

NFPA 430

Code for the Storage of Liquid and Solid Oxidizers

2000 Edition



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

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NFPA 430

Code for the Storage of Liquid and Solid Oxidizers

2000 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 the National Fire Protection Association, Inc., at its November Meeting held November 14–17, 1999, in New Orleans, LA. It was issued by the Standards Council on January 14, 2000, with an effective date of February 11, 2000, and supersedes all previous editions.

This edition of NFPA 430 was approved as an American National Standard on February 11, 2000.

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.

This 2000 edition of NFPA 430 contains new requirements for the storage and display of oxidizing materials in retail occupancies. These requirements are located in the new Chapter 7. These requirements address quantities of materials stored, location and arrangement of materials, and fire protection.

Technical Committee on Hazardous Chemicals

John A. Davenport, *Chair*
HSB Industrial Risk Insurers, CT [I]

John R. Anderson, Leslie's Swimming Pool Supplies, CA [U]

Anthony Andrews, Witco Corp., TX [M]
Rep. The Society of the Plastics Industry, Inc.

James E. Benge, Hercules Inc., DE [U]

William J. Bradford, Brookfield, CT [SE]

Henry L. Febo, Jr., Factory Mutual Research Corp., MA [I]

Richard Ferguson, PPG Industries, PA [M]

Charles L. Gibson, Gibson Technology & Engr Assoc., GA [SE]

H. Dieter Heinz, Heinz Laboratories Int'l, CA [SE]

John M. Hoffmann, Safety Engr Laboratories, Inc., MI [SE]

Bart Howard, Davenport Fire Dept., IA [E]

Chester M. McCloskey, The Norac Co. Inc., CA [M]

Robert A. Michaels, RAM TRAC Corp., NY [SE]

Ralph J. Mikida, FMC Corp., PA [M]

Milton Norsworthy, Olin Corp., TN [M]

David P. Nugent, Schirmer Engr Corp., IL [SE]

Anthony M. Ordile, Loss Control Assoc., Inc., PA [SE]

David F. Purdy, BioLab, Inc., GA [M]

Gary A. Page, American Home Products, NJ [M]

George W. Rambo, GRCS Inc., VA [SE]

Gary F. Trojak, Chlorine Inst. Inc., DC [M]

(Vote Ltd. NFPA 434)

Michael A. Viggiani, George Eastman House, NY [U]

Matthew C. Woody, Des Moines Fire Dept., IA [E]

Philip Yeager, Phoenix Fire Dept., AZ [E]

Alternates

Paul A. Cera, HSB Industrial Risk Insurers, CT [I]

(Alt. to J. A. Davenport)

Richard Cobb, The Norac Co., Inc., CA [M]

(Alt. to C. M. McCloskey)

Lynne R. Harris, The Society of the Plastics Industry, Inc., DC [M]

(Alt. to A. Andrews)

Donald J. Hoffmann, Safety Engr Laboratories, Inc., MI [SE]

(Alt. to J. M. Hoffmann)

Thomas M. Lachocki, BioLab, Inc., GA [M]

(Alt. to D. F. Purdy)

R. K. Lee, PPG Industries, PA [M]

(Alt. to R. Ferguson)

Nonvoting

Charles H. Ke, U.S. Dept. of Transportation, DC

Samuel J. Porter, Lakeridge, VA

(Member Emeritus)

Carl H. Rivkin, NFPA Staff Liaison

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

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

Committee Scope: This Committee shall have primary responsibility for documents on, 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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NFPA 430

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

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

Chapter 1 General

1-1 Scope.

1-1.1 This code applies to the storage of oxidizers that are liquid or solid at ambient conditions.

Exception: This code does not apply to the storage of solid and liquid oxidizers for normal use on the premises of single-family dwellings.

1-1.1.1 Separate chapters specify requirements for storage of oxidizers by class where the quantities stored are greater than the stated minimums.

1-1.1.2* 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, sprinkler protection and compatibility, and all of Chapter 2 of this code should be used as requirements.

1-1.1.3 Existing buildings that do not comply with the requirements of this code pertaining to types of construction, separation of buildings, and fixed fire protection should be used for storing oxidizers at the discretion of the authority having jurisdiction, provided that the buildings do not constitute a distinct hazard to life or adjoining property.

1-1.2 This code does not apply to explosives or blasting agents, which are covered by NFPA 495, *Explosive Materials Code*; or 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 do not apply to the storage of oxidizers at plants where oxidizers are manufactured.

1-1.4 The quantity and arrangement limits in this code do 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 is to provide reasonable requirements for the safe storage of commercially available strengths of liquid and solid oxidizers. 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.

1-3 **Applicability of Other Documents.** The requirements of NFPA 30, *Flammable and Combustible Liquids Code*, and NFPA 230, *Standard for the Fire Protection of Storage*, apply where applicable and where they are more restrictive than this code.

1-4 **Equivalency.** Nothing in this code is intended to prevent the use of systems, methods, or devices equivalent to those prescribed by this code, provided technical documentation is submitted to the authority having jurisdiction that demonstrates equivalency, and provided the system, method, or device is approved for the intended purpose.

1-5 **Definitions.** For the purposes of this code, the following terms are defined.

1-5.1* **Approved.** Acceptable to the authority having jurisdiction.

1-5.2* **Authority Having Jurisdiction.** The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

1-5.3 **Combustible.** A substance that will burn.

1-5.4 **Containers, Combustible.** 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.

1-5.5 **Containers, Noncombustible.** Containers constructed of glass or metal that can be coated with a polymeric material no more than 2 mils (50.8 μm) in thickness.

1-5.6* **Explosive Reaction.** A reaction, which includes both deflagration and detonation, producing a sudden rise in pressure with potentially destructive results.

1-5.7 **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.

1-5.8* **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.

1-5.9 **Manufacturing Plants.** Those facilities where oxidizers are produced by chemical means.

1-5.10 **Material, Compatible.** A material that, when in contact with an oxidizer, will not react with the oxidizer or promote or initiate its decomposition.

1-5.11 **Material, Incompatible.** A material that, when in contact with an oxidizer, can cause hazardous reactions or can promote or initiate decomposition of the oxidizer.

1-5.12* **Material, Noncombustible.** A material that, in the form in which it is used and under the conditions anticipated, will not ignite, support combustion, burn, or release flammable vapors when subjected to fire or heat.

1-5.13* Oxidizer. Any material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials.

1-5.14 Pile. Material in a single contiguous storage area, including any material not properly separated by appropriate distance.

1-5.15 Processing Plants. Those facilities, not located on the premises of manufacturing plants, where oxidizers are pelletized, ground, dissolved, packaged, mixed, or blended.

1-5.16 Retail Establishments. Those facilities where oxidizers are sold directly to the general public.

1-5.17 Shall. Indicates a mandatory requirement.

1-5.18 Warehouses. Those facilities where oxidizers are received, stored, and subsequently shipped in their original containers.

1-6 Classification of Oxidizers. For the purpose of this code, oxidizers are classified according to the system listed in (a) through (d) of Section 1-6. The classification 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 definition 1-5.13, Oxidizer. See Sections B-2 through B-5 for oxidizer classifications.*)

(a) *Class 1.* An oxidizer that meets the definition of an oxidizer in 1-5.13 and does not moderately increase the burning rate of combustible materials with which it comes into contact.

(b) *Class 2.* An oxidizer that will cause a moderate increase in the burning rate of combustible materials with which it comes into contact.

(c) **Class 3.* An oxidizer that will cause a severe increase in the burning rate of combustible materials with which it comes into contact or that will undergo vigorous self-sustained decomposition due to contamination or exposure to heat.

(d) **Class 4.* An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock. In addition, the oxidizer will cause a severe increase in the burning rate of combustible materials with which it comes into contact.

1-7 Classification of Storage Facilities. For the purpose of this code, storage facilities are classified according to the system described in (a) through (c).

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

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

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

Chapter 2 Basic Requirements

2-1 Hazard Management.

2-1.1 The design of a new or significantly modified facility for storage of oxidizers shall be reviewed by the authority having jurisdiction. (*For existing structures, see 1-1.1.3.*)

2-1.2 Emergency plans shall be prepared for each facility. These plans shall be reviewed, and training exercises shall be conducted, at least annually in cooperation with local emergency organizations.

2-2 Identification of Materials in Storage.

2-2.1* All storage areas containing oxidizers shall be conspicuously identified by the words "Class [appropriate classification number] Oxidizers," as defined in Section 1-6.

Exception: Retail display areas.

2-2.2 Where oxidizers having different classifications as defined by Section 1-6 are stored in the same area, the area shall be marked for the most severe hazard class present.

2-2.3 All packages shall be approved and individually marked with the chemical name of the oxidizer.

2-3 Storage Containers, Tanks, and Bins.

2-3.1 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).

2-3.2 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.

2-3.3 Bulk Liquid Storage. Bulk liquid storage is defined as the storage of more than 600 gal (U.S.) (2271 L) in a single container.

2-3.4 Bulk Solid Storage. Bulk solid storage is defined as the storage of more than 6000 lb (2722 kg) in a single container.

2-3.5 Outside Storage. Outside storage tank size shall not be limited by this code.

Exception: Class 4 oxidizers.

2-4 Storage Arrangements.

2-4.1* 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 succeeding chapters and in the manufacturer's or processor's instructions. 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 acceptable to the authority having jurisdiction are provided.

2-4.2* Oxidizers shall be stored to avoid contact with incompatible materials such as ordinary combustibles, combustible or flammable liquids, greases, and those materials that have the potential to react with the oxidizer or promote or initiate

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

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

2-4.2.1 Special care shall be taken to prevent any contamination of oxidizers in storage.

2-4.2.2 Where oxidizers are stored in segregated warehouses with flammable liquids, the oxidizer containers and flammable liquid drums shall be separated by at least 25 ft (7.6 m). The separation shall be maintained by dikes, drains, or floor slopes to prevent flammable liquid leakage from encroaching on the separation.

2-4.2.3 Solid oxidizers shall not be stored directly beneath incompatible liquids.

2-4.3 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.

2-5* Storage Limitations. Where two or more different classes of oxidizers are stored in the same segregated, cutoff, or detached area, the maximum quantity permitted for each class shall be limited to the sum of the maximum proportion permitted for that class. The total of the proportional amounts shall not exceed 100 percent.

2-6 Other Considerations.

2-6.1 In storage facility design, consideration shall be given to the need to provide for containment. Containment on-site or off-site shall be required where necessary to protect the environment from oxidizers and fire extinguishing agents and their liquid decomposition products.

2-6.2 Approval of the arrangement of storage 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.

2-7 Employee Instruction.

2-7.1 Personnel involved in operations where oxidizers are stored shall receive instruction in handling the materials in a safe manner, including the manufacturer's and processor's recommendations.

2-7.2 Particular attention shall be given to proper disposal of spilled material to prevent contamination.

2-8 Heating and Electrical Installations.

2-8.1 Heating shall be arranged so that stored materials cannot be placed in direct contact with heating units, piping, or ducts, and oxidizers shall be separated so that they cannot be heated to within 25°F (14°C) of their decomposition temperature or to 120°F (49°C), whichever is lower.

2-8.2 Electrical installations shall be in conformance with NFPA 70, *National Electrical Code*[®].

2-9 Smoking.

2-9.1 Smoking shall be prohibited in all storage areas containing oxidizers.

2-9.2 "No Smoking" signs shall be placed conspicuously within and at all entrances to storage areas.

2-10 Maintenance and Repairs.

2-10.1 The performance of maintenance work in an oxidizer storage area shall be subject to prior review and approval by supervisory personnel.

2-10.2 Cutting and welding procedures shall be in conformance with NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*.

2-11 Fire Protection.

2-11.1* Fire hydrants and water supplies shall be provided as required by the authority having jurisdiction. Hydrants shall be installed in accordance with NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*.

2-11.2* The need for automatic sprinkler protection shall be determined by the nature of the materials, the manner of storage, and the construction of the buildings under consideration. Where automatic sprinkler systems are required, the systems shall be installed in conformance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

2-11.3 Dry-pipe and double-interlock pre-action sprinkler systems shall not be permitted for protection of buildings or areas containing oxidizers.

Exception: Dry-pipe and double-interlock pre-action systems shall be permitted for protection of Class I oxidizers in noncombustible structures.

2-11.4 Fire Protection Water Supplies.

2-11.4.1 Water supplies shall be adequate for the protection of the oxidizer storage by hose streams and automatic sprinklers. The water system shall be capable of providing not less than 750 gpm (2840 L/min) where protection is by means of hose streams, or 500 gpm (1890 L/min) for hose streams in excess of the automatic sprinkler water demand.

2-11.4.2 Duration of the water supply shall be a minimum of 2 hours.

2-11.5 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*.

2-11.6 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, Private Hydrants, and Hose Systems*.

2-11.6.1* 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.

2-11.6.2* Halon extinguishers shall not be used in areas where oxidizers are stored.

2-12* Construction. 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.

2-13 Housekeeping and Waste Disposal.

2-13.1 Accumulation of combustible waste in oxidizer storage areas shall be prohibited.

2-13.2 Spilled oxidizers and leaking or broken containers shall be removed immediately to a safe area to await disposal in conformance with applicable regulations and manufacturer's and processor's instructions. Spilled materials shall be placed in a clean, separate container and shall not be returned to the original container. The disposal of such materials shall not be combined with that of ordinary trash.

2-13.3 Used, empty, combustible containers shall be stored in a detached or sprinklered area.

2-13.4 Operations shall be arranged to prevent fugitive dust accumulation.

2-13.5* 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.

2-14 Dust Collection Systems. 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*. Separate systems shall be provided for incompatible materials.

Chapter 3 Class 1 Oxidizers

3-1 Application. This chapter shall apply to storage of Class 1 oxidizers where stored in quantities in excess of 4000 lb (1814 kg). Chapter 2 also applies to storage of Class 1 oxidizers.

3-2 Storage Arrangements.

3-2.1 The storage of Class 1 oxidizers shall be segregated, cutoff, or detached.

3-2.2 Storage of Class 1 oxidizers shall be in accordance with Tables 3-2.2(a) and 3-2.2(b).

Table 3-2.2(a) Storage of Class 1 Oxidizers in a Nonsprinklered Building for Nonretail Establishment

Storage Configurations and Allowable Distances	U.S. Units	Metric Units
Building limit	200 tons	181 met ton
Pile limit	20 tons	18 met ton
Pile height	8 ft	2.4 m
Pile width	16 ft	4.9 m
Maximum distance from any container to a working aisle	8 ft	2.4 m
Distance to next pile	*	*
Distance to wall	4 ft	1.2 m
Distance to incompatible material	12 ft	3.7 m

*Aisle width equal to pile height.

Table 3-2.2(b) Storage of Class 1 Oxidizers in a Sprinklered Building for Nonretail Establishment

Storage Configurations and Allowable Distances	U.S. Units	Metric Units
Building limit	2000 tons	1814 met ton
Pile limit	200 tons	181 met ton
Pile height	12 ft	3.7 m
Pile width	24 ft	7.3 m
Maximum distance from any container to a working aisle	12 ft	3.7 m
Distance to next pile	*	*
Distance to wall	2 ft	0.6 m
Distance to incompatible material	8 ft	2.4 m

Note: If the storage is to be considered sprinklered, see Section 3-3.

*Aisle width equal to pile height.

3-2.3* The building limit (tons) shall be permitted to be four times the quantities shown in Table 3-2.2(b) if all of the following conditions are met:

- (1) Storage is cutoff or detached.
- (2) Storage is located in nonretail occupancies.
- (3) Noncombustible containers are used or buildings are noncombustible.

3-2.4 Bulk Storage.

3-2.4.1 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 2-12.)

3-2.4.2 Bulk storage, either in permanent bins or in piles, shall be separated from all other materials.

3-2.4.3 Bins shall be of noncombustible construction.

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

3-2.4.4 Storage shall be managed to prevent excessive dust accumulation.

3-3 Sprinkler Protection.

3-3.1 Sprinkler protection for Class 1 oxidizers shall be in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

3-3.2* For the purpose of applying the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*, Class 1 oxidizers in noncombustible or combustible containers (paper bags or noncombustible containers with removable combustible liners) shall be designated as a Class 1 commodity. Class 1 oxidizers contained in fiber packs or noncombustible containers in combustible packaging shall be designated as a Class 2 commodity. Class 1 oxidizers contained in plastic containers shall be designated as a Class 3 commodity.

Chapter 4 Class 2 Oxidizers

4-1 Application. This chapter shall apply to Class 2 oxidizers where stored in quantities in excess of 1000 lb (454 kg). Chapter 2 also applies to storage of Class 2 oxidizers.

4-2 Storage Arrangements.

4-2.1 The storage of Class 2 oxidizers shall be segregated, cutoff, or detached.

4-2.2 Cutoff walls shall have a fire resistance rating of at least 1 hour.

4-2.3 Storage of Class 2 oxidizers shall be in accordance with Tables 4-2.3(a) and 4-2.3(b).

4-2.4* The building limit (tons) shall be permitted to be four times the quantities shown in Table 4-2.3(b) if all of the following conditions are met:

- (1) Storage is cutoff or detached.
- (2) Storage is located in nonretail occupancies.
- (3) Noncombustible containers are used or buildings are noncombustible.

4-2.5 Storage in glass carboys shall not be more than two carboys high.

4-2.6 Storage in basements shall be prohibited.

Exception: Where the oxidizer is stored in fixed tanks.

4-2.7 Maximum Height of Storage.

4-2.7.1 Maximum storage height for nonsprinklered buildings shall be in accordance with Table 4-2.3(a).

4-2.7.2 Maximum storage height for sprinklered buildings shall be in accordance with Table 4-4.1.

Table 4-2.3(a) Storage of Class 2 Oxidizers in a Nonsprinklered Building

Storage Configurations and Allowable Distances	Segregated Storage Process Plant General Warehouse		Cutoff Storage Process Plant General Warehouse		Detached Storage	
	U.S. Units	Metric Units	U.S. Units	Metric Units	U.S. Units	Metric Units
Building limit	50 tons	45 met ton	200 tons	181 met ton	300 tons	272 met ton
Pile limit	10 tons	8.8 met ton	20 tons	18.1 met ton	30 tons	27.2 met ton
Pile height	6 ft	1.8 m	8 ft	2.4 m	8 ft	2.4 m
Pile width	8 ft	2.4 m	12 ft	3.7 m	16 ft	4.9 m
Maximum distance from any container to a working aisle	4 ft	1.2 m	6 ft	1.8 m	8 ft	2.4 m
Distance to next pile	*	*	*	*	*	*
Distance to wall	4 ft	1.2 m	4 ft	1.2 m	4 ft	1.2 m
Distance to incompatible material	12 ft	3.7 m	**	**	**	**

*Aisle width equal to pile height.

**Not permitted by definition.

Table 4-2.3(b) Storage of Class 2 Oxidizers in a Sprinklered Building

Storage Configurations and Allowable Distances	Segregated Storage Process Plant General Warehouse		Cutoff Storage Process Plant General Warehouse		Detached Storage	
	U.S. Units	Metric Units	U.S. Units	Metric Units	U.S. Units	Metric Units
Building limit	100 tons	91 met ton	1000 tons	907 met ton	2000 tons	1814 met ton
Pile limit	20 tons	18.1 met ton	100 tons	91 met ton	200 tons	181 met ton
Pile height*	*	*	*	*	*	*
Pile width	16 ft	4.9 m	25 ft	7.6 m	25 ft	7.6 m
Maximum distance from any container to a working aisle	8 ft	2.4 m	12 ft	3.7 m	12 ft	3.7 m
Distance to next pile	**	**	**	**	**	**
Distance to wall	2 ft	0.6 m	2 ft	0.6 m	2 ft	0.6 m
Distance to incompatible material	12 ft	3.7 m	***	***	***	***

Note: If the storage is considered to be sprinklered, see Section 4-4.

*See 4-2.7 and Table 4-4.1.

**Aisle width equal to pile height.

***Not permitted by definition.

Table 4-4.1 Ceiling Sprinkler Protection for Class 2 Oxidizers in Palletized or Bulk and Rack Storage Areas

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

4-3 Building Construction.

4-3.1 Construction materials that are permitted to be in contact with oxidizers, all cutoff partitions, and all construction in stories or basements below storage of liquid oxidizers shall be noncombustible.

4-3.2 Storage areas for oxidizing materials in combustible containers shall be provided with means to vent fumes in a fire emergency.

4-4 Sprinkler Protection.

4-4.1* Sprinkler protection for Class 2 oxidizers shall be designed in accordance with Table 4-4.1.

4-4.2 Sprinkler protection shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

4-4.3 Ceiling sprinklers shall have heads rated at 286°F (141°C).

4-4.4 Storage Protection with In-Rack Sprinklers.

4-4.4.1 In-rack sprinklers shall have heads rated at 165°F (74°C) and shall be designed to provide 30 psi (207 kPa) on the hydraulically most remote six heads on each level.

4-4.4.2 The in-rack sprinklers shall be spaced on 8-ft to 10-ft (2.4-m to 3.0-m) centers at rack uprights.

4-4.4.3 Where multiple levels are provided, the in-rack sprinklers shall be staggered and shall be provided with water shields.

4-5 Detached Storage.

4-5.1 To be considered detached, a sprinklered building for storage of Class 2 oxidizers shall be a minimum of 35 ft (10.7 m) from other buildings and from a line of property that can be built upon.

4-5.2 To be considered detached, a nonsprinklered building for storage of Class 2 oxidizers shall be located no less than 50 ft (15.2 m) from other buildings or a line of property that can be built upon.

Chapter 5 Class 3 Oxidizers

5-1 Application. This chapter shall apply to Class 3 oxidizers where stored in quantities in excess of 200 lb (91 kg). Chapter 2 also applies to storage of Class 3 oxidizers.

5-2 Storage Arrangements.

5-2.1 The storage of Class 3 oxidizers shall be segregated, cutoff, or detached.

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

5-2.2 Class 3 oxidizer storage shall be located on the ground floor only.

5-2.3 Cutoff walls shall have a fire resistance rating of at least 2 hours.

5-2.4 Storage of Class 3 oxidizers shall be in accordance with Tables 5-2.4(a) and (b).

5-2.5* The building limit (tons) shall be permitted to be twice the quantities shown in Table 5-2.4(b) if all of the following conditions are met:

- (1) Storage is cutoff or detached.
- (2) Noncombustible containers are used or buildings are noncombustible.
- (3) Storage is located in nonretail occupancies.

5-2.6 Storage in glass carboys shall be one carboy high.

5-2.7 Bulk storage in open bins or piles shall not be permitted.

5-2.8 Maximum Height of Storage.

5-2.8.1 Maximum storage height for nonsprinklered buildings shall be in accordance with Table 5-2.4(a).

5-2.8.2 Maximum storage height for sprinklered buildings shall be in accordance with Table 5-4.1.

5-3 Building Construction.

5-3.1 Buildings used for the storage of liquid Class 3 oxidizers shall not have basements.

5-3.2 Construction materials that can come in contact with oxidizers shall be noncombustible.

5-3.3 Storage areas for oxidizing materials in combustible containers shall be provided with means to vent fumes in a fire emergency.

Table 5-2.4(a) Storage of Class 3 Oxidizers in a Nonsprinklered Building

Storage Limit	Segregated Storage Process Plant General Warehouse		Cutoff Storage Process Plant General Warehouse		Detached Storage	
	U.S. Units	Metric Units	U.S. Units	Metric Units	U.S. Units	Metric Units
Building limit	20 tons	18.1 met ton	100 tons	91 met ton	200 tons	181 met ton
Pile limit	5 tons	4.5 met ton	10 tons	9.1 met ton	30 tons	27.2 met ton
Pile height	6 ft	1.8 m	6 ft	1.8 m	6 ft	1.8 m
Pile width	8 ft	2.4 m	12 ft	3.7 m	12 ft	3.7 m
Maximum distance from any container to a working aisle	4 ft	1.2 m	8 ft	2.4 m	8 ft	2.4 m
Distance to next pile	*	*	*	*	*	*
Distance to wall	4 ft	1.2 m	4 ft	1.2 m	4 ft	1.2 m
Distance to incompatible material	12 ft	3.7 m	**	**	**	**

*Aisle width equal to pile height.

**Not permitted by definition.

Table 5-2.4(b) Storage of Class 3 Oxidizers in a Sprinklered Building

Storage Limit	Segregated Storage Process Plant General Warehouse		Cutoff Storage Process Plant General Warehouse		Detached Storage	
	U.S. Units	Metric Units	U.S. Units	Metric Units	U.S. Units	Metric Units
Building limit	50 tons	45 met ton	500 tons	454 met ton	1500 tons	1360 met ton
Pile limit	10 tons	8.8 met ton	30 tons	27.2 met ton	100 tons	91 met ton
Pile height*	*	*	*	*	*	*
Pile width	12 ft	3.7 m	16 ft	4.9 m	20 ft	6.1 m
Maximum distance from any container to a working aisle	8 ft	2.4 m	10 ft	3 m	10 ft	3 m
Distance to next pile	**	**	**	**	**	**
Distance to wall	2 ft	0.6 m	2 ft	0.6 m	2 ft	0.6 m
Distance to incompatible material	12 ft	3.7 m	***	***	***	***

Note: If the storage is considered to be sprinklered, the sprinkler system shall be designed in accordance with the requirements of Section 5-4.

*See 5-2.8 and Table 5-4.1.

**Aisle width equal to pile height.

***Not permitted by definition.

Table 5-4.1 Sprinkler Protection for Class 3 Oxidizers in Palletized or Bulk Rack Storage

Type of Storage	Storage Height		Density		Area of Application		In-Rack Sprinklers
	ft	m	gpm/ft ²	L/min/m ²	ft ²	m ²	
Palletized or bulk	5	1.5	0.35	14	5000	465	
Palletized rack or bulk	10	3	0.65	26	5000	465	
Rack	10	3	0.35	14	5000	465	1 level at midpoint of rack

5-4 Sprinkler Protection.**5-4.1*** Sprinkler protection for Class 3 oxidizers shall be designed in accordance with Table 5-4.1.**5-4.2** Sprinkler protection shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.**5-4.3** Ceiling sprinklers shall have heads rated at 286°F (141°C).**5-4.4** In-rack sprinklers shall have heads rated at 165°F (74°C) and shall be designed to provide 30 psi (207 kPa) on the hydraulically most remote six heads on each level. The in-rack sprinklers shall be spaced on 8-ft to 10-ft (2.4-m to 3.0-m) centers at rack uprights.**5-5 Detached Storage.** 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, and any inhabited building, passenger railroad, public highway, or other tanks. The minimum separation distance shall be one of the following:

- (1) 50 ft (15 m) for a sprinklered building
- (2) 75 ft (23 m) for an unsprinklered building

Chapter 6 Class 4 Oxidizers

6-1 Application. This chapter shall apply to Class 4 oxidizers where stored in quantities in excess of 10 lb (4.5 kg). Chapter 2 also applies to storage of Class 4 oxidizers.

6-2 Storage Arrangements.

6-2.1 The storage of Class 4 oxidizers shall be detached.

6-2.2 Storage in glass carboys shall be one carboy high. Storage in drums or in containers or in cases shall not exceed the limits outlined in Table 6-2.2.

Table 6-2.2 Storage of Class 4 Oxidizers in Drums, Containers, and Cases

Storage Configurations and Quantities	Nonsprinklered Building		Sprinklered Building	
	U.S. Units	Metric Units	U.S. Units	Metric Units
Piles				
Length	10 ft	3.0 m	10 ft	3.0 m
Width	4 ft	1.2 m	4 ft	1.2 m
Height	4 ft	1.2 m	8 ft	2.4 m
Distance to next pile	6 ft	1.8 m	8 ft	2.4 m
Quantity limit per building	1 ton	0.9 met tons	No limit	

6-2.3 Bulk storage in piles or fixed bins shall not be permitted.

6-3 Building Construction and Location.

6-3.1 Buildings shall be constructed as one story without basement. Construction materials that could come in contact with oxidizers shall be noncombustible.

6-3.2 Storage areas shall be provided with means to vent fumes in an emergency.

6-3.3 A storage building or storage tank shall be located not less than the minimum distance provided in Table 6-3.4 from flammable liquid storage, combustible material in the open, and any inhabited building, passenger railroad, public highway, property line, or tank other than oxidizer storage.

6-3.4* Where tanks are not separated from each other by 10 percent of the distance specified in Table 6-3.4 for the largest

tank, the total contents of all tanks shall be used when using Table 6-3.4.

Table 6-3.4 Separation of Buildings, Tanks Containing Class 4 Oxidizers

Weight of Class 4 Oxidizer		Distance	
lb	kg	ft	m
over 10-100	4.5-45.4	75	23
101-500	4.5-227	100	30
501-1,000	227-454	125	38
1,001-3,000	454-1,361	200	61
3,001-5,000	1,361-2,268	300	91
5,001-10,000	2,268-4,536	400	122
over 10,000	over 4,536	Subject to approval by the authority having jurisdiction	

6-4 Sprinkler Protection.

6-4.1 Sprinkler protection for Class 4 oxidizers shall be installed on a deluge sprinkler system to provide water density of 0.35 gpm/ft² (14.4 L/min/m²) over the entire storage area.

6-4.2 Sprinkler protection shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

Chapter 7 Storage and Display of Oxidizing Materials in Retail Occupancies

7-1 Scope. This chapter shall apply to the display and storage of oxidizing materials in retail 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.

7-2 General Requirements. Oxidizing materials that are displayed in areas accessible to the general public shall meet the requirements of 7-2.1 through 7-2.5.

7-2.1* 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 4 ft.

Exception No. 1: Ordinary combustibles shall not include approved packaging materials, pallets, or other dunnage used for the oxidizers.

Exception No. 2: Separation from ordinary combustible materials is not required for Class I oxidizers.

7-2.2 Solid oxidizing materials shall not be displayed directly beneath liquids.

7-2.3 Display of oxidizing materials shall extend no higher than 7 ft (2.1 m) from the floor to the top of the uppermost container. The display shall not exceed 4 ft (1.2 m) in depth. Shelves and vertical barriers shall be placed between incompatible materials and shall be solid and of noncombustible construction.

Exception No. 1: Display or storage of Class 2 and 3 oxidizers that meet the requirements of Section 7-4.

Exception No. 2: This restriction shall not apply to Class 1 oxidizing materials.

7-2.4 Containers shall be approved for their intended use. Individual containers shall not exceed 100 lb (45.4 kg) capacity.

7-2.5* For the purpose of this chapter, sprinklered retail occupancies storing and displaying oxidizers shall be protected using criteria from codes and standards applicable to the surrounding occupancy determined by the authority having jurisdiction.

7-3 Quantity Limitations.

7-3.1 The quantity of oxidizing materials permitted in a retail occupancy shall not exceed the quantities given in Table 7-3.1 for either nonsprinklered or sprinklered areas, whichever is applicable.

Table 7-3.1 Maximum Quantity of Oxidizers Allowed in Retail Occupancies Without Special Fire Protection, in Pounds

Class of Material	Nonsprinklered	Sprinklered
3	1,150	2,300
2	2,250	4,500
1	18,000	36,000

Exception: Display or storage of Class 2 and 3 oxidizers that meets the requirements of Section 7-4.

7-3.2 An equal quantity as permitted by Table 7-3.1 shall be permitted if the additional quantities are located in a separate area protected by a fire resistance of not less than 1 hour.

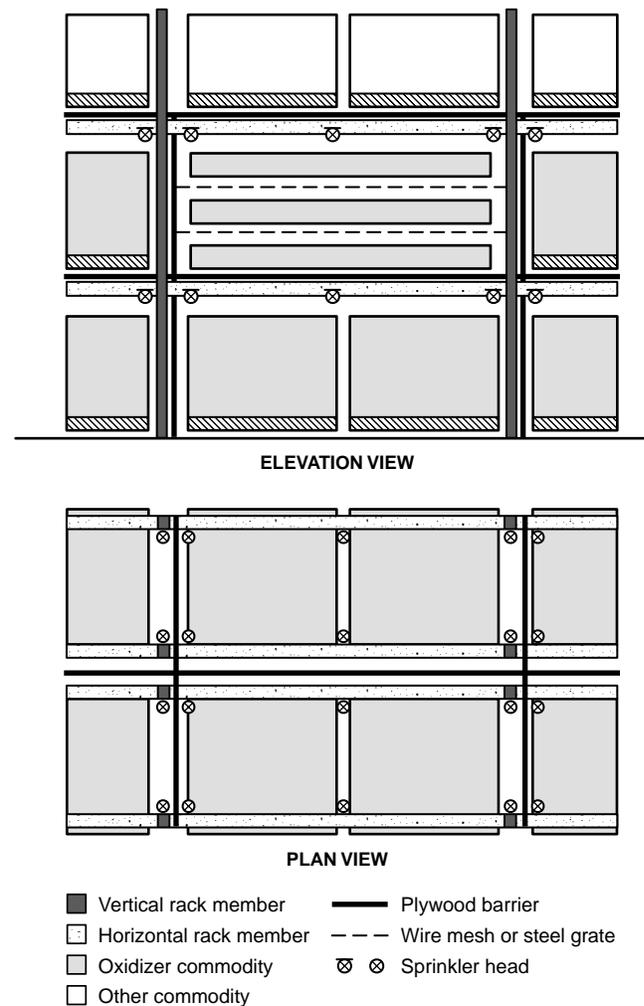
7-3.3 If a storage area in a retail occupancy is separated from the rest of the facility by a fire partition having not less than a 2-hour fire resistance rating, the maximum quantity of oxidizing materials allowed in that area shall be permitted to be that allowed in Chapters 3, 4, and 5, as applicable.

7-4 Special Fire Protection for Class 2 and 3 Oxidizers. Special fire protection shall be as shown in Figure 7-4 and as listed in 7-4.1(a) through 7-4.1(e).

7-4.1 Oxidizing materials using the special fire protection provisions in Section 7-4 shall be stored on racks arranged as described in 7-4.1(a) through 7-4.1(h).

- Racks shall be of steel construction.
- Racks shall have vertical supports spaced no more than 10 ft (3.05 m) apart.
- Horizontal rack members shall be spaced no more than 6 ft (1.83 m) apart vertically.
- Display or storage shall be limited in height to two protected tiers.
- Horizontal barriers constructed of plywood at least $\frac{3}{8}$ in. (9.5 mm) thick shall be provided above each level of oxidizing material storage. These barriers shall extend from rack face to rack face and shall be tight to the vertical barriers described in 7-4.1(f) and 7-4.1(g). These barriers shall be supported by horizontal rack members.
- Transverse vertical barriers constructed of plywood at least $\frac{3}{8}$ in. (9.5 mm) thick shall be provided at the rack uprights extending from the rack face to rack face.
- For double row racks, longitudinal vertical barriers constructed of plywood at least $\frac{3}{8}$ in. (9.5 mm) thick shall be provided at the rack uprights in the center of the rack.
- If intermediate shelves are used between the horizontal barriers, the shelves shall be constructed of open wire mesh or steel grating.

FIGURE 7-4 Arrangement of barriers and in-rack sprinklers for special fire protection provisions.



7-4.2 In-rack automatic sprinklers shall be provided under each horizontal barrier and arranged as described in 7-4.2(a) through 7-4.2(f).

- 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. For single row racks, two lines of in-rack sprinklers shall be provided between each rack face.
- Three in-rack sprinklers shall be provided on each in-rack sprinkler line. Two sprinklers on each line shall be spaced approximately $1\frac{1}{2}$ in. (38.1 mm) from each transverse vertical barrier. One in-rack sprinkler on each in-rack sprinkler line shall be located approximately equidistant between the transverse vertical barriers.
- In-rack sprinklers shall be upright or pendent type with the fusible element located no more than 6 in. (152.4 mm) from the horizontal barrier.
- The stock shall be maintained at least 6 in. (152.4 mm) below the sprinkler deflector.
- In-rack sprinklers shall be $\frac{17}{32}$ in. (13.5 mm) orifice, quick response, 165°F (74°C) temperature rated.

(f) 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 25 psi.

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

7-4.3 Pallets, if used, shall be solid deck type.

Chapter 8 Referenced Publications

8-1 The following documents or portions thereof are referenced within this code as mandatory requirements and shall be considered part of the requirements of this code. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this code. Some of these mandatory documents might also be referenced in this code for specific informational purposes and, therefore, are also listed in Appendix C.

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

NFPA 10, *Standard for Portable Fire Extinguishers*, 1998 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1999 edition.

NFPA 14, *Standard for the Installation of Standpipe, Private Hydrants and Hose Systems*, 2000 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 1995 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 1998 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 1996 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 1999 edition.

NFPA 70, *National Electrical Code®*, 1999 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*, 1999 edition.

NFPA 230, *Standard for the Fire Protection of Storage*, 1999 edition.

NFPA 432, *Code for the Storage of Organic Peroxide Formulations*, 1997 edition.

NFPA 490, *Code for the Storage of Ammonium Nitrate*, 1998 edition.

NFPA 495, *Explosive Materials Code*, 1996 edition.

8-1.2 Other Publications.

8-1.2.1 Canadian Government Publication. Transport Canada, 330 Sparks Street, Ottawa, Canada K1A 0N5.

Canadian Ministry of Transport Regulations.

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

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

Appendix A Explanatory Material

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

A-1-1.1.2 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.

A-1-5.1 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.

A-1-5.2 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, 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-1-5.6 Explosive Reaction. For further information on venting explosive reactions, see NFPA 68, *Guide for Venting of Deflagrations*.

A-1-5.8 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-1-5.12 Material, Noncombustible. 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-1-5.13 Oxidizer. Examples of other oxidizing gases include bromine, chlorine, and fluorine.

A-1-6(c) The term *contamination* in this definition means minor contamination that can occur if the material is spilled or placed into improperly cleaned equipment. It does not mean gross contamination with large quantities of combustibles or incompatible materials.

A-1-6(d) The term *contamination* in this definition means minor contamination that can occur if the material is spilled or placed into improperly cleaned equipment. It does not mean gross contamination with large quantities of combustibles or incompatible materials.

A-1-7(a) Sills, curbs, or intervening storage of nonhazardous compatible materials and aisles should be used as aids in maintaining separation.

A-2-2.1 The classification system described in Section 1-7 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-2-4.1 Automatic sprinklers should not be relied upon to control all fires involving oxidizers packed in plastic containers.

A-2-4.2 Care should be exercised since some oxidizers are mutually incompatible. Triazinetriones, chlorinated isocyanurates, and hypochlorites are examples of oxidizers that are incompatible. The NFPA *Fire Protection Guide to Hazardous Materials* list many oxidizers and other materials that result in hazardous interactions.

A-2-5 For example, a sprinklered warehouse containing both Class 2 and Class 3 oxidizers in combustible containers that are cut off from other storage by a 2-hour fire separation is permitted to contain 500 tons (454,000 kg) of Class 2 oxidizers and 250 tons (227,000 kg) of Class 3 oxidizers in accordance with the following ratios:

$$\frac{500 \text{ tons}}{1000 \text{ tons (max)}} \times 100 = 50\% \text{ Class 2}$$

$$\frac{250 \text{ tons}}{500 \text{ tons (max)}} \times 100 = 50\% \text{ Class 3}$$

SI units: 1 lb = 0.454 kg

In no case should a quantity in storage exceed the maximum for its class, nor should the sum of the percentages exceed 100 percent.

A-2-11.1 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-2-11.2 For certain oxidizers in combustible containers (e.g., calcium hypochlorite in plastic containers), automatic sprinkler protection is effective only for the control of exposure fires.

A-2-11.6.1 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-2-11.6.2 Halon extinguishers should not be used on fires involving oxidizers since they can react with the oxidizer.

A-2-12 Impregnation of wood for fire retardancy or to prevent decay does not protect the wood from impregnation by the oxidizer.

A-2-13.5 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 will create 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.

A-3-2.3 Only the building limit, not the pile limit, height, or width, can be increased by this provision.

A-3-3.2 Commodity refers to the definition in NFPA 230, *Standard for the Fire Protection of Storage*.

A-4-2.4 Only the building limit, not the pile limit, height, or width, can be increased by this provision.

A-4-4.1 For the purposes of Table 4-4.1, the fire hazard potential of Class 2 oxidizers has been considered as approximately equal to Group A plastic (nonexpanded), stable cartoned, in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

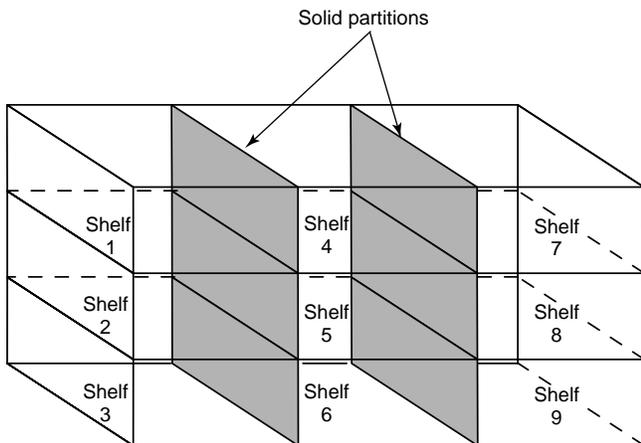
A-5-2.5 Only the building limit, not the pile limit, height, or width, can be increased by this provision.

A-5-4.1 For the purposes of Table 5-4.1, the sprinkler density has been derived from fire loss history.

A-6-3.4 For example, two tanks contain 4000 lb (1814 kg) and 3000 lb (1360 kg) of Class 4 oxidizer and they are separated by 25 ft (7.6 m). Since they are separated by less than 10 percent of 300 ft (92 m), the total quantity of 7000 lb (3175 kg) requires a minimum separation of 400 ft (122 m) to the nearest important structure in accordance with 6-3.3.

A-7-2.1 Recommended retail store arrangements for mutually incompatible oxidizers are shown in Figures A-7-2.1(a) and (b). These two diagrams illustrate arrangements that minimize the chance of contamination between incompatible materials. Wherever possible, vertical separation should be maintained between incompatible materials.

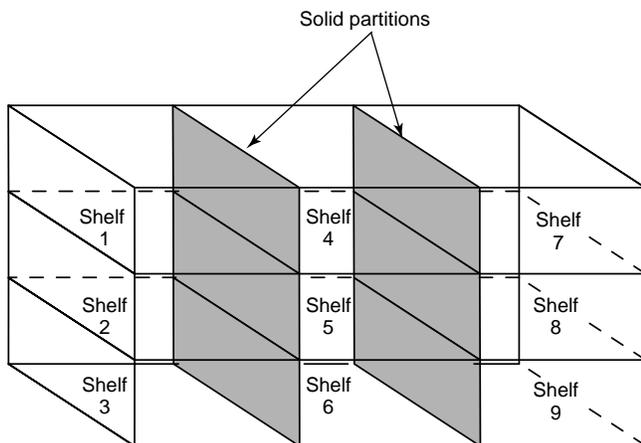
FIGURE A-7-2.1(a) Recommended retail store arrangement for mutually incompatible oxidizers.



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-7-2.1(b) Recommended retail store arrangement for mutually incompatible oxidizers and other incompatible materials.



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.

A-7.2.5 For certain oxidizers in combustible containers, (e.g., calcium hypochlorite in plastic containers) automatic sprinkler protection is effective only for control of exposure fires.

Appendix B Typical Oxidizers

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

B-1 Unless concentration is specified, undiluted material is referenced. The following lists of oxidizers 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 Typical Class 1 Oxidizers.

All inorganic nitrites (unless otherwise classified)
 Ammonium persulfate
 Barium peroxide
 Calcium peroxide
 Hydrogen peroxide solutions (greater than 8 percent up to 27.5 percent)
 Lead dioxide
 Lithium hypochlorite (39 percent or less available chlorine)
 Lithium peroxide
 Magnesium peroxide
 Manganese dioxide
 Nitric acid (40 percent concentration or less)
 Perchloric acid solutions (less than 50 percent by weight)
 Potassium dichromate
 Potassium percarbonate
 Potassium persulfate
 Sodium carbonate peroxide
 Sodium dichloro-triazinetriene dihydrate
 Sodium dichromate
 Sodium perborate (anhydrous)
 Sodium perborate monohydrate
 Sodium perborate tetrahydrate
 Sodium percarbonate
 Sodium persulfate
 Strontium peroxide
 Trichloro-triazinetriene (trichloroisocyanuric) (acid all forms)
 Zinc peroxide

B-3 Typical Class 2 Oxidizers.

Barium bromate
 Barium chlorate
 Barium hypochlorite
 Barium perchlorate
 Barium permanganate
 1-Bromo-3-chloro-5,5-dimethylhydantoin (BCDMH)
 Calcium chlorate
 Calcium chlorite
 Calcium hypochlorite (50 percent or less by weight)
 Calcium perchlorate
 Calcium permanganate