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NFPA 495 Explosive Materials Code 1992 Edition

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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NFPA 495

Explosive Materials Code

1992 Edition

This edition of NFPA 495, *Explosive Materials Code*, was prepared by the Technical Committee on Explosives and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 18-21, 1992, in New Orleans, LA. It was issued by the Standards Council on July 17, 1992, with an effective date of August 14, 1992, and supersedes all previous editions.

The 1992 edition of this document has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 495

This code was originally issued in 1912 as the *Suggested State Law to Regulate the Manufacture, Storage, Sale, and Use of Explosives*. The second edition was issued in 1941 by the Committee on Laws and Ordinances and retitled *Suggested Explosives Ordinance for Cities*. Later, the document number NFPA 495L was designated.

After being assigned to the Committee on Chemicals and Explosives, a new edition was issued in 1959. This was retitled as the *Code for the Manufacture, Transportation, Storage, and Use of Explosives and Blasting Agents* and redesignated as NFPA 495.

Following reorganization of the committee in 1960, the responsibility for amendments to NFPA 495 was assigned to the Sectional Committee on Explosives. This committee reported to the Correlating Committee of the Committee on Chemicals and Explosives. Revised editions were issued in 1962, 1965, 1967, 1968, 1969, and 1970. A new edition was issued in 1972 with the document title revised to *Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials*. A subsequent edition followed in 1973.

Following the issuance of the 1973 edition, the Sectional Committee on Explosives was redesignated as a Technical Committee. In 1976, the committee began a detailed review intended to amend requirements so that there were no conflicts with the regulations promulgated by the various federal agencies concerned with explosive materials (U.S. Bureau of Alcohol, Tobacco, and Firearms, U.S. Mine Safety and Health Administration, U.S. Department of Transportation, etc.). This effort resulted in the 1982 edition, which was subsequently followed by a new edition in 1985. In 1990, the document was again revised and included the title being changed to the *Explosive Materials Code*. The latest edition, issued in 1992, incorporates various technical and editorial amendments.

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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.

Contents

NFPA 495

Explosive Materials Code

1992 Edition

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 Chapter 11 and Appendix F.

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 U.S. 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 or 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 U.S. Department of Defense. This code shall also not apply to the distribution of explosive materials to or storage of explosive materials 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, fuses, and railway torpedoes. It also shall not apply to common fireworks, as defined in NFPA 1123, *Standard for Outdoor Display of Fireworks*, and NFPA 1124, *Code for the Manufacture, Transportation, and Storage 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 provide 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.

Acceptor. A charge of explosives or blasting agent receiving an impulse from an exploding donor charge.

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

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.

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."

Blast Area. The area including the blast site and the immediate adjacent area within the influence of flying rock, missiles, and concussion.

Blast Site. The area in which explosive materials are being or have been loaded and which includes all holes loaded or to be loaded for the same blast and for a distance of 50 ft (15.3 m) in all directions.

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 $\frac{1}{2}$-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 Propellant. 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 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 per unit, excluding ignition or delay charges. The term includes, but is not limited to, electric detonators of instantaneous and delay types, detonators for use with safety fuses, detonating cord delay connectors, and nonelectric detonators of instantaneous and delay types that consist of detonating cord, shock tube, or any other replacement for electric leg wires.

Donor. An exploding charge producing an impulse that impinges upon an explosive acceptor charge.

Emulsion Explosive. An explosive material that consists of a slurry of substantial amounts of ammonium nitrate dissolved in water droplets surrounded by an oil-like material.

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 U.S. Department of Transportation.

NOTE: These regulations were revised in 1991 and are to be phased in over the next several years. See Appendix E.

Explosive-Actuated Device. Any tool or special mechanized device that is actuated by explosive materials. 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 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 that are characterized by a very high rate of reaction, high pressure development, and the presence of a detonation wave.

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.

Initiating Tube System. A system for initiating detonators in which the energy is transmitted through the system by means of a detonation wave guided within a plastic tube.

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 that 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.

Misfire. A charge of explosive material that fails to detonate completely after initiation.

Motor Vehicle. Any self-propelled vehicle, truck, tractor, semi-trailer, 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 Oxidizers.*)

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

Plosophoric Materials. Two or more unmixed, commercially manufactured, prepackaged chemical substances including oxidizers, flammable liquids or solids, or similar substances that are not independently classified as explosives but which when mixed or combined form a mixture that is classified as an explosive and that is intended for blasting. It may be classified by the Hazardous Materials Regulations of the U.S. Department of Transportation as Class A or Class B, depending on its susceptibility to detonation.

Plywood. Exterior grade plywood.

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

Propellant. An explosive that normally functions by deflagration and is used for propulsion purposes. It may be classified by the Hazardous Materials Regulations of the U.S. Department of Transportation as Class A or Class B, depending on its susceptibility to detonation.

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

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

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

Semiconductive Hose. Any hose with an electrical resistance 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 1,000 ohms resistance per ft (3,280 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 that can cause explosive decomposition.

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.

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

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

Special Industrial Explosive Material.* 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 No attempt shall be made to fight a fire that 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.

2-1.2 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.

2-1.3 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.

2-1.4 The manufacture of explosive materials shall be prohibited when such manufacture presents an undue hazard to life or property.

2-1.5 The authority having jurisdiction may restrict the quantity of explosive materials that may be handled at any location.

2-1.6 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").

2-1.7 A person intending to engage in business as an importer of, a 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).

2-1.8 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 without 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.

Exception: 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.

2-4.2 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.

2-4.3 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.

2-4.4 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.

2-4.5 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 old.

2-6.3 Permits shall be dated and numbered and shall be valid for no more than 3 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 by 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 1 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 in which the issuing authority denies or revokes a permit, the issuing authority 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 10 days after the date of the request.

2-7.3 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.

2-7.4 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 5 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 5 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.

2-8.5 Accidents involving explosive material that cause a lost-time injury or property damage shall be reported immediately to the authority having jurisdiction.

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 other explosive materials.

3-1.2 Water gels, slurries, and emulsion explosives 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 Table 6-4(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 that may propagate [i.e., are closer than the distances specified in Table 6-4(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 other noncombustible material. They shall be constructed without open floor drains and without piping into which molten materials could flow and be confined in case of fire.

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

3-2.2.4 The mixing building shall be well ventilated.

3-2.2.5 Heating units that 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 mixing and handling blasting agent compositions.

3-2.4.1 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.

3-2.4.2 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.

3-2.4.3 Reclaimed crankcase oil shall be permitted to be used, provided each new supply of oil is checked for its compliance with 3-2.4.2.

3-2.4.4 Metal powders such as aluminum shall be kept dry and shall be stored in containers or bins that are moisture-resistant and weather-tight. Solid fuels shall be handled so that dust explosion hazards are minimized.

3-2.4.5 Peroxides or chlorates shall not be used.

3-2.4.6 The requirements of 3-2.4.3, 3-2.4.4, and 3-2.4.5 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 oxidizing 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 1/2-in. (13-mm) diameter opening.

(i) Other explosive materials 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 Mixing and Delivery Vehicles.

3-3.1 The provisions of this section shall apply to all bulk mixing and delivery. The requirements of 3-2.4 shall also apply to 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 the mixing system shall be designed so that heat buildup is prevented. Shafts or axles that 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 the charge of a driver at least 21 years old 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 explosive materials, 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 around 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 has 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 1/2-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 contact between vehicles and the support legs of the bin.

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 Table 6-4(b) with respect to inhabited buildings, passenger railroads, and public highways.

3-4.7 Bins containing blasting agents shall be located in accordance with Tables 6-4(b) and 6-4(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 Table 6-4(c).

3-4.9 Good housekeeping shall be maintained around any bin containing ammonium nitrate or other 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 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 other explosive materials 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 other explosive materials 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 Table 6-4(b) with respect to inhabited buildings, passenger railways, and public highways, and with Table 6-4(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 oxidizer, 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 old.

3-6 Transportation of Packaged Blasting Agents.

3-6.1 When blasting agents are transported in the same vehicle with other explosive materials, all of the requirements of Chapter 5 shall be met.

3-6.2 Vehicles transporting blasting agents shall only be driven by and be in the charge of a driver at least 21 years old who is capable, careful, reliable, and possesses 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 on 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 U.S. Department of Transportation regulations.

3-6.8 Vehicles used for transporting blasting agents on public highways shall be placarded in accordance with U.S. 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.

3-8 Utilization of Used Oil in Ammonium Nitrate/Fuel Oil (ANFO). In order to safely utilize used oil in ANFO, three areas of compliance and control are required:

(a) Comprehensive initial testing and characterization of the used oil to assure that the safety and performance of ANFO will not be affected;

(b) Procedures governing the collection, monitoring, treatment, and use in ANFO of the used oil; and

(c) Periodic testing to ensure that the initial characterization remains valid.

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 U.S. 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 Table 6-4(b) with respect to inhabited buildings, passenger railroads, and public highways.

In determining the distances separating highways, railroads, and inhabited buildings from potential explosions, as specified in Table 6-4(b), the sum of all masses that may

propagate [i.e., lie at distances less than those specified by Table 6-4(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 other noncombustible material. They shall be constructed without open floor drains and without piping into which molten materials could flow and be confined in case of fire.

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

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 that 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 weathertight.

(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 connection 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 materials may accumulate shall be kept safe. 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 Mixing and Delivery 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 that 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 mixing and delivery 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 Table 6-4(b) with respect to inhabited buildings, passenger railways, and public highways, and according to Table 6-4(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 U.S. 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 or with blasting agents.

Exception: As permitted by the U.S. 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 store the explosive materials.

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 of transportation vehicles 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 U.S. 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 fire extinguishers shall be used. Fire extinguishers shall be designed, constructed, and maintained to permit visual determination of whether it is fully charged.

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 explosive materials shall be inspected to determine that it is in proper condition. 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 fuel 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 explosive materials.

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 problem has been corrected.

5-3 Operation of Transportation Vehicles.

5-3.1 Vehicles transporting explosive materials 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 old. 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 explosive materials 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/her 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 that may divert 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 explosive materials 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 explosive materials.

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

5-3.6 Vehicles transporting explosive materials 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 other explosive materials. (*See 6-2.3.*)

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 material 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.

NOTE: See Tentative Interim Amendment 92-1 on page 39.

6-2.4 Explosive materials classified as Class A by the U.S. 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.

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 so as to comply with the American Table of Distances for Storage of Explosives (ADT) or the Table of Distances for Storage of Low Explosives, as applicable. [*See Table 6-4(b) for the American Table of Distances. See Code of Federal Regulations. Title 27, Part 55, for the Table of Distances for Low Explosives.*]

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 Tables 6-4(b) and 6-4(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(a).

Table 6-3 Construction Features and Allowable Storage in Magazines

Classification and Use of Magazines	Magazine Types				
Construction Features	**1**	**2**	**3**	**4**	**5**
Permanent	X			X	X
Portable		X	X	X	X
Bullet-Resistant	X	X			
Fire-Resistant	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]
Storage in Magazines					
High Explosives (dynamite; cap-sensitive water gels; slurries; emulsions; cast boosters)	X	X	X		
Low Explosives (black powder)	X	X	X	X	
Class A Detonators	X	X	X		
Detonating Cords	X	X	X		
Class C Detonators[3]	X	X	X	X	
Safety fuse, electric squibs,[4] igniters and igniter cord	X	X	X	X	
Blasting Agents	X	X	X	X	X

NOTE 1: Each door of a mobile type 5 magazine should be equipped with at least one 5-tumbler padlock having a ⅜ in. (0.95 cm) 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: Includes electric detonators with leg wires 4 ft (1.22 m) long or longer or detonators with empty plastic tubing 12 ft (3.66 m) long or longer that contain not more than 0.35 oz (1 g) explosives (excluding ignition and delay charges.)

NOTE 4: Detonators are not to be stored in the same magazine with other explosive materials, except that Class C detonators and those described in Note 3 may be stored with safety fuse, electric squibs, igniters or igniter cord in type 1, 2, 3, or 4 magazines.

Table 6-4(a) 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 Agent
Blasting Agent	Explosives	ATD	Separation of Magazines
Blasting Agent	Blasting Agent	SDT	Blasting Agent
Blasting Agent	Ammonium Nitrate	SDT	Ammonium Nitrate

Table 6-4(b) The American Table of Distances for Storage of Explosives

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Quantity of Explosive Materials[1,2,3,4]		Distances in Feet							
		Inhabited Buildings[9]		Public Highways Class A to D[11]		Passenger Railways — Public Highways with Traffic Volume of More than 3,000 Vehicles/Day[10,11]		Separation of Magazines[12]	
Pounds Over	Pounds Not Over	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded
0	5	70	140	30	60	51	102	6	12
5	10	90	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	318	636	39	78
1,200	1,400	450	900	170	340	336	672	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	45	90
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	635	1,270	210	420	474	948	58	116
4,000	5,000	685	1,370	225	450	513	1,026	61	122
5,000	6,000	730	1,460	235	470	546	1,092	65	130
6,000	7,000	770	1,540	245	490	573	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	255	510	624	1,248	75	150
9,000	10,000	865	1,730	260	520	645	1,290	78	156
10,000	12,000	875	1,750	270	540	687	1,374	82	164
12,000	14,000	885	1,770	275	550	723	1,446	87	174
14,000	16,000	900	1,800	280	560	756	1,512	90	180
16,000	18,000	940	1,880	285	570	786	1,572	94	188
18,000	20,000	975	1,950	290	580	813	1,626	98	196
20,000	25,000	1,055	2,000	315	630	876	1,752	105	210
25,000	30,000	1,130	2,000	340	680	933	1,866	112	224
30,000	35,000	1,205	2,000	360	720	981	1,962	119	238
35,000	40,000	1,275	2,000	380	760	1,026	2,000	124	248
40,000	45,000	1,340	2,000	400	800	1,068	2,000	129	258
45,000	50,000	1,400	2,000	420	840	1,104	2,000	135	270
50,000	55,000	1,460	2,000	440	880	1,140	2,000	140	280
55,000	60,000	1,515	2,000	455	910	1,173	2,000	145	290
60,000	65,000	1,565	2,000	470	940	1,206	2,000	150	300
65,000	70,000	1,610	2,000	485	970	1,236	2,000	155	310
70,000	75,000	1,655	2,000	500	1,000	1,263	2,000	160	320

Table 6-4(b) (continued)

Quantity of Explosive Materials[1,2,3,4]		Distances in Feet							
		Inhabited Buildings[9]		Public Highways Class A to D[11]		Passenger Railways — Public Highways with Traffic Volume of More than 3,000 Vehicles/Day[10,11]		Separation of Magazines[12]	
Pounds Over	Pounds Not Over	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded
75,000	80,000	1,695	2,000	510	1,020	1,293	2,000	165	330
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000	170	340
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000	175	350
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000	180	360
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000	185	370
100,000	110,000	1,835	2,000	550	1,100	1,437	2,000	195	390
110,000	120,000	1,855	2,000	555	1,110	1,479	2,000	205	410
120,000	130,000	1,875	2,000	560	1,120	1,521	2,000	215	430
130,000	140,000	1,890	2,000	565	1,130	1,557	2,000	225	450
140,000	150,000	1,900	2,000	570	1,140	1,593	2,000	235	470
150,000	160,000	1,935	2,000	580	1,160	1,629	2,000	245	490
160,000	170,000	1,965	2,000	590	1,180	1,662	2,000	255	510
170,000	180,000	1,990	2,000	600	1,200	1,695	2,000	265	530
180,000	190,000	2,010	2,010	605	1,210	1,725	2,000	275	550
190,000	200,000	2,030	2,030	610	1,220	1,755	2,000	285	570
200,000	210,000	2,055	2,055	620	1,240	1,782	2,000	295	590
210,000	230,000	2,100	2,100	635	1,270	1,836	2,000	315	630
230,000	250,000	2,155	2,155	650	1,300	1,890	2,000	335	670
250,000	275,000	2,215	2,215	670	1,340	1,950	2,000	360	720
275,000	300,000	2,275	2,275	690	1,380	2,000	2,000	385	770

Numbers in ( ) refer to explanatory notes.

Explanatory Notes Essential to the Application of the American Table of Distances for Storage of Explosives

NOTE 1: "Explosive materials" means explosives, blasting agents, and detonators.

NOTE 2: "Explosives" means any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. A list of explosives determined to be within the coverage of "18 *U.S.C.* Chapter 40, Importation, Manufacturer, Distribution and Storage of Explosive Materials" is issued at least annually by the Director of theBureau of Alcohol, Tobacco, and Firearms of the Department of the Treasury. For quantity and distance purposes, detonating cord of 50 grains per foot should be calculated as equivalent to 8 lb (3.7 kg) of high explosives per 1,000 ft (305 m). Heavier or lighter core loads should be rated proportionately.

NOTE 3: "Blasting agents" means any material or mixture, consisting of fuel and oxidizer, intended for blasting, not otherwise defined as an explosive: Provided that the finished product, as mixed for use or shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined.

NOTE 4: "Detonator" means any device containing any initiating or primary explosive that is used for initiating detonation. A detonator may not contain more than 10 g of total explosives by weight, excluding ignition or delay charges. 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 that use detonating cord, shock tube, or any other replacement for electric leg wires. All types of detonators in strengths through No. 8 cap should be rated at 1½ lb (.7 kg) of explosives per 1,000 caps. For strengths higher than No. 8 cap, consult the manufacturer.

NOTE 5: "Magazine" means any building, structure, or container, other than an explosives manufacturing building, approved for the storage of explosive materials.

NOTE 6: "Natural Barricade" means natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine when the trees are bare of leaves.

NOTE 7: "Artificial Barricade" means an artificial mound or revetted wall of earth of a minimum thickness of 3 ft (0.9 m).

NOTE 8: "Barricaded" means the effective screening of a building containing explosive materials from the magazine or other building, railway, or highway by a natural or an artificial barrier. A straight line from the top of any sidewall of the building containing explosive materials to the eave line of any magazine or other building or to a point 12 ft (3.7 m) above the center of a railway or highway shall pass through such barrier.

NOTE 9: "Inhabited Building" means a building regularly occupied in whole or part as a habitation for human beings, or any church, schoolhouse, railroad station, store, or other structure where people are accustomed to assemble, except any building or structure occupied in connection with the manufacture, transportation, storage, or use of explosive materials.

NOTE 10: "Railway" means any stream, electric, or other railroad or railway that carries passengers for hire.

NOTE 11: "Highway" means any public street, public alley, or public road.

NOTE 12: When 2 or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways; and, in addition, they should be separated from each other by not less than the distances shown for "Separation of Magazines," except that the quantity of explosive materials contained in detonator magazines shall govern in regard to the spacing of said detonator magazines from magazines containing other explosive materials. If any 2 or more magazines are separated from each other by less than the specified "Separation of Magazines" distances, then such 2 or more magazines, as a group, must be considered as 1 magazine, and the total quantity of explosive materials stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum of distances specified from other magazines, inhabited buildings, railways, and highways.

NOTE 13: Storage in excess of 300,000 lb (136,200 kg) of explosive materials in one magazine is generally not required for commercial enterprises.

NOTE 14: This table applies only to the manufacture and permanent storage of commercial explosive materials. It is not applicable to transportation of explosives or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles, or other heavily encased explosives.

NOTE 15: When a manufacturing building on an explosive materials plant site is designed to contain explosive materials, such building shall be located from inhabited buildings, public highways, and passenger railways in accordance with the American Table of Distances based on the maximum quantity of explosive materials permitted to be in the building at one time.

Table 6-4(c) Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents[1,6]

Donor Weight		Minimum Separation Distance of Acceptor when Barricaded[2] (ft)		Minimum Thickness of Artificial Barricades[5] (in.)
Pounds Over	Pounds Not Over	Ammonium Nitrate[3]	Blasting Agent[4]	
	100	3	11	12
100	300	4	14	12
300	600	5	18	12
600	1,000	6	22	12
1,000	1,600	7	25	12
1,600	2,000	8	29	12
2,000	3,000	9	32	15
3,000	4,000	10	36	15
4,000	6,000	11	40	15
6,000	8,000	12	43	20
8,000	10,000	13	47	20
10,000	12,000	14	50	20
12,000	16,000	15	54	25
16,000	20,000	16	58	25
20,000	25,000	18	65	25
25,000	30,000	19	68	30
30,000	35,000	20	72	30
35,000	40,000	21	76	30
40,000	45,000	22	79	35
45,000	50,000	23	83	35
50,000	55,000	24	86	35
55,000	60,000	25	90	35
60,000	70,000	26	94	40
70,000	80,000	28	101	40
80,000	90,000	30	108	40
90,000	100,000	32	115	40
100,000	120,000	34	122	50
120,000	140,000	37	133	50
140,000	160,000	40	144	50
160,000	180,000	44	158	50
180,000	200,000	48	173	50
200,000	220,000	52	187	60
220,000	250,000	56	202	60
250,000	275,000	60	216	60
275,000	300,000	64	230	60

For SI Units: 1 lb = 0.454 kg; 1 ft = 0.305 m; 1 in. = 2.54 cm

Notes to Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents

NOTE 1: Recommended separation distances to prevent explosion of ammonium nitrate and ammonium nitrate-based blasting agents by propagation from nearby stores of high explosives or blasting agents referred to in the table as the "donor." Ammonium nitrate, by itself, is not considered to be a donor when applying this table. Ammonium nitrate, ammonium nitrate-fuel oil, or combinations thereof are acceptors. If stores of ammonium nitrate are located within the sympathetic detonation distance of explosives or blasting agents, one-half the mass of the ammonium nitrate should be included in the mass of the donor.

NOTE 2: When the ammonium nitrate and/or blasting agent is not barricaded, the distances shown in the table shall be multiplied by 6. These distances allow for the possibility of high velocity metal fragments from mixers, hoppers, truck bodies, sheet metal structures, metal containers, and the like which may enclose the donor. Where storage is in bullet-resistant magazines[1] recommended for explosives or where the storage is protected by a bullet-resistant wall, distances and barricade thicknesses in excess of those prescribed in the American Table of Distances are not required.

NOTE 3: The distances in the table apply to ammonium nitrate that passes the insensitivity test prescribed in the definition of ammonium nitrate fertilizer promulgated by the Fertilizer Institute;[2] ammonium nitrate failing to pass said test shall be stored at separation distances determined by competent persons and approved by the authority having jurisdiction.

NOTE 4: These distances apply to blasting agents that pass the insensitivity test prescribed in regulations of the U.S. Department of Transportation and the U.S. Department of the Treasury, Bureau of Alcohol, Tobacco, and Firearms.

NOTE 5: Earth, sand dikes, or enclosures filled with the prescribed minimum thickness of earth or sand are acceptable artificial barricades. Natural barricades, such as hills or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the donor when the trees are bare of leaves, are also acceptable.

NOTE 6: For determining the distances to be maintained from inhabited buildings, passenger railways, and public highways, use the Table of Distances for Storage of Explosives in Table 6-4(b).

[1] For construction of bullet-resistant magazines see Appendix C.

[2] *Definition and Test Procedures for Ammonium Nitrate Fertilizer*, Fertilizer Institute, November 1964.

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 as far away as practicable from neighboring inhabited buildings, railways, highways, and other magazines.

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 detonators.

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 explosive materials. 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 that 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 to 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 that may release flammable vapors shall have wiring and fixtures that 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 C.

(b) The roof may be constructed of any type of structurally sound materials that 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 metal of not less than 26 gauge thickness.

(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 explosive materials shall be placed on pallets of nonsparking material.

(f) Type 1 magazines shall be ventilated to prevent dampness or heating of explosive materials. 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 explosive materials 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 5 tumblers, and shall have at least a $\frac{3}{8}$ in. (9.5 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 structure, 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 cubic yard (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 5-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 gauge. Nails exposed to the interior of the magazines shall be countersunk.

(e) Type 2 indoor magazines constructed of metal shall be of 12 gauge 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 is a "day box" or portable structure used for the temporary storage of explosive materials. A type 3 magazine shall be fire-resistant, theft-resistant, and weather-resistant.

(a) The magazine shall be equipped with one steel padlock (which need not be protected by a steel hood) having at least 5 tumblers and a case-hardened steel shackle at least 3/8 in. (9.5 mm) in diameter. Doors must overlap sides by at least 1 in. (25.4 mm). Hinges and hasps are to be attached by welding, riveting, or bolting (nuts on inside).

(b) The magazine shall be constructed of not less than 12 gauge (.1046 in. – 2.66 mm) steel, lined with at least 1/2 in. (12.7 mm) plywood or 1/2 in. (12.7 mm) masonite-type hard board.

(c) Type 3 magazines containing explosive materials shall be within line-of-site vision of a blaster.

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 5-tumbler padlock having at least a 3/8 in. (9.5 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 old and shall be responsible for the enforcement of all safety precautions.

6-7.2 All magazines containing explosive materials shall be opened and inspected at intervals not exceeding 3 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 explosive materials 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 explosive materials.

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, and 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 explosive materials shall be removed and the floor shall be cleaned.

6-7.15 In making repairs that may result in sparks or fire to the exterior of a magazine, all explosive materials shall be removed.

6-7.16 Explosive materials removed from a magazine undergoing repair shall be placed either in another magazine or at a safe distance from the magazine. They shall be properly guarded and protected. Upon completion of the repairs, they 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 explosive 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.

6-8.6 When blasting agents are stored in an over-the-road trailer type 5 storage magazine, it shall be placarded with an approved U.S. Department of Transportation placard for blasting agents until it is empty.

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 that 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 taken to prevent damage and to minimize earth vibrations and air blast effects. 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 or rights-of-way, 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 detonators 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) The posting of signs warning against the use of mobile radio transmitters on all roads within 350 ft (107 m) of blasting operations.

(b) 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 Commercial Electric Detonators (Blasting Caps).*

(c) Surface, underground use, and all handling of explosive materials shall be discontinued during the approach and progress of an electrical storm. All personnel shall move to a safe location.

7-1.15.1 Consideration shall be given to the fact that lightning has been known to follow steel, piping, and conductive ore into underground mines.

7-1.16 Precautions shall be taken to prevent accidental initiation of nonelectric detonators from stray currents induced by lightning or static electricity.

7-2 Preblast Operations.

7-2.1 During the time that holes are being loaded or are loaded with explosive materials, blasting agents, or detonators, the blast site shall be barred to all but those authorized persons engaged in the drilling and loading opera-

tions or otherwise authorized to enter the site. The blast site shall be guarded or barricaded and posted.

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 that 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 detonators 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.

7-2.7 As soon as practical after all blast holes are connected, prior to connecting to a source of initiation such as a blasting machine, and until the shot has been fired and subjected to post-blast examination, the blast area shall be guarded or barricaded and posted.

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 detonator shall be securely attached to the fuse with a standard ring-type cap crimper.

7-3.3 When electric detonators 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 blast site. Nonelectric initiating systems shall be used unless corrective action is taken to reduce the stray current below the limits indicated in this paragraph.

7-3.4 Electric detonators of different brands shall not be used in the same firing circuit.

7-3.5 All electric blasting circuits and other initiating systems whose continuity can be tested (such as gas detonator initiating systems) shall be tested with a blasting galvanometer or other blast continuity test instrument, as appropriate, that has been designed and approved for the purpose. All electrically initiated blasts shall be made by using blasting machines suitable for the circuitry being fired.

7-3.6 No detonator shall be inserted in explosive materials that 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.

7-3.6.1 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.

7-3.6.2 Adequate priming shall be used. If any uncertainty exists about the amount of priming necessary, the manufacturer shall be consulted.

7-3.6.3 Primers shall be made up only at the time of use and as close to the blast site as conditions allow.

7-3.6.4 When using nonelectric initiation systems:

(a) The selection of the initiation system and the design of the blast shall be under the supervision of the blaster in charge;

(b) The initiation system shall be used in accordance with the manufacturer's instructions;

(c) The blaster in charge shall conduct a visual check after blast hookup;

(d) When using a system that can be tested for continuity, the blast layout shall be tested for continuity as recommended by the manufacturer; and

(e) Where judged to be necessary by the blaster in charge, a double trunkline or closed-loop hookup shall be used.

7-3.7 Only the person making the lead line connections or the blaster in charge 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.

7-3.8 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 Procedures After Blasting.

7-4.1 No person shall return to the blast area until permitted to do so by the blaster.

7-4.2 The blaster shall allow sufficient time for smoke and fumes to dissipate and for dust to settle before returning to the blast site.

7-4.3 The blaster shall inspect the entire blast site for misfires before allowing other personnel to return to the blast area.

7-5 Misfires.

7-5.1 If a misfire is found, the blaster shall provide the proper safeguards for excluding all personnel from the blast area. Misfires shall be reported to the supervisor immediately.

7-5.2 No other work shall be done other than that necessary to remove the hazard. Only those persons necessary to do this work shall remain at the blast site.

7-5.3 No attempt shall be made to extract explosive materials from a misfired hole. A new primer shall be inserted, and the hole shall be reblasted.

Exception: If reblasting presents a hazard, the explosive materials may be washed out with water, or, where the misfire is under water, blown out with air.

7-5.4 If there are any misfires using cap and fuse, all personnel shall stay out of the blast site for at least 1 hour.

7-5.5 If there are any misfires using other nonelectric detonators (i.e., other than cap and fuse) or using electric detonators, all personnel shall stay out of the blast site for at least 30 minutes.

7-5.6 Misfires shall be handled under the direction of the person in charge of the blasting operation.

7-5.7 If a misfire is suspected, all initiating circuits (electric or non-electric) shall be carefully traced and a search made for unexploded charges.

7-5.8 No drilling, digging, or picking shall be permitted until all misfires have been detonated or until the authority having jurisdiction approves the resumption of work.

7-6 Disposal of Explosive Materials.

7-6.1 Empty containers and packages and paper or fiberboard packing materials that 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.

7-6.1.1 All personnel shall remain at a safe distance from the disposal area.

7-6.2 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.

7-6.3* In the event that it becomes necessary to destroy any explosives, either because of damage to containers, deterioration, or any other reason, all handling of explosives shall cease and the manufacturer shall be immediately contacted for assistance. The manufacturer's advice shall be followed without deviation.

Chapter 8 Explosive Materials at Piers and 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 U.S. 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 U.S. Department of Transportation.

8-1.3 Every railway car containing explosive materials that 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 U.S. 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 explosive materials 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 by the Bureau complete information as to restrictions imposed by the carriers themselves on the acceptance, delivery, or transportation of explosive materials 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, explosive materials that 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 U.S. 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 explosive materials, 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 Table 6-4(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 explosive materials.

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 explosive materials.

9-4.3 Dealers in plosophoric materials shall require that all purchasers possess a license or permit to use explosive materials. 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 U.S. 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 U.S. 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 U.S. 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 resistance 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 explosive materials.

10-2.5* Small arms ammunition that has been exposed to fire or damaged by exposure to water shall not be returned to commercial 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 U.S. Department of Transportation may be transported in a private vehicle.

10-3.2 Quantities of smokeless propellants 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 U.S. 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 U.S. Department of Transportation regulations for Class B propellant explosives.

10-3.6 Smokeless propellants shall be stored in shipping containers specified by U.S. 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 resistance of at least 1 hr.

(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 more 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 1/4-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 U.S. 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 resistance 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 U.S. Department of Transportation Regulations. (*See also Chapter 5.*)

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

10-4.3 Black powder intended for personal use in quantities not exceeding 20 lb (9.1 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.

10-4.8 Commercial shipments of black powder intended for personal use in small arms may be shipped in quantities not exceeding 50 lb (23 kg), subject to the requirements set forth in U.S. Department of Transportation, Exemption Certificate E-8958.

10-5 Small Arms Primers.

10-5.1 Small arms primers shall be transported or stored in containers approved by the U.S. Department of Transportation.

10-5.2 Transportation of small arms primers shall comply with U.S. 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 1/4-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 U.S. 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 resistance 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.

Chapter 11 Referenced Publications

11-1 The following documents or portions thereof are referenced within this code and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

11-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 10, *Standard for Portable Fire Extinguishers*, 1990 edition

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1991 edition

NFPA 30, *Flammable and Combustible Liquids Code*, 1990 edition

NFPA 43A, *Code for the Storage of Liquid and Solid Oxidizers*, 1990 edition

NFPA 70, *National Electrical Code*, 1993 edition

NFPA 498, *Standard for Explosives Motor Vehicle Terminals*, 1992 edition

NFPA 1123, *Standard for Outdoor Display of Fireworks*, 1990 edition

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks*, 1988 edition.

11-1.2 U.S. Government Publications. The following publications are available from the U.S. Government Printing Office, Washington, DC 20402.

"Federal Motor Carrier Safety Regulations," Title 49, *Code of Federal Regulations*, Part 397

"Hazardous Materials Regulations," Title 49, *Code of Federal Regulations*, Parts 100-199

"Organized Crime Control Act of 1970," Title 18, *United States Code*, Chapter 40

"Table of Distances for Low Explosives," Title 27, *Code of Federal Regulations*, Part 55

U.S. Department of Transportation, *Exemption Certificate, E-8958.*

11-1.3 IME Publications. The following publications are available from the Institute of Makers of Explosives, 1120 19th St., NW, Suite 310, Washington, DC 20036-3605.

"American Table of Distances for Storage of Explosives," June 1991

"Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electric Detonators (Blasting Caps)," December 1988, *IME Safety Library Publication No. 20.*

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 that 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, U.S. Department of the Treasury.

Classification of explosives described in the Hazardous Materials Regulations of the U.S. 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 that contain Class A or Class B explosives, or both, as components, but in restricted quantities.
Forbidden Explosives:	Explosives that 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 U.S. 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 that itself is classified as an explosive material, 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 C. 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 C;

2. A sand tray having a sand depth of at least 4 in. (102 mm).

A-7-6.3 The member companies of the Institute of Makers of Explosives have agreed to supply advice or assistance in destroying commercial explosives to law enforcement agencies, fire departments, inspection and regulatory officials, as well as to users of explosives. If the manufacturer is known, seek his assistance. If the manufacturer is not known, a member company of the Institute of Makers of Explosives will provide advice or assistance.

A-8-3.1(b) The specific requirement is stated in the U.S. 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 Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents

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

B-1 Derivation of Table.

B-1.1 The Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents is shown in Table 6-4(c) of this code.

B-1.2 A test program sponsored by the Chemical Manufacturers Association and the Institute of Makers of Explosives and conducted by the U.S. Bureau of Mines developed data on the relative sensitivity of ammonium nitrate (AN) and ammonium nitrate-fuel oil (ANFO) to sympathetic detonation. The data was then applied to the American Table of Distances for Storage of Explosives [*see Table 6-4(b)*] to produce the table of recommended separation distances for ammonium nitrate and blasting agents from stores of high explosives or other blasting agents.

B-1.3 The American Table of Distances for barricaded storage of explosives has proven adequate through the years; no data developed in this test program suggested modification of the table. On the other hand, a factor of 2 has been suggested in the past for increasing the distances from unbarricaded magazines. The results, employing two charge sizes of AN and one of ANFO, gave ratios of unbarricaded to barricaded distances of 4.2 to 7.4. This averaged about 6, which was taken as the appropriate factor. In other words, unbarricaded stores of AN or ANFO not in bullet-resistant magazines should have 6 times the separation distances as barricaded stores.

B-1.4 The relative sensitivity of AN and ANFO to dynamite was obtained by examining the relative K factors for 50 percent propagation distances when the cube root of the weight was employed in the following equation:

$$S = KW^{1/3}$$

where S = distance in ft,
W = weight in lb.

This equation allowed comparison of 1,600-lb (726.4-kg) dynamite acceptors with 5,400-lb (2451.6-kg) AN and ANFO acceptors; the results of these large charges are believed to be the most reliable available. The ratio of K factors for dynamite and AN was 6.27, which was rounded to 6. The ratio for dynamite and ANFO was 1.6. These factors were applied to the American Table of Distances, thus reducing the distance for barricaded ammonium nitrate to 1/6 the corresponding distance for explosives. The corresponding reduction for ANFO was 0.6.

B-1.5 One point should be emphasized: the distances in the table are for separation of stores only. Since the blast effect from ANFO is not significantly less than from high explosives, the American Table of Distances should still be used for separation from inhabited buildings, passenger railways, and public highways. (The blast effect from AN is about 50 percent of that from high explosives.) Further, the blast effect is little modified by barricades. The American Table of Distances for unbarricaded stores provides an additional factor of safety and should be used.

B-2 Guide to Use of the Table.

B-2.1 Sketch location of all potential donor and acceptor materials together with the maximum mass of material to be allowed in that vicinity. (Potential donors are high explosives, blasting agents, and combination of masses of detonating materials. Potential acceptors are high explosives, blasting agents, and ammonium nitrate.)

B-2.2 Consider separately each donor mass in combination with each acceptor mass. If the masses are closer than table allowance (distances measured between nearest edges), the combination of masses becomes a new potential donor of weight equal to the total mass. When individual masses are considered as donors, distances to potential acceptors shall be measured between edges. When combined masses within propagating distance of each other are considered as a donor, the appropriate distance to the edge of potential acceptors shall be computed as a weighted distance from the combined masses.

Calculation of weighted distance from combined masses:

Let $M_2, M_3 \ldots\ldots M_n$ be donor masses to be combined.
M_1 is a potential acceptor mass.
D_{12} is distance from M_1 to M_2 (edge to edge).
D_{13} is distance from M_1 to M_3 (edge to edge), etc.

To find weighted distance $[D_{1(2,3,\ldots n)}]$ from combined masses to M_1, add the products of the individual masses and distances and divide the total by the sum of the masses, thus:

$$D_{1(2,3,\cdots n)} = \frac{M_2 \times D_{12} + M_3 \times D_{13} \ldots + M_n \times D_{1n}}{M_2 + M_3 \ldots + M_n} \quad (1)$$

Propagation is possible if either an individual donor mass is less than the tabulated distance from an acceptor or a combined mass is less than the weighted distance from an acceptor.

B-2.3 In determining the distances separating highways, railroads, and inhabited buildings from potential explosions [*see Table 6-4(b)*], the sum of all masses that may propagate (i.e., lie at distances less than prescribed in the table) from either individual or combined donor masses are included. However, when the ammonium nitrate must be included, only 50 percent of its weight shall be used because of its reduced blast effects.

In applying the American Table of Distances to distances from highways, railroads, and inhabited buildings, distances are measured from the nearest edge of potentially explodable material as prescribed in the American Table of Distances, Note 5. [*See Table 6-4(b).*]

B-2.4 When all or part of a potential acceptor comprises Explosives Class A as defined in DOT regulations, storage in bullet-resistant magazines is required. Safe distances to stores in bullet-resistant magazines may be obtained from the intermagazine distances prescribed in the American Table of Distances.

B-2.5 Barricades must not have line-of-sight openings between potential donors and acceptors that permit blast or missiles to move directly between masses.

Example 1	**ANFO Mix Plant (Figure B-1)**
M_1	100,000 lb Fertilizer AN Prills (maximum)
M_2	2,500 lb ANFO (maximum)
M_3	80,000 lb ANFO (maximum)
D_{12}	20 ft
D_{23}	20 ft
D_{13}	50 ft

No other stores on site; no barricade exists. (For SI Units: 1 lb = 0.454 kg; 1 ft = 0.305 m)

Potential Donor	Potential Acceptor	Distance on Site (ft)	Table Distance, Minimum Required (ft)	Propagation Possible?
M_2 (2,500 lb)	M_1	20	9 × 6 = 54	Yes
M_2 (2,500 lb)	M_3	20	32 × 6 = 192	Yes
M_3 (80,000 lb)	M_1	50	28 × 6 = 168	Yes
M_3 (80,000 lb)	M_2	20	101 × 6 = 606	Yes

Conclusion:

The maximum amount of blasting agent to be considered for public protection at this site is the sum of all masses, reducing Fertilizer AN mass by 50 percent as indicated in B-2.3.

$$\begin{aligned} 100{,}000 \times 50\% &= 50{,}000 \\ &\quad 2{,}500 \\ &\quad 80{,}000 \\ &\quad 132{,}500 \text{ lb} \end{aligned}$$

In accordance with the American Table of Distances, the required separation distance from an inhabited building (unbarricaded) is 2,000 ft.

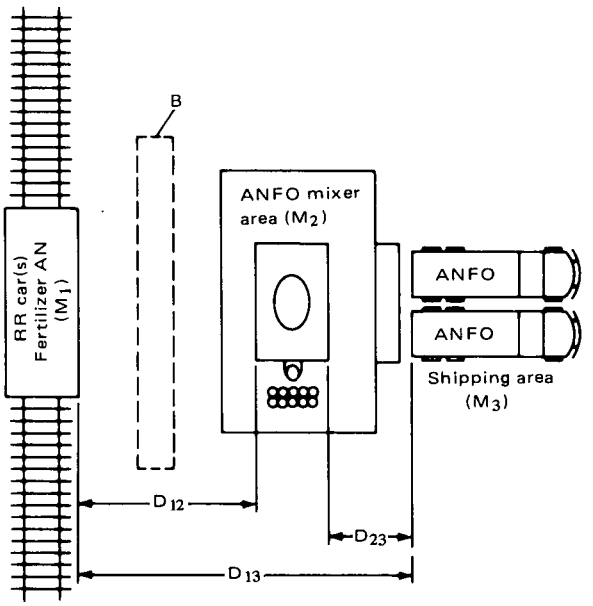

Figure B-1

Example 2	**ANFO Mix Plant (Figure B-1)**
M_1	100,000 lb Fertilizer AN Prills (maximum)
M_2	2,500 lb ANFO (maximum)
M_3	80,000 lb ANFO (maximum)
D_{12}	20 ft
D_{23}	20 ft
D_{13}	50 ft

No other stores on site; a 4-ft (1.2 m) thick earth barricade exists at B (*see Figure B-1*). For SI Units: 1 lb = 0.454 kg; 1 ft = 0.305 m.

Potential Donor	Potential Acceptor	Distance on Site (ft)	Table Distance, Minimum Required (ft)	Propagation Possible?
M_2 (2,500 lb)	M_1	20	9	No
M_2 (2,500 lb)	M_3	20	6 × 32 = 192	Yes
M_3(80,000 lb)	M_1	50	28	No
M_3(80,000 lb)	M_2	20	6 × 101 = 606	Yes
Combined M_2 + M_3 (82,500 lb)	M_1	49*	30	No

Conclusion:

The maximum amount of blasting agent to be considered for public protection at this site is the sum of M_2 plus M_3, or 82,500 lb (37,455 kg). In accordance with the American Table of Distances, the required separation distance from an inhabited building (unbarricaded) is 2,000 ft (610 m). If a natural or artificial barricade protects the building, the required distance is 1,730 ft (528 m).

*Compute weighted distance to combined mass by equation 1:

$$\frac{2{,}500 \times 20 + 80{,}000 \times 50}{2{,}500 + 80{,}000} = 49 \text{ ft}$$

Appendix C Magazine Construction

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

Magazines constructed according to the following minimum specifications are approved as bullet-resistant (as defined in Chapter 1). All steel and wood dimensions are actual thickness; concrete block and brick dimensions are nominal.

C-1 Steel Exterior.

C-1.1 Five-eighths in. (15.9 mm) steel with an interior lining of nonsparking material.

C-1.2 One-half in. (12.7 mm) steel with an interior lining of plywood at least 3/8 in. (9.5 mm) thick.

C-1.3 Three-eighths in. (9.5 mm) steel lined with one of the following:

(a) 2 in. (50.8 mm) of hardwood;

(b) 3 in. (76.2 mm) of softwood;

(c) 2 1/4 in. (57.1 mm) of plywood.

C-1.4 One-fourth in. (6.3 mm) steel lined with one of the following:

(a) 3 in. (76.2 mm) of hardwood;

(b) 5 in. (127 mm) of softwood;

(c) 5 1/4 in. (133.3 mm) of plywood;

(d) 1 1/2 in. (38.1 mm) of plywood with an intermediate layer of 2 in. (50.8 mm) of hardwood.

C-1.5 Three-sixteenths in. (4.8 mm) steel lined with one of the following:

(a) 4 in. (101.6 mm) of hardwood;

(b) 7 in. (177.8 mm) of softwood;

(c) 6 3/4 in. (171.5 mm) of plywood;

(d) 3/4 in. (19 mm) of plywood with an intermediate layer of 3 in. (76.2 mm) of hardwood.

C-1.6 One-eighth in. (3.2 mm) steel lined with one of the following:

(a) 5 in. (127 mm) of hardwood;

(b) 9 in. (228.6 mm) of softwood;

(c) 3/4 in. (19 mm) of plywood with an intermediate layer of 4 in. (101.6 mm) of hardwood.

(d) Two layers of 3/4-in. (19 mm) plywood with an intermediate layer of 3 5/8 in. (92.1 mm) of well-tamped dry sand or sand/cement mixture.

C-2 Fire-Resistant Exterior. Exterior of any type of fire-resistant material that is structurally sound with:

C-2.1 An interior lining of 1/2-in. (12.7 mm) plywood placed securely against an intermediate 4-in. (101.6 mm) thick layer of solid concrete block, solid brick, or solid concrete.

C-2.2 An interior lining of 3/4-in. (19 mm) plywood, a first intermediate layer of 3/4-in. (19 mm) plywood, a second intermediate layer of 3 5/8 in. (92.1 mm) of well-tamped dry sand or sand/cement mixture, a third intermediate layer of 3/4-in. (19 mm) plywood, and a fourth intermediate layer of 2-in. (50.8 mm) hardwood or 14 gauge steel.

C-2.3 An intermediate 6-in. (152.4 mm) space filled with well-tamped dry sand or sand/cement mixture.

C-3 Masonry Exterior.

C-3.1 Standard 8-in. (203.2 mm) concrete block with voids filled with well-tamped dry sand or sand/cement mixture.

C-3.2 Standard 8-in. (203.2 mm) solid brick.

C-3.3 8-in. (203.2 mm) solid concrete.

C-3.4 Two layers of 4-in. (101.6 mm) concrete block.

Appendix D Training and Information Sources

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

D-1 General. This appendix summarizes available training and educational material that provides useful supplementary information regarding explosives.

D-2 IME Educational Materials. Institute of Makers of Explosives, 1120 Nineteenth St., NW, Suite 310, Washington, DC 20036-3605.

D-2.1 Videos.

"Don't Touch," pertaining to blasting cap safety.

"Emergency Instructions," pertaining to first response for transportation accidents involving explosives.

"Storage of Commercial Explosive Material."

D-2.2 Posters. Assorted posters pertaining to blasting cap safety, emergency responses, and other important safety issues.

D-2.3 Publications.

Safety Library Publication No. 1, "Construction Guide for Storage Magazines," June 1986.

Safety Library Publication No. 2, "The American Table of Distances," June 1991.

Safety Library Publication No. 3, "Suggested Code of Regulations for the Manufacture, Transportation, Storage, Sale, Possession, and Use of Explosive Materials," January 1985.

Safety Library Publication No. 4, "Warnings and Instructions for Consumers in Transporting, Storing, Handling and Using Explosive Materials," June 1989.

Safety Library Publication No. 12, "Glossary of Commercial Explosives Industry Terms," February 1991.

Safety Library Publication No. 14, "Handbook for the Transportation and Distribution of Explosive Materials," June 1986.

Safety Library Publication No. 17, "Safety in the Transportation, Storage, Handling, and Use of Explosive Materials," March 1987.

Safety Library Publication No. 20, "Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electric Detonators (Blasting Caps)," December 1988.

Safety Library Publication No. 21, "Destruction of Commercial Explosive Materials," September 1987.

Safety Library Publication No. 22, "Recommendations for the Safe Transportation of Detonators in a Vehicle with Certain Other Explosive Materials," January 1, 1985.

"Guide for the Use of IME 22 Container," July 1991.

D-3 SAAMI Educational Materials. Sporting Arms and Ammunition Manufacturers' Institute, Inc., 555 Danbury Rd., Wilton, CT 06897

D-3.1 Video.

"Sporting Ammunition and the Firefighter."

D-4 Miscellaneous Reference Materials.

Atlas Powder Co. (Dallas, TX). *Handbook of Electric Blasting*, Rev. 1985, 74 pp.

Borg, D. G., R. F. Chiappetta, R. C. Morhard, and V. A. Sterner. *Explosives and Rock Blasting*. Atlas Powder Co. (Dallas, TX) ISBN 0-9616284-0-5, 1987, 662 pp.

D'Andrea, D. V, and L. R. Fletcher. *Analysis of Recent Mine Blasting Accidents*. Paper in Proceedings of the 9th Conference on Explosives and Blasting Technique, ed. by C. J. Konya (Dallas, TX, Jan. 31 – Feb. 4, 1983). Soc. Explos. Eng., Montville, OH, 1983, pp. 105-122.

E. I. du Pont de Nemours & Co., Inc. (Wilmington, DE). *Blaster's Handbook*, 16th ed., 1978, 494 pp.

Fischer, R. L. *Blasting Incidents in Mining*. MSHA Program Circular 7026, August 1988, 54 pp.

Appendix E

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

U.S. Department of Transportation Proposed Revisions of Explosive Materials Transport Regulations

On December 21, 1990, the U.S. Department of Transportation (U.S. DOT) issued a final rule that revised the Hazardous Materials Regulations contained in Title 49, *Code of Federal Regulations*, Parts 171 to 180.

These regulations cover the classification, packaging, and shipping of explosives (including blasting agents), oxidizers (ammonium nitrate), flammable liquids, and flammable solids. The complete final regulations can be found in the *Federal Register, Volume 55, No. 246* of December 21, 1990, pages 52401 through 52729.

Essentially, the U.S. DOT has revised the U.S. hazardous materials regulations so that they will conform with international regulations which are based on the *United Nations Recommendations on the Transport of Dangerous Goods*. The revised regulations are designed to standardize testing and classification procedures, nomenclature, packaging, labeling, placarding, and handling, and eliminate inconsistencies that currently exist between the U.S. (domestic) and UN (international) standards.

Probably the most important change to the user of explosive materials will be the elimination of the *Class A, B, and C Explosives* and *Blasting Agents*. Under the UN Recommendations all explosive materials will be placed into *Class 1 Explosives*. *Class 1* is divided into six divisions, the divisions being characteristic of the properties and hazards of the particular explosive. The breakdown of *Class 1 Explosives* into its six divisions is as follows:

CLASS 1: EXPLOSIVES

Division 1.1: explosives that have a mass explosion hazard.

Division 1.2: explosives that have a projection hazard but not a mass explosion hazard.

Division 1.3: explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.

Division 1.4: explosive devices that present a minor explosion hazard. No device may contain more than 25 g (0.9 oz) of a detonating material.

Division 1.5: very insensitive explosives that have a mass explosion hazard but are so insensitive that there is little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Division 1.6: extremely insensitive articles that do not have a mass explosion hazard, and articles that demonstrate a negligible probability of accidental initiation or propagation. [No applicable hazard class]

The classification code for an explosive consists of the division number followed by the compatibility group letter. Compatibility group letters are used to specify the controls for the transportation, and storage related thereto, of explosives and to prevent an increase in hazard that might result if certain types of explosives were stored or transported together.

Compatibility groups and classification codes for the various types of explosives are set forth in the following tables. Table E-1 sets forth compatibility groups and classification

codes for substances and articles described in the first column of Table E-1. Table E-2 shows the number of classification codes that are possible within each explosive division. Altogether, there are 35 possible classification codes for explosives.

For comparative purposes the classification of explosive materials under the UN Recommendations and the current U.S. DOT system is shown below:

UN Classification Current DOT System

Division 1.1 Class A Explosives [Dynamite, cast boosters, cap sensitive emulsions, water gels and slurries, Class A detonators].

Division 1.2 Class A or Class B explosives [Division 1.2 will generally be some sort of ammunition or materials that have a projection hazard].

Division 1.3 Class B explosives [Generally propellants or explosives that have a fire hazard but not a mass detonation hazard].

Division 1.4 Class C explosives [Class C detonators, safety fuse, and other Class C explosives].

Division 1.5 Blasting Agents [AN/FO, noncap-sensitive emulsions, water gels, slurries, packaged blasting agents].

Division 1.6 No applicable class [Presently there are no commercial explosives in Division 1.6].

In the UN system, oxidizers and organic peroxides form *Class 5*. Ammonium nitrate, an oxidizer, is classified as 5.1 (Class 5, Division 1). Flammable and combustible liquids (fuel oils) are Class 3, and flammable solids are Class 4.

To determine the proper classification of an explosive (class and division) criteria and test procedures have been set up in the UN Recommendations. Through this criteria and test it can be initially determined if the material is an explosive and subsequently to what hazard division it belongs.

In addition to the class and division number, every explosive under UN Recommendations will have a proper shipping name and a 4-digit identification number. When this regulation becomes effective, shipping cases will be required to show the proper shipping name and the identification number.

According to the U.S. DOT announcement, the UN Recommendation on the shipment of Dangerous Goods became effective October 1, 1991, and voluntary compliance was authorized after January 1, 1991. The DOT has provided a transition period, and present packaging for explosives may be used until October 1, 1996, although packagings presently authorized under DOT regulations may not be manufactured after October 1, 1994.