3.2.5* 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.

3.2.6 Shall. Indicates a mandatory requirement.

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

3.3 General Definitions.

3.3.1 Combustible. A substance that will burn.

3.3.2 Containers.

3.3.2.1 ***Combustible Containers.*** Containers that include paper bags, fiber drums, plastic containers, and wooden or fiber boxes or barrels, as well as noncombustible containers having removable combustible liners or packing, and noncombustible containers in combustible overpacks.

3.3.2.2 ***Noncombustible Containers.*** Containers constructed of glass or metal that can be coated with a polymeric material no more than 2 mils (50.8 μm) in thickness.

3.3.3* Explosive Reaction. A reaction, which includes both deflagration and detonation, producing a sudden rise in pressure with potentially destructive results.

3.3.4 Handling. The deliberate movement of material by any means to a point of storage or use.

3.3.5 Material.

3.3.5.1 ***Compatible Material.*** A material that, when in contact with an oxidizer, will not react with the oxidizer or promote or initiate its decomposition.

3.3.5.2 ***Incompatible Material.*** A material that, when in contact with an oxidizer, can cause hazardous reactions or can promote or initiate decomposition of the oxidizer.

3.3.5.3* ***Noncombustible Material.*** A 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.

3.3.6 Mercantile Occupancy. An occupancy used for the display and sale of merchandise.

3.3.7* Oxidizer. Any material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials and can undergo a vigorous self-sustained decomposition due to contamination or heat exposure.

3.3.7.1 ***Class 1.*** An oxidizer that does not moderately increase the burning rate of combustible materials with which it comes into contact.

3.3.7.2 ***Class 2.*** An oxidizer that causes a moderate increase in the burning rate of combustible materials with which it comes into contact.

3.3.7.3 ***Class 3.*** An oxidizer that causes a severe increase in the burning rate of combustible materials with which it comes into contact.

3.3.7.4 ***Class 4.*** An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock and that causes a severe increase in the burning rate of combustible materials with which it comes into contact.

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3.3.8 Pile. Material in a single contiguous storage area, including any material not properly separated by appropriate distance.

3.3.9 Plants.

3.3.9.1 ***Manufacturing Plants.*** Those facilities where oxidizers are produced by chemical means or where oxidizers are pelletized, ground, dissolved, packaged, mixed, or blended.

3.3.10 Storage.

3.3.10.1 ***Bulk Liquid Storage.*** The storage of more than 2271 L (600 gal) in a single container.

3.3.10.2 ***Bulk Solid Storage.*** The storage of more than 2722 kg (6000 lb) in a single container.

3.3.10.3 ***Cutoff Storage.*** Storage in the same building or inside area but physically separated from incompatible materials by partitions or walls, or storage in a fixed tank.

3.3.10.4 ***Detached Storage.*** Storage in either an open outside area or a separate building containing no incompatible materials and located away from all other structures.

3.3.10.5* ***Segregated Storage.*** Storage in the same room or inside area but physically separated by distance from incompatible materials.

3.3.11 Storage Height. The height from the finished floor to the top of the highest container.

Chapter 4 Basic Requirements

4.1 Hazard Management.

4.1.1 The design of a new or modified facility or a facility that has had a change of use or occupancy to handle or store oxidizers shall be submitted to the authority having jurisdiction. *(For existing structures, see Section 1.4.)*

4.1.1.1 All new or existing facilities handling or storing oxidizers greater than 1814 kg (4000 lb) for Class 1 oxidizers, 454 kg (1000 lb) for Class 2 oxidizers, 91 kg (200 lb) for Class 3 oxidizers, and 4.5 kg (10 lb) for Class 4 oxidizers shall provide written notification to the authority having jurisdiction.

4.1.2 No new or existing facility shall store materials in any occupancy covered by this code over 16,329 kg (36,000 lb) for Class 1 oxidizers, 2041 kg (4500 lb) for Class 2 oxidizers, 1043 kg (2300 lb) for Class 3 oxidizers, and 4.5 kg (10 lb) for Class 4 oxidizers until a Hazardous Materials Management Plan (HMMP) has been completed and submitted to the authority having jurisdiction.

4.1.2.1 The HMMP shall be reviewed and updated annually and when the facility is modified.

4.1.2.2 The HMMP shall comply with the requirements NFPA 1, *Uniform Fire Code*.

4.1.2.3 Training exercises according to the HMMP shall be conducted at least every 3 years in cooperation with local emergency organizations.

4.1.2.4 The authority having jurisdiction shall be notified immediately of any of the following:

(1) Release of oxidizers in excess of 45.4 kg (100 lb)
(2) Release of oxidizers that might pose a threat to people, property, or the environment
(3) Signs of reacting oxidizer, contaminated oxidizer, or package deterioration of more than 45.4 kg (100 lb) of oxidizer.

4.1.2.4.1 Manufacturing plants shall not be required to notify the authority having jurisdiction of an accidental release unless it poses a threat to people, property, or the environment or when required by local, state, or federal law.

4.1.2.5 The facility responsible for an accidental release shall activate the HMMP immediately.

4.1.3 No facility shall close or abandon any oxidizer storage facility without notifying the authority having jurisdiction at least 30 days prior to the scheduled closing.

4.2 Identification of Materials in Storage.

4.2.1* All storage areas containing oxidizers shall be conspicuously identified as to the hazard class by the words "Class *[appropriate classification number]* Oxidizers," as defined in 3.3.7.

4.2.2 Oxidizers in mercantile display areas shall not be required to be identified in accordance with 4.2.1.

4.2.3 Where oxidizers having different classifications are stored in the same area, the area shall be marked for the most severe hazard class present.

4.2.4 All packages shall be approved and individually marked with the chemical name of the oxidizer.

4.3 Storage Containers, Tanks, and Bins.

4.3.1 Shipping Containers. Where a storage container for solid and liquid oxidizers also functions as the shipping container, the container shall meet the requirements of the U.S. Department of Transportation, 49 CFR 100 to end, or the *Canadian Ministry of Transport Regulations* (Transport Canada).

4.3.2 Tanks and Bins. Tanks for the storage of bulk liquid oxidizers and bins for the storage of bulk solid oxidizers shall meet the following requirements:

(1) Materials of construction shall be compatible with the oxidizer being stored.
(2) Tanks and bins shall be designed and constructed in accordance with federal, state, and local regulations or, as a minimum, in accordance with nationally recognized engineering practices [e.g., American Society of Mechanical Engineers (ASME), American Petroleum Institute (API)].
(3) Tanks and bins shall be equipped with a vent or other relief device to prevent overpressurization due to decomposition or fire exposure.

4.3.3 Outside Storage.

4.3.3.1 The size of outside storage tanks for Class 1, Class 2, and Class 3 oxidizers shall not be limited by this code.

4.3.3.2 The size of outside storage tanks for Class 4 oxidizers shall be limited in accordance with this code.

4.4 Storage Arrangements.

4.4.1 At least one side of each pile of oxidizer shall be on an aisle.

4.4.2* The arrangement and quantity of oxidizers in storage shall depend upon their classification, type of container, type of storage (segregated, cutoff, or detached), and fire protection as specified in this code and in the manufacturer's or processor's instructions.

4.4.2.1 Mercantile occupancies shall comply with Chapter 9.

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4.4.2.2 Storage occupancies shall store and protect oxidizers in accordance with Chapter 5 through Chapter 8.

4.4.3* Oxidizers shall be stored to avoid contact with incompatible materials such as ordinary combustibles, combustible or flammable liquids, greases, other oxidizers, and those materials that have the potential to react with the oxidizer or promote or initiate its decomposition.

4.4.3.1 These incompatible materials shall not include approved packaging materials, pallets, or other dunnage.

4.4.3.2 Hydrogen peroxide (Classes 2 through 4) stored in drums shall not be stored on wooden pallets.

4.4.3.3 Where oxidizers are in segregated storage with flammable and combustible liquids, the oxidizer containers and flammable and combustible liquid containers shall be separated by at least 7.6 m (25 ft).

4.4.3.4 The separation shall be maintained by dikes, drains, or floor slopes to prevent flammable liquid leakage from encroaching on the separation.

4.4.3.5 Solid oxidizers shall not be stored directly beneath liquids.

4.4.4 Where Class 2, Class 3, or Class 4 liquid oxidizers are stored, means shall be provided to prevent the liquid oxidizer from flowing out of a cutoff area into an area containing incompatible materials.

4.4.5* Oxidizers shall be stored to prevent contact with water, which can affect either container integrity or product stability.

4.4.6 Oxidizers shall be stored so that the storage temperature cannot be within 14°C (25°F) of their decomposition temperature or to 52°C (125°F), whichever is lower and in accordance with the manufacturer's recommendations.

4.5 Mixed Storage. Each class shall be considered independent of the others, and a facility shall be permitted to carry up to the maximum quantity for each class of material.

4.6 Other Considerations.

4.6.1 Where required by *NFPA 5000, Building Construction and Safety Code*, spill control and secondary containment shall be provided in accordance with the requirements of *NFPA 5000*.

4.6.2 Storage arrangement shall take into consideration the potential evolution of large quantities of smoke and toxic fumes, especially as storage affects manual fire-fighting operations, building egress, and evacuation of adjacent occupancies or communities.

4.7 Training.

4.7.1 General.

4.7.1.1 Facilities storing oxidizers shall have a training program.

4.7.1.2 The training shall be based on current material safety data sheets (MSDS) and other information supplied by manufacturers.

4.7.2 Personnel Training Requirements.

4.7.2.1 Persons responsible for the operation and maintenance of areas in which oxidizers are stored shall be trained in the chemical and physical hazards of the stored materials and compatibility of stored materials.

4.7.2.2 The training shall include coverage of other topical areas as required by 29 CFR 1910.1200, "Hazard Communication," or other applicable hazard communication regulations.

4.7.3 Persons responsible for the operation and maintenance, sequence of mitigation, and protection against oxidizer incidents and/or releases in areas in which oxidizers are stored in excess of 16,329 kg (36,000 lb) for Class 1 oxidizers, 2041 kg (4500 lb) for Class 2 oxidizers, 1043 kg (2300 lb) for Class 3 oxidizers, and 4.5 kg (10 lb) for Class 4 oxidizers shall be trained to meet all requirements of 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response," and the technician level as described in NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*.

4.8 Heating and Electrical Installations.

4.8.1 Heating shall be arranged so that stored materials cannot be placed in direct contact with heating units, piping, or ducts.

4.8.2 Oxidizers shall be separated from sources of heat such as heating units, piping, or ducts so that they cannot be heated to within 14°C (25°F) of their decomposition temperature or to 52°C (125°F), whichever is lower and in accordance with the manufacturer's recommendations.

4.8.3 Electrical installations shall be in conformance with NFPA 70, *National Electrical Code*.

4.9 Smoking.

4.9.1 Smoking shall be prohibited in all storage areas containing oxidizers.

4.9.2 "No Smoking" signs shall be placed conspicuously within storage areas and at all entrances to storage areas.

4.10 Maintenance and Repairs.

4.10.1 The performance of maintenance work in an oxidizer storage area shall be subject to prior review and approval by supervisory personnel.

4.10.2 Cutting and welding procedures shall be in conformance with NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*.

4.11 Fire Protection.

4.11.1* Fire Hydrants.

4.11.1.1 Fire hydrants and water supplies shall be provided as required by the authority having jurisdiction.

4.11.1.2 Hydrants shall be installed in accordance with NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*.

4.11.2 Automatic Sprinkler Protection.

4.11.2.1 Automatic sprinklers shall be provided in accordance with the requirements of Chapters 5 through 9.

4.11.2.2 Where automatic sprinkler systems are required, the sprinkler system shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems* and the system density shall meet the required densities contained in this code for the class of oxidizer, the storage arrangements, and the stored quantities.

4.11.2.2.1 Buildings with automatic sprinkler systems that do not meet the installation requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems* or the required densities contained in this code shall be considered as nonsprinklered and shall follow the storage arrangements and quantities for a nonsprinklered building.

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4.11.2.2.2 Buildings that require sprinkler protection having total quantities of Class 3 oxidizers greater than 91 kg (200 lb) but less than 1043 kg (2300 lb) shall comply with 7.4.1.1.

4.11.3* Dry Pipe and Preaction Sprinkler Systems.

4.11.3.1 Dry-pipe and double-interlock preaction (DIPA) sprinkler systems shall not be permitted for protection of buildings or areas containing oxidizers.

4.11.3.2 Dry-pipe and DIPA systems shall be permitted for protection of Class 1 oxidizers in Type I through Type IV building construction and Class 2 and 3 oxidizers in detached storage in Type I and Type II construction as specified in *NFPA 5000, Building Construction and Safety Code*.

4.11.3.3 Dry-pipe and DIPA sprinkler systems shall be permitted in mercantile occupancies when the oxidizers are stored in open air environments, such as retail garden centers and buildings without exterior walls. For Class 3 oxidizers, the location shall be approved by the fire chief.

4.11.4 Fire Protection Water Supplies.

4.11.4.1 Water supplies shall be adequate for the protection of the oxidizer storage by hose streams and automatic sprinklers.

4.11.4.2 The water system shall be capable of providing not less than 2840 L/min (750 gpm) where protection is by means of hose streams, or 1890 L/min (500 gpm) for hose streams in excess of the automatic sprinkler water demand.

4.11.4.3 Duration of the water supply shall be a minimum of 2 hours.

4.11.5 Water-based fire protection systems shall be inspected, tested, and maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.

4.11.6 Manual Fire Fighting. Manual fire-fighting equipment in the form of portable water extinguishers or water hose reel stations shall be provided in accordance with the requirements of NFPA 10, *Standard for Portable Fire Extinguishers*, and NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*.

4.11.6.1* The placement and use of dry chemical extinguishers containing ammonium compounds (Class A:B:C) shall be prohibited in areas where oxidizers that can release chlorine are stored.

4.11.6.2* Halon extinguishers shall not be used in areas where oxidizers are stored.

4.11.6.3* Halocarbon clean agent extinguishers shall not be used in areas where oxidizers are stored unless they have been tested to the satisfaction of the authority having jurisdiction.

4.12* Construction.

4.12.1 Combustible construction materials that have the potential to come into contact with oxidizers shall be protected with a compatible coating to prevent impregnation of the combustible materials by the oxidizers.

4.12.2 Except for surface coating less than 4 mm, floors of storage areas shall be of noncombustible construction.

4.13 Housekeeping and Waste Disposal.

4.13.1 Accumulation of combustible waste in oxidizer storage areas shall be prohibited.

4.13.2* Spilled oxidizers, reacting oxidizers, and leaking or broken containers shall be removed immediately by a competent individual to a safe, secure, dry outside area or to a location designated by the competent individual to await disposal in conformance with applicable regulations and manufacturer's and processor's instructions.

4.13.2.1 Spilled materials shall be placed in a clean, separate container and shall not be returned to the original container.

4.13.2.2 The disposal of such materials shall not be combined with that of ordinary trash.

4.13.3 Used, empty, combustible containers that previously contained oxidizers shall be stored in a detached or sprinklered area.

4.13.4 Storage shall be managed to prevent excessive dust accumulation.

4.13.5* Absorptive combustible packing materials used to contain water-soluble oxidizers that have become wet during either fire or nonfire conditions and wooden pallets that are exposed to water solutions of an oxidizer shall be relocated to a safe outside area and shall be disposed of properly.

4.14 Dust Collection Systems.

4.14.1 If provided, dust collection systems shall meet the requirements of NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*.

4.14.2 Separate systems shall be provided for incompatible materials.

Chapter 5 Class 1 Oxidizers

5.1 Application.

5.1.1 This chapter applies to storage of Class 1 oxidizers where stored in quantities in excess of 1814 kg (4000 lb).

5.1.2 Chapter 4 also applies to storage of Class 1 oxidizers.

5.2 Storage Arrangements.

5.2.1 The storage of Class 1 oxidizers shall be segregated, cutoff, or detached.

5.2.2 Storage of Class 1 oxidizers shall be in accordance with Table 5.2.2(a) and Table 5.2.2(b).

5.2.2.1 For Class 1 oxidizers stored in nonsprinklered buildings, the minimum aisle width shall be equal to the pile height.

5.2.2.2 For Class 1 oxidizers stored in sprinklered buildings, the minimum aisle width shall be equal to the pile height, but the aisle width shall be no less than 1.2 m (4 ft) and no greater than 2.4 m (8 ft).

5.2.2.3 There shall be no minimum distance from the pile to a wall for amounts less than 4082 kg (9000 lb).

5.2.2.4 Class 1 oxidizers shall be permitted to be separated from ordinary combustible and incompatible materials by a solid noncombustible barrier or by a horizontal distance in accordance with Table 5.2.2(a) or Table 5.2.2(b).

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Table 5.2.2(a) Storage Limits of Class 1 Oxidizers in a Nonsprinklered Building

Storage Configurations and Allowable Distances	Segregated Storage		Cutoff Storage		Detached Storage	
	Metric Units	U.S. Units	Metric Units	U.S. Units	Metric Units	U.S. Units
Building limit	8 met ton	9 tons	27 met ton	36 tons	Unlimited	Unlimited
Pile limit	8 met ton	9 tons	18 met ton	20 tons	18 met ton	20 tons
Storage limit	2.4 m	8 ft	2.4 m	8 ft	2.4 m	8 ft
Pile width	4.9 m	16 ft	4.9 m	16 ft	4.9 m	16 ft
Maximum distance from any container to a working aisle	2.4 m	8 ft	2.4 m	8 ft	2.4 m	8 ft
Distance to next pile*						
Distance to wall	1.2 m	4 ft	1.2 m	4 ft	1.2 m	4 ft
Distance to incompatible materials and combustible commodities	3.7 m	12 ft	NP	NP	NP	NP

NP: Not permitted.
* See 5.2.2.1.

Table 5.2.2(b) Storage of Class 1 Oxidizers in a Sprinklered Building

Storage Configurations and Allowable Distances	Metric Units	U.S. Units
Building limit	Unlimited	Unlimited
Pile limit	181 met ton	200 tons
Storage height	6.1 m	20 ft
Pile width	7.3 m	24 ft
Maximum distance from any container to a working aisle	3.7 m	12 ft
Distance to next pile*		
Distance to wall†	0.6 m	2 ft
Distance to incompatible materials and combustible commodities greater than NFPA 13 Class III	2.4 m	8 ft

Note: If the storage is to be considered sprinklered, see Section 5.3.
*See 5.2.2.2.
†See 5.2.2.3.

5.2.3 Bulk Storage.

5.2.3.1 Bulk storage in combustible buildings shall not come in contact with combustible building members unless the members are protected by a compatible coating to prevent their impregnation by the oxidizer. *(See Section 4.12.)*

5.2.3.2 Bulk storage, either in permanent bins or in piles, shall be separated from all other materials.

5.2.3.3 Bins shall be of noncombustible construction.

5.2.3.4 Wooden bins shall be permitted to be protected with a compatible coating to prevent impregnation of the combustible material by the oxidizer.

5.3 Sprinkler Protection.

5.3.1 Sprinkler protection for Class 1 oxidizers shall be in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

5.3.2* For the purpose of applying the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*, Class 1 oxidizers shall be designated as follows:

(1) Class 1 oxidizers in noncombustible or combustible containers (paper bags or noncombustible containers with removable combustible liners) shall be designated as a Class I commodity.
(2) Class 1 oxidizers contained in fiber drums, wooden or fiber boxes or barrels, or noncombustible containers in combustible packaging shall be designated as a Class II commodity.
(3) Class 1 oxidizers contained in plastic containers shall be designated as a Class III commodity.

5.4 Detached Storage.

5.4.1 To be considered detached, a building for storage of Class 1 oxidizers shall be separated from flammable or combustible liquid storage, flammable gas storage, combustible material in the open, any building, passenger railroad, public highway, or other tanks.

5.4.2 The minimum separation distance shall be 7.6 m (25 ft).

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Chapter 6 Class 2 Oxidizers

6.1 Application.

6.1.1 This chapter applies to Class 2 oxidizers where stored in quantities in excess of 454 kg (1000 lb).

6.1.2 Chapter 4 also applies to storage of Class 2 oxidizers.

6.2 Storage Arrangements. Class 2 oxidizers shall be permitted to be separated from ordinary combustible and incompatible materials by a solid noncombustible barrier or by a horizontal distance in accordance with Table 6.2.3(a) or Table 6.2.3(b).

6.2.1 The storage of Class 2 oxidizers shall be segregated, cutoff, or detached.

6.2.2 Cutoff walls shall have a fire resistance rating of at least 1 hour.

6.2.3 Storage of Class 2 oxidizers shall be in accordance with Table 6.2.3(a) and Table 6.2.3(b).

6.2.3.1 For Class 2 oxidizers stored in nonsprinklered buildings, the minimum aisle width shall be equal to the pile height.

6.2.3.2 For Class 2 oxidizers stored in sprinklered buildings, the minimum aisle width shall be equal to the pile height, but the aisle width shall be no less than 1.2 m (4 ft) and no greater than 2.4 m (8 ft).

6.2.3.3 For cutoff or detached storage under 2041 kg (4500 lb), there shall be no minimum separation distance between the pile and any wall.

6.2.4* The building limit shall be permitted to be four times the quantities shown in Table 6.2.3(b) for cutoff storage if noncombustible containers are used and buildings are of Type I or Type II construction as specified in *NFPA 5000, Building Construction and Safety Code*.

6.2.5 Storage in glass carboys shall not be more than two carboys high.

6.2.6 Basement Storage.

6.2.6.1 Storage in basements shall be prohibited.

6.2.6.2 Where the oxidizer is stored in fixed tanks, storage in basements shall be permitted.

6.2.7 Maximum Height of Storage.

6.2.7.1 Maximum storage height for nonsprinklered buildings shall be in accordance with Table 6.2.3(a).

6.2.7.2 Maximum storage height for sprinklered buildings shall be in accordance with Table 6.4.1.

6.3 Building Construction.

6.3.1 Construction materials that can come into contact with oxidizers shall be noncombustible.

6.3.2 All construction materials used in stories or basements below the storage of liquid oxidizers shall be noncombustible.

6.3.3 Storage areas for oxidizing materials shall be provided with means acceptable to the authority having jurisdiction to vent products of combustion or decomposition.

6.4 Sprinkler Protection.

6.4.1 Sprinkler protection for Class 2 oxidizers shall be designed in accordance with Table 6.4.1.

6.4.2 Sprinkler protection shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

6.4.3 Ceiling sprinklers shall be high-temperature sprinklers.

6.4.4 Storage Protection with In-Rack Sprinklers.

6.4.4.1 In-rack sprinklers shall be quick response with an ordinary temperature rating and have a K-factor of not less than K = 8.0.

6.4.4.2 In-rack sprinklers shall be designed to provide 172 kPa (25 psi) for the six most hydraulically remote sprinklers on each level.

Table 6.2.3(a) Storage of Class 2 Oxidizers in a Nonsprinklered Building

Storage Configurations and Allowable Distances	Segregated Storage		Cutoff Storage		Detached Storage	
	Metric Units	U.S. Units	Metric Units	U.S. Units	Metric Units	U.S. Units
Building limit	1022 kg	2250 lb	4086 kg	9000 lb	45,400 kg	100,000 lb
Pile limit					9080 kg	20,000 lb
Storage height	1.8 m	6 ft	2.4 m	8 ft	2.4 m	8 ft
Pile width	2.4 m	8 ft	3.7 m	12 ft	4.9 m	16 ft
Maximum distance from any container to a working aisle	1.2 m	4 ft	1.8 m	6 ft	2.4 m	8 ft
Distance to next pile*						
Distance to wall	1.2 m	4 ft	1.2 m	4 ft	1.2 m	4 ft
Distance to incompatible materials and combustible commodities	3.7 m	12 ft	NP	NP	NP	NP

NP: Not permitted.
*See 6.2.3.1.

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Table 6.2.3(b) Storage of Class 2 Oxidizers in a Sprinklered Building

Storage Configurations and Allowable Distances	Segregated Storage		Cutoff Storage		Detached Storage	
	Metric Units	U.S. Units	Metric Units	U.S. Units	Metric Units	U.S. Units
Building limit	91 met ton	100 tons	907 met ton	1000 tons	Unlimited	Unlimited
Pile limit	18.1 met ton	20 tons	91 met ton	100 tons	18.1 met ton	200 tons
Storage height[a]						
Pile width	4.9 m	16 ft	7.6 m	25 ft	7.6 m	25 ft
Maximum distance from any container to a working aisle	2.4 m	8 ft	3.7 m	12 ft	3.7 m	12 ft
Distance to next pile[b]						
Distance to wall[c]	0.6 m	2 ft	0.6 m	2 ft	0.6 m	2 ft
Distance to incompatible materials and combustible commodities	3.7 m	12 ft	NP	NP	NP	NP

NP: Not permitted.
Note: If the storage is considered to be sprinklered, see Section 6.4.
[a]See 6.2.7 and Table 6.4.1.
[b]See 6.2.3.2.
[c]See 6.2.3.3.

Table 6.4.1 Ceiling Sprinkler Protection for Class 2 Oxidizers in Palletized or Bulk and Rack Storage Areas

Type of Storage	Ceiling Sprinklers						
	Storage Height		Density		Area of Application		
	m	ft	$L/min/m^2$	gpm/ft^2	m^2	ft^2	In-Rack Sprinklers
Palletized or bulk	2.4	8	8	0.20	348	3750	—
Palletized or bulk	3.7	12	14	0.35	348	3750	—
Rack	3.7	12	8	0.20	348	3750	One line above each level of storage except the top level
Rack	4.9	16	12	0.30	186	2000	One line above each level of storage except the top level

6.4.4.3 The in-rack sprinklers shall be 2.4 m to 3.0 m (8 ft to 10 ft) spacings in the longitudinal flue space at the intersection of the transverse flue spaces.

6.5 Detached Storage.

6.5.1 To be considered detached, a building for storage of Class 2 oxidizers shall be separated from flammable or combustible liquid storage, flammable gas storage, combustible material in the open, any building, passenger railroad, public highway, or other tanks.

6.5.2 The minimum separation distance shall be 15 m (35 ft) for a sprinklered building or 23 m (50 ft) for an unsprinklered building.

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Chapter 7 Class 3 Oxidizers

7.1 Application.

7.1.1 This chapter applies to Class 3 oxidizers where stored in quantities in excess of 91 kg (200 lb).

7.1.2 Chapter 4 also applies to storage of Class 3 oxidizers.

7.2 Storage Arrangements.

7.2.1 Type of Storage.

7.2.1.1 The storage of Class 3 oxidizers shall be segregated, cutoff, or detached.

7.2.1.2 Storage for sodium chlorate, potassium chlorate, sodium bromate, potassium bromate, and ammonium dichromate shall only be cutoff or detached, not segregated.

7.2.2 Class 3 oxidizer storage shall be located on the ground floor only.

7.2.3 Cutoff walls shall have a fire resistance rating of at least 2 hours.

7.2.4 Storage of Class 3 oxidizers shall be in accordance with Table 7.2.4(a) and Table 7.2.4(b).

7.2.4.1 For Class 3 oxidizers stored in nonsprinklered buildings, the minimum aisle width shall be equal to the storage height, but the aisle width shall be no less than 1.2 m (4 ft) and no greater than 2.4 m (8 ft).

7.2.4.2 For cutoff or detached storage, there shall be no minimum separation distance required between oxidizer storage of less than 1043 kg (2300 lb) and any wall.

7.2.4.3 Class 3 oxidizers shall be permitted to be separated from ordinary combustible and incompatible materials by a solid noncombustible barrier or by a horizontal distance in accordance with Table 7.2.4(a) or Table 7.2.4(b).

7.2.5 Storage in glass carboys shall be one carboy high.

7.2.6 Bulk storage in open bins or piles shall not be permitted.

7.2.7 Maximum Height of Storage.

7.2.7.1 Maximum storage height for nonsprinklered buildings shall be in accordance with Table 7.2.4(a).

7.2.7.2 Maximum storage height for sprinklered buildings shall be in accordance with Table 7.4.1.1.

7.3 Building Construction.

7.3.1 Buildings used for the storage of liquid Class 3 oxidizers shall not have basements.

7.3.2 Construction materials that can come in contact with oxidizers shall be noncombustible.

7.3.3 Storage areas for oxidizing materials shall be provided with means acceptable to the authority having jurisdiction to vent products of combustion or decomposition.

7.3.4 Storage of Class 3 oxidizers in excess of 27.2 met ton (30 tons) shall be in buildings of Type I or Type II construction as specified in *NFPA 5000, Building Construction and Safety Code*.

7.3.4.1 If Class 3 oxidizers are stored in accordance with rack storage requirements in Table 7.4.2.1, then they shall be permitted to be in buildings of construction Type I through Type IV, as specified in *NFPA 5000, Building Construction and Safety Code*.

7.4 Sprinkler Criteria for Class 3 Oxidizers.

7.4.1 Class 3 Oxidizers Less Than 1043 kg (2300 lb). Sprinkler design criteria for buildings that require sprinkler protection having total quantities of Class 3 oxidizers less than the 1043 kg (2300 lb) shall be in accordance with the requirements of 7.4.1.1.

7.4.1.1 Facilities that require sprinkler protection having total quantities of Class 3 oxidizers greater than 91 kg (200 lb) but less than 1043 kg (2300 lb) shall follow the sprinkler design criteria in accordance with Table 7.4.1.1.

Table 7.2.4(a) Storage of Class 3 Oxidizers in a Nonsprinklered Building

	Segregated Storage		Cutoff Storage		Detached Storage	
Storage Limit	Metric Units	U.S. Units	Metric Units	U.S. Units	Metric Units	U.S. Units
Building limit	522 kg	1150 lb	2088 kg	4600 lb	18,160 kg	40,000 lb
Pile limit	522 kg	1150 lb	2088 kg	4600 lb	4540 kg	10,000 lb
Storage height	1.8 m	6 ft	1.8 m	6 ft	1.8 m	6 ft
Pile width	2.4 m	8 ft	3.7 m	12 ft	3.7 m	12 ft
Maximum distance from any container to a working aisle	1.2 m	4 ft	2.4 m	8 ft	2.4 m	8 ft
Distance to next pile*						
Distance to wall	1.2 m	4 ft	1.2 m	4 ft	1.2 m	4 ft
Distance to incompatible materials and combustible commodities	3.7 m	12 ft	NP	NP	NP	NP

NP: Not permitted.
*See 7.2.4.1.

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Table 7.2.4(b) Storage of Class 3 Oxidizers in a Sprinklered Building

	Segregated Storage		Cutoff Storage		Detached Storage	
Storage Limit	**Metric Units**	**U.S. Units**	**Metric Units**	**U.S. Units**	**Metric Units**	**U.S. Units**
Building limit	45 met ton	50 tons	900 met ton	1000 tons	Unlimited	Unlimited
Pile limit	8.8 met ton	10 tons	27.2 met ton	30 tons	91 met ton	100 tons
Storage height[a]						
Pile width	3.7 m	12 ft	4.9 m	16 ft	6.1 m	20 ft
Maximum distance from any container to a working aisle	2.4 m	8 ft	3 m	10 ft	3 m	10 ft
Distance to next pile[b]						
Distance to wall[c]	0.6 m	2 ft	0.6 m	2 ft	0.6 m	2 ft
Distance to incompatible materials and combustible commodities	3.7 m	12 ft	NP	NP	NP	NP

NP: Not permitted.
Note: If the storage is considered to be sprinklered, see the sprinkler system design requirements of Section 7.4.
[a]See 7.2.7, Table 7.4.1.1, and Table 7.4.2.1.
[b]See 7.2.4.1.
[c]See 7.2.4.2.

Table 7.4.1.1 Sprinkler Protection of Class 3 Oxidizers Stored in Total Quantities of Greater Than 91 kg (200 lb) But Less Than 1043 kg (2300 lb)

	Shelf	Bulk or Pile	Bulk or Pile	Rack
Maximum storage height	1.8 m (6 ft)	1.5 m (5 ft)	3 m (10 ft)	3 m (10 ft)
Maximum ceiling height	7.6 m (25 ft)	7.6 m (25 ft)	7.6 m (25 ft)	NA
Aisles — pile separation	1.2 m (4 ft) min clear aisles	1.2 m (4 ft) min clear aisles	2.4 m (8 ft) min clear aisles	2.4 m (8 ft) min clear aisles
Ceiling design criteria	0.45 gpm/2000 ft^2	0.35 gpm/5000 ft^2 or 0.6 gpm/2000 ft^2	0.65 gpm/5000 ft^2	0.35 gpm/5000 ft^2 or 0.6 gpm/2000 ft^2
In-rack sprinklers	NP	NP	NA	See 7.4.1.2
Hose stream demand	500 gpm	500 gpm	500 gpm	500 gpm
Duration	120 minutes	120 minutes	120 minutes	120 minutes

NP: Not permitted.

7.4.1.2 In-Rack Sprinkler Criteria.

7.4.1.2.1 Where required by Table 7.4.1.1 in-rack sprinkler protection shall be as follows:

(1) In-rack sprinklers shall be installed above every level of oxidizer storage.
(2) In-rack sprinklers shall be spaced at a maximum of 1.2 m (4 ft) intervals to provide one sprinkler in each flue space.
(3) In-rack sprinklers shall be quick response with an ordinary temperature rating and have a K-factor of not less than K = 8.0.
(4) In-rack sprinklers shall be designed to provide 172 kPa (25 psi) for the six most hydraulically remote sprinklers on each level.

7.4.1.2.2 It shall be permitted to protect Class 3 oxidizers in racks meeting the requirements of 7.4.1.1 in accordance with the protection requirements of 7.4.1.2.

7.4.2 Class 3 Oxidizers Greater Than or Equal to 1043 kg (2300 lb). Facilities having total quantities of Class 3 oxidizers equal to or greater than the threshold limits of Section 7.4 shall be protected in accordance with the requirements of 7.4.2.1.

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Table 7.4.2.1 Sprinkler Protection of Class 3 Oxidizers Stored in Total Quantities of Greater Than or Equal to 1043 kg (2300 lb)

	Bulk or Pile	Rack
Maximum storage height	3 m (10 ft)	3 m (10 ft)
Maximum ceiling height	7.6 m (25 ft)	NP
Aisles — pile separation	2.4 m (8 ft) min clear aisles	2.4 m (8 ft) min clear aisles
Ceiling design criteria	0.65 gpm/5000 ft^2	Predominant for other commodities but not less than ordinary hazard Group II
In-rack sprinklers	NP	See 7.4.2.2
Hose stream demand	500 gpm	500 gpm
Duration	120 minutes	120 minutes

NP: Not permitted.

7.4.2.1 Sprinkler protection required by 7.4.2.1 shall be in accordance with the requirements of Table 7.4.2.1.

7.4.2.2 Special In-Rack Sprinkler Protection for Class 3 Oxidizers.

7.4.2.2.1 Where required by Table 7.4.2.1, special in-rack sprinkler protection shall be as shown in Figure 7.4.2.2.1, which is required by 7.4.2.2.2, 7.4.2.2.3, and 7.4.2.2.4.

7.4.2.2.2 Racks shall be arranged in accordance with 7.4.2.2.2.1 through 7.4.2.2.2.8.

7.4.2.2.2.1 Racks shall be of steel construction.

7.4.2.2.2.2 Racks shall have vertical supports spaced no more than 3.05 m (10 ft) apart.

7.4.2.2.2.3 Horizontal rack members shall be spaced no more than 1.83 m (6 ft) apart vertically.

7.4.2.2.2.4 Display or storage shall be limited in height to two protected tiers.

7.4.2.2.2.5 Horizontal barriers constructed of plywood at least 9.5 mm (⅜ in.) thick shall be provided above each level of oxidizing material storage.

(A) These barriers shall extend from rack face to rack face and shall be tight to the vertical barriers described in 7.4.2.2.2.6 and 7.4.2.2.2.7.

(B) These barriers shall be supported by horizontal rack members.

7.4.2.2.2.6 Transverse vertical barriers constructed of plywood at least 9.5 mm (⅜ in.) thick shall be provided at the rack uprights extending from the rack face to rack face.

7.4.2.2.2.7 For double-row racks, longitudinal vertical barriers constructed of plywood at least 9.5 mm (⅜ in.) thick shall be provided at the rack uprights in the center of the rack.

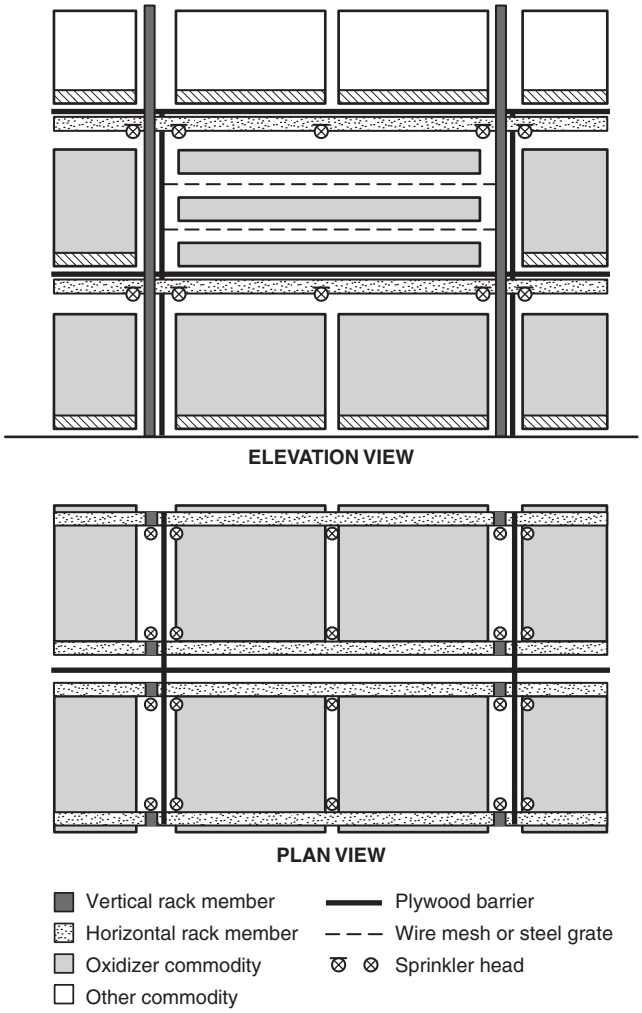


FIGURE 7.4.2.2.1 Arrangement of Barriers and In-Rack Sprinklers for Special Fire Protection Provisions.

7.4.2.2.2.8 If intermediate shelves are used between the horizontal barriers, the shelves shall be constructed of open wire mesh or steel grating.

7.4.2.2.3 In-rack automatic sprinklers shall be provided under each horizontal barrier and arranged in accordance with 7.4.2.2.3.1 through 7.4.2.2.3.8.

7.4.2.2.3.1 For double-row racks, two lines of in-rack sprinklers shall be provided between the face of the rack and the longitudinal vertical barrier located in the center of the rack.

7.4.2.2.3.2 For single-row racks, two lines of in-rack sprinklers shall be provided between each rack face.

7.4.2.2.3.3 Three in-rack sprinklers shall be provided on each in-rack sprinkler line.

(A) Two sprinklers on each line shall be spaced approximately 38.1 mm (1½ in.) from each transverse vertical barrier.

(B) One in-rack sprinkler on each in-rack sprinkler line shall be located approximately equidistant between the transverse vertical barriers.

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7.4.2.2.3.4 In-rack sprinklers shall be upright or pendent type with the fusible element located no more than 152.4 mm (6 in.) from the horizontal barrier.

7.4.2.2.3.5 The stock shall be maintained at least 152.4 mm (6 in.) below the sprinkler deflector.

7.4.2.2.3.6 In-rack sprinklers shall be K = 8.0, quick response, ordinary temperature rated.

7.4.2.2.3.7 The in-rack sprinkler system shall be designed to supply six sprinklers on each line with a total of 12 sprinklers operating at gauge pressure of 172 kPa (25 psi).

7.4.2.2.3.8 The design of the in-rack sprinkler system shall be independent of, and is not required to be balanced with, ceiling sprinkler systems.

7.4.2.2.4 Pallets, if used, shall be solid-deck type.

7.5 Detached Storage.

7.5.1 To be considered detached, a building for storage of Class 3 oxidizers shall be separated from flammable or combustible liquid storage, flammable gas storage, combustible material in the open, any building, passenger railroad, public highway, or other tanks.

7.5.2 The minimum separation distance shall be 15 m (50 ft) for a sprinklered building or 23 m (75 ft) for an unsprinklered building.

Chapter 8 Class 4 Oxidizers

8.1 Application.

8.1.1 This chapter applies to Class 4 oxidizers where stored in quantities in excess of 4.5 kg (10 lb).

8.1.2 Chapter 4 also applies to storage of Class 4 oxidizers.

8.1.3 Outdoor container storage shall meet the requirements of nonsprinklered buildings.

8.2 Storage Arrangements.

8.2.1 The storage of Class 4 oxidizers shall be detached.

8.2.2 Storage in glass carboys shall be one carboy high.

8.2.3 Storage in drums or in containers or in cases shall not exceed the limits outlined in Table 8.2.3.

8.2.4 Bulk storage in piles or fixed bins shall not be permitted.

8.3 Building Construction and Location.

8.3.1 Buildings shall be constructed as one story without basement.

8.3.2 Construction materials that could come in contact with oxidizers shall be noncombustible.

8.3.3 Storage areas shall be provided with means to vent fumes in an emergency.

8.3.4 A storage building or storage tank shall be located not less than the minimum distance provided in Table 8.3.4 from flammable liquid storage, combustible material in the open, any inhabited building, passenger railroad, public highway, property line, or tank other than oxidizer storage.

Table 8.2.3 Storage of Class 4 Oxidizers in Drums, Containers, and Cases

Storage Configurations and Quantities	Nonsprinklered Building		Sprinklered Building	
	Metric Units	U.S. Units	Metric Units	U.S. Units
Piles				
Length	3.0 m	10 ft	3.0 m	10 ft
Width	1.2 m	4 ft	1.2 m	4 ft
Height	1.2 m	4 ft	2.4 m	8 ft
Distance to next pile	1.8 m	6 ft	2.4 m	8 ft
Quantity limit per building	0.9 met ton	1 ton	Unlimited	Unlimited

Table 8.3.4 Separation of Buildings from Tanks Containing Class 4 Oxidizers

Weight of Class 4 Oxidizer		Distance	
kg	lb	m	ft
4.5–45.4	10–100	23	75
45.4–227	100–500	30	100
227–454	501–1,000	38	125
454–1,361	1,001–3,000	61	200
1,361–2,268	3,001–5,000	91	300
2,268–4,536	5,001–10,000	122	400
over 4,536	over 10,000	Subject to approval by the AHJ	

8.3.5* Where tanks are not separated from each other by 10 percent of the distance specified in Table 8.3.4 for the largest tank, the total contents of all tanks shall be used when using Table 8.3.4.

8.4 Sprinkler Protection.

8.4.1 Sprinkler protection for Class 4 oxidizers shall be installed on a deluge sprinkler system to provide water density of 14.4 L/min/m^2 (0.35 gpm/ft^2) over the entire storage area.

8.4.2 Sprinkler protection shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Chapter 9 Storage and Display of Oxidizing Materials in Mercantile Occupancies and Storage Occupancies

9.1 Application. This chapter applies to the display and storage of Class 1 through Class 3 oxidizers in mercantile occupancies and storage occupancies where the general public has access to the materials for sale and to the storage of additional oxidizing materials in such occupancies in areas that are not accessible to the public.

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9.2 General Requirements. Oxidizing materials that are displayed or stored in areas accessible to the general public shall meet the requirements of 9.2.1 through 9.2.5.

9.2.1* Oxidizing materials shall be separated from ordinary combustible and incompatible materials by a solid noncombustible barrier or by a horizontal distance of not less than 1.2 m (4 ft).

9.2.1.1 Ordinary combustibles shall not include approved packaging materials, pallets, or other dunnage used for the oxidizers.

9.2.1.2 Separation from ordinary combustible materials shall not be required for Class 1 oxidizers.

9.2.2 Solid oxidizing materials shall not be displayed directly beneath liquids.

9.2.3 For sprinklered mercantile occupancies and storage occupancies, storage heights and sprinkler protection criteria shall be in accordance with Chapter 5 through Chapter 8.

9.2.4 Storage and display of solids shall not exceed 200 lb/ft^2 (976.4 kg/m^2) of floor area actually occupied by solid merchandise.

9.2.5 Storage and display of liquids shall not exceed 20 gal/ft^2 (76 L/m^2) of floor area actually occupied by liquid merchandise.

9.2.6 Racks and shelves used for storage or display shall be of substantial construction and adequately braced and anchored.

9.2.7 Containers shall be approved for their intended use.

9.2.8 Individual containers shall not exceed 100 lb (45.4 kg) capacity for solids or a 5 gal (19 L) capacity for liquids.

9.2.9 Except for 4 mm surface coating, floors shall be of noncombustible construction.

9.2.10 Aisles 4 ft (1.2 m) in width shall be maintained on three sides of the storage or display area.

9.2.11 Hazard identification signs shall be provided in accordance with NFPA 1, *Uniform Fire Code*.

9.2.12 Storage Arrangements in Nonsprinklered Mercantile Occupancies and Storage Occupancies.

9.2.12.1 Storage and display of Class 2 and Class 3 oxidizing materials shall extend no higher than 1.8 m (6 ft) from the floor to the top of the uppermost container.

9.2.12.2 The storage and display of Class 2 and Class 3 oxidizers shall not exceed 1.2 m (4 ft) in depth.

9.2.13 Containers.

9.2.13.1 Individual containers less than 19 L (5 gal) or less than 11 kg (25 lb) shall be stored or displayed on pallets, racks, or shelves.

9.3 Quantity Limitations.

9.3.1 The quantity of oxidizing materials permitted in a mercantile occupancy or storage occupancy shall not exceed the quantities given in Table 9.3.1 for either nonsprinklered or sprinklered areas, whichever is applicable.

9.3.1.1 Facilities that require sprinkler protection having total quantities of Class 3 oxidizers greater than 91 kg (200 lb) but less than 1043 kg (2300 lb) shall comply with 7.4.1.1.

Table 9.3.1 Maximum Quantity of Oxidizers Allowed in Mercantile and Storage Occupancies

Class of Material	Weight Nonsprinklered		Weight Sprinklered	
	kg	lb	kg	lb
3	522	1,150	1,044	2,300
2	1,021	2,250	2,042	4,500
1	8,165	18,000	Unlimited	Unlimited

9.3.1.2 Additional quantities shall be permitted if located in control areas.

9.3.1.2.1 Control areas shall be constructed in accordance with *NFPA 5000, Building Construction and Safety Code*.

9.3.1.2.2 The number of control areas allowed shall be in accordance with *NFPA 5000*.

9.3.2 Quantities in excess of those in Table 9.3.1 shall comply with 7.4.2.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.1.3 The NFPA *Fire Protection Guide to Hazardous Materials* should be used for guidance on compatibility.

A.1.2 The decomposition of stored commercially available strengths of liquid and solid oxidizers can emit toxic gases. Additionally, the runoff from spills of stored oxidizers or from oxidizers mixed with fire-extinguishing agents can contain materials hazardous to the environment.

The hazards of stored oxidizers can manifest themselves in one or more of five distinct hazardous situations as follows:

(1) They increase the burning rate of combustible materials.
(2) They can cause spontaneous ignition of combustible materials.
(3) They can decompose rapidly.
(4) They can liberate hazardous gases.
(5) They can undergo self-sustained decomposition, which can result in an explosion.
(6) They can react explosively if mixed with incompatibles or in fire conditions.

A.3.2.1 Approved. 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 that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

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A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, 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.

A.3.2.3 Code. The decision to designate a standard as a "code" is based on such factors as the size and scope of the document, its intended use and form of adoption, and whether it contains substantial enforcement and administrative provisions.

A.3.2.5 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations 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.

A.3.3.3 Explosive Reaction. For further information on venting explosive reactions, see NFPA 68, *Guide for Venting of Deflagrations*.

A.3.3.5.3 Noncombustible Material. See NFPA 220, *Standard on Types of Building Construction*.

Materials that are reported as having passed ASTM E 136-969, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C*, are considered noncombustible materials. For the purposes of this code, noncombustible construction and limited-combustible construction are both considered to be noncombustible.

A.3.3.7 Oxidizer. Examples of other oxidizing gases include bromine, chlorine, and fluorine.

The classification of oxidizers is based on the technical committee's evaluation of available scientific and technical data, actual experience, and its considered opinion. Classification refers to the pure oxidizer. Gross contamination can cause oxidizers of all classes to undergo exothermic or explosive reaction, particularly if they also are subjected to confinement and heating. *(See Sections B.2 through B.5 for oxidizer classifications.)*

A.3.3.10.5 Segregated Storage. Sills, curbs, or intervening storage of nonhazardous compatible materials and aisles should be used as aids in maintaining separation.

A.4.2.1 The classification system for oxidizer hazard *(see 3.3.7)* should be used only to determine the storage requirements established by this code. It is not meant to be a substitute for the hazard identification system established by NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*. Since the hazard characteristics of oxidizers vary widely depending on the type of oxidizer and its relative concentration, each oxidizer should be rated individually according to the criteria established in NFPA 704.

NFPA 704 is designed to apprise fire fighters or emergency personnel of the inherent hazards related to the manufacture, storage, or use of hazardous materials. It is concerned with the health, fire, reactivity, and other related hazards created by short-term exposure that might be encountered under fire or related emergency conditions.

The hazard rating classifications for oxidizers do not correlate to the reactivity classification in NFPA 704.

A.4.4.2 Automatic sprinklers are an effective method to control fires involving oxidizers in conjunction with the other fire prevention requirements in the document.

A.4.4.3 Care should be exercised because some oxidizers are mutually incompatible. Chlorinated isocyanurates and hypochlorites are examples of oxidizers that are incompatible. The NFPA *Fire Protection Guide to Hazardous Materials* lists many oxidizers and other materials that result in hazardous interactions.

A.4.4.5 This requirement to restrict exposure to water is not intended to apply to the application of fire protection water.

A.4.11.1 Conditions that affect the need for hydrant protection include nearness of the exposures, size and construction of the building, amount and class of the oxidizer stored, and availability of public fire protection.

A.4.11.3 Dry-pipe and double-interlock preaction (DIPA) sprinkler systems are generally prohibited by 4.11.3 for use with oxidizers. In mercantile occupancies with open air environments that are already protected by these types of systems as prescribed by other codes, it is considered acceptable to store quantities defined by this code, with the recognition that these commodities may not be adequately protected. Outside storage in this manner is preferred to inside storage.

A.4.11.6.1 A dry chemical fire-extinguishing agent containing ammonium compounds (such as some A:B:C agents) should not be used on oxidizers that contain chlorine. The reaction between the oxidizer and the ammonium salts in the fire-extinguishing agent can produce an explosive compound (NCl_3). Carbon dioxide or other extinguishing agents that function by a smothering action for effective use are of no value in extinguishing fires involving oxidizers.

A.4.11.6.2 Halon extinguishers should not be used on fires involving oxidizers because they can react with the oxidizer.

A.4.11.6.3 Halocarbon clean agent extinguishers as identified in NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, are chemically similar to Halon and unless proven differently should be assumed to react with the oxidizer.

A.4.12 Impregnation of wood for fire retardancy or to prevent decay does not protect the wood from impregnation by the oxidizer.

A.4.13.2 Spill control, drainage, and containment are typically required under environmental regulations. Check the building code to determine whether it contains spill control requirements.

A.4.13.5 Where absorptive combustible packing materials used to contain water-soluble oxidizers have become wet during either fire or nonfire conditions, the oxidizer can impregnate the packing material. This creates a serious fire hazard when the packing material dries. Wooden pallets that are exposed to water solutions of an oxidizer also can exhibit this behavior.

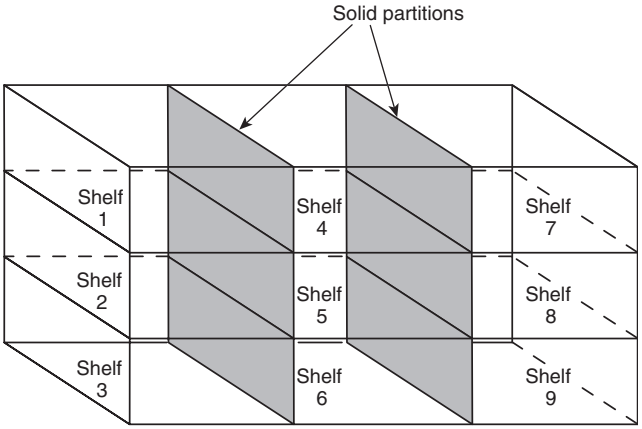
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A.5.3.2 Commodity refers to the definition in NFPA 13, *Standard for the Installation of Sprinkler Systems.*

A.6.2.4 Only the building limit, not the pile limit, height, or width, can be increased by this provision.

A.8.3.5 For example, two tanks contain 1814 kg (4000 lb) and 1360 kg (3000 lb) of Class 4 oxidizer and they are separated by 7.6 m (25 ft). Because they are separated by less than 10 percent of 92 m (300 ft), the total quantity of 3175 kg (7000 lb) requires a minimum separation of 122 m (400 ft) to the nearest important structure in accordance with 8.3.4.

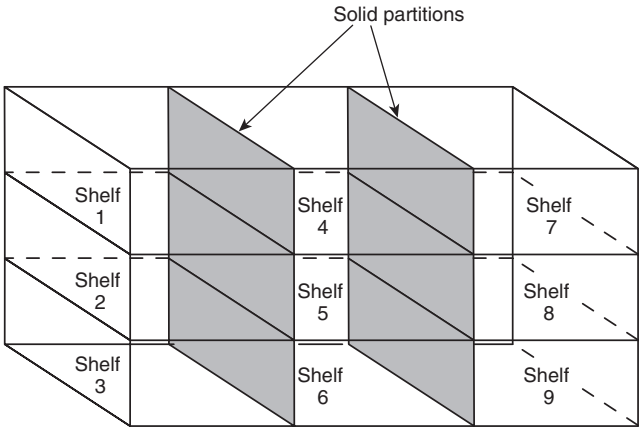
A.9.2.1 Recommended mercantile store arrangements for mutually incompatible oxidizers are shown in Figure A.9.2.1(a) and Figure A.9.2.1(b). These two diagrams illustrate arrangements that minimize the chance of exposure to incompatible materials. Wherever possible, vertical separation should be maintained between incompatible materials.



Shelf 1: Oxidizer A	Shelf 4: Oxidizer B	Shelf 7: Oxidizer C
Shelf 2: Oxidizer A	Shelf 5: Oxidizer B	Shelf 8: Oxidizer C
Shelf 3: Oxidizer A	Shelf 6: Oxidizer B	Shelf 9: Oxidizer C

Oxidizers A, B, and C are mutually incompatible.

FIGURE A.9.2.1(a) Recommended Mercantile Store Arrangement for Mutually Incompatible Oxidizers.



Shelf 1: Oxidizer A	Shelf 4: Oxidizer C	Shelf 7: Oxidizer D
Shelf 2: Inert	Shelf 5: Inert	Shelf 8: Inert
Shelf 3: Oxidizer B	Shelf 6: Incompatible liquid	Shelf 9: Incompatible liquid

Oxidizers A, B, C, and D are mutually incompatible with each other and with the incompatible liquids.

FIGURE A.9.2.1(b) Recommended Mercantile Store Arrangement for Mutually Incompatible Oxidizers and Other Incompatible Materials.

Annex B Typical Oxidizers

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

B.1 General. Unless concentration is specified, undiluted material is referenced. The lists of oxidizers in B.2 through B.5 are provided to clarify how the committee has classified typical oxidizers. The lists are not all-inclusive and are amended to reflect typical oxidizers used.

B.2 Class 1 Oxidizers. The following are typical Class 1 oxidizers:

(1) All inorganic nitrates (unless otherwise classified)
(2) All inorganic nitrites (unless otherwise classified)
(3) Ammonium persulfate
(4) Barium peroxide
(5) Calcium peroxide
(6) Hydrogen peroxide solutions (greater than 8 percent up to 27.5 percent)
(7) Lead dioxide
(8) Lithium hypochlorite (39 percent or less available chlorine)
(9) Lithium peroxide
(10) Magnesium peroxide
(11) Manganese dioxide
(12) Nitric acid (40 percent concentration or less)
(13) Perchloric acid solutions (less than 50 percent by weight)
(14) Potassium dichromate
(15) Potassium percarbonate
(16) Potassium persulfate
(17) Sodium carbonate peroxide
(18) Sodium dichloro-s-triazinetrione dihydrate (sodium dicholorisocyanurate dihydrate)
(19) Sodium dichromate
(20) Sodium perborate (anhydrous)
(21) Sodium perborate monohydrate
(22) Sodium perborate tetrahydrate
(23) Sodium percarbonate
(24) Sodium persulfate
(25) Strontium peroxide
(26) Trichloro-s-triazinetrione [trichloroisocyanuric acid (TCCA; trichlor), all physical forms]
(27) Zinc peroxide

B.3 Class 2 Oxidizers. The following are typical Class 2 oxidizers:

(1) Barium bromate
(2) Barium chlorate
(3) Barium hypochlorite
(4) Barium perchlorate
(5) Barium permanganate
(6) 1-Bromo-3-chloro-5,5-dimethylhydantoin (BCDMH)
(7) Calcium chlorate
(8) Calcium chlorite

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(9) Calcium hypochlorite (50 percent or less by weight)
(10) Calcium perchlorate
(11) Calcium permanganate
(12) Chromium trioxide (chromic acid)
(13) Copper chlorate
(14) Halane (1,3-dichloro-5,5-dimethylhydantoin)
(15) Hydrogen peroxide (greater than 27.5 percent up to 52 percent)
(16) Lead perchlorate
(17) Lithium chlorate
(18) Lithium hypochlorite (more than 39 percent available chlorine)
(19) Lithium perchlorate
(20) Magnesium bromate
(21) Magnesium chlorate
(22) Magnesium perchlorate
(23) Mercurous chlorate
(24) Nitric acid (more than 40 percent but less than 86 percent)
(25) Nitrogen tetroxide
(26) Perchloric acid solutions (more than 50 percent but less than 60 percent)
(27) Potassium perchlorate
(28) Potassium permanganate
(29) Potassium peroxide
(30) Potassium superoxide
(31) Silver peroxide
(32) Sodium chlorite (40 percent or less by weight)
(33) Sodium perchlorate
(34) Sodium perchlorate monohydrate
(35) Sodium permanganate
(36) Sodium peroxide
(37) Strontium chlorate
(38) Strontium perchlorate
(39) Thallium chlorate
(40) Urea hydrogen peroxide
(41) Zinc bromate
(42) Zinc chlorate
(43) Zinc permanganate

B.4 Class 3 Oxidizers. The following are typical Class 3 oxidizers:

(1) Ammonium dichromate
(2) Calcium hypochlorite (over 50 percent by weight)
(3) Chloric acid (10 percent maximum concentration)
(4) Hydrogen peroxide solutions (greater than 52 percent up to 91 percent)
(5) Mono-(trichloro)-tetra-(monopotassium dichloro)-penta-s-triazinetrione
(6) Nitric acid, fuming (more than 86 percent concentration)
(7) Perchloric acid solutions (60 percent to 72 percent by weight)
(8) Potassium bromate
(9) Potassium chlorate
(10) Potassium dichloro-s-triazinetrione (potassium dichloroisocyanurate)
(11) Sodium bromate
(12) Sodium chlorate
(13) Sodium chlorite (over 40 percent by weight)
(14) Sodium dichloro-s-triazinetrione anhydrous (sodium dichloroisocyanurate anhydrous)

B.5 Class 4 Oxidizers. The following are typical Class 4 oxidizers:

(1) Ammonium perchlorate (particle size greater than 15 microns)
(2) Ammonium permanganate
(3) Guanidine nitrate
(4) Hydrogen peroxide solutions (greater than 91 percent)
(5) Tetranitromethane

Ammonium perchlorate less than 15 microns is classified as an explosive and, as such, is not covered by this code. *(See* NFPA 495, *Explosive Materials Code.)*

Annex C Methods and Procedures for Emergency Response Involving Solid Oxidizers

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

C.1 Oxidizer Hazards. Incidents that involve oxidizers must be handled in a timely manner and with an understanding of the hazards and properties of the materials involved. This section identifies the key elements that must be understood when dealing with oxidizers that are under distress either from a spill, contamination, decomposition, or fire from a source other than the oxidizers.

The hazards of stored oxidizers can manifest themselves in one or more of six distinct hazardous situations as follows:

(1) They increase the burning rate of combustible materials.
(2) They can cause spontaneous ignition of combustible materials.
(3) They can decompose rapidly.
(4) They can liberate hazardous gases.
(5) They can undergo self-sustained decomposition, which can result in an explosion.
(6) They can react explosively if mixed with incompatibles or in fire conditions.

C.2 Handling Incidents Involving Oxidizers. Anyone handling or using oxidizers should be fully aware of proper storage and handling requirements as well as emergency and first-aid procedures in case of an accident. Oxidizers are incompatible with many chemicals or other materials. It is essential to follow all storage and handling procedures in order to prevent conditions that might cause emergencies, such as a fire or explosion.

Before attempting to clean any oxidizer spill, be certain that the spilled material is dry and has not been contaminated. If there are any signs that a reaction has begun (hissing, bubbling, smoking, gassing, burning, or bulging or hot containers), evacuate the area immediately and contact your local fire department for assistance. If the product is not reacting but has mixed with chemicals or other materials, contact your local fire department. If you have any concerns regarding emergency procedures, immediately contact Chemtrec® at 1-800-424-9300 or the manufacturer for emergency instructions.

C.2.1 General considerations when responding to an oxidizer incident are as follows:

(1) Use trained personnel who understand the specific hazards of the oxidizers involved.
(2) Consult the manufacturer for technical assistance.
(3) Understand the reaction characteristic of the hazards of the specific oxidizer involved.
(4) Use a specific protocol on how to clean up the oxidizers involved.
(5) Prevent oxidizer and incompatibles from contacting each other.
(6) Control temperature below the maximum recommended storage temperature.
(7) If there are signs of decomposition, allow for heat dissipation.

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(8) Control the cleanup site, including moving overpack containers to a safe and secure location, preferably outside the storage building.
(9) Move container to a safe, secure, dry, open outside area, or to a location designated by the competent individual, to await disposal in conformance with applicable regulations and manufacturer's or processor's instructions.
(10) Monitor overpacks to ensure that a slow decomposition reaction cannot lead to a self-accelerated decomposition reaction or fire.
(11) Manage the size and location of the cleanup pile so that a decomposition reaction cannot spread to other areas.
(12) Have water available for early intervention if a reaction starts.
(13) Do not use any material or equipment that could contaminate the spilled material.
(14) Do not dispose of the material with incompatible chemicals or materials.
(15) Keep material dry during cleanup and, if material becomes damp, see Section D.3.
(16) Do not allow unnecessary or untrained personnel in the area during the cleanup.
(17) Wear appropriate protective gear and refer to Emergency Response Plan or material safety data sheet (MSDS).
(18) Store cleanup supplies in a cabinet or marked off area where they can be accessed quickly when needed.
(19) Train employees in the cleanup procedures of the facility.

C.2.1.1 Water is the most important element in controlling an oxidizer incident or fire. The proper use of water is the most important element in controlling a fire involving oxidizers. Do not use dry chemical extinguishing agent on oxidizer fires.

C.2.1.2 The following are guidelines for the use of water in fire control:

(1) Water in sufficient quantities stops or prevents an oxidizer fire from spreading.
(2) Water in sufficient quantities greatly reduces the reactivity of most oxidizers. Refer to the MSDS to determine the characteristics of the specific oxidizers that you are handling.
(3) Adding water normally slows the decomposition, reduces liberation of hazardous gas, and eliminates self-sustained decomposition.
(4) Some oxidizers, primarily trichlor, can react with small amounts of water over a period of time and form NCl_3, a potentially explosive compound. Even though NCl_3 is formed, water should continue to be added. Water in sufficient quantities is still the best method to control an oxidizer in a fire. Consult the manufacturer on how to handle and dispose of damp oxidizers.
(5) Some oxidizers can dry out after wetting and, if contaminated, can react, causing a possible fire.
(6) The water runoff from an oxidizer fire should be contained to protect the environment.

C.2.2 Spill Responses. If you have expertise addressing chemical spills, be sure to evaluate whether the material you are handling and the containers you are using are dry and uncontaminated. Follow applicable regulations when disposing of any material. Whether or not there is a fire, call the supplier for instructions on how best to clean up and remove spilled material and for other useful information. (Use the emergency telephone number on the container, the MSDS, or other information supplied by the manufacturer. Additional emergency information can be obtained through Chemtrec® and Canutec.)

C.2.3 Procedure for Cleaning Uncontaminated Dry Spills. If the spill is dry and uncontaminated and there are no signs of decomposition or fire, the following approach should be used. Alternate or additional procedures might be advisable, depending upon site-specific circumstances. Users must tailor the cleanup to their own particular circumstances. Contact the manufacturer for further instructions.

(1) Evaluate and respond as follows:
  (a) If reacting, call the fire department.
  (b) If product is contaminated with any other chemical or material, call the fire department.
  (c) In the event of a large spill [45.4 kg (100 lb) or more], call the fire department.
  (d) In the event of a small spill [under 45.4 kg (100 lb)], proceed only if trained or refer to manufacturer's instructions.
  (e) Contact the manufacturer.
(2) Isolate and ventilate the area as follows:
  (a) Mark off area.
  (b) Keep people away.
  (c) Do not breathe dust.
  (d) Open doors and windows.
(3) Wear protective clothing as follows:
  (a) Rubber or neoprene gloves, boots, and aprons
  (b) Protective goggles or safety glasses
  (c) NIOSH/MSHA-approved respirator or breathing apparatus
(4) Get two clean, dry, plastic containers (or suitable containers) large enough to hold the spilled material and proceed as follows:
  (a) Line clean, suitable container with two clear-plastic bags.
  (b) Place damaged container into one of the suitable containers.
  (c) Label the container(s) properly and identify contents.
  (d) Loosely place lid and leave unsealed.
  (e) Do not place spilled chemical into original container.
(5) Get clean broom and shovel and proceed as follows:
  (a) Carefully sweep up spilled chemical.
  (b) Place spilled material in clean clear-plastic bag.
  (c) Place plastic bag into second container.
  (d) Label container(s) accordingly to identify contents.
(6) Remove containers to isolated area as follows:
  (a) Move waste material to a safe and protected location in case there is a decomposition reaction.
  (b) Keep away from children and high traffic areas.
  (c) Avoid getting process duct wet.
(7) Thoroughly wash area with water to remove residue.
(8) Wash and dry the following equipment:
  (a) Broom and shovel
  (b) Protective clothing
(9) Contact manufacturer for proper disposal of chemicals.

C.3 Specific Hazards of Oxidizer Fires, Reacting Oxidizers, and Large Oxidizer Incidents.

C.3.1 Emergency Response Plans and Actions. It is the responsibility of each facility to have an emergency plan and train their employees in the requirements of the plan.

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It is the primary responsibility of each facility employee to follow the pre-established guidelines set forth in an emergency plan.

C.3.2 Specific Emergencies.

C.3.2.1 Fire and Fume Hazards. Oxidizers are not combustible per se. However, if oxidizers are heated and/or contaminated to their decomposition range by an outside source, they can decompose, resulting in the generation of heat. The intensity of the decomposition can be sufficient to ignite paper and wood and a fire can result. Upon thermal decomposition, some oxidizers can give off dense clouds of gases that can be toxic, noxious, and very difficult to see through. Check MSDS or contact manufacturer for the possible types of hazardous decomposition products during a thermal decomposition.

In case of fire or decomposition, immediately implement your emergency plan to minimize loss of life or property. An emergency plan commonly includes the following steps:

(1) In the event of an emergency, contact your local fire department, ambulatory service, or police department immediately.
(2) State your full name, company name, address, and telephone number.
(3) State nature of emergency (i.e., fire, gas leak).
(4) State type of assistance required (i.e., ambulance, fire).
(5) If possible, stay on the line until the emergency operator understands the information.

Emergency numbers should be pre-set on all store phones to assist calling. Numbers should be in bold or colored print.

The following are issues regarding the use of personal protective equipment that should be considered:

(1) Be prepared to use the appropriate personal protective equipment, which can include SCBA, in an emergency.
(2) For small, controllable fires, use appropriate safety equipment. Only trained personnel should attempt to extinguish fires. Do not fight any fire alone.
(3) If swimming pool chemicals are involved in a fire or reaction, use large quantities of water. Do not use dry chemical extinguishers because they can contain ammonium compounds, which could react and release toxic or explosive gases. Provisions should be made for the containment of runoff water (i.e., diking with sandbags, dirt, or other suitable material). If there is a fire or if the pool chemical product is contaminated with another chemical, the area should be evacuated and the fire department called immediately even if the building has a sprinkler system.
(4) Direct unnecessary personnel away from the area.

Do not allow oxidizers or fire water to enter sewers, waterways, or trash containers and keep unneutralized and chlorinated chemicals out of sewers, watersheds, or water systems.

C.3.2.2 Reacting Oxidizers. Oxidizers are stable when stored in a cool, dry, well-ventilated area and not contaminated by other materials, such as acids, bases, or easily oxidizable materials. Oxidizers can become dangerous if mishandled, improperly stored, or contaminated. They could become unstable or undergo a decomposition reaction, which could produce intense heat, hazardous gases, fire, or explosion.

Oxidizers are also incompatible with many of the other chemicals used in commerce, such as organic solvents, algaecides, other oxidizers, and pH adjusting materials. Some of the materials that are incompatible with oxidizers are listed as follows:

(1) Acids
(2) Alcohols (methyl, ethyl, propyl, and higher alcohols)
(3) Aliphatic and aromatic unsaturated compounds
(4) Amines
(5) Ammonia and ammonium salts
(6) Bases
(7) Carbonated beverages
(8) Ethers
(9) Floor sweeping compounds
(10) Glycerin
(11) Paint, oils, and greases
(12) Peroxides (hydrogen, sodium, calcium, etc.)
(13) Petroleum products (gasoline, kerosene, etc.)
(14) Phenols
(15) Other oxidizers
(16) Quaternary ammonium compounds ("quats" such as algaecides)
(17) Reducing agents (sulfides, sulfites, bisulfites, thiosulfates)
(18) Solvents (toluene, xylene, etc.)

It should be noted that this list is not comprehensive. For more information on the incompatibilities between pool chemicals and other materials, the appropriate pool chemical supplier or manufacturer should be contacted.

Some oxidizers, such as trichloroisocyanuric acid (TCCA; trichlor) can give off toxic gases and form NCl_3 if small amounts of water are added. Special precautions should be used when handling these oxidizers. If containers of one of these oxidizers become wet, they could contain NCl_3, which is a potential explosive. Before handling wet oxidizers, the manufacturer should be contacted for instructions.

A response to a reacting oxidizer incident is as follows:

(1) Contact appropriate emergency personnel. Responder should assess the nature and magnitude of the emergency.
(2) If there are any signs that a reaction has begun (hissing, bubbling, smoking, gassing, burning, or bulging or hot containers), evacuate the area immediately and contact the local fire department for assistance. If the product is not reacting but has mixed with other chemicals or other materials, contact your local fire department.
(3) Additional information can be obtained by using the emergency telephone number on the container or other information supplied by the manufacturer or by calling Chemtrec.
(4) Water in sufficient quantities greatly reduces the reactivity of most oxidizers and can stop or prevent a fire. Water slows the decomposition reaction, reduces liberation of hazardous gas, and eliminates self-sustained decomposition.
(5) When overpacking product, continuously monitor to be sure that the product is not decomposing, because if the heat of decomposition cannot be dissipated, then the increased temperature can result in a self-sustained decomposition and possible fire.
(6) On-site neutralization might be the only acceptable solution for reacting and contaminated material.
(7) Have a sufficient water source available to stop an oxidizer reaction in case a decomposition reaction starts.
(8) Contamination and high temperatures are the major reasons an oxidizer reaction starts. During a cleanup, packaging materials should be handled so that the product is not contaminated and the temperatures of all packages are maintained below the recommended storage temperature for the specific oxidizers involved.

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(9) Contaminated oxidizers should never be mixed with packaging material. Only original noncontaminated packaging material can be in overpack.
(10) Do not place spilled chemicals into the trash. Contact with incompatible materials could cause a reaction.
(11) Keep spilled material dry. If allowed to stand in damp or wet areas, tear-producing vapors can result. Dampening the product with water during the cleanup process can cause a decomposition reaction.
(12) Keep unneutralized and chlorinated chemicals out of sewers, watersheds, or water systems.

C.3.2.3 Personal Protective Equipment. When handling chemicals or cleaning up a spill, the manufacturer's MSDS for personal protective equipment recommendations should be consulted, which can include:

(1) Chemical-resistant gloves
(2) Chemical-resistant boots
(3) Chemical-resistant coveralls/aprons
(4) Face shields
(5) NIOSH-approved respiratory protection for the conditions

A NIOSH-approved, positive-pressure, self-contained breathing apparatus (SCBA) plus any other necessary personal protective equipment should be worn if toxic fumes are present. Chlorine and other toxic gases can be released during a fire or decomposing reaction.

Annex D Safety Information on Swimming Pool Chemicals

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

D.1 Handling Swimming Pool Chemicals. Pool chemicals oxidizers and sanitizers are one of the most widely used, manufactured, and distributed oxidizers. Anyone handling or using swimming pool chemicals should be fully aware of proper storage and handling requirements, as well as emergency and first-aid procedures in case of an accident. Chlorinated pool chemicals are incompatible with many chemicals associated with pool care, including algaecides, pool conditioners (stabilizers), clarifiers, and other types of chlorine. It is essential to follow all storage and handling procedures in order to prevent conditions that might cause emergencies, such as a fire or explosion. This section includes specific information on pool chemicals oxidizers.

Calcium hypochlorite (cal hypo), lithium hypochlorite, and chlorinated isocyanurates (dichlor and trichlor) are not combustibles. They are oxidizers. This means that some oxidizers can cause the spontaneous ignition and increase the burning rate of combustible materials, including the majority of their packaging material. Oxidizers decompose rapidly and undergo self-sustained decomposition, which can result in an intense fire or explosion. The decomposition of dry chlorinated pool chemicals can also produce toxic and corrosive gases.

Because of the composition and properties of calcium hypochlorite, lithium hypochlorite, and chlorinated isocyanurates, special precautions are required to prevent contact and reaction with each other and other chemicals. Reactions will occur if they are physically mixed together.

D.1.1 Calcium Hypochlorite. Calcium hypochlorite, commonly known as cal hypo, decomposes above 177°C (350°F). The decomposition will generate oxygen and heat, possibly resulting in a fire of great intensity if combustible materials are present. Direct exposure fire could cause the materials to decompose, the container to erupt, and the fire to reach vastly higher levels of intensity. Decomposition leaves an inert residue consisting mainly of calcium chloride. Cal hypo (over 50% by weight) is classified as a Class 3 oxidizer. Cal hypo (50% or less by weight) is classified as a Class 2 oxidizer.

D.1.2 Lithium Hypochlorite. Lithium hypochlorite decomposes at 135°C (275°F), producing oxygen, lithium hydroxide, lithium chlorates, and hazardous gases. Contamination with moisture, organic matter, or other chemicals may start a chemical reaction that generates heat, hazardous gases, fire, and explosion. Lithium hypochlorite (available chlorine of 39% or less) is classified as a Class 1 oxidizer. Lithium hypochlorite (more than 39% available chlorine) is classified as a Class 2 oxidizer.

D.1.3 Sodium Dichloroisocyanurate. Sodium dichloroisocyanurate is commonly known as dichlor. It decomposes in the range of 220°C to 250°C (428°F to 482°F) and can generate enough heat to ignite items such as paper and wood. Dichlors will sustain thermal decomposition above 220°C (428°F), even in the absence of oxygen. Decomposition results in a yellow or brown porous inert residue. Anhydrous dichlor is classified as a Class 3 oxidizer. Dichlor dihydrate is classified by NFPA as a Class 1 oxidizer.

D.1.4 Trichloroisocyanuric Acid. Trichloroisocyanuric acid is commonly known as trichlor. It decomposes in the range of 220°C to 250°C (428°F to 482°F). Decomposition of trichlor requires a continuous source of heat. Once the heat source is removed, trichlor will not continue to decompose. Partial decomposition leaves a yellow or brown residue. Complete decomposition leaves only traces of residue. Trichlor is classified by NFPA as a Class 1 oxidizer.

D.2 Specific Response Information for Chlorinated Isocyanurates (Chlorinated Isocyanurates, Dichlor, Trichlor). It is necessary for emergency responders to be aware of properties of chlorinated isocyanurates (chlorinated isocyanurates, dichlor, trichlor) that can create hazardous conditions. The reaction of these chemicals or mixtures containing these chemicals with other materials can lead to the generation of hazardous gases and fire.

When stored correctly and not exposed to other materials, these chemicals are safe to transport, store, handle, and use. However, in emergencies, conditions can occur that will cause containers to rupture, material to spill, or become contaminated. It is important that correct actions be taken quickly in response to these conditions.

D.2.1 Reactivity. The best approach to dealing with the reactivity of these chemicals is to assume that they will react with anything they contact. Some of the reactions, particularly those with fuels (kerosene, diesel oil, etc.) and some other organic materials, are very fast and violent. Others take some time to happen. An example of this is when spilled material is placed in a dumpster with no apparent reaction. Hours later, a fire occurs because of a slow reaction with other material.

Other oxidizers, particularly cal hypo, also reacts with chlorinated isocyanurates. Wet mixtures of chlorinated isocyanurates and calcium hypochlorite react vigorously, releasing large volumes of chlorine (Cl_2) gas.

Emergency responders should be aware of oxidizers being stored in their area of response, visit the facilities, and obtain copies of the MSDS associated with the chemicals being

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stored. Knowledge of the facility and the chemicals being stored makes any response more efficient and effective.

The following suggested actions and precautions should be taken during an emergency where chlorinated isocyanurates are present:

(1) Emergency responders need to know their capabilities and limitations. If you are not completely sure that you can deal effectively with an emergency, get help from other responders or the manufacturer of the chemical. Contact chemical manufacturers directly or through Chemtrec® at 1-800-424-9300.
(2) During an emergency, only allow necessary personnel in the affected area.
(3) Because hazardous gases might be present, be sure to have self-contained breathing apparatus (SCBA) available and wear when necessary. Other personal protective equipment might also be necessary to use.
(4) Do not flush these chemicals or otherwise allow them to go into waterways or sewers without clearance from the appropriate officials.
(5) If there is any sign of a reaction taking place, cordon off and do not approach the area until a complete assessment has taken place.
(6) If any packaging containing chlorinated isocyanurates become breached and the chlorinated isocyanurate becomes wet, NCl_3, a potential explosive, may be formed. Before handling, contact the manufacturer for instructions.
(7) Do not put spilled material back into its original container or any trash receptacle.
(8) Read the MSDS and product label for additional safety information.

D.3 Specific Response Information for Calcium Hypochlorite. It is necessary for emergency responders to be aware of properties of calcium hypochlorite that can create hazardous conditions. The reactions of calcium hypochlorite or mixtures containing calcium hypochlorite with other materials can lead to fire and hazardous gases. When stored correctly and not exposed to other materials, these chemicals are safe to transport, store, handle, and use. However, in emergencies, conditions can occur that will cause containers to rupture and material to spill or become contaminated. It is important that correct actions be taken quickly in response to these conditions.

In its initial stage, the decomposition of calcium hypochlorite [$Ca(OCl)_2$] proceeds to calcium chloride and oxygen and calcium chlorate. This reaction is an exothermic reaction, which can produce sufficient heat to decompose the product and ignite surrounding materials. Thermal runaway reaction does not occur as long as material is at equilibrium, where the heat generated is equal to the heat lost to the surroundings. A secondary reaction can give off chlorine gas.

D.3.1 Storage. Calcium hypochlorite products should be stored in sealed original containers in a cool, dry, well-ventilated area. Containers should be stored away from combustible or flammable products, and product packaging should be kept clean and free of all contamination, including other pool treatment products, acids, organic materials, nitrogen-containing compounds, dry powder fire extinguishers (containing mono-ammonium phosphate), oxidizers, all corrosive liquids, flammable or combustible materials, etc. These products must not be stored at temperatures above 52°C (125°F). Storage above this temperature for an extended period of time (5 days or more) may result in decomposition, evolution of chlorine gas, and heat sufficient to ignite combustible products.

If calcium hypochlorite has been contaminated or stored at elevated temperatures above 52°C (125°F) for an extended period of time, decomposition can occur. Signs of decomposition are heat; $CaCl_2$ release, which can be seen as moisture on the surrounding walls from the $CaCl_2$ absorbing moisture from the air; Cl_2 gas plus container discolorization; or degrading of the packaging.

Extra precaution should be taken when handling calcium hypochlorite or any other oxidizer that might be decomposing.

If the material shows signs of decomposition, it should be moved to a safe, protected, and well-ventilated area away from other hazardous materials. This movement would prevent a fire spreading in the event of rapid decomposition.

(1) Special care should be taken when overpacking material that may be slowly decomposing to be sure that the heat can be dissipated and that a runaway reaction does not occur.
(2) If the decomposing material cannot be moved, move other hazardous or combustible material out of the area.
(3) A fire water protection source should be available during the disposal and cleanup operation in case the product starts an accelerated decomposition. Water can be used to mitigate decomposing calcium hypochlorite; once the material is thoroughly wet, the risk of a runaway reaction has been greatly reduced. Lime can be added to reduce the fuming or off gassing of wet calcium hypochlorite.

Annex E Sample Ordinance Adopting NFPA 430

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

E.1 The following sample ordinance is provided to assist a jurisdiction in the adoption of this code and is not part of this code.

ORDINANCE NO. _____

An ordinance of the *[jurisdiction]* adopting the *[year]* edition of NFPA *[document number]*, *[complete document title]*, and documents listed in Chapter 2 of that *[code, standard]*; prescribing regulations governing conditions hazardous to life and property from fire or explosion; providing for the issuance of permits and collection of fees; repealing Ordinance No. _____ of the *[jurisdiction]* and all other ordinances and parts of ordinances in conflict therewith; providing a penalty; providing a severability clause; and providing for publication; and providing an effective date.

BE IT ORDAINED BY THE *[governing body]* OF THE *[jurisdiction]*:

SECTION 1 That the *[complete document title]* and documents adopted by Chapter 2, three (3) copies of which are on file and are open to inspection by the public in the office of the *[jurisdiction's keeper of records]* of the *[jurisdiction]*, are hereby adopted and incorporated into this ordinance as fully as if set out at length herein, and from the date on which this ordinance shall take effect, the provisions thereof shall be controlling within the limits of the *[jurisdiction]*. The same are hereby adopted as the *[code, standard]* of the *[jurisdiction]* for the purpose of prescribing regulations governing conditions hazardous to life and property from fire or explosion and providing for issuance of permits and collection of fees.

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SECTION 2 Any person who shall violate any provision of this code or standard hereby adopted or fail to comply therewith; or who shall violate or fail to comply with any order made thereunder; or who shall build in violation of any detailed statement of specifications or plans submitted and approved thereunder; or fail to operate in accordance with any certificate or permit issued thereunder; and from which no appeal has been taken; or who shall fail to comply with such an order as affirmed or modified by a court of competent jurisdiction, within the time fixed herein, shall severally for each and every such violation and noncompliance, respectively, be guilty of a misdemeanor, punishable by a fine of not less than $ _____ nor more than $_____ or by imprisonment for not less than _____ days nor more than _____ days or by both such fine and imprisonment. The imposition of one penalty for any violation shall not excuse the violation or permit it to continue; and all such persons shall be required to correct or remedy such violations or defects within a reasonable time; and when not otherwise specified the application of the above penalty shall not be held to prevent the enforced removal of prohibited conditions. Each day that prohibited conditions are maintained shall constitute a separate offense.

SECTION 3 Additions, insertions, and changes — that the *[year]* edition of NFPA *[document number]*, *[complete document title]* is amended and changed in the following respects:

List Amendments

SECTION 4 That ordinance No. _____ of *[jurisdiction]* entitled *[fill in the title of the ordinance or ordinances in effect at the present time]* and all other ordinances or parts of ordinances in conflict herewith are hereby repealed.

SECTION 5 That if any section, subsection, sentence, clause, or phrase of this ordinance is, for any reason, held to be invalid or unconstitutional, such decision shall not affect the validity or constitutionality of the remaining portions of this ordinance. The *[governing body]* hereby declares that it would have passed this ordinance, and each section, subsection, clause, or phrase hereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, and phrases be declared unconstitutional.

SECTION 6 That the *[jurisdiction's keeper of records]* is hereby ordered and directed to cause this ordinance to be published.

[NOTE: An additional provision may be required to direct the number of times the ordinance is to be published and to specify that it is to be in a newspaper in general circulation. Posting may also be required.]

SECTION 7 That this ordinance and the rules, regulations, provisions, requirements, orders, and matters established and adopted hereby shall take effect and be in full force and effect *[time period]* from and after the date of its final passage and adoption.

Annex F Informational References

F.1 Referenced Publications. The following documents or portions thereof are referenced within this code for informational purposes only and are thus not part of the requirements of this document unless also listed in Chapter 2.

F.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2002 edition.

NFPA 68, *Guide for Venting of Deflagrations*, 2002 edition.

NFPA 220, *Standard on Types of Building Construction*, 1999 edition.

NFPA 495, *Explosive Materials Code*, 2001 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2001 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2004 edition.

Fire Protection Guide to Hazardous Materials, 1997 edition.

F.1.2 Other Publications.

F.1.2.1 ASTM Publication. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 136-969, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C*, 1998.

F.2 Informational Publications. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

F.2.1 NFPA Publication. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 230, *Standard for the Fire Protection of Storage*, 2003 edition.

F.3 References for Extracts. (Reserved)

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