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MANUFACTURE, TRANSPORTATION, STORAGE, AND USE OF EXPLOSIVE MATERIALS 1982

NATIONAL FIRE PROTECTION ASSOCIATION, INC.
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Code for the Manufacture, Transportation, Storage, and Use of

Explosive Materials

NFPA 495-1982

1982 Edition of NFPA 495

This edition of NFPA 495, *Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials*, was prepared by the Technical Committee on Explosives, released by the Correlating Committee on Chemicals and Explosives, and acted on by the National Fire Protection Association, Inc. on May 19, 1982, at its Annual Meeting in San Francisco, California. It was issued by the Standards Council on June 8, 1982, with an effective date of June 28, 1982, and supersedes all previous editions.

The 1973 edition of this standard was approved by the American National Standards Institute as an American National Standard. This edition has also been submitted for similar approval.

Origin and Development of NFPA 495

This Code, originally developed by the Committee on Hazardous Chemicals and Explosives, was first adopted by the NFPA in 1959. Following reorganization of the Committee in 1960, NFPA 495 was assigned to the Technical Committee on Explosives. Amendments were adopted in 1963, 1965, 1967, 1968, 1969, and 1970. A complete revision was adopted in 1972 and this complete revision was amended in 1973.

In 1976, the Technical Committee on Explosives began a detailed review of the 1973 edition, primarily to amend its requirements so that there were no conflicts with the regulations promulgated by the various federal agencies concerned with explosive materials (US Bureau of Alcohol, Tobacco, and Firearms, US Mine Safety and Health Administration, US Department of Transportation, etc.). This review, plus editorial and minor technical amendments, resulted in this 1982 edition of NFPA 495.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

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.

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Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials

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

Information on referenced publications can be found in Appendix E.

Chapter 1 General

1-1 Scope.

1-1.1 This Code shall apply to the manufacture, transportation, storage, sale, and use of explosive materials.

1-1.2 This Code shall not apply to the transportation of explosive materials when under the jurisdiction of the US Department of Transportation (DOT). It shall, however, apply to state and municipal supervision of compliance with the Hazardous Materials Regulations of DOT (Title 49, *Code of Federal Regulations*, Parts 100-199).

1-1.3 This Code shall not apply to the transportation and use of military explosives by federal and state military agencies nor shall it apply to the transportation and use of explosive materials by federal, state, or municipal agencies while engaged in normal or emergency performance of duties.

1-1.4 This Code shall not apply to the manufacture of explosive materials under the jurisdiction of the US Department of Defense. This Code shall also not apply to the distribution to or storage by military agencies of the United States, nor shall it apply to arsenals, navy yards, depots or other establishments owned by or operated by or on behalf of the United States.

1-1.5 This Code shall not apply to pyrotechnics such as flares, fusees, and railway torpedoes. It also shall not apply to common fireworks, as defined in NFPA 1121L, *Model State Fireworks Law*. (*See also NFPA 44A, Code for the Manufacture, Transportation and Storage of Fireworks, and NFPA 1123, Standard for Public Display of Fireworks.*)

1-1.6 This Code shall not apply to the use of explosive materials in medicines and medicinal agents in the forms prescribed by the United States Pharmacopeia or the National Formulary.

1-2 Purpose. This Code is intended to provide reasonable safety in the manufacture, storage, transportation, and use of explosive materials.

1-3 Equivalency. The authority having jurisdiction may authorize alternate provisions to those in this Code to meet unusual conditions, if such alternate provisions give substantially equivalent degrees of safety and security.

1-4 Definitions. For the purpose of this Code, the following terms shall have the meanings given below.

Approved. Acceptable to the "authority having jurisdiction."

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

Ammonium Nitrate. A chemical compound represented by the formula NH_4NO_3.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since 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, 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 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."

Blaster. A person qualified to be in charge of and responsible for the loading and firing of a blast.

Blasting Agent.* A material or mixture intended for blasting and which meets the requirements of the DOT Hazardous Materials Regulations, as set forth in Title 49, *Code of Federal Regulations*, Part 173.114a.

Bulk Mix. A mass of explosive material prepared for use in bulk form without packaging.

Bulk Mix Delivery Equipment. Equipment (usually a motor vehicle with or without a mechanical delivery device) that transports explosive materials in bulk form for mixing, or loading directly into boreholes, or both.

Bullet-Resistant Construction.* With reference to magazine walls or doors, constructed so as to resist penetration of a bullet of 150-grain M2 ball ammunition having a nominal muzzle velocity of 2,700 fps (824 mps) when fired from a 0.30 caliber rifle from a distance of 100 ft (30.5 m) perpendicular to the wall or door.

Bullet-Sensitive Explosive Material. Explosive material that can be detonated by 150-grain M2 ball ammunition having a nominal muzzle velocity of 2,700 fps (824 mps) when fired from a 0.30 caliber rifle at a distance of 100 ft (30.5 m), measured perpendicular. The test material is at a temperature of 70° to 75°F (21° to 24°C) and is placed against a ½-in. (12.7-mm) steel plate.

Cap-Sensitive Explosive Material.* Any explosive material that can be detonated by means of a No. 8 blasting cap or its equivalent.

Composite Propellants. A mixture consisting of an elastomeric-type fuel and an oxidizer. Composite propellants are used in gas generators and rocket motors.

Detonating Cord. A flexible cord containing a center core of high explosive and used to initiate other explosives.

Detonator. Any device containing an initiating or primary explosive that is used for initiating detonation. A detonator may not contain more than 10 g of total explosive material by weight, excluding ignition or delay charges per unit. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses, detonating cord delay connectors, and nonelectric instantaneous and delay blasting caps which consist of detonating cord, shock tube, or any other replacement for electric leg wires.

Emulsion Explosive. A slurry explosive which contains substantial amounts of ammonium nitrate dissolved in water droplets surrounded by an oil-like material.

Explosive-Actuated Device. Any tool or special mechanized device which is actuated by explosives. The term does not include propellant-actuated devices. (*See definition of Propellant-Actuated Device.*) Examples of explosive-actuated devices are jet-tappers and jet perforators.

Explosive.* Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, and igniters.

The term "explosive" includes any material determined to be within the scope of Title 18, *United States Code*, Chapter 40, "Importation, Manufacture, Distribution and Storage of Explosive Materials," and also includes any material classified as an explosive by the Hazardous Materials Regulations of the US Department of Transportation.

Explosive Material. Any explosive, blasting agent, emulsion explosive, water gel, or detonator.

Fire Extinguisher Rating. A rating set forth in NFPA 10, *Standard for Portable Fire Extinguishers*. This rating may be identified on an extinguisher by a number (5, 20, 70 etc.), indicating relative effectiveness, followed by a letter (A, B, C, or D) indicating the class or classes of fires for which the extinguisher has been found to be effective.

Fire-Resistant. Construction designed to offer reasonable protection against fire.

Flash Point. The lowest temperature at which vapors from a volatile combustible substance ignite in air when exposed to flame. (*See also NFPA 30, Flammable and Combustible Liquids Code.*)

Fuel. Any substance that will react with the oxygen in the air or with the oxygen yielded by an oxidizer to produce combustion.

Hardwood. Any close-grained wood such as oak, maple, ash, hickory, etc., free from loose knots, wind shakes, or similar defects.

High Explosive Materials. Explosive materials which are characterized by a very high rate of reaction, high pressure development, and the presence of a detonation wave in the explosion.

Highway. Any public street, public alley, or public road.

Inhabited Building. Any building or structure regularly used in whole or part as a place of human habitation. The term includes any church, school, store, railway passenger station, airport passenger terminal, and any other building or structure where people are accustomed to congregate or assemble. The term does not include any building or structure occupied in connection with the manufacture, transportation, storage or use of explosive materials.

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

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

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

Low Explosive Materials. Explosive materials which are characterized by deflagration or a low rate of reaction and the development of low pressure.

Magazine. Any building or structure, other than an explosives manufacturing building, approved for the storage of explosive materials.

Mass Detonate (Mass Explode). Simultaneous detonation or explosion of the total or substantial amount of a quantity of explosive material caused by explosion of a unit or part of the explosive material.

Motor Vehicle. Any self-propelled vehicle, truck, tractor, semitrailer, or truck-trailer combination used for the transportation of freight over public highways.

Nonelectric Delay Device. A detonator with an integral delay element used in conjunction with and capable of being initiated by a detonating impulse.

Oxidizing Material. Any solid or liquid that readily yields oxygen or other oxidizing gas or that readily reacts to oxidize combustible material. (*See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizing Materials.*)

Person. Any individual, firm, copartnership, corporation, company, association, joint stock association, and including any trustee, receiver, assignee, or personal representative thereof.

Propellant. An explosive that normally functions by deflagration and is used for propulsion purposes. It may be a Class A or a Class B explosive, depending on its susceptibility to detonation.

Propellant-Actuated Device. Any tool or special mechanized device or gas generator system which is actuated by a propellant or which releases or directs work through a propellant charge.

Plosophoric Materials. Two or more unmixed, commercially manufactured, prepackaged chemical substances including oxidizers, flammable liquids or solids, or similar substances which are not independently classified as explosives, but which when mixed or combined form a mixture which is classified as an explosive and which is intended for blasting. Also known as "two-component" or "binary" explosives.

Plywood. Exterior grade plywood.

Primer. A unit, package, or cartridge of explosive material used to initiate other explosives or blasting agents and which contains (1) a detonator, or (2) a detonating cord to which is attached a detonator designed to initiate the cord.

Public Conveyance. Any railroad car, streetcar, ferry, cab, bus, airplane, or other vehicle which carries passengers for hire.

Railway. Any steam, electric, diesel electric, or other railroad or railway which carries passengers for hire on the particular line or branch in the vicinity of an explosives storage or manufacturing facility.

Semiconductive Hose. Any hose whose electrical resistance is great enough to limit the flow of stray electric currents to safe levels, yet not so high as to prevent relaxation of static electric charges to

ground. Any hose having no more than 2.0 megohms resistance over its entire length and no less than 5,000 ohms resistance per ft (16,393 ohms/m) meets this definition.

Sensitivity. A characteristic of an explosive material, classifying its ability to detonate upon receiving an external impulse such as impact shock, flame or other influence which can cause explosive decomposition.

Softwood. Any coarse-grained wood such as fir, hemlock, spruce, or pine, free from loose knots, wind shakes, or similar defects.

Small Arms Ammunition. Any shotgun, rifle, or pistol cartridge and any cartridge for propellant-actuated devices. This definition does not include military ammunition containing bursting charges or incendiary, tracer, spotting or pyrotechnic projectiles.

Small Arms Ammunition Primers. Small percussion-sensitive explosive charges, encased in a cap, used to ignite propellant powder.

Smokeless Propellants. Solid propellants, commonly referred to as smokeless powders, used in small arms ammunition, cannons, rockets, propellant-actuated devices, etc.

Special Industrial Explosives Devices. Explosive-actuated devices and propellant-actuated devices.

Special Industrial Explosives Materials.* Shaped materials, sheet forms, and various other extrusions, pellets, and packages of high explosives used for high-energy-rate forming, expanding, and shaping in metal fabrication and for dismemberment and reduction of scrap metal.

Steel. General purpose, hot- or cold-rolled, low carbon steel, such as ASTM A366 or equivalent.

Theft-Resistant. Construction designed to deter illegal entry into facilities for the storage of explosive material.

Water Gel.* Any explosive or blasting agent that contains a substantial portion of water.

Weather-Resistant. Construction designed to offer reasonable protection against weather.

Chapter 2 Security and Safety of Explosive Materials

2-1 Basic Requirements.

2-1.1 The manufacture of any explosive material, as defined by this Code, shall be prohibited unless such manufacture is authorized by federal license and is conducted in accordance with recognized safe practices.

Exception: This requirement does not apply to hand loading of small arms ammunition prepared for personal use and not for resale.

2-1.2 The manufacture of explosive materials shall be prohibited when such manufacture presents an undue hazard to life or property.

2-1.3 The authority having jurisdiction may restrict the quantity of explosive materials that may be handled at any location.

2-1.4 All explosive materials and any newly developed and unclassified explosive materials shall meet the license and permit requirements of this chapter.

Exception: This requirement does not apply to stocks of small arms ammunition and components thereof, to the extent that they are covered by the provisions of Title 18, United States Code, Chapter 44 ("Gun Control Act of 1968").

2-1.5 Persons intending to engage in business as an importer or manufacturer of, or dealer in, explosive materials shall obtain a federal license in accordance with Title XI, Regulation of Explosives, of the "Organized Crime Control Act of 1970" (Title 18, *United States Code*, Chapter 40).

2-1.6 This chapter is intended to supplement existing federal laws and regulations. Therefore, any person who possesses a license or permit under Title XI, 18 *U.S.C.*, Chapter 40, properly covering the activities of such person, shall not be required to obtain a permit under this chapter.

2-2 Permit Requirements.

2-2.1 No person shall be in possession of explosive materials, or conduct an operation or activity requiring the use of explosive materials, or perform or supervise the loading and firing of explosive materials wihout first obtaining the proper permit.

2-2.2 Explosive materials shall not be sold, given, delivered, or transferred to any person not possessing a valid permit.

2-2.3 Every person conducting an operation or activity that requires the use of explosive materials shall obtain a permit to use explosive materials and shall be responsible for the results and consequences of any loading or firing of explosive materials. Such person shall also ensure that loading and firing are performed or supervised by a person possessing a Permit to Blast.

2-2.3.1 Laboratories engaged in testing explosive materials, other than when conducting test blast explosions, require only a Permit to Use.

2-3 Permit Classes.

2-3.1 Permit to Use. Before a person may conduct an operation or activity that requires the use of explosive materials, that person shall obtain a Permit to Use, which will provide authorization to purchase, possess, store, and use such materials.

2-3.2 Permit to Blast. Before a person may supervise and perform the loading and firing of explosive materials, that person shall obtain the appropriate Permit to Blast, as categorized below:

Class	Category	Blasting Permitted
A	Unlimited	All types of blasting.
B	General Aboveground	All phases of blasting operations in quarries, open pit mines, and aboveground construction.
C	General Underground	All phases of blasting operations in underground mines, shafts, tunnels, and drifts.
D	Demolition	All phases of blasting in demolition projects.
E	Seismic	All phases of blasting in seismic prospecting.
F	Agriculture	All phases of blasting in agriculture, but limited to not more than 50 lb (22.7 kg) per blast.
G	Special	Special blasting as described on the permit.

2-4 Requirements for Blaster's Permit.

2-4.1 The applicant for an initial permit to supervise and perform the loading and firing of explosive materials, as set forth in 2-3.2, shall demonstrate adequate training and experience in the use of explosive materials in the class authorized by the specific permit for which application is made.

2-4.1.1 Each applicant shall pass a qualifying examination. The examination may be written, oral, or by such other means as necessary to determine that the applicant is competent to conduct blasting operations and to perform the duties of a blaster.

2-4.2 Any holder of a Permit to Blast who is convicted of a violation of any explosives law or regulation shall be required to pass a qualifying examination as a condition of retention of the permit.

2-4.3 Any person whose Permit to Blast has been revoked shall be required to pass a qualifying examination as a condition of reinstatement of the permit.

2-4.4 Any person whose Permit to Blast has lapsed for a period of one year or more shall be required to pass a qualifying examination as a condition of renewal of the permit.

2-5 Posting of Permits.

2-5.1 **Permit to Use.** A copy of the permit shall be posted at each place of operation.

2-5.2 **Permit to Blast.** A copy of the permit shall be carried by the permit holder during blasting operations.

2-5.3 Permit holders shall take every reasonable precaution to protect their permits from loss, theft, defacement, destruction, or unauthorized duplication. Any such occurrence shall be reported immediately to the issuing authority.

2-6 Permit Restrictions.

2-6.1 No permit may be assigned or transferred.

2-6.2 No permit shall be issued to a person under 21 years of age.

2-6.3 Permits shall be dated and numbered and shall be valid for no more than three years from the date of issue.

2-7 Denial or Revocation of Permits.

2-7.1 A permit for the possession and use of explosive materials may be denied or revoked for any of the following reasons:

(a) Noncompliance with any order of the issuing authority within the time specified in such order.

(b) Proof that the permit applicant or holder is under indictment for, or has been convicted of, a crime punishable by imprisonment for a term exceeding one year.

(c) The applicant or holder is a fugitive from justice.

(d) The applicant or holder is an unlawful user of, or is addicted to, narcotics or dangerous drugs.

(e) The applicant has been adjudicated as mentally defective.

(f) Proof that the permit applicant or holder advocates, or knowingly belongs to, any organization or group that advocates violent overthrow of or violent action against any federal, state, or local government.

(g) Proof that the permit applicant or holder suffers from a mental or physical defect that would interfere with the safe handling of explosives.

(h) Violation by the permit applicant or holder of any provision of any explosives law or regulation; or proof that false information was given or a misrepresentation was made to obtain the permit.

2-7.2 In any case where the issuing authority denies or revokes a permit, it shall promptly notify the permit applicant or holder. Such notification shall specify the basis for denial or revocation of the permit and shall state that, upon written request by the applicant or holder, a hearing before the issuing authority will be held within ten days after the date of the request.

2-7.2.1 Promptly after such hearing, the issuing authority shall state its findings and conclusions in writing and shall transmit a copy to the applicant or former permit holder.

2-7.3 Upon notice of the revocation of any permit, the former permit holder shall immediately surrender to the issuing authority the revoked permit and all copies thereof.

2-8 Record Keeping and Reporting.

2-8.1 A holder of a Permit to Use shall keep a record of all transactions or operations involving explosive materials. Such record shall be retained for five years and shall be made available to the issuing authority upon request.

2-8.1.1 An accumulation of invoices, sales slips, delivery tickets or receipts, or similar records representing individual transactions will satisfy the requirements for record-keeping, provided they include the signature of the receiver of the explosive materials.

2-8.2 A holder of a Permit to Blast shall keep a daily record of all explosive materials received and fired or otherwise disposed of by the permit holder. Such records shall be retained for five years and shall be made available to the issuing authority upon request.

2-8.3 A holder of a permit shall notify the issuing authority promptly of any change in address.

2-8.4* The loss, theft, or unlawful removal of explosive materials shall be reported within 24 hours to the Bureau of Alcohol, Tobacco and Firearms, to the permit-issuing authority, and to the local law enforcement agency.

2-9 Applications and Renewals.

2-9.1 Application for a permit or for renewal of a permit shall be made to the issuing authority on forms provided by it and shall contain such information as may be required.

2-9.2 If an application for renewal is filed with the issuing authority before expiration of the current permit, the renewal will become effective upon expiration of the current permit. No renewal permit shall be issued more than 30 days prior to the expiration date of the current permit.

2-9.3 An application for renewal filed after the expiration date of the current permit shall be considered an application for a new permit.

Chapter 3 Blasting Agents

3-1 Scope.

3-1.1 Unless otherwise set forth in this chapter, blasting agents shall be transported, stored, and used in the same manner as explosives.

3-1.2 Water gels, slurries, and emulsions are not subject to the requirements of this chapter. (*See Chapter 4.*)

3-2 Fixed Location Mixing.

3-2.1 Buildings or other facilities used for mixing blasting agents shall be located, in relation to inhabited buildings, passenger railroads, and public highways, according to the American Table of Distances. (*See Appendix B.*)

3-2.1.1 In determining the distance separating inhabited buildings, passenger railroads, or public highways from potential explosions, the sum of all masses which may propagate (i.e., are closer than the distances specified in Appendix C) from either individual or combined donor masses shall be included. However, when ammonium nitrate is included, only 50 percent of its weight shall be used due to its reduced blast effect.

3-2.2 Buildings used for the mixing of blasting agents shall comply with the requirements of this subsection, unless otherwise specifically approved by the authority having jurisdiction.

3-2.2.1 Buildings shall be constructed of noncombustible materials or of sheet metal on wood studs.

3-2.2.2 Floors shall be of concrete or of other nonabsorbent materials.

3-2.2.3 All fuel oil storage facilities shall be separated from the mixing plant and located so that the oil will drain away from the mixing plant building, should rupture of the tank occur.

3-2.2.4 The mixing building shall be well ventilated.

3-2.2.5 Heating units which do not depend on combustion of a fuel may be used within the mixing building when properly designed and located. All direct sources of heat shall be provided exclusively from units located outside of the mixing building.

3-2.2.6 Internal combustion engines used for electric power generation shall be located outside of the mixing building or shall be properly ventilated and isolated by a firewall. The exhaust systems on such engines shall be located so that any spark emission cannot be a hazard to any materials in or adjacent to the plant.

3-2.3 Equipment used for mixing blasting agents shall comply with the requirements of this subsection.

3-2.3.1 The design of the mixer shall minimize the possibility of frictional heating, compaction, and confinement. All bearings and drive assemblies shall be mounted outside the mixer and protected against accumulation of dust. All surfaces shall be accessible for cleaning.

3-2.3.2 Mixing and packaging equipment shall be constructed of materials compatible with the blasting agent composition.

3-2.3.3 Means shall be provided to prevent the flow of fuel oil to the mixer in case of fire. In gravity flow systems, an automatic spring-loaded shutoff valve with a fusible link shall be installed.

3-2.4 The requirements of this subsection shall apply when evaluating blasting agent compositions.

3-2.4.1 The cap sensitivity shall be determined by means of a No. 8 blasting cap (*see Appendix A-1-4, Cap-Sensitive Explosive Material*) at regular intervals or as often as required by the authority having jurisdiction.

3-2.4.2 Oxidizers of small particle size, such as crushed ammonium nitrate prills or fines, shall be handled with special care, due to their possible greater sensitivity.

3-2.4.3 No hydrocarbon liquid fuel with a flash point lower than that of No. 2 fuel oil, 125°F (51.7°C) minimum or legal minimum, shall be used.

3-2.4.4 Reclaimed crankcase oil shall be permitted to be used, provided each new supply of oil is checked for its compliance with 3-2.4.3.

3-2.4.5 Metal powders such as aluminum shall be kept dry and shall be stored in containers or bins which are moisture-resistant and weathertight. Solid fuels shall be handled so that dust explosion hazards are minimized.

3-2.4.6 Peroxides or chlorates shall not be used.

3-2.4.7 The requirements of 3-2.4.3, 3-2.4.4 and 3-2.4.6 do not apply to compositions made under the supervision of qualified personnel capable of determining the overall hazards of the resulting product during its manufacture, transportation, storage and use.

3-2.5 All electrical switches, controls, motors and lights located in the mixing room shall comply with Article 502 of NFPA 70, *National Electrical Code®*

Exception: Electrical wiring and equipment located outside the mixing building need not meet this requirement.

3-2.5.1 The frame of the mixer and all other equipment that may be used shall be electrically bonded and grounded.

3-2.6 Safety precautions at mixing plants shall include the following requirements:

(a) Floors shall have no drains or piping into which molten materials could flow and be confined during a fire.

(b) The floors and equipment of the mixing and packaging rooms or areas shall be thoroughly cleaned on a regular basis to prevent accumulations of oxidizers, fuels, and sensitizers.

(c) The entire building shall be thoroughly cleaned on a regular basis to prevent excessive accumulation of dust.

(d) Smoking, matches, open flames, spark-producing devices, and firearms shall not be permitted inside of or within 50 ft (15.25 m) of any building or facility used for the mixing of blasting agents.

Exception: Firearms may be carried by authorized guards when approved by the authority having jurisdiction.

(e) The area surrounding the mixing plant shall be kept clear of brush, dried grass, leaves, and other materials for a distance of at least 25 ft (7.63 m).

(f) Empty ammonium nitrate bags shall be disposed of daily in a safe manner.

(g) No welding or open flames shall be permitted in or around the mixing or storage area unless the equipment and the area have been completely washed down and all oxidizer material has been removed.

(h) Before welding on or making repairs to hollow shafts, all oxidizing material shall be removed from the outside and inside of the shaft and the shaft shall be vented with a minimum ½-in. (13-mm) diameter opening.

(i) Explosives shall not be stored inside of or within 50 ft (15.25 m) of any building or facility used for the mixing of blasting agents.

3-3 Bulk Delivery and Mixing Vehicles.

3-3.1 The provisions of this section shall apply to all bulk delivery and mixing vehicles.

3-3.2 The body of a vehicle for mixing and delivering blasting agents in bulk shall comply with the following requirements:

(a) The body shall be constructed of noncombustible materials.

(b) Vehicles used to transport bulk premixed blasting agents shall have covered bodies.

(c) All moving parts of this mixing system shall be designed so that heat buildup is prevented. Shafts or axles which make contact with the product shall have outboard bearings with a minimum 1-in. (25.4-mm) clearance between the bearings and the outside of the product container. Attention shall be given to adequate clearance on all moving parts.

(d) The bulk delivery vehicle shall be strong enough to carry the load without difficulty and shall be in good mechanical condition.

3-3.3 Operation of bulk delivery vehicles shall comply with the following requirements:

(a) Vehicles transporting blasting agents shall only be driven by and be in charge of a driver at least 21 years of age who is capable, careful, reliable, and who possesses a valid motor vehicle operator's license. The driver shall be familiar with all traffic regulations, applicable federal and state regulations pertaining to explosives, and the requirements of this Code.

(b) The vehicle operator shall be trained in the safe operation of the vehicle, as well as with its mixing, conveying, and related equipment. The operator shall be familiar with the commodities being delivered and the general procedure for handling emergency procedures.

(c) No person shall be permitted to ride upon, drive, load, or unload a vehicle containing blasting agents while smoking or while under the influence of intoxicants, narcotics, or other dangerous drugs.

(d) Vehicles transporting blasting agents shall be in safe operating condition at all times.

(e) No person shall smoke, carry matches or any flame-producing device, or carry any firearms while in or about bulk vehicles effecting the mixing, transfer, or down-the-hole loading of blasting agents at or near the blasting site.

(f) Caution shall be exercised in moving the vehicle in the blasting area to avoid driving the vehicle over or dragging hoses over firing

lines, cap wires, or explosive materials. The driver shall obtain the assistance of a second person to guide the driver's movements when moving the vehicle.

(g) Material shall not be mixed while in transit.

3-3.4 Pneumatic loading from bulk delivery vehicles into blast holes primed with electric blasting caps or other static-sensitive systems shall comply with the following requirements:

(a) A positive grounding device shall be used to prevent the accumulation of static electricity.

(b) A semiconductive discharge hose shall be used.

(c) A qualified person shall evaluate all systems to determine that they will adequately dissipate static electricity under potential field conditions.

3-3.5 Repairs to bulk delivery vehicles shall comply with the following requirements:

(a) No welding or open flames shall be used on or around any part of the delivery equipment until all oxidizing material has been removed and the equipment as been completely washed down.

(b) Before welding on or making repairs to hollow shafts, all oxidizing material shall be removed from the outside and inside of the shaft and the shaft shall be vented with a minimum ½-in. (13-mm) diameter opening.

3-4 Bulk Storage Bins.

3-4.1 The bin shall be a Type 5 magazine and shall be waterproof.

3-4.2* The bin, including supports, shall be constructed of compatible materials and shall be adequately supported and braced to withstand the combination of all loads, including impact forces arising from product movement within the bin and accidental vehicle contact with the support legs.

3-4.3 The bin discharge gate shall be designed to provide a closure tight enough to prevent leakage of the stored product. Provision shall also be made for locking the discharge gate.

3-4.4 Bin loading manways or access hatches shall be hinged or otherwise attached to the bin and shall be designed to permit locking.

3-4.5 Any electrically driven conveyors for loading or unloading bins shall comply with the requirements of NFPA 70, *National Electrical Code*. They shall be designed to minimize damage from corrosion.

3-4.6 Bins containing blasting agents shall be located in accordance with Appendix B with respect to inhabited buildings, passenger railroads, and public highways.

3-4.7 Bins containing blasting agents shall be located in accordance with Appendices B and C with respect to the storage of other blasting agents or explosives.

3-4.8 Bins containing ammonium nitrate shall be separated from storage of blasting agents and explosives in accordance with Appendix C.

3-4.9 Good housekeeping shall be maintained around any bin containing ammonium nitrate or blasting agent. This shall include keeping weeds and other combustible materials cleared within 25 ft (7.63 m) of the bin. Accumulations of spilled product on the ground shall be prevented.

3-5 Storage of Blasting Agents and Supplies.

3-5.1 Blasting agents and oxidizers used for mixing of blasting agents shall be stored according to the following requirements:

(a) Blasting agents or ammonium nitrate stored with explosives shall be stored according to the requirements of Chapter 3. The total mass of the blasting agents and one-half the mass of ammonium nitrate shall be included when computing the total quantity of explosive materials for determining separation distance requirements.

(b) Blasting agents stored entirely separate from explosives shall be stored in a Type 5 magazine or a magazine of higher classification (lower number).

(c) Magazines in which blasting agents are stored shall be constructed so that there are no open floor drains or piping into which molten materials may flow and be confined in case of fire.

(d) Semi-trailer and trailer vans used for highway or on-site transportation of blasting agents are satisfactory for temporary storage, provided they are located in accordance with Appendix B with respect to inhabited buildings, passenger railways, and public highways, and with Appendix C with respect to each other. Trailers and semi-trailers shall be provided with substantial means for locking and the doors shall be kept locked unless stocks of blasting agents are actually being placed or removed.

3-5.2 Piles of ammonium nitrate and warehouses containing ammonium nitrate shall be adequately separated from readily combustible fuels.

3-5.3 Caked oxidizers, either in bags or in bulk, shall not be loosened by blasting.

3-5.4 Every magazine used for the storage of blasting agents shall be under the supervision of a competent person who shall be at least 21 years of age.

3-6 Transportation of Packaged Blasting Agents.

3-6.1 When blasting agents are transported in the same vehicle with explosives, all of the requirements of Chapter 4 shall be met.

3-6.2 Vehicles transporting blasting agents shall only be driven by and be in charge of a driver at least 21 years of age who is capable, careful, reliable, and possessing a valid motor vehicle operator's license. This person shall also be familiar with state vehicle and traffic laws.

3-6.3 No matches, firearms, acids or other corrosive liquids shall be carried in the bed or body of any vehicle carrying blasting agents.

3-6.4 No person shall be permitted to ride upon, drive, load, or unload a vehicle containing blasting agents while smoking or while under the influence of intoxicants, narcotics, or other dangerous drugs.

3-6.5 It is forbidden for any person to transport or carry any blasting agents upon any public vehicle carrying passengers for hire.

3-6.6 Vehicles transporting blasting agents shall be in safe operating condition at all times.

3-6.7 When blasting agents are transported over public highways, the packaging, marking, and labeling of containers of blasting agents shall comply with US Department of Transportation regulations.

3-6.8 Vehicles used for transporting blasting agents on public highways shall be placarded in accordance with US Department of Transportation regulations.

3-7 Use of Blasting Agents. Persons using blasting agents shall comply with all applicable requirements of Chapters 2 and 7 of this Code.

Chapter 4 Water Gel and Emulsion Explosive Materials

4-1 Scope. For the purposes of this chapter, the term water gel means water gel explosive materials or emulsion explosive materials.

4-2 Types and Classifications. Water gels shall be classified as Class A or Class B explosives or as Blasting Agents, according to US Department of Transportation regulations. They shall be manufactured, transported, stored, and used as specified by this Code.

Exception: As otherwise provided for in this chapter.

4-3 Fixed Location Mixing.

4-3.1 Buildings or other facilities used for mixing water gels shall be located according to Appendix B with respect to inhabited buildings, passenger railroads and public highways.

In determining the distances separating highways, railroads, inhabited buildings from potential explosions, as specified in Appendix B, the sum of all masses that may propagate (i.e., lie at distances less than those specified by Appendix C) from either individual or combined donor masses shall be included. However, when ammonium nitrate must be included, only one-half its mass shall be used because of its reduced blast effects.

4-3.2 Buildings used for the mixing of water gels shall comply with the following requirements, unless otherwise specifically approved by the authority having jurisdiction.

(a) Buildings shall be constructed of noncombustible materials or of sheet metal on wood studs.

(b) Floors shall be of concrete or of other nonabsorbent materials.

(c) Where fuel oil is used, fuel oil storage facilities shall be separated from the mixing plant and so located that the oil will drain away from the mixing building is case of tank rupture.

(d) The building shall be well ventilated.

(e) Heating units that do not depend on combustion processes may be used in the mixing building, if properly designed and located. Direct-fired heating units shall be located outside of the mixing building.

(f) Internal combustion engines used to generate electrical power shall be located outside of the mixing plant building or shall be isolated by a fire partition and shall be properly ventilated. The engine exhaust system shall be located so that any sparks emitted cannot endanger any materials in or adjacent to the mixing plant.

4-3.3 Ingredients used in water gels shall comply with the following requirements:

(a) Ingredients classified as explosives shall be stored as required by Chapter 6 of this Code.

(b) Nitrate-water solutions may be stored in tank cars, tank trucks, or fixed tanks without quantity-distance limitations. Spills or leaks which may contaminate combustible materials shall be cleaned immediately.

(c) Metal powders, such as aluminum, shall be kept dry and shall be stored in containers or bins that are moisture-resistant or weather-tight. Solid fuels shall be used to minimize dust explosion hazards.

(d) Ingredients shall not be stored with incompatible materials.

(e) Peroxides or chlorates shall not be used.

4-3.4 Mixing equipment shall meet the following requirements:

(a) The design of the processing equipment, including mixing and conveying equipment, shall be compatible with the materials being handled. Equipment shall be designed to minimize frictional heating, compaction, overloading and confinement.

(b) Equipment and handling procedures shall be designed to prevent introduction of foreign objects or material.

(c) Mixers, pumps, valves, and related equipment shall be designed to permit regular and periodic flushing, cleaning, dismantling and inspection.

(d) All electrical equipment and wiring shall comply with NFPA 70, *National Electrical Code*.

(e) Electric motors and generators shall be provided with suitable overload protection devices. All motors, generators, proportioning devices, and all other electrical enclosures shall be bonded. The grounding conductor to all such equipment shall be effectively bonded to the service-entrance ground connnection and to all equipment ground connections so as to provide a continuous path to ground.

4-3.5 Mixing facilities shall meet the following requirements:

(a) The mixing, loading, and ingredient transfer areas where residues and spilled material may accumulate shall be cleaned periodically. A cleaning and collection system shall be provided for dangerous residues.

(b) A visual inspection of the mixing, conveying, and electrical equipment shall be made daily to ensure that all equipment is in good operating condition. A program of systematic maintenance shall be carried out on a regular schedule.

(c) Heating units that do not depend on combustion processes may be used within the confines of the processing building or area, if provided with temperature and safety controls and if located away from combustible materials and finished product.

4-4 Bulk Delivery and Mixing Vehicles.

4-4.1 Vehicle design shall meet the following requirements:

(a) Vehicles used for bulk transportation of water gels shall meet the requirements of Chapter 5 and Section 3-6 of this Code.

(b) When electric power is supplied by a self-contained motor-generator located on the vehicle, the generator shall be separated from the discharge point of the water gel.

(c) Processing equipment shall comply with 4-3.3 and 4-3.4.

(d) A positive action parking brake which will set the brakes on at least one axle shall be provided on vehicles equipped with air brakes. This brake shall be used during bulk delivery operations. Wheel chocks shall be used as required.

4-4.2 Operation of bulk delivery and mixing vehicles shall meet the following requirements:

(a) The operator shall be trained in the safe operation of the vehicle, together with its mixing, conveying, and related equipment. The operator shall be familiar with the commodity being carried and with the general procedures for handling emergencies.

(b) No person shall smoke, carry matches or any flame-producing device, or carry any firearms while in or around bulk vehicles that are mixing, transferring, or down-the-hole loading water gels at or near the blasting site.

(c) Caution shall be exercised in moving the vehicle in the blasting area to avoid driving the vehicle over or dragging hoses over firing lines, cap wires, or explosive materials. The driver shall obtain the assistance of a second person to guide the driver's movements when moving the vehicle.

(d) Material shall not be mixed while in transit.

(e) The location chosen for transferring the water gel or its ingredients from a support vehicle to the borehole-loading vehicle shall be away from the blast hole site when the boreholes are loaded or in the process of being loaded.

4-5 Storage of Water Gels.

4-5.1 Water gels shall be stored as required by Chapter 6.

4-5.2 When tests on specific formulations result in classification as Class B explosives, bullet-resistant magazines are not required. (*See 6-2.4, Exception No. 2.*)

4-5.3 Semi-trailer or full trailer vans or tanks used for transportation of water gels are suitable for temporary storage of these materials provided they are located according to Appendix B with respect to inhabited buildings, passenger railways, and public highways, and according to Appendix C with respect to one another. Trailers and semi-trailers shall be provided with substantial means for locking, and doors, hatches, or valves shall be kept locked except during loading or removal of stocks of water gels. Locking mechanisms shall be as specified for Type 5 magazines. (*See 6-6.5.*)

Chapter 5 Transportation of Explosive Materials on Highways

5-1 Basic Requirements.

5-1.1 In addition to all other applicable requirements of this Code, transportation of explosive materials shall comply with the Hazardous Materials Regulations of the US Department of Transportation, 49 *CFR* 100-179, and Federal Motor Carrier Safety Regulations, 49 *CFR* 397.

5-1.2 This chapter does not apply to the transportation of small arms ammunition and components. (*See Chapter 10.*)

5-1.3 Explosive materials shall not be transported through any prohibited vehicular tunnel or subway or over any prohibited bridge, roadway or elevated highway.

5-1.4 No person shall smoke, carry matches or any other flame-producing device, or carry unauthorized firearms or cartridges while transporting explosive materials.

5-1.5 No person shall drive, load or unload a motor vehicle transporting explosive materials in a careless or reckless manner.

5-1.6 Explosive materials shall not be carried or transported in or upon a public conveyance or vehicle carrying passengers for hire.

5-1.7 Explosive materials shall not be transferred from one vehicle to another without informing the local authority having jurisdiction. In the event of breakdown or collision, the local authority having jurisdiction shall be promptly notified to help safeguard such emergencies. Explosive materials shall be transferred from the disabled vehicle to another only when proper and qualified supervision is provided.

5-1.8 Detonators shall not be transported in the same vehicle with Class A or Class B explosive materials.

Exception: As permitted by the US Department of Transportation in 49 CFR 172-178.

5-2 Transportation Vehicles.

5-2.1 Vehicles used for transporting explosive materials shall be strong enough to carry the load and shall be in good mechanical condition.

5-2.2 When explosive materials are transported on a vehicle with an open body, a portable magazine, securely fastened to the vehicle body, shall be used to protect the explosives.

5-2.3 Vehicles used for transporting explosive materials shall have no exposed spark-producing surface on the inside of the body.

Exception: Vehicles transporting blasting agents and oxidizing materials need not comply with this requirement.

5-2.4 Floors shall be tight.

5-2.5 Motor vehicles used for transporting any quantity of explosive materials on public highways shall display all placards, lettering or numbering required by the US Department of Transportation.

5-2.6 Each motor vehicle used for transporting explosive materials shall be equipped with fire extinguishers according to the following schedule.

(a)	Trucks — Gross Vehicle Weight (GVW) less than 14,000 lb (6350 kg)	At least 2 extinguishers having combined capacity of 4-A:20-B,C.
(b)	Trucks — GVW 14,000 lb (6350 kg) or greater; tractor/semi-trailer units	At least 2 extinguishers having combined capacity of 4-A:70-B,C.

5-2.6.1 Only listed extinguishers shall be used. They shall be equipped with a device permitting visual determination of the charge condition.

5-2.6.2 Extinguishers shall be located where they will be accessible for immediate use.

5-2.6.3 Extinguishers shall be examined and recharged periodically according to manufacturers' recommendations.

5-2.6.4 Where motor vehicles are operated in temperatures below 0°F (−17.8°C), dry chemical extinguishers shall be pressurized with nitrogen.

5-2.7 A motor vehicle used for transporting explosives shall be inspected to determine that it is in proper condition for safe transportation of explosives. The following items shall be checked.

(a) Fire extinguisher filled and in working order.

(b) All electrical wiring completely protected and securely fastened to prevent short-circuiting.

(c) Chassis, motor, oil pan and body undersides reasonably clean and free of excess oil and grease.

(d) Fuel tank and feed lines secure and not leaking.

(e) Brakes, lights, horn, windshield wipers and steering apparatus functioning properly.

(f) Tires inflated properly and free of defects.

(g) Vehicle in proper condition in every other respect and acceptable for handling explosives.

5-2.8 Tires shall be checked for proper inflation and general condition after each 2 hours or 100 miles (161 km) of travel, whichever occurs first, and at every rest stop. Flat or overheated tires shall be removed from the vehicle immediately. After removal the tire shall be placed far enough from the vehicle so that a spontaneous ignition of the tire will not endanger the vehicle or its cargo. The tire shall not be replaced on the vehicle until it has been cooled below the danger of ignition nor shall it be used until the cause has been corrected.

5-3 Operation of Transportation Vehicles.

5-3.1 Vehicles transporting explosives shall only be driven by and be in the charge of a properly licensed driver who is physically fit, careful, capable, reliable, able to read and write the English language, and not addicted to the use of, or under the influence of, intoxicants, narcotics or other dangerous drugs.

5-3.2 The driver of a vehicle transporting explosive materials on public highways shall be not less than 21 years of age. The driver shall be familiar with traffic regulations, applicable federal and state regulations concerning explosive materials and the provisions of this chapter.

5-3.3 No vehicle transporting explosives shall be parked before reaching its destination, even though attended, on any public street adjacent to or in proximity to any bridge, tunnel, dwelling, building or place where people work, congregate or assemble.

Exception: This requirement does not apply under emergency conditions.

5-3.4 Every motor vehicle transporting any quantity of Class A or B explosives shall, at all times, be attended by a driver or other qualified representative of the motor carrier operating the vehicle. This attendant shall have been made aware of the class of the explosive in the vehicle and its inherent dangers, and shall have been instructed in the procedures to be followed in order to protect the

public from those dangers. The attendant shall be familiar with the vehicle assigned and shall be trained, supplied with the necessary means, and authorized to move the vehicle when required.

5-3.4.1 For the purpose of this chapter, a motor vehicle shall be considered "attended" only when the driver or attendant is physically on or in the vehicle or has the vehicle within his field of vision and can reach it quickly and with no interference. "Attended" also means that the driver or attendant is awake, alert and not engaged in other duties or activities which may divert his attention from the vehicle.

Exception: Necessary communication with public officers or representatives of the shipper, carrier, or consignee and necessary absence from the vehicle to obtain food or provide for physical comfort does not violate this requirement.

5-3.4.2 A vehicle carrying explosives may be left unattended if parked in an area where such parking is permitted, such as an area meeting the requirements of NFPA 498, *Standard for Explosives Motor Vehicle Terminals*.

5-3.5 No spark-producing metal or tools, oils, matches, firearms, electric storage batteries, flammable materials, acids, oxidizers, or corrosives shall be carried in the body of any motor vehicle transporting explosives.

Exception: As allowed by the US Department of Transportation Hazardous Materials Regulations.

5-3.6 Vehicles transporting explosives shall avoid congested areas and heavy traffic. Where routes through congested areas have been designated by the authority having jurisdiction, such routes shall be followed.

5-3.7 Delivery shall only be made to authorized persons and into authorized magazines or approved temporary storage or handling areas.

Chapter 6 Aboveground Storage of Explosive Materials

6-1 Scope.

6-1.1 Explosive materials shall be kept in magazines meeting the requirements of this chapter.

6-1.2 This chapter shall not apply to storage of small arms ammunition, propellant-actuated cartridges, small arms ammunition primers, and smokeless propellants. (*See Chapter 10.*)

6-2 Basic Requirements.

6-2.1 All explosive materials not in the process of manufacture, being transported, or being used shall be kept in storage magazines.

6-2.2 Ammonium nitrate may be stored in the same magazine with blasting agents. Ammonium nitrate and blasting agents may be stored in the same magazine with explosives.

6-2.2.1 When ammonium nitrate is stored in the same magazine with blasting agents, the magazine shall be suitable for storage of blasting agents.

6-2.2.2 When ammonium nitrate is stored in the same magazine with explosives or with explosives and blasting agents, the magazine shall be suitable for storage of explosives.

6-2.2.3 In determining the maximum quantity of explosive materials that may be placed in a magazine, one-half the weight of the ammonium nitrate shall be added to the weight of the explosive material.

6-2.3 Detonators shall be stored in a separate magazine for blasting supplies and shall not be stored in a magazine with other explosive materials.

Exception: Detonators may be stored in the same magazine with other explosive materials only where specifically allowed by the authority having jurisdiction.

6-2.4 Explosive materials classified as Class A by the US Department of Transportation shall be stored in Type 1, 2 or 3 magazines.

Exception No. 1: Black powder may be stored in a Type 4 magazine or a magazine of higher classification (lower type number).

Exception No. 2: If it can be demonstrated by test that a cap-sensitive explosive material is not bullet-sensitive, that material may be stored in a Type 4 or Type 5 magazine.

6-2.5 Explosive materials that are not cap-sensitive may be stored in a Type 4 or Type 5 magazine.

6-3 Classification and Use of Magazines.

6-3.1 Outdoor magazines shall be classified and used according to Table 6-3.

Table 6-3 Construction Features and Allowable Storage in Magazines

	Magazine Types				
Construction Features	**1**	**2**	**3**	**4**	**5**
Permanent	X			X	X
Portable or Mobile		X	X	X	X
Bullet-Resistant	X	X	X		
Spark-Resistant Interior	X	X	X	X	
Fire-Resistant Exterior	X	X	X	X[2]	X[2]
Theft-Resistant	X	X	X	X	X[1]
Weather-Resistant	X	X	X	X	X
Ventilated	X	X	X	X[2]	X[2]
Allowable Storage[3, 4, 5]					
High Explosives (dynamite, detonating cord, blasting caps, and other mass detonating explosives and bullet-sensitive materials)	X	X	X		
Low Explosives (black powder, electric blasting caps, and other nonmass detonating detonators)	X	X	X	X	
Blasting Agents	X	X	X	X	X

NOTE 1: Each door of a mobile Type 5 magazine shall be equipped with at least one 5-tumbler padlock having a $\frac{7}{16}$-in. (11-mm) case-hardened shackle. The lock need not be hooded.

NOTE 2: Over-the-road trucks or semi-trailers used for temporary storage as Type 4 or 5 magazines need not be fire-resistant or ventilated.

NOTE 3: Detonators shall not be stored with other explosive materials except when specifically allowed by the authority having jurisdiction. (*See Exception to 6-2.3.*)

NOTE 4: Ammonium nitrate may be stored with any explosive material other than detonators.

NOTE 5: Certain initiating explosives, such as lead azide and lead styphnate, shall not be stored with any other explosive materials.

6-3.2 Indoor magazines used for the storage of 50 lb (22.7 kg) or less of explosive materials in warehouses and in wholesale or retail establishments shall be fire-resistant and theft-resistant and shall be subject to the approval of the authority having jurisdiction.

6-4 Location of Magazines.

6-4.1 All outdoor magazines other than Type 3 shall be located in compliance with the American Table of Distances for Storage of Explosives (ATD) when determining minimum distances to inhabited buildings, railways, and highways. (*See Appendix B.*)

6-4.2 Blasting agent manufacturing plants and storage of blasting agents and ammonium nitrate shall be located in compliance with the Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents (SDT) as well as with the American Table of Distances. (*See Appendices B and C.*)

6-4.3 The separation distances given by the American Table of Distances or the Table of Recommended Separation Distances, or both, shall be used to determine minimum separation of storage facilities for explosives, blasting agents, and ammonium nitrate. The tables to be applied shall be as specified in Table 6-4.

Table 6-4 Application of Separation Distance Tables

Type of Donor	Type of Acceptor	Table	Separation Distance Found in Column:
Explosives	Explosives	ATD	Separation of Magazines
Explosives	Ammonium Nitrate	SDT	Ammonium Nitrate
Explosives	Blasting Agent	SDT	Blasting Agents
Blasting Agent	Explosives	ATD	Separation of Magazines
Blasting Agent	Blasting Agent	SDT	Blasting Agent
Blasting Agent	Ammonium Nitrate	SDT	Ammonium Nitrate

6-4.4 An indoor magazine shall only be located on a floor that has an entrance at or a ramp to grade level. It shall be located no more than 10 ft (3 m) from the entrance.

6-4.5 Two magazines may be located in the same building only if one magazine is used solely for the storage of detonators in quantities not exceeding 5,000. A distance of 10 ft (3 m) shall be maintained between the magazines.

6-4.6 The local fire department and other local emergency response agencies shall be notified of the location of all magazines and shall be notified of any changes in location.

6-4.7 Type 3 magazines shall be located away from neighboring inhabited buildings, railways, highways, and other magazines. A distance of 150 ft (45.8 m) or greater, if required by the local authority having jurisdiction, shall be maintained between magazines and work in progress whenever the quantity of explosives in the magazines exceeds 25 lb (11.3 kg).

6-4.7.1 The separation distance between magazines and work in progress may be reduced to 50 ft (15.24 m) if the quantity of explosives in the magazines does not exceed 25 lb (11.3 kg).

6-4.8 Type 3 magazines shall be attended when explosive materials are stored within. All explosive materials shall be removed to appropriate storage magazines for unattended storage at the end of the work day.

6-4.9 Two Type 3 magazines may be located at a blasting site, if one magazine is used solely for the storage of blasting caps or electric blasting caps.

6-4.10 A Type 5 magazine shall not be located in a residence or dwelling.

6-5 Magazine Construction—Basic Requirements.

6-5.1 Magazines shall be constructed so as to comply with this section or in a manner substantially equivalent to the requirements for safety and security embodied in this section.

6-5.2 The ground around a magazine shall be graded so that water drains away from the magazine.

6-5.3 Magazines requiring heat shall be heated by either hot water radiant heating within the magazine building or by indirect warm air heating.

6-5.3.1 Indirect warm air shall be heated by either hot water or low pressure [15 psig (103 kPa) or less] steam coils located outside the magazine building.

6-5.4 Magazine heating systems shall meet the following requirements:

(a) Radiant heating coils within the building shall be installed so that explosive materials or their containers cannot contact the coils and so that air is free to circulate between the coils and the explosives. The surface temperature of the coils shall not exceed 165°F (74°C).

(b) Heating ducts shall be installed so that the hot air discharged from the ducts is not directed against explosive materials or containers.

(c) The heating system shall be controlled so that the ambient temperature of the magazine does not exceed 130°F (54°C).

(d) Any electric fan or pump used in the heating system shall be located outside the magazine, separate from the magazine walls, and shall be grounded.

(e) Any electric motor and any controls for electric heating devices used to heat water or produce steam shall have overload devices and disconnects which comply with NFPA 70, *National Electrical Code*. All electrical switch-gear shall be located at least 25 ft (7.6 m) from the magazine.

(f) Any fuel-fired heating source for the hot water or steam shall be separated from the magazine by a distance of not less than 25 ft (7.6 m). The area between the heating unit and the magazine shall be cleared of all combustible material.

(g) Explosive materials stored in magazines shall be arranged so that uniform circulation of air is assured.

6-5.5 When lighting is necessary within the magazine, electric safety flashlights or electric safety lanterns shall be used.

Exception: As provided for in 6-5.5.1.

6-5.5.1 Electric lighting may be used within a magazine only if the installation meets the following requirements:

(a) Junction boxes containing fuses or circuit breakers and electrical disconnects shall be located at least 25 ft (7.6 m) from the magazine.

(b) Disconnects, fuses, and circuit breakers shall be protected by a voltage surge arrestor capable of handling 2500 amperes for 0.1 seconds.

(c) All wiring from switches, both inside and outside the magazine, shall be installed in rigid conduit. Wiring leading into the magazine shall be installed underground.

(d) Conduit and light fixtures inside the magazine shall be protected from physical damage by suitable guards or by location.

(e) Light fixtures shall be suitably enclosed to prevent sparks or hot metal from falling on the floor or onto material stored in the magazine.

(f) Junction boxes located within the magazine shall have no openings and shall be equipped with close-fitting covers.

(g) Magazines containing explosive materials which may release flammable vapors shall have wiring and fixtures which meet the requirements of Article 501 of NFPA 70, *National Electrical Code*.

(h) Lights inside magazines shall not be left on when the magazine is unattended.

6-5.6 There shall be no exposed ferrous metal on the interior of a magazine where it may contact packages of explosives.

Exception: This requirement does not apply to Type 5 magazines.

6-6 Magazine Construction—Requirements for Specific Types.

6-6.1 Type 1 Magazines. A Type 1 magazine shall be a permanent structure, such as a building or igloo, that is bullet-resistant, fire-resistant, theft-resistant, weather-resistant and ventilated.

(a) Walls and doors shall be bullet-resistant and may be constructed according to any of the specifications listed in Appendix D.

(b) The roof may be constructed of any type of structurally sound materials which are or have been made fire-resistant on the exterior.

(c)* Where the natural terrain around a Type 1 magazine makes it possible for a bullet to be shot through the roof and ceiling at such an angle that the bullet can strike the explosive materials within, then either the roof or ceiling shall be of bullet-resistant construction.

(d) The foundation may be of masonry, wood, or metal and shall be completely enclosed except for openings to provide cross ventilation. A wood foundation enclosure shall be covered on the exterior with not less than 26 gage metal.

(e) The floor shall be constructed of wood or other suitable material. Floors constructed of materials that may cause sparks shall be covered with a nonsparking surface or the packages of explosives shall be placed on pallets of nonsparking material.

(f) Type 1 magazines shall be ventilated to prevent dampness or heating of explosives. Ventilation openings shall be screened to prevent entrance of sparks. Ventilators in side walls shall be offset or shielded. Magazines having foundation and roof ventilators, with the air circulating between side walls and floor and between side walls and ceiling, shall have a wood lattice lining or equivalent means to prevent packages of explosives from being stacked against side walls and blocking air circulation. A 2-in. (51-mm) air space shall be provided between side walls and the floor.

(g) Each door of a Type 1 magazine shall be equipped with one of the following locking systems:

1. two mortise locks;

2. two padlocks in separate hasps and staples;

3. a mortise lock and a padlock;

4. a mortise lock that requires two keys to open; or

5. a three-point lock or an equivalent lock that secures the door to the frame at more than one point.

Padlocks shall be steel, shall have at least five tumblers, and shall have at least a $\frac{7}{16}$-in. (11-mm) case-hardened shackle. All padlocks shall be protected by steel hoods installed so as to discourage insertion of bolt cutters. Doors secured by a substantial internal bolt do not require additional locking devices. Hinges and hasps shall be securely fastened to the magazine and all locking hardware shall be secured rigidly and directly to the door frame.

6-6.2 Type 2 Magazines. A Type 2 magazine shall be a portable or mobile stucture, such as a box, skid-magazine, trailer, or semi-trailer that is fire-resistant, theft-resistant, weather-resistant and ventilated. If used for outdoor storage, Type 2 magazines shall also be bullet-resistant.

6-6.2.1 Type 2 Outdoor Magazines.

(a) Walls and roof or ceiling shall be constructed according to the provisions of 6-6.1(a), (b) and (c).

(b) Doors shall be of metal, constructed according to the provisions of 6-6.1(a) or shall have a metal exterior with an inner door meeting the provisions of 6-6.1(a).

(c) Floors constructed of ferrous metal shall be covered with a nonsparking surface.

(d) A magazine that is top-opening shall have a lid that overlaps the sides by at least 1 in. (25.4 mm) when in the closed position.

(e) The magazine shall be supported so that its floor does not directly contact the ground.

(f) Magazines less than 1 cu yd (0.766 m^3) in size shall be securely fastened to a fixed object to prevent theft of the entire magazine.

(g) Hinges, hasps, locks and locking hardware shall comply with 6-6.1(g).

Exception: Padlocks on vehicular magazines need not be protected by steel hoods.

(h) Whenever a vehicular magazine is left unattended, its wheels shall be removed or its kingpins shall be locked or it shall otherwise be effectively immobilized.

6-6.2.2 Type 2 Indoor Magazines.

(a) The magazine shall have substantial wheels or casters to facilitate removal from the building in case of emergency.

(b) The cover of the magazine shall have substantial strap hinges and a means for locking. The magazine shall be kept locked, except during placement or removal of explosive materials, with a five-tumbler padlock or its equivalent.

(c) The magazine shall be painted red and the top shall bear the words "Explosives—Keep Fire Away" in white letters at least 3 in. (76 mm) high.

(d) Type 2 indoor magazines constructed of wood shall have sides, bottoms, and covers or doors constructed of 2-in. (51-mm) hardwood, well braced at corners. The magazines shall be covered with sheet metal of not less than 26 gage. Nails exposed to the interior of the magazines shall be countersunk.

(e) Type 2 indoor magazines constructed of metal shall be of 12 gage sheet metal and shall be lined with a nonsparking material. Edges of metal covers shall overlap the side by at least 1 in. (25.4 mm).

6-6.3 Type 3 Magazines. A Type 3 magazine shall be a portable structure that is fire-resistant, theft-resistant, and weather-resistant.

(a) The magazine shall be equipped with a five-tumbler padlock.

(b) Magazines constructed of wood shall have sides, bottoms, and covers or doors constructed of 4-in. (102-mm) hardwood, well braced at corners. They shall be covered with sheet metal of not less than 26 gage. Nails exposed to the interior of the magazine shall be countersunk.

(c) Magazines constructed of metal shall meet the requirements of 6-6.2.2(e).

6-6.4 Type 4 Magazines. A Type 4 magazine shall be a permanent, portable, or mobile structure such as a building, igloo, box, semi-trailer or other mobile container that is fire-resistant, theft-resistant and weather-resistant.

6-6.4.1 Type 4 Outdoor Magazine.

(a) A Type 4 outdoor magazine shall be constructed of masonry, wood covered with sheet metal, fabricated metal or a combination of these materials. Doors shall be metal or wood covered with metal.

(b) Permanent Type 4 magazines shall comply with 6-6.1(d), (f) and (g).

(c) Vehicular Type 4 magazines shall comply with 6-6.2.1(g) and shall be immobilized when unattended, as described in 6-6.2.1(h).

6-6.4.2 Type 4 Indoor Magazine. A Type 4 indoor magazine shall comply with all provisions of 6-6.2.2.

6-6.5 Type 5 Magazines. A Type 5 magazine shall be a permanent, portable, or mobile structure such as a building, igloo, box, bin, tank, semi-trailer, bulk trailer, tank trailer, bulk truck, tank truck or other mobile container that is theft-resistant. No ventilation is required and ferrous metal need not be covered with nonsparking material.

6-6.5.1 Type 5 Outdoor Magazine.

(a) A Type 5 permanent outdoor magazine shall be weather-resistant and shall be locked with at least one steel five-tumbler padlock having at least a $\frac{7}{16}$-in. (11-mm) case-hardened shackle. A hood for the padlock is not required.

(b) Hinges and hasps shall be securely fastened to the magazine and all locking hardware shall be secured rigidly and directly to the door frame.

(c) A vehicular Type 5 magazine shall be immobilized when unattended as described in 6-6.2.1(h).

6-6.5.2 Type 5 Indoor Magazine.

(a) A Type 5 indoor magazine shall be constructed according to the requirements for Type 5 outdoor magazines.

Exception: A Type 5 indoor magazine need not be weather-resistant.

6-7 Storage Within Magazines.

6-7.1 Magazines shall be under the responsibility of a competent person at all times. This person shall be at least 21 years of age and shall be responsible for the enforcement of all safety precautions.

6-7.2 All magazines containing explosives shall be opened and inspected at intervals not exceeding three days to determine whether there has been unauthorized or attempted entry into the magazines, or whether there has been unauthorized removal of the magazines or their contents.

6-7.3 Magazine doors shall be kept locked except during placement or removal of explosives or during inspection.

6-7.4 Safety rules covering the operations of magazines shall be posted on the interior side of the magazine door.

6-7.5 When explosive materials are removed from the magazine for use, the oldest stock shall be used first.

6-7.6 Corresponding grades and brands of explosives shall be stored together so that brand and grade markings are readily visible. All stocks shall be stored so as to be easily counted and checked.

6-7.7 Containers of explosive materials shall be piled in a stable manner, laid flat and with top side up.

6-7.8 Open containers of explosive materials shall be securely closed before being returned to a magazine. No container without a closed lid may be stored in the magazine. Only fiberboard containers may be opened in the magazine.

6-7.9 Containers of explosive materials, other than fiberboard, shall not be unpacked or repacked inside or within 50 ft (15.25 m) of a magazine or in close proximity to other explosives.

6-7.10 Tools used for opening containers of explosive materials shall be constructed of nonsparking material.

Exception: Metal slitters may be used for opening fiberboard containers.

6-7.11 Magazines shall be used exclusively for the storage of explosive materials, blasting materials, and blasting accessories. Metal tools other than nonferrous transfer conveyors shall not be stored in a magazine containing explosives or detonators. Ferrous metal conveyor stands protected by a coat of paint may be stored within a magazine.

6-7.12 Magazine floors shall be regularly swept and kept clean, dry, free of grit, paper, empty packages and rubbish. Brooms and other cleaning utensils shall not have any spark-producing metal parts. Sweepings from magazine floors shall be disposed of according to manufacturers' instructions.

6-7.13 When any explosive material has deteriorated to the extent that it is in an unstable or dangerous condition or if nitroglycerine or other liquid is leaking from any explosive, the person responsible for the explosives shall immediately contact the manufacturer for assistance. Magazine floors stained with nitroglycerine or other liquid shall be cleaned according to manufacturers' instructions.

6-7.14 Before making repairs to the interior of a magazine, all explosives shall be removed and the floor shall be cleaned.

6-7.15 In making repairs to the exterior of a magazine where there is a possibility of causing sparks or fire, all explosives shall be removed.

6-7.16 Explosives removed from a magazine undergoing repair shall either be placed in another magazine or be placed a safe distance from the magazine where they shall be properly guarded and protected. Upon completion of the repairs, the explosives shall be promptly returned to the magazine.

6-8 Miscellaneous Safety Precautions.

6-8.1 Smoking, matches, open flames, spark-producing devices and firearms shall not be permitted inside of or within 50 ft (15.25 m) of a magazine.

Exception: Firearms carried by authorized guards.

6-8.2 The area around a magazine shall be kept clear of brush, dried grass, leaves and similar combustibles for a distance of at least 25 ft (7.63 m).

6-8.3 Combustible materials shall not be stored within 50 ft (15.25 m) of magazines.

6-8.4 Explosive materials recovered from blasting misfires shall be stored in a separate magazine until disposal instructions have been received from the manufacturer. Such explosvie materials shall then be disposed of in the manner recommended. Detonators recovered from blasting misfires shall not be reused.

6-8.5 Property on which Type 1 magazines and outdoor magazines of Types 2, 4 and 5 are located shall be posted with signs reading "Explosives — Keep Off." Such signs shall be located so as to minimize the possibility that a bullet shot at the sign will hit the magazine.

Chapter 7 Use of Explosive Materials for Blasting

7-1 Basic Requirements.

7-1.1 All federal, state and local laws and regulations applicable to obtaining, owning, transporting, storing, handling, and using explosive materials shall be followed.

7-1.2 Explosive materials shall be protected from unauthorized possession and shall not be abandoned.

7-1.3 Explosive materials shall be used only by experienced persons who are familiar with the hazards involved and who hold all required permits.

7-1.3.1 Loading and firing shall be performed or supervised only by a person possessing an appropriate blaster's permit.

7-1.3.2 Trainees, helpers and other persons who do not hold the required permits shall work only under the supervision of persons holding such permits.

7-1.4 No explosive materials shall be located or stored where they may be exposed to flame, excessive heat, sparks or impact.

7-1.4.1 No firearms shall be discharged into or in the vicinity of a vehicle containing explosive materials or into or in the vicinity of a location where explosive materials are being handled, used, or stored.

7-1.4.2 No smoking shall be permitted within 50 ft (15.25 m) of any location where explosives are being handled or used.

7-1.4.3 No person within 50 ft (15.25 m) of any location where explosives are being handled or used shall carry any matches, open light, or other fire or flame.

Exception: Suitable devices for lighting safety fuse are exempt from this requirement.

7-1.5 No person under the influence of intoxicating liquors, narcotics, or other dangerous drugs shall be allowed to handle explosive materials.

7-1.6 No attempt shall be made to fight a fire which cannot be contained or controlled before it reaches explosive materials. In such cases, all personnel shall be immediately evacuated to a safe location and the area shall be guarded from entry by spectators or intruders.

7-1.7 Unauthorized or unnecessary personnel shall not be present where explosive materials are being handled, used, or stored.

7-1.8 Explosive materials shall be kept in closed containers or packages while being transported between the storage magazine and the blasting site.

Exception: Partial reels of detonating cord need not be in closed containers, unless transported over public highways.

7-1.9 Containers of explosive materials shall not be opened in any magazine or within 50 ft (15.25 m) of any magazine.

Exception: Explosive materials in fiberboard containers need not comply with this requirement.

7-1.9.1 Nonsparking tools shall be used for opening any package or container of explosive materials.

Exception: Metal slitters may be used for opening fiberboard containers.

7-1.10 No blasting operation shall be done in a manner contrary to the instructions of the manufacturer of the explosive materials being used.

7-1.11 When blasting is done in a congested area or in close proximity to a structure, railway, or highway, or any other installation that may be affected, special precautions shall be exercised to prevent damage and to minimize earth vibrations and air blasts. Blasting mats or other protective devices shall be used to prevent fragments from being thrown.

7-1.12 Persons authorized to prepare explosive charges or to conduct blasting operations shall use every reasonable precaution, including but not limited to warning signals, flags, barricades, mats, or other equally effective means to ensure the safety of the general public and workers.

7-1.13 Surface blasting operations shall be conducted during daylight hours only.

Exception: This requirement may be waived with the approval of the authority having jurisdiction.

7-1.14 Whenever blasting is being conducted in the vicinity of utility lines, the blaster shall notify the appropriate representatives of the utilities at least 24 hours in advance of blasting, specifying the location and intended time of such blasting. Verbal notice shall be confirmed with written notice.

Exception: In an emergency situation, this time limit may be waived by the authority having jurisdiction.

7-1.15 Precautions shall be taken to prevent accidental discharge of electric blasting caps from currents induced by radar and radio transmitters, lightning, adjacent power lines, dust and snow storms, or other sources of extraneous electricity. These precautions shall include:

(a) Suspension of all blasting operations and removal of all personnel from the blasting area during the approach and progress of an electrical storm.

(b) The posting of signs warning against the use of mobile radio transmitters on all roads within 350 ft (107 m) of blasting operations.

(c) Observance of the latest recommendations with regard to blasting in the vicinity of radio transmitters or power lines, as set forth in IME Safety Library Publication No. 20, *Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Electric Blasting Caps*.

7-2 Pre-Blast Operations.

7-2.1 Face material shall be carefully examined before drilling to determine the possible presence of unfired explosive material.

7-2.2 Drill holes shall be large enough to permit free insertion of cartridges of explosive materials. Drill holes shall not be collared in bootlegs or in holes which have previously contained explosive materials. Holes shall not be drilled where there is a danger of intersecting another hole containing explosive material.

7-2.3 All drill holes shall be inspected and cleared of any obstruction before loading.

7-2.4 Pneumatic loading of blasting agents into blast holes primed with electric blasting caps or other static-sensitive initiation systems shall comply with the following requirements:

(a) A positive grounding device shall be used for the equipment to prevent accumulation of static electricity.

(b) A semiconductive discharge hose shall be used.

(c) A qualified person shall evaluate all systems to assure that they will adequately dissipate static charges under field conditions.

7-2.5 Tamping shall be done only with wooden rods or approved plastic poles having no exposed metal parts.

Exception: Nonsparking metal connectors may be used on jointed tamping poles.

7-2.5.1 Violent tamping shall be avoided.

7-2.5.2 The primer shall never be tamped.

7-2.6 After loading for a blast is completed and before firing, all excess explosive materials shall be removed from the area and returned to the proper storage facilities.

7-3 Initiating Blasts.

7-3.1 Cap and fuse shall not be used to initiate blasts in congested areas or on or adjacent to highways open to traffic.

7-3.2 When safety fuse is used, the burning rate shall be determined and in no case shall fuse lengths less than 120 seconds be used. The blasting cap shall be securely attached to the fuse with a standard ring-type cap crimper.

7-3.3 When electric blasting caps are used, stray current tests shall be made as frequently as necessary. Maximum stray current shall not exceed 0.05 amperes through a 1-ohm resistor, measured at the location of the blasting cap. Nonelectric initiating systems shall be used if extraneous currents exceed this limit. Electric detonators of different brands shall not be used in the same firing circuit.

7-3.4 No detonator shall be inserted in explosive materials which do not have a cap well without first making a hole in the cartridge with a proper size, nonsparking tool or the appropriate pointed handle of an approved cap crimper.

7-3.4.1 Primers shall not be assembled closer than 50 ft (15.25 m) from any magazine. Primers shall be made up only when and as required for immediate needs.

7-3.4.2 In underground blasting, consideration shall be given to making up primers at a location away from the face to be fired.

7-3.5 When testing initiating circuits, only blasting galvanometers or other instruments which have been designed and approved for the purpose shall be used. All electrically initiated blasts shall be made by using blasting machines suitable for the circuitry being fired.

7-3.6 Explosive materials shall not be extracted from a hole that has misfired unless it is impossible or hazardous to detonate the misfired explosives by insertion of an additional primer.

7-3.7 If a misfire occurs, all personnel shall remain at a safe distance for at least one hour from the time of initiation. Correction of misfires shall be handled under the direction of the blaster in charge. A thorough search shall be made for unexploded charges before correction is attempted.

7-3.8 Only the person making the lead line connections shall fire the blast. All connections shall be made progressively from the borehole back to the initiation point. Blasting lead lines shall remain shunted (shorted) and shall not be connected to the blasting machine or other source of current until the blast is to be fired.

7-3.9 No blast shall be fired until the blaster in charge has made certain that all surplus explosive materials are in a safe place, all persons and equipment are at a safe distance or under sufficient cover, and that an adequate warning signal has been given.

7-4 Disposal of Explosive Materials.

7-4.1 Empty containers and packages and paper or fiberboard packing materials which have previously contained explosive materials shall not be reused for any purpose. Such packaging materials shall be destroyed by burning at an approved outdoor location.

7-4.1.1 All personnel shall remain at a safe distance from the disposal area.

7-4.2 All explosive materials that are obviously deteriorated or damaged shall not be used and shall be destroyed according to the requirements of 6-7.13.

Chapter 8 Explosive Materials at Piers, Railway, Truck, and Air Terminals

8-1 Basic Requirements.

8-1.1 Explosive materials shall not be kept in a railway car unless the car, its contents and methods of loading comply with the regulations of the US Department of Transportation.

Exception: This requirement may be waived in an emergency with the approval of the authority having jurisdiction.

8-1.2 Explosive materials shall not be delivered to any carrier unless the explosives comply in all respects, including marking and packing, to the regulations of the US Department of Transportation.

8-1.3 Every railway car containing explosive materials which has reached its destination, or has stopped in transit so as to no longer be considered in interstate commerce, shall remain placarded in accordance with US Department of Transportation regulations.

8-1.4 Any explosive materials at a railway facility, truck terminal, pier, wharf, harbor facility, or airport terminal, whether for delivery to a consignee or forwarded to some other destination, shall be kept in a safe place, isolated as far as practicable and in such a manner that they can be easily and quickly removed.

8-1.5 Truck terminals for explosives vehicles shall meet the requirements of NFPA 498, *Standard for Explosives Motor Vehicle Terminals*.

8-2 Notifications. A consignee, having been notified that a shipment of explosives is in the hands of any carrier, shall remove the explosives within 48 hours, Saturdays, Sundays, and holidays excluded, to some storage area meeting the requirements of this Code.

8-3 Facilities for Trailer-on-Flatcar and Container-on-Flatcar.

8-3.1 Rail shipments of explosives by trailer-on-flatcar (TOFC) or container-on-flatcar (COFC) shall meet the following requirements:

(a) Shipments by TOFC or COFC shall not be unloaded at a nonagency station unless the consignee is present to receive them or unless properly locked and secure storage facilities are available at that location. If delivery cannot be made, the shipment shall be taken to the next or nearest agency station for delivery.

(b)* Carriers shall require the consignee to remove TOFC and COFC shipments from the carrier's property within 48 hours after notice of arrival has been given, Saturdays, Sundays, and holidays excluded. If the trailers or containers are not so removed, the carrier shall immediately dispose of the shipment by storage, by disposal, or, when necessary for safety, by destruction under the supervision of a competent person.

(c) If storage is required to comply with 8-3.1(b), storage shall be in an interchange lot meeting the requirements of Chapters 2 and 3 of NFPA 498, *Standard for Explosives Motor Vehicle Terminals*, or in a place that will provide equivalent safety to the public.

(d) When local conditions make the acceptance, transportation, or delivery of explosives unusually hazardous, appropriate local restrictions shall be imposed by the carrier.

(e) All rail carriers shall report to the Bureau of Explosives of the Association of American Railroads for publication of full information as to restrictions imposed by the carriers themselves on the acceptance, delivery, or transportation of explosives over any portion of their lines.

(f) For shipment of Class A explosives, regular days for receiving trailers and containers for shipment shall be assigned whenever it is practicable to do so.

(g) To enable the carrier to provide suitable flatcars for the shipment of Class A explosives, the shipper shall give the carrier at least 24 hours notice of the intent to offer such shipments and state their destinations. When a regular day has been appointed to receive trailers and containers for shipment, this notice may be waived by the carrier. In such cases, the shipments shall be delivered on the assigned days in time to permit proper inspection, billing, and loading on that day.

(h) Carriers shall forward shipments promptly within 48 hours after acceptance at the originating point or after receipt at any yard transfer station or interchange point, Saturdays, Sundays, and holidays excluded.

Exception: Where biweekly or weekly service is performed, shipments must be forwarded on the next train.

(i) The Bureau of Explosives of the Association of American Railroads shall be consulted by rail carriers to determine that the storage facility required by 8-3.1(b) is safe, adequate, and complies with Chapter 2 of NFPA 498, *Standard for Explosives Motor Vehicle Terminals*.

(j) Cars loaded with explosive materials shall be so placed that they will be safe from all probable danger from fire. They shall not be placed under bridges or overhead highway crossings, nor in or alongside of passenger sheds or stations unless being loaded or unloaded.

8-4 Designation of Facilities. The local authority having jurisdiction has the authority to and may designate the location for, and limit the quantity of, explosives which may be loaded, unloaded, reloaded, or temporarily retained at any facility within his jurisdiction.

Chapter 9 Plosophoric Materials*

9-1 Basic Requirements.

9-1.1 Mixed or combined plosophoric materials shall be transported, stored, and used in the same manner as explosive materials. (*See Chapters 2, 5, 6, and 7.*)

9-1.2 For transportation and storage, individual packages of each plosophoric component shall be packaged in separate shipping containers, in compliance with US Department of Transportation Hazardous Materials Regulations.

9-2 Storage.

9-2.1 Plosophoric components shall be stored in separate locked containers. If any component possesses a hazard classification, it shall be stored in a location and manner appropriate to its hazard class.

9-2.2 Plosophoric materials may be stored in the same magazine with explosives, provided their total weight is included in the weight of explosives permitted in the magazine so as to comply with the quantity-distance requirements of Appendix B. Storage shall not introduce a hazard due to chemical incompatibility.

9-3 Use.

9-3.1 When plosophoric materials are mixed or combined at the point of use, the procedures recommended by the manufacturer shall be strictly followed.

9-3.2 Since the mixing or combining of plosophoric components produces an explosive material, the number of packages combined at any one time shall be limited to the number needed for immediate use.

Exception: This requirement may be waived if the extra explosive material produced can be handled and stored as such.

9-4 Record Keeping and Reporting.

9-4.1 Dealers in plosophoric materials shall record all transactions on appropriate federal, state, and local forms, as required for transactions with explosives.

9-4.2 Thefts of plosophoric materials during transportation, storage, and use shall be reported to the authority having jurisdiction, as required for thefts of explosives.

9-4.3 Dealers in plosophoric materials shall require that all purchasers possess a license or permit to use explosives. The license or permit number shall be recorded with other records of the sale.

Chapter 10 Small Arms Ammunition and Primers, Smokeless Propellants, and Black Powder Propellants

10-1 Basic Requirements.

10-1.1 In addition to all other applicable requirements of this Code, intrastate transportation of small arms ammunition, small arms primers, smokeless propellants, and black powder shall comply with US Department of Transportation Hazardous Materials Regulations.

10-1.2 This chapter applies to the channels of distribution of and to the users of small arms ammunition, small arms primers, smokeless propellants, and black powder.

10-1.3 This chapter does not apply to in-process storage and intraplant transportation during manufacture.

10-1.4 This chapter applies to the transportation and storage of small arms ammunition and components.

10-1.5 This chapter does not apply to safety procedures in the use of small arms ammunition and components.

10-2 Small Arms Ammunition.

10-2.1 No restrictions shall be imposed on transportation of small arms ammunition other than those imposed by the US Department of Transportation or by the presence of other hazardous materials.

10-2.2 No quantity limitations shall be imposed on the storage of small arms ammunition in warehouses, retail stores, and other occupancies other than those imposed by limitations of the storage facility and by public safety regulations.

10-2.3 Small arms ammunition shall be separated from materials classified by the US Department of Transportation as flammable liquids, flammable solids, and oxidizing materials by a distance of 15 ft (4.6 m) or by a fire partition having a fire endurance of at least 1 hour.

10-2.4 Small arms ammunition shall not be stored together with Class A or Class B explosives unless the storage facility is suitable for storage of explosives.

10-2.5* Small arms ammunition which has been exposed to fire or damaged by exposure to water shall not be returned to commerical channels for reasons of consumer safety. The manufacturer shall be contacted to obtain recommendations for disposal of damaged ammunition.

10-3 Smokeless Propellants.

10-3.1 Quantities of smokeless propellants not exceeding 25 lb (11.3 kg), in shipping containers approved by the US Department of Transportation, may be transported in a private vehicle.

10-3.2 Quantities of smokeless propellents exceeding 25 lb (11.3 kg) but not exceeding 50 lb (22.7 kg), transported in a private vehicle, shall be transported in a portable magazine having wood walls of at least 1-in. (25.4-mm) nominal thickness.

10-3.3 Transportation of more than 50 lb (22.7 kg) of smokeless propellants in a private vehicle is prohibited.

10-3.4 Commercial shipments of smokeless propellants in quantities not exceeding 100 lb (45.4 kg) are classified for transportation purposes as flammable solids when packaged according to US Department of Transportation Hazardous Materials Regulations (Title 49, *Code of Federal Regulations*, Part 173.197a), and shall be transported accordingly.

10-3.5 Commercial shipments of smokeless propellants exceeding 100 lb (45.4 kg) or not packaged in accordance with the regulations cited in 10-3.4 shall be transported according to US Department of Transportation regulations for Class B propellant explosives.

10-3.6 Smokeless propellants shall be stored in shipping containers specified by US Department of Transportation Hazardous Materials Regulations.

10-3.7 Smokeless propellants intended for personal use in quantities not exceeding 20 lb (9.1 kg) may be stored in original containers in residences. Quantities exceeding 20 lb (9.1 kg), but not exceeding 50 lb (22.7 kg), may be stored in residences if kept in a wooden box or cabinet having walls of at least 1-in. (25.4-mm) nominal thickness.

10-3.8 Not more than 20 lb (9.1 kg) of smokeless propellants, in containers of 1-lb (0.45-kg) maximum capacity, shall be displayed in commercial establishments.

10-3.9 Commercial stocks of smokeless propellants shall be stored as follows:

(a) Quantities exceeding 20 lb (9.1 kg), but not exceeding 100 lb (45.4 kg), shall be stored in portable wooden boxes having walls of at least 1-in. (25.4-mm) thickness.

(b) Quantities exceeding 100 lb (45.4 kg), but not exceeding 800 lb (363 kg), shall be stored in nonportable storage cabinets having walls of at least 1-in. (25.4-mm) thickness. Not more than 400 lb (181 kg) may be stored in any one cabinet and cabinets shall be separated by a distance of an least 25 ft (7.63 m) or by a fire partition having a fire endurance of at least 1 hour.

(c) Quantities exceeding 800 lb (363 kg), but not exceeding 5,000 lb (2268 kg), may be stored in a building if the following requirements are met:

1. The warehouse or storage room shall not be accessible to unauthorized personnel.

2. Smokeless propellant shall be stored in nonportable storage cabinets having wood walls at least 1 in. (25.4 mm) thick and having shelves with no less than 3 ft (0.92 m) separation between shelves.

3. No more than 400 lb (181 kg) shall be stored in any one cabinet.

4. Cabinets shall be located against walls of the storage room or warehouse with at least 40 ft (12.2 m) between cabinets.

5. Separation between cabinets may be reduced to 20 ft (6.1 m) if barricades twice the height of the cabinets are attached to the wall, midway between each cabinet. The barricades shall extend at least 10 ft (3 m) outward, shall be firmly attached to the wall, and shall be constructed of ¼-in. (6.4-mm) boiler plate, 2-in. (51-mm) thick wood, brick, or concrete block.

6. Smokeless propellant shall be separated from materials classified by the US Department of Transportation as flammable liquids, flammable solids, and oxidizing materials by a distance of 25 ft (7.63 m) or by a fire partition having a fire endurance of at least 1 hour.

7. The building shall be protected by an automatic sprinkler system installed according to NFPA 13, *Standard for the Installation of Sprinkler Systems*.

(d) Smokeless propellants not stored according to (a), (b) and (c) above shall be stored in a Type 4 magazine constructed and located according to Chapter 6.

10-4 Black Powder.

10-4.1 Black powder shall be transported according to US Department of Transportation Regulations. (*See also Chapter 5.*)

10-4.2 Black powder shall be stored in shipping containers approved by the US Department of Transportation.

10-4.3 Black powder intended for personal use in quantities not exceeding 5 lb (2.3 kg) may be stored in residences if in original containers and stored in a wooden box or cabinet having walls of at least 1-in. (25.4-mm) nominal thickness.

10-4.4 No more than 1 lb (0.45 kg) of black powder shall be displayed in commercial establishments.

10-4.5 Commercial stocks in a building in quantities not exceeding 50 lb (22.7 kg) shall be stored in a Type 4 indoor magazine.

10-4.6 Commercial stocks in quantities exceeding 50 lb (22.7 kg) shall be stored in a Type 4 outdoor magazine.

10-4.7 If smokeless propellants are stored in the same magazine with black powder, the total quantity shall not exceed that permitted for black powder.

10-5 Small Arms Primers.

10-5.1 Small arms primers shall not be transported or stored in containers not approved by the US Department of Transportation.

10-5.2 Transportation of small arms primers shall comply with US Department of Transportation Regulations.

10-5.3 No more than 25,000 small arms primers may be transported in a private vehicle.

10-5.4 No more than 10,000 small arms primers may be stored in residences.

10-5.5 No more than 10,000 small arms primers may be displayed in commercial establishments.

10-5.6 Commercial stocks of small arms primers shall be stored as follows:

(a) Quantities not exceeding 750,000 may be stored in a building if not more than 100,000 are stored in any one pile and piles are at least 15 ft (4.6 m) apart.

(b) Quantities exceeding 750,000 may be stored in a building if the following conditions are met:

1. The warehouse or storage room shall not be accessible to unauthorized personnel.

2. Primers shall be stored in cabinets. No more than 200,000 primers shall be stored in any one cabinet.

3. Shelves in cabinets shall have vertical separation of at least 2 ft (0.6 m).

4. Cabinets shall be located against walls of the warehouse or storage room with at least 40 ft (12.2 m) between cabinets.

5. Separation between cabinets may be reduced to 20 ft (6.1 m) if barricades twice the height of the cabinets are attached to the wall, midway between each cabinet. The barricades shall extend at least 10 ft (3 m) outward, shall be firmly attached to the wall, and shall be constructed of ¼-in. (6.4-mm) boiler plate, 2-in. (51-mm) thick wood, brick, or concrete block.

6. Primers shall be separated from materials classified by the US Department of Transportation as flammable liquids, flammable solids, and oxidizing materials by a distance of 25 ft (7.63 m) or by a fire partition having a fire endurance of at least 1 hour.

7. The building shall be protected by an automatic sprinkler system installed according to NFPA 13, *Standard for the Installation of Sprinkler Systems*.

(c) Small arms primers not stored according to (a) or (b) above shall be stored in a magazine meeting the requirements of Chapter 6.

Appendix A Explanatory Notes

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

A-1-4 Blasting Agent. Such materials or mixtures have been found to be so insensitive that there is little probability of accidental initiation of explosion or of transition from deflagration to detonation. The tests required by 49 *CFR* 173.114a include blasting cap sensitivity, differential thermal analysis, thermal stability, electrostatic sensitivity, impact sensitivity, and fire exposure.

A-1-4 Bullet-Resistant Construction. Tests to determine bullet-resistance must be conducted on test panels or empty magazines. The panels or magazines must resist penetration of 5 out of 5 shots placed independently of each other in an area at least 3 ft by 3 ft (0.9 m by 0.9 m). If hardwood or softwood is used, its water content must not exceed 15 percent.

When a magazine roof or ceiling is required to be bullet-resistant, it shall be constructed of materials comparable to the side walls or of other materials which will withstand penetration of the bullets when fired at an angle of 45 degrees from perpendicular.

A-1-4 Cap-Sensitive Explosive Material. A No. 8 blasting cap contains 0.40 to 0.45 grams of PETN (pentaerythritol tetranitrate) base charge pressed into an aluminum shell having a bottom thickness not greater than 0.03 in. (0.8 mm) to a specific gravity not less than 1.4 g/cc and primed with standard weights of primer, in accordance with the manufacturer's specifications.

A-1-4 Explosive. A list of explosives determined to be within the scope of 18 *U.S.C.*, Chapter 40, is published at least annually by the Bureau of Alcohol, Tobacco, and Firearms, US Department of the Treasury.

Classification of explosives described in the Hazardous Materials Regulations of the US Department of Transportation is as follows:

Class A Explosives: Possessing detonating or otherwise maximum hazard, such as dynamite, desensitized nitroglycerine, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.

Class B Explosives:	Possessing flammability hazards, such as propellants, including some smokeless propellants, and photographic flash powders.
Blasting Agents:	Possessing minimum accidental explosion hazard. (*See definition of Blasting Agent in Section 1-4.*)
Class C Explosives:	Includes certain manufactured articles which contain Class A or Class B explosives, or both, as components, but in restricted quantities.
Forbidden Explosives:	Explosives which are forbidden from or not acceptable for transportation by common carriers.

Certain chemicals and fuel materials may have explosive characteristics, but are not within the scope of 18 *U.S.C.*, Chapter 40, and are not specifically classified as explosives by the US Department of Transportation. Authoritative information should be obtained for such materials and action commensurate with their hazards, location, isolation, and safeguards should be taken.

A-1-4 Special Industrial Explosive Materials. The high explosives used include dynamite, TNT (trinitrotoluene), PETN (pentaerythritol tetranitrate), and RDX (cyclotrimethylenetrinitramine).

A-1-4 Water Gel. Water gels (or slurries) are manufactured with varying degrees of sensitivity to initiation and may be classified as Class A Explosives, Class B Explosives, or Blasting Agents, as appropriate. Water gels may be sensitized by a material which itself is classified as an explosive, such as TNT or smokeless powder, or they may contain no ingredient classified as an explosive. Water gels in this latter category are sensitized with metals such as aluminum, or with other fuels.

A-2-8.4 The toll free telephone number for reporting incidents to the Bureau of Alcohol, Tobacco, and Firearms is 800-424-9555.

A-3-4.2 See NFPA 490, *Code for the Storage of Ammonium Nitrate*, for guidance on choosing compatible materials.

A-6-6.1(c) A bullet-resistant roof may be constructed according to any of the specifications listed in Appendix D. A bullet-resistant ceiling may be constructed at the eave line, covering the entire area of the magazine, except for the necessary ventilation space. Examples of bullet-resistant ceiling construction include:

1. any construction meeting the specifications listed in Appendix D;
2. a sand tray having a sand depth of at least 4 in. (102 mm).

A-8-3.1(b) The specific requirement is stated in the US Department of Transportation Hazardous Materials Regulations, Title 49, *Code of Federal Regulations*, Part 174.16.

A-9 Plosophoric materials, or plosophors, are also known as two-component or binary explosives.

A-10-2.5 A bulletin on this subject is available from the Sporting Arms and Ammunition Manufacturer's Institute, P.O. Box 281, Wallingford, CT 06492.

Appendix B

The American Table of Distances for Storage of Explosives

(As Revised and Approved by the Institute of Makers of Explosives on November 5, 1971)

This Appendix is specifically referenced in certain requirements of this Code, and thus is considered part of the requirements of this Code.

The American Table of Distances for Storage of Explosives follows on pages 62 and 63.

For SI Units: 1 lb = 0.454 kg; 1 ft = 0.305 m.