Report on Proposals — Copyright, NFPA

Report of the Committee on

Explosives

Thomas P. Dowling, Chair
Harpers Ferry, WV [SE]

W. S. Chang, Explosives Bureau, NJ [RT]
John A. Conkling, Chestertown, MD [M]
Rep. American Pyrotechnics Association
C. James Duhm, Safety Consulting Engineers, Inc., IL [SE]
Frank H. Fenton, III, The Township of Northampton, PA [E]
Mark A. Fry, Mark A. Fry & Associates, Inc., NJ [SE]
J. Edmund Hay, Clairton, PA [SE]
Robert B. Hopler, Powderman Consulting, Inc., MD [SE]
Juri T. Kasemets, Natural Resources Canada, Canada [E]
Kenneth L. Kosanke, Pyro Labs Incorporated, CO [SE]
David K. Nichols, TRW Vehicle Safety Systems Inc., AZ [M]
Roger N. Prescott, Austin Powder Company, OH [M]
Rep. International Society of Explosives Engineers
Lon D. Santis, Institute of Makers of Explosives, DC [U]
David S. Shatzer, US Bureau of Alcohol, Tobacco & Firearms, DC [E]
Robert A. Van Duzer, SAAMI, PA [M]
Bert von Rosen, Canadian Explosives Research Laboratory, Canada [RT]

Alternates

(Alt. to Ben Barrett)
Larry L. Fluer, Fluer, Incorporated, CA [M]
(Alt. to David K. Nichols)
Eldon K. Hurley, Dyno Nobel Incorporated, NY [U]
(Alt. to Lon D. Santis)
Michael S. Kitch, Defense Logistics Agency, CO [E]
(Alt. to Paul W. Dickinson)
Lawrence Weinman, Luna Tech/Schneier-Weinman Consultants, AL [SE]
(Alt. to Kenneth L. Kosanke)

Nonvoting

Terence P. Smith, US Department of Labor, DC

Staff Liaison: Guy R. Colonna

Committee Scope: This Committee shall have primary responsibility for documents on the manufacture, transportation, storage and use of explosives and related materials. This Committee does not have responsibility for documents on consumer and display fireworks, model and high power rockets and motors and pyrotechnic special effects.

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. A key to classifications is found at the front of this book.

The Technical Committee on Explosives is presenting two Reports for adoption, as follows:

The Reports were prepared by the:

- Technical Committee on Explosives (EXP-AAA)


NFPA 495 has been submitted to letter ballot of the Technical Committee on Explosives, which consists of 18 voting members. The results of the balloting, after circulation of any negative votes, can be found in the report.


NFPA 498 has been submitted to letter ballot of the Technical Committee on Explosives, which consists of 18 voting members. The results of the balloting, after circulation of any negative votes, can be found in the report.
495-1 Log# CP1 EXP-AAA Final Action: Accept
(Entire Document (MOS))

Submitter : Technical Committee on Explosives
Recommendation: The Technical Committee on Explosives proposes a com-
plete revision to NFPA 495, Explosive Materials Code, as shown at the end
of this report.
Substantiation: The standard was revised to comply to the NFPA Manual of
Style. Additionally proposals with affirmative actions were incorporated into
this complete revision of the document.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: Too many changes and too much material to be examined care-
fully at this time.

495-2 Log# 4 EXP-AAA Final Action: Reject
(Entire Document)

Submitter : Karin Rountree, Roseanne Gullo, Ampco Safety Tools
Recommendation: Anywhere ignition sources are a concern please include as
a requirement: Non-Sparking Tools are required where hazardous, combustible
or flammable gases, liquids, dusts or residues are present.
Substantiation: Ordinary hand tools are usually made of steel and if struck,
scraped, or dropped, can cause sparks which can be disastrous in an exp
sive environment. Non-Sparking Tools eliminate this hazard, however, standards
regarding their application are incomplete, inconsistent and in some cases inac-
curate.
We feel prevention is one of the most effective means of ensuring safety. If we
can prevent an accident and save someone's life and business, if we can inst
ment standards and codes to educate and inform before an accident happens,
then we should make the necessary standards and codes to solve the problem.
The standards and recommended practices developed by NFPA are designed to
improve overall safety and protection of property and personnel. Implementing a
Non-Sparking Tools requirement wherever an ignition source is a concern
would reduce the risk of fire and explosion where hazardous conditions are present.
Non-Sparking tools are recommended by Safety Engineers and Insurance
Companies and meet OSHA and EPA requirements where hazardous, combustible
or flammable gases, liquids, dusts and residues are present. Non-Sparking Tools
should be used when storing, processing, handling hazardous materials
as well as maintenance and repair operations within hazardous environments.
All it takes is just one spark to cause an explosion.
Committee Meeting Action: Reject
Committee Statement: The NFPA Regulations Governing Committee
Projects require specific language be provided by the submitter in the recom-
mendation; no specific language was provided. The submitter did not provide
any data with the substantiation demonstrating the need for this type of tool.
The Committee believes that these tools might be applicable for explosive
materials within the scope of NFPA 495, but no evidence has been provided
supporting that ignition can be achieved by use of hand tools. The submitter
needs to provide specific data regarding the ignition potential in order to sub-
stantiate the need for the recommended change.
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-3 Log# CP3 EXP-AAA Final Action: Accept
(Entire Document)

Submitter : Technical Committee on Explosives
Recommendation: Completely revise entire document to comply with the
NFPA Manual of Style as follows:
1. Revise Chapter 1 to contain administrative text only as follows: (show revised text here or indicate where revised text can be found)
2. Revise Chapter 2 to contain only referenced publications cited in the manda-
tory portions of the document.
3. Revise Chapter 3 to contain only definitions.
4. Revise so that all units of measure in document are converted to SI units
with inch/pound units in parentheses.
5. Appendices are to be restructured and renamed as "Annexes."
6. All mandatory sections of the document must be evaluated for usability,
adoptability, and enforceability language. Generate necessary committee pro-
posals as shown (or indicate where shown).
7. Single sentences per requirement as shown (or indicate where shown).
Substantiation: Editorial restructuring, to conform with the 2000 edition of
the NFPA Manual of Style. The Committee has not reworded all exceptions as
requirements at this time.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).
Comment on Affirmative
KASEMETS: All units of measure have not been converted to SI, e.g., 5.3.4.1,
5.3.4.4. Perhaps this is because they relate to QD and the tables in Chapter 5
will not be in SI.

495-4 Log# 5 EXP-AAA Final Action: Reject
(New Chapter)

Note: Note: Since the ballot on this Proposal did not confirm the Committee
Action, the Committee is soliciting public comment for review when the pro-
posal is reconsidered by the Committee as a Public Comment.
Submitter : Larry Fuer, Fluor, Inc.
Recommendation:
Chapter xx Manufacturing, Assembling, and Testing
X.1 Scope
Manufacture, assembly, testing and loading of explosives shall be in accordance
with the requirements of this chapter.
X.1.1 Blasting agents shall not be subject to the requirements of this chapter
(See Chapter 5).
X.1.2 Water gels, slurries, and emulsion explosives shall not be subject to the
requirements of this chapter (See Chapter 5).
X.2 General Requirements
X.2.1 Emergency Procedures. Emergency procedures shall be developed for
each manufacturing facility.
X.2.2 Posting of pertinent information. Detailed operating instructions
and the manufacturing process shall be located at workstations where the
work is to be conducted.
X.2.2.1 Operating rules. General operating rules applicable to the manufactur-
ing area shall be posted in proximity to operator locations.
X.2.2.2 Training. Persons handling explosive materials or entering operating
buildings shall be trained in accordance with Sections X.2.2.1 through X.2.2.5.
X.2.2.3 The physical and health hazards of the materials to be manufactured.
X.2.2.4 The operational activities involved in processing the materials to include
instructions in emergencies that are anticipated in the manufacturing process.
X.2.2.5 The operating rules applicable to the materials in the manufacturing
processes.
X.2.3 Special plans for emergency procedures in the event of a fire or explosion.
X.2.3.1 Personnel shall be made aware of emergency warning signals and
actions to take in the event the warning signal is activated.
X.2.3.2 Special plans for emergency procedures in the event of a fire or explosion.
X.2.3.3 Special plans for emergency procedures in the event of a fire or explosion.
X.2.3.4 Special plans for emergency procedures in the event of a fire or explosion.
X.2.4 Containers. Bulk explosive materials shall be stored in approved non-
estatic containers when not in use.
X.2.4.1 Transport. Explosives shall not be stored or transported in open con-
tainers.
X.2.4.2 Waste. Approved receptacles with covers shall be provided for each
location where explosive materials are manufactured for the disposing of waste
materials, liquids, and debris.
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materials, liquids, and debris.
X.2.4.5 Waste. Approved receptacles with covers shall be provided for each
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materials, liquids, and debris.
X.2.4.6 Waste. Approved receptacles with covers shall be provided for each
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X.2.4.7 Waste. Approved receptacles with covers shall be provided for each
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X.2.4.8 Waste. Approved receptacles with covers shall be provided for each
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materials, liquids, and debris.
X.2.4.9 Waste. Approved receptacles with covers shall be provided for each
location where explosive materials are manufactured for the disposing of waste
materials, liquids, and debris.
X.2.5 Maintenance. Maintenance and repair work shall not be performed in
an explosive manufacturing area until explosive materials have been removed
and the area has been prepared for such maintenance or repair work to be con-
ducted.
X.2.5.1 Operational adjustments. Operational adjustments or emergency
repairs to mitigate immediate hazardous conditions shall be permitted without
having removed the explosive materials from the area.
X.2.5.2 Ignition source control.
X.2.5.2.1 Smoking. Smoking shall be prohibited on the plant site, except where
notices permitting it are posted.
X.2.5.2.2 Flame producing devices. Matches, torches or other flame-producing
devices shall be prohibited from being taken into explosives manufacturing areas
without a written permit signed by an authorized supervisor.
X.2.5.2.3 Portable Electrical Devices. Portable electrical devices including
flashlights shall be prohibited from being taken into explosives manufacturing
areas.
X.2.5.2.4 Portable equipment. Portable equipment approved for use in the
specific manufacturing environment shall be permitted when designated by the

Watches, jewelry, finger rings, earrings, and items used for personal adornment shall be used only by authorized personnel.

Floors of manufacturing areas shall be kept clear of brush, leaves, vegetation and other combustible materials. Floors of manufacturing areas shall be swept or otherwise maintained to prevent the accumulation of explosive materials. Floors of manufacturing areas shall be swept or otherwise maintained to prevent the accumulation of explosive materials. Floors of manufacturing areas shall be swept or otherwise maintained to prevent the accumulation of explosive materials.

Tools and equipment shall be kept in designated work areas when not in use. Such areas shall not be overstocked with tools and equipment.

The classification of the explosives and the weight of the explosives are primary factors used to determine the distances for the total quantity first as 1.1, next as 1.2 and finally as 1.3. The required distance is the greater of the two. When the division 1.1 requirements are controlling and the TNT equivalence of the 1.3 is known, the TNT equivalent weight of the 1.3 items shall be added to the total explosive weight of Division 1.1 items to determine the net explosive weight of explosives for division 1.1 distance determination. See Tables X.3.3(a) or X.3.3(b) as applicable.

When Division 1.1, 1.2 and 1.3 explosives are located in the same site, determine the distances for these quantities first as 1.1, then as 1.2 and finally as 1.3. The required distance is the greatest of the three. As permitted by Sections X.3.2.3.1 and X.3.2.3.2 above, TNT equivalent weights for 1.2 and 1.3 items are added to be used to determine the net weight of explosives for Division 1.1 distance determination. Table X.3.3(a) or X.3.3(b) shall be used when TNT equivalence is used to establish the net explosive weight.

When processes or conditions exist where an explosive material is being handled or stored, the required distances for the total quantity shall be determined in accordance with the requirements of the Building Code. In addition to physical hazards that are present, materials that have not been assigned an in-process hazard classification by testing in the configuration and quantity specified to the process shall be classified as a mass or high explosion hazard.

Materials that have multiple hazards shall conform to the Code requirements for each applicable hazard category specified.

The required separation and other applicable provisions are contained in Section X.3.2.2. The storage of explosive materials in outdoor magazines in quantities exceeding 50 pounds net explosive weight shall be limited to storage in outdoor magazines located not less than 100 feet from all other operating buildings, magazines, inhabited buildings, public highways, roads, public service railways at a distance not less than those shown in Tables X.3.3(a), X.3.3(b) or X.3.3(c) as applicable. Distances to assumed property lines shall be used for the purposes of determination of exterior wall and opening protection under the requirements of the Building Code shall not be used to establish the minimum distance for separation between buildings on a lot.

The storage of explosive materials in outdoor magazines located at less than the intraline distances from operating buildings shall be limited to a net explosive weight not to exceed 50 pounds.

The storage of explosive materials in outdoor magazines located at less than the intraline distances from operating buildings shall be limited to a net explosive weight not to exceed 50 pounds.

The storage of explosive materials located in indoor magazines in quantities exceeding 50 pounds net explosive weight shall be limited to storage in indoor magazines located not less than 100 feet from all other operating buildings, magazines, inhabited buildings, public highways, roads, public service railways at a distance not less than those shown in Tables X.3.3(a), X.3.3(b) or X.3.3(c) as applicable.

The building occupancy classification of the explosives and the weight of the explosives are primary factors used to determine the distances for the total quantity first as 1.1, next as 1.2 and finally as 1.3. The required distance is the greatest of the three. As permitted by Sections X.3.2.3.1 and X.3.2.3.2 above, TNT equivalent weights for 1.2 and 1.3 items are added to be used to determine the net weight of explosives for Division 1.1 distance determination. Table X.3.3(a) or X.3.3(b) shall be used when TNT equivalence is used to establish the net explosive weight.

The sum of the net weights of metal powders and pyrotechnic compositions shall be used to determine the net explosive weight.

The total net explosive weight shall be used. See Table X.3.3(b) for operating buildings.

When Division 1.1 and 1.2 explosives are located in the same site, determine the distances for the total quantity first as 1.1 and then as 1.2. The required distance is the greater of the two. When the Division 1.1 requirements are controlling and the TNT equivalence of the 1.2 is known, the TNT equivalent weight of the 1.2 items shall be added to the total explosive weight of Division 1.1 items to determine the net explosive weight of explosives for Division 1.1 distance determination. See Table X.3.3(a) or X.3.3(b) as applicable.

When Division 1.1 and 1.3 explosives are located in the same site, determine the distances for the total quantity first as 1.1 and then as 1.3. The required distance is the greater of the two. When the division 1.1 requirements are controlling and the TNT equivalence of the 1.3 is known, the TNT equivalent weight of the 1.3 items shall be added to the total explosive weight of Division 1.1 items to determine the net explosive weight of explosives for Division 1.1 distance determination.
X.4.5.1 Local Exhaust. Local exhaust systems shall be provided to collect and remove moisture and odors, fumes, smoke, gas, mist, heat, dust, or other materials that are in present in quantities that irritate or injure occupants.

X.4.5.2 Intrinsically safe ventilation system. Squirrel cage blowers shall not be used for exhausting hazardous dusts, fumes, mists or the ventilation system.

X.4.5.2.1 Electric motors. Electrical motors used to power fans or blowers used in the ventilation system shall be located outside of the duct or portion of the system exposed to explosive materials.

X.4.5.3 Explosive dust. Explosive dust shall not be exhausted to the atmosphere.

X.4.5.3.1 Dust collection. Explosive dust shall be collected using a “wet” collector system or other approved means. Wetting agents shall be compatible with the explosive materials being collected.

X.4.5.3.2 Cleaning of collection systems. Explosive dusts shall be removed from the collection system on a regular basis to prevent overloading and accumulation within the system. The system shall be cleaned at a frequency that eliminates hazardous concentrations of explosive dusts from accumulating in pipes, tubing or ducts.

X.5 Operations

X.5.1 Posted limits. Personnel and explosive limits shall be posted within each operating building. The posted limits shall be able to be seen by operating personnel or those that inspect operating buildings upon entry.

X.5.2 Workstation protection. Workstations shall be separated by distance, barrier or other approved means.

X.5.2.1 Fire. Means shall be provided so that fire in one workstation will not ignite material in the next workstation.

X.5.2.2 Shielding. Workstations shall be evaluated to determine the need for operator shielding to protect operators from the effects of an inadvertent fire or explosion. When determined to be necessary, operators shall be protected by a personnel shield located between the operator and the explosive device or material being processed.

X.5.2.2.1 Construction. When provided, shields and supports shall be constructed to a tested design to withstand the effects from the maximum amount of explosive materials for which they are designed.

X.5.3 Remote processing. When the type of material and processing warrants, mechanical operations involving the processing of more than 1 pound (0.45 kg) of explosive material shall be performed at isolated stations or at intraplant distances.

X.5.3.1 Operator location. When remote processing operations are conducted, operators and controls shall be located behind barricades or at separation distances that provide operator protection while machinery is operating.

X.5.4 Protection against entry of foreign objects. Procedures shall be taken, and equipment shall be designed in a manner that prevents the entry of foreign objects or materials from entering the process in other than a controlled manner.

X.5.5 Equipment repair. Repairs to explosive material processing equipment shall not be undertaken until prescribed decontamination of the equipment has been performed.

X.5.5.1 Supervision. Repair work to be conducted in process areas shall be approved by supervisory personnel before repair work commences.

X.5.5.2 Examination of repairs. Repaired process equipment shall be examined and tested for operability before being place back into service. The required testing shall be verified by supervisory personnel.

X.5.5.3 Tools. Tools used for repair, construction or maintenance in processing areas shall be limited to those described in the operating procedures for the process being operated.

X.5.6 Temperature extremes. Process temperatures and surface temperatures of equipment that will be in contact with explosive materials, ingredients or mixtures being processed shall be maintained less than the decomposition temperature of such materials.

X.6 Explosive materials testing sites

X.6.1 Location. Detonation or ignition of explosive materials shall be performed in isolated areas or areas that have been designed specifically for the tests to be conducted.

X.6.1.1 Personnel protection. Protection shall be provided through the use of barricades, shielding or other means to protect personnel and property from the effects of explosion or ignition of the materials being tested.

X.6.1.2 Personal protective equipment. Protective clothing and equipment shall be provided to protect persons engaged in the testing, ignition or detonation of explosive materials.

X.6.1.3 Safeguards.

X.6.1.3.1 Authorized personnel. Test areas shall be restricted to access by authorized personnel.

X.6.1.3.2 Posting. When test areas are located out of doors, areas where explosives are to be ignited shall be fenced and posted with warning signs.

X.6.1.3.3 Warning devices. Warning devices shall be used before igniting or detonating explosive materials in test areas to warn persons from any direction of approach that they are approaching a danger zone.
### Table X.3.3(a)

MINIMUM INTRALINE (INTRAPLANT) SEPARATION DISTANCES (ILD or IPD) BETWEEN BARRICADED OPERATING BUILDINGS CONTAINING EXPLOSIVES – DIVISION 1.1, 1.2 OR 1.5 – MASS EXPLOSION HAZARD

<table>
<thead>
<tr>
<th>NET EXPLOSIVE WEIGHT</th>
<th>NET EXPLOSIVE WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pounds over 0</td>
<td>Pounds over 25,000</td>
</tr>
<tr>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>100</td>
<td>30</td>
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<tr>
<td>200</td>
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<td>275,000</td>
<td>270</td>
</tr>
<tr>
<td>300,000</td>
<td>275</td>
</tr>
</tbody>
</table>

a. Where a building or magazine containing explosives is not barricaded, the intraline distances shown in this table shall be doubled.

b. Linear interpolation between tabular values shall not be allowed. Non-linear interpolation of the values shall be allowed subject to an approved technical opinion and report prepared in accordance with the requirements of NFPA 1.

c. D shall be a minimum of 60 feet. Where a building or magazine containing explosives is barricaded, the minimum distance shall be 30 feet.
### Table X.3.3(b)

**TABLE OF DISTANCES (Q-D) FOR BUILDINGS CONTAINING EXPLOSIVES – DIVISION 1.3 MASS-FIRE HAZARD**

<table>
<thead>
<tr>
<th>QUANTITY OF DIVISION 1.3 EXPLOSIVES (Net Explosive Weight)</th>
<th>DISTANCES IN FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pounds over</td>
<td>Pounds not over</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>0</td>
<td>1,000</td>
</tr>
<tr>
<td>1,000</td>
<td>2,000</td>
</tr>
<tr>
<td>2,000</td>
<td>3,000</td>
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<tr>
<td>3,000</td>
<td>4,000</td>
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<tr>
<td>4,000</td>
<td>5,000</td>
</tr>
<tr>
<td>5,000</td>
<td>6,000</td>
</tr>
</tbody>
</table>

- **a.** Black powder, when stored in magazines, is defined as low explosive by the Bureau of Alcohol, Tobacco and Firearms (BATF).
- **b.** For quantities less than 1,000 pounds, the required distances are those specified for 1,000 pounds. The user of lesser distances shall be permitted when supported by approved test data and/or analysis.
- **c.** Linear interpolation of explosive quantities between table entries is permitted.
- **d.** D shall be a minimum of 50 feet.

### Table X.3.3(c)

**TABLE OF DISTANCES (Q-D) FOR BUILDINGS CONTAINING EXPLOSIVES – DIVISION 1.4**

<table>
<thead>
<tr>
<th>QUANTITY OF DIVISION 1.4 EXPLOSIVES (Net Explosive Weight)</th>
<th>DISTANCES IN FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pounds over</td>
<td>Pounds not over</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>50</td>
<td>Not Limited</td>
</tr>
</tbody>
</table>

- **a.** A separation distance of 100 feet is required for buildings of other than Type I and II construction as defined in NFPA 5000.
- **b.** For earth-covered magazines, no specified separation is required.

1. Earth cover material used for magazines shall be cohesive. Solid or wet clay and types of soil that are too cohesive and shall not be used. Soil shall be free from unsanitary organic matter, trash, debris and stones heavier than 10 pounds or longer than 6 inches in diameter. Compaction and surface preparation shall be provided to maintain structural integrity and to prevent erosion. Where cohesive material are not used, as in sandy soil, the earth cover over magazines shall be finished with materials that ensure structural integrity.

2. The earth fill or earth cover between earth-covered magazines shall be either solid or sloped in accordance with the requirements of other construction features. There shall be a minimum of 2 feet of earth cover maintained over the tope of each magazine. The cover shall have a slope of 2 to 1 horizontal to vertical.

- **c.** Restricted to articles, including articles packaged for shipment, that are not regulated as an explosive by Bureau of Alcohol, Tobacco and Firearms regulations, or to unpacked articles used in process operations that do not propagate a detonation or deflagration between articles.
- **d.** Linear interpolation between tabular values is not applicable.
- **e.** D shall be a minimum of 50 feet.

### Substantiation:

A new chapter has been proposed for inclusion into NFPA 495 to provide fundamental requirements affecting the manufacture of explosive materials.

Section 65.9.1 of NFPA 1-UFC refers to NFPA 495 and 498 for requirements concerning the manufacture, transportation, storage, sale, and use of explosive materials. With a few exceptions for specific materials, existing NFPA 495 is limited regarding requirements for manufacturing and operational activities.

During the recent revisions to NFPA 1, the Uniform Fire Code was absorbed into NFPA 1 and an effort was made to correlate provisions in NFPA 1 with the subjects addressed by other NFPA material specific standards when possible. UFC Article 77 contains provisions affecting the manufacturing process that were not transferred into Chapter 16 when NFPA 1-UFC was drafted, deferring at the time to NFPA 495 for requirements. Under policies promulgated by the Standards Council technical provisions that are found in NFPA 1 are to be extracted from the special hazards standards when the provisions in the standards address the items of concern. On the other hand, when the standards do not address the concern, there is latitude on the part of the NFPA 1 Technical Committee to draft requirements accordingly.

It is appropriate that the NFPA 495 Technical Committee apply its collective expertise to address the needs of the public regarding the use of explosive materials in manufacturing operations, thereby providing the needed guidance to the NFPA 1-UFC Technical Committee. Changes have been proposed to NFPA 495 that are patterned after the framework found within the 1997 Edition of the UFC.

The technical content of the proposed changes have been derived in concept and to some degree in content from the following sources:

Uniform Fire Code, International Fire Code Institute, Whittier, CA,


The 1997 UFC was used as the basis to develop the requirements regulating explosive materials found within the International Fire Code, Chapter 33. One of the advantages of the NFPA standards process over that used by the other model codes is the ability to provide the user with ancillary reference material and explanatory text by way of an informational Annex, and changes have been proposed to add information to the Annexes of NFPA 495 accordingly.

Definitions for Division 1.1 through 1.6 materials have been provided, consistent with those used by the DOT/UN regulations as well as with the Department of Defense (DOD). Building siting is determined based on the hazards of the materials employed consistent with the Federal definitions. The user can either assume that the explosive material represents a mass explosion hazard, or testing can be used to demonstrate that the material is other than a mass explosion hazard.

The typical manufacturing operation may have materials that range in hazard from Division 1.1, 1.3 or 1.5. End products that are manufactured may also include Division 1.2, 1.6 and/or 1.4 articles or materials. The quantities of materials in each of the hazard classes may vary depending on the process.

Classification for “in-process” hazard classification is based on the use of test methodologies that are well accepted by those in the industry and those involved in the assessment of the hazards of these materials using DOT/UN criteria. Although the intent of the DOT protocol has been to determine the hazards from a shipping perspective, the same classifications are used by the DOD to establish safety criteria that affect operating buildings. The term “in-process” has been used to differentiate the hazards of materials that are not in a shipping configuration from those that are packaged as finished goods.

The test protocol provided for inclusion in Annex A was developed by Safety Management Services, Inc. (SMS) under contract with TRW’S Occupant Safety Systems, Inc. (TRW), released to the public, and first published as a reference standard to the Uniform Fire Code with a set of local amendments made by the City of Mesa, Arizona in 1999. The protocol has been subjected to peer review by a number of entities, including those that were being regulated by this jurisdiction including Talley Defense Systems, SDI, TRW, Boeing, and others. The technical work has been improved as it has evolved, and it is now referenced in Annex E. Providing a standardized approach to hazard classification for materials employed in “in-process” operations promotes uniformity in approach in the use of the code by code officials, building owners and designers alike. Building siting is based on the use of the appropriate quantity-distance tables (Q-D), which is established either by testing or by assuming a worst case classification of a mass explosion hazard.

The following table has been prepared to provide the reader with a cross reference material to expedite the understanding of the basis for the proposed changes.

See tables on pages 8 through 11.
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<td>UFC establishes limit of 60 pounds for high explosives in magazines allowed to be stored indoors thereby setting up the case. It is common for magazines to be used in conjunction with manufacturing operations where the magazine holds operational quantities of materials or material that is staged for production. The quantities in these in-process magazines is limited by the following sections.</td>
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<td>If up to 50 pounds can be located in an indoor magazine, it is reasonable to assume that the same 50 pounds can be stored in a magazine within the Q-D circle in close proximity to the operating building.</td>
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<td>If up to 50 pounds can be located in an indoor magazine, it is reasonable to assume that the same 50 pounds can be stored in a magazine within the Q-D circle in close proximity to the operating building.</td>
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<td>Magazines with quantities greater than 50 pounds are required to be moved to magazine distances.</td>
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<td>Accounts for a combination of indoor and outdoor magazines located within the Q-D circle.</td>
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The term "Quantity-Distance (Q-D)" is the relationship between a quantity of explosive material and the minimum separation distances required. The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials. Section 4.1.5 authorizes the code official to limit the quantity of explosives at any given location. The limitations on quantity are typically derived based on the location where the explosives are to be located. The distances required vary depending on the sensitivity of the receptor. Distances are generally greater where the public or those not engaged in the manufacturing process are involved.

The sub-elements of the definition include terms that typically appear (or should appear) on building and site plans that are used to confirm that the siting for the structure used to contain the explosive material (building or magazine) is properly located. Acronyms, e.g., IBD, ILD, IMD, etc. are typically used to describe the distance used to separate the explosives from receptors such as inhabited buildings, public traffic or transportation routes (highways), other storage (magazines) and the like. Definitions have been provided and correlated with tables to be used for distance determination. The use of the acronyms and their attendant definitions will aid the regulatory and design community alike by bringing a consistent set of terminologies to the code.

Notwithstanding the tabular distance established by the Q-D tables integral to the explosives industry there are occasions where ancillary buildings are needed to be constructed that do not contain explosive materials per se, where the ancillary building will encroach on the building containing explosive materials. D, is a fire separation distance, and not unlike that used by the building code to determine the location of “detached buildings.” As the buildings regulated by the Q-D tables are required to be detached a minimum fire separation distance is established. This distance is noted in the proposed tables X.3.3(a) through X.3.3(c) with 50 feet established as the minimum for buildings containing materials with mass fire and fire hazards, and 60 feet established as the minimum for buildings containing materials with mass explosion hazards. From a practical standpoint the D distances will apply only to facilities where the explosive quantities are near the minimums as the distances are increased rapidly with increases in material content.

The term intraline distance (intra = within the line) is used synonymously with “intraplant distance,” although there are differences applied on military sites for the purpose of separating different operating lines. For example, on military sites it is common to separate one operating line from another by the intraline building distance. On the other hand on commercial sites it is common to produce multiple product lines within an associated building group and to separate the various buildings within the group by intraplant distances (IPD). By equating the terms IPD and ILD commercial uses are provided with a level of protection that is designed to address building safety that is not product specific, but is designed to address the explosive nature of materials involved.

Several new definitions have been added to Chapter 3 to correlate the terminology used by those engaged in the storage and manufacture of explosive materials as well as with the regulators of these materials including the Department of Defense (DOD). The terms that have been added are consistent with terminology used by the DOD and the Institute of Makers of Explosives (IME), albeit there are subtle differences with respect to DOD to account for application to commercial operations.

### Table: Changes to Chapter 3

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495-10
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Chapter xx Manufacturing and Testing

X.1 Scope
Manufacture and, testing of explosives shall be in accordance with the requirements of this chapter. Although maintenance and repair work shall not be subject to the requirements of this chapter (See Chapter 5).

X.1.2 Water, gels, slurries, and emulsion explosives shall not be subject to the requirements of this chapter (See Chapter 6).

X.2 General Requirements

X.2.1 Emergency Procedures. Emergency procedures shall be developed for each manufacturing facility.

X.2.2 Posting of pertinent information. Standard operating procedures governing the manufacturing process shall be located at workstations where the work is to be conducted.

X.2.3 Training. Persons handling explosive materials or working in operating buildings shall be trained in accordance with Sections X.2.3.1 through X.2.3.5.

X.2.3.1 The physical and health hazards of the explosive materials to be manufactured.

X.2.3.2 The operational activities involved in processing the materials to include instructions in emergencies that are anticipated in the manufacturing process.

X.2.3.3 The operating rules applicable to the materials in the manufacturing process.

X.2.3.4 Plans for emergency procedures in the event of a fire or explosion.

X.2.3.5 Personnel shall be made aware of emergency warning signals and actions to take in the event the warning signal is activated.

X.2.3.6 Contract personnel working in explosive manufacturing areas shall be instructed on site specific operating procedures, emergency procedures, hot work operations and procedures applicable to the area prior to engaging in any activity whether maintained or not.

X.2.3.7 Visitors entering operational areas shall receive orientation training and shall be accompanied by a trained escort.

X.2.4* Containers. Bulk explosive materials shall be stored in approved containers when not in use.

X.2.5 Waste. Approved receptacles with covers shall be provided for each location where explosive materials are manufactured for the disposing of waste material and debris.

X.2.5.1 Emptying waste containers. Waste receptacles shall be emptied and cleaned as often as necessary but not less than once each day or at the end of each shift when more than once per day are required.

X.2.5.2 Collection of spilled material. Spilled or dropped explosive materials shall be collected immediately for disposal or disposition and the area in which the materials were spilled shall be cleaned.

X.2.5.3 Cleaning Materials. Shipping containers, cleaning materials or other materials that have been contaminated with explosive materials shall be removed daily and disposed of in an approved manner.

X.2.6 Maintenance. Maintenance and repair work shall not be performed in an explosive manufacturing area until explosive materials have been removed and the area has been prepared for such maintenance or repair work to be conducted.

X.2.6.1 Operational adjustments. Operational adjustments or emergency repairs to mitigate immediate hazardous conditions shall be permitted without having removed the explosive materials from the area.

X.2.7 Ignition source control.

X.2.7.1 Smoking. Smoking shall be prohibited on the plant site, except where notices permit it are posted.

X.2.7.2 Flame producing devices. Matches, torches or other flame-producing devices shall be prohibited from being taken into explosives manufacturing areas without written permit signed by an authorized supervisor.

X.2.7.3 Portable Electrical Devices. Portable electrical devices including flashlights shall be prohibited from being taken into explosives manufacturing areas.

X.2.7.3.1 Portable equipment. Portable equipment approved for use in the specific manufacturing environment shall be permitted when designated by the manufacturing process and incorporated into the operating instructions described in Section X.2.2.

X.2.8 Clothing

X.2.8.1 Type of clothing. Clothing to be worn by persons involved in the manufacturing process shall be of a type approved by management.

X.2.8.2 Accessories. Watches, jewelry, finger rings, earrings, and items intended for use as accessories shall not be worn in manufacturing areas where explosive materials are manufactured.

X.2.8.3 Contaminated clothing. Persons wearing clothing that has been contaminated with explosive materials shall not be permitted to enter areas where smoking is permitted or where operations involving the use of open flame or open ignition sources are present.

X.2.9 Clearance from combustibles. The area within 25 feet (7.5 m) of operating buildings shall be kept clear of brush, leaves, vegetation and other combustible materials.

X.2.10 Limited access by authorized personnel. Manufacturing areas shall be secured against unauthorized entry with access limited to that necessary for the performance of operating functions.

X.2.11 Separation of incompatible materials. Incompatible materials in storage and or on site shall not be separated with less than the distance specified in NFPA 995.

X.2.12.2 Tools and equipment. Tools and equipment shall be kept in designated areas when not in use during manufacturing operations.

X.2.13 Hot work. Hot work operations shall be conducted in accordance with the requirements of NFPA 1.

X.2.14 Management. Management shall be responsible for the supervision of hot work activity.

X.2.14.2 Permits. Permits to conduct hot work operations shall be required.

X.3 Classification and characterization of energetic materials used in process operations

X.3.1 In-process hazard classification. Explosive materials being processed shall be classified with an in-process hazard classification based on the hazards of the materials in the configuration and quantity employed.

X.3.1.1 Physical hazards established by testing. Characterization of explosive materials shall be confirmed by utilizing test methods established by DOT or other appropriate organization.

X.3.1.1.1 Technical assistance. The AHJ shall be permitted to require a review by an independent third party with expertise in the matter to be reviewed at the submitter’s expense.

X.3.1.2 Physical hazards alternative methodology. Materials that have not been determined an in-process hazard classification by testing in the configuration and quantity specific to the process shall be classified as a mass or high explosive hazard.

X.3.1.3 Health hazard classification. The health hazards of materials used in the manufacturing process shall be determined in accordance with the requirements of NFPA 1. In addition to physical hazards that are present, materials classified as toxic, highly toxic or corrosive materials shall be classified as health hazards.

X.3.1.4 Multiple Hazards. Materials that have multiple hazards shall conform to the Code requirements for each applicable hazard category specified.

X.3.2 Quantity of Explosives.

X.3.2.1 Mass-detonating explosives. Division 1, 1.5, 1.6 explosives. The total net explosive weight shall be used. See Table X.3.1(a) for operating buildings, and Table 8.4.1 for all other cases.

X.3.2.2* When the TNT equivalence of the explosive material has been determined, the equivalent is allowed to be used to establish the net explosive weight.

X.3.2.3 Nonmass-detonating Explosives (excluding Division 1.4).

X.3.2.3.1 Division 1.3 propellants. The total weight of the propellants alone is the net explosive weight. The net weight of the propellants shall be used. See Table X.3.3(b).

X.3.2.3.2* When Division 1.1 and 1.3 explosives are located in the same site determine the distances for the total quantity first as 1.1 and then as 1.3. The required distance is the greater of the two. When the Division 1.1 requirements are controlling and the TNT equivalence of the 1.3 is known, the TNT equivalent weight of the 1.3 items shall be added to the total explosive weight of Division 1.1 items to determine the net explosive weight of explosives for Division 1.1 distance determination. See Table X.3.3(a) or X.3.3(b) as applicable.

X.3.2.3.2* When Division 1.1 and 1.3 explosives are located in the same site determine the distances for the total quantity first as 1.1 and then as 1.3. The required distance is the greater of the two. When the Division 1.1 requirements are controlling and the TNT equivalence of the 1.3 is known, the TNT equivalent weight of the 1.3 items shall be added to the total explosive weight of Division 1.1 items to determine the net explosive weight of explosives for Division 1.1 distance determination. See Tables X.3.3(a) or X.3.3(b) as applicable.

X.3.2.3.2* When Division 1.1 and 1.3 explosives are located in the same site determine the distances for the total quantity first as 1.1 and then as 1.3. The required distance is the greater of the three. As permitted by Sections X.3.2.3.1 and X.3.2.3.2 above, TNT equivalent weights for 1.2 and 1.3 items are allowed to be used to determine the net weight of explosives for Division 1.1 distance determination. Table X.3.3(a) or X.3.3(b) shall be used when TNT equivalency is used to establish the net explosive weight.

X.3.2.4* When Division 1.1 and 1.3 explosives are located in the same site, determine the distances for the total quantity first as 1.1 and then as 1.3. The required distance is the greater of the two. When the Division 1.1 requirements are controlling and the TNT equivalence of the 1.3 is known, the TNT equivalent weight of the 1.3 items shall be added to the total explosive weight of Division 1.1 items to determine the net explosive weight of explosives for Division 1.1 distance determination. See Tables X.3.2.3.1 and X.3.2.3.2 above, TNT equivalent weights for 1.2 and 1.3 items are allowed to be used to determine the net weight of explosives for Division 1.1 distance determination. Table X.3.3(a) or X.3.3(b) shall be used when TNT equivalency is used to establish the net explosive weight.
X.3.2.4.1. Determine the required separation for each division.
X.3.2.4.2. Use the greatest separation of those determined.

X.3 Intraplant separation of operating buildings. Operating buildings, including those where explosive charges are assembled, manufactured, prepared or released, shall be separated from other operating buildings, magazines, inhabited buildings, public high-
ways, and passenger railways at a distance not less than those shown in Tables X.3.3(a), X.3.3(b) or X.3.3(c) as applicable. Distances to assumed property lines are based on the decom-
tion characteristics of the contents of a building.

See tables on pages 14-15

X.4 Determination of net explosive weight for operating buildings. In addition
to the requirements of Section X.3.2 to determine the net explosive weight
for materials stored in magazines or in the buildings served, quantities of explosives mater-
ials stored in magazines located at distances less than intraline distances from the oper-
ating building shall be added to the contents of the operating building to
determine the net explosive weight for the operating building.

X.4.1 Indoor magazines. The storage of explosive materials located in indoor
magazines in quantities exceeding 50 pounds net explosive weight shall be limited to a net explosive weight not to exceed 50 pounds.

X.4.2 Outdoor magazines with a net explosive weight less than 50 pounds.
The storage of explosive materials in outdoor magazines located at distances less than intraline distances from operating buildings shall be limited to a net explosive weight not to exceed 50 pounds.

X.4.3 Outdoor magazines with a net explosive weight greater than 50 pounds.
The storage of explosive materials in outdoor magazines exceeding 50 pounds net explosive weight shall be limited to storage in outdoor magazines located not less than intraline distances from the operating building in accordance with Section X.3.2.4.1.

X.4.4.2 Bonding and grounding. Electrical wiring and equipment shall be installed in accordance with NFPA 70, National Electrical Code®.

X.4.4.2.1 Electrical wiring. The required fire-resistive rating of walls, ceil-
ings and openings that are a part of a means of egress shall be maintained.

X.4.4.2.2 Electrical equipment. Exit signage, operable doors for exits through operating buildings and the like shall be unaltered and operable at all times.

X.4.4.3 Bonding. Electrical wiring and equipment shall be installed in accordance with NFPA 70, National Electrical Code®.

X.4.4.3.1 Bonding conductor. Bonding conductors shall be connected together and to the supply system ground conductor in accordance with the requirements of NFPA 70, National Electrical Code®.

X.4.5.1 Static Accumulation. Materials that are in present in quantities that irritate or injure occupants.

X.4.5.2 Cleaning of collection systems. Explosive dusts shall be removed from the collection system on a regular basis to prevent overloading and accu-
mulation within the system. The system shall be cleaned at a frequency that
eliminates hazardous concentrations of explosive dusts from accumulating in pipes, tubing or ducts.

X.5 Operations

X.5.1 Posted limits. Personnel and explosive limits shall be posted within each operating building. The posted limits shall be able to be seen by operating personnel or those that inspect operating buildings upon entry.

X.5.2 Workstation protection. Workstations shall be separated by distance,
barriers or other means that provide equivalent protection.

X.5.3 Remote processing. When the type of material and processing is not
regulated by other means, chemical operations involving the processing of more than 1 pound (0.45 kg) of explosive material shall be performed at isolated stations or at intraplant
barriers or other means that provide equivalent protection.

X.5.4.1 Operator location. When remote processing operations are conducted, operators and controls shall be located behind barricades or at separation dis-
tances that provide operator protection while machinery is operating.

X.5.5 Protection against entry of foreign objects. Procedures shall be taken to prevent explosive material from entering the process area through open or unobscured windows.

X.5.6 Equipment repair. Repairs to explosive material processing equipment shall not be undertaken until prescribed decontamination of the equipment has been performed.

X.5.7.1 Supervision. Repair work to be conducted in process areas shall be
approved by supervisory personnel before repair work commences.

X.5.8 Examination of repairs. Released explosive materials shall be per-
formed in isolated areas or areas that have been designated specifically for the
purposes of repair.

X.5.9 Tools. Tools used for repair, construction or maintenance in process-
ing areas shall be limited to those described in the operating procedures for the
area being operated.

X.5.10 Temperature extremes. Process temperatures and surface temperatures of equipment that will be in contact with explosive materials, ingredients or mixtures being processed shall be maintained less than the decomposition tem-
perture of such materials.

X.6 Explosive materials testing sites

X.6.1 Location. Detonation or ignition of explosive materials shall be per-
formed in isolated areas or areas that have been designed specifically for the
purposes of testing.

X.6.2 Personnel protection. Protection shall be provided through the use of
Arcades, shielding or other means to protect personnel and property from the
effects of explosion or ignition of the materials being tested.

X.6.3 Safeguards. Test areas shall be restricted to access by authorized
personnel.

X.6.4.1 Authorized personnel. Test areas shall be restricted to access by
authorized personnel.

X.6.4.2 Posting. When explosive materials are to be ignited shall be provided with means to prevent access by unauthorized personnel.

X.6.4.3 Warning devices. Warning devices shall be used before igniting or
detonating explosive materials in test areas to warn persons from any direction
of approach that they are approaching a danger zone.

X.6.4.4.1 Indoor or outdoor magazines utilized in conjunction with operating buildings shall be in accordance with the requirements of X.3.3 and X.3.4 as applicable.

A.x.2.5 The disposal of hazardous waste may be further regulated by authori-
yes that are in present in quantities that irritate or injure occupants.

X.6.4.5.1 Intrinsically safe ventilation system. Exhauster systems shall be in
accordance with NFPA 5000 and the Mechanical Code.

X.6.4.5.2 Local Exhaust. Local exhaust systems shall be provided to collect and
remove moisture and odors, fumes, smoke, gas, mist, heat, dust, or other mater-
als that are in present in quantities that irritate or injure occupants.

X.6.4.6.1 Electric motors. Electric motors used to power fans or blowers
used in the ventilation system shall be located outside of the duct or portion of the
system exposed to explosive materials.

X.6.4.6.2 Explosive dust. Explosive dust shall not be exhausted to the atmo-
sphere.
### Table X.3.3(a)

**MINIMUM INTRALINE (INTRAPLANT) SEPARATION DISTANCES (ILD or IPD) BETWEEN BARRICADED OPERATING BUILDINGS CONTAINING EXPLOSIVES – DIVISION 1.1 or 1.2 – MASS EXPLOSION HAZARD**

<table>
<thead>
<tr>
<th>NET EXPLOSIVE WEIGHT</th>
<th>NET EXPLOSIVE WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pounds over</strong></td>
<td><strong>Pounds not over</strong></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
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<td>5</td>
<td>10</td>
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</tbody>
</table>

**Notes:**

a. Where a building or magazine containing explosives is not barricaded, the intraline distances shown in this table shall be doubled.

b. Linear interpolation between tabular values shall not be allowed. Non-linear interpolation of the values shall be allowed subject to an approved technical opinion and report prepared in accordance with the requirements of NFPA 1.

c. D shall be a minimum of 60 feet. Where a building or magazine containing explosives is barricaded, the minimum distance shall be 30 feet. When the distance is less than 60 feet and the building is unbarricaded the fire-resistance of exterior walls and protection of wall openings shall be in accordance with the building code.
### Table X.3.3(b)

**TABLE OF DISTANCES (Q-D) FOR BUILDINGS CONTAINING EXPLOSIVES – DIVISION 1.3 MASS-FIRE HAZARD**

<table>
<thead>
<tr>
<th>QUANTITY OF DIVISION 1.3 EXPLOSIVES (Net Explosive Weight)</th>
<th>DISTANCES IN FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pounds over 1,000 pounds not over 1,000 pounds</td>
<td>Inhabited buildings-distance IBD</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-------------------</td>
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<tr>
<td>0</td>
<td>100</td>
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<td>200,000</td>
<td>300,000</td>
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</tbody>
</table>

- **a.** Black powder, when stored in magazines, is defined as low explosive by the Bureau of Alcohol, Tobacco and Firearms (ATF).
- **b.** For quantities less than 1,000 pounds, the required distances are those specified for 1,000 pounds. The user of lesser distances shall be permitted when supported by test data and/or analysis.
- **c.** Linear interpolation of explosive quantities between table entries is permitted.
- **d.** D shall be a minimum of 50 feet.

### Table X.3.3(c)

**TABLE OF DISTANCES (Q-D) FOR BUILDINGS CONTAINING EXPLOSIVES – DIVISION 1.4**

<table>
<thead>
<tr>
<th>QUANTITY OF DIVISION 1.4 EXPLOSIVES (Net Explosives Weight)</th>
<th>DISTANCES IN FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pounds over 50 pounds not over Not Limited</td>
<td>Inhabited buildings-distance IBD</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>50</td>
<td>Not Limited</td>
</tr>
</tbody>
</table>

- **a.** A separation distance of 100 feet is required for buildings of other than Type I and II construction as defined in NFPA 5000.
- **b.** For earth-covered magazines, no specified separation is required.
  1. Earth cover material used for magazines shall be cohesive. Solid or wet clay and types of soil that are too cohesive and shall not be used. Soil shall be free from unsanitary organic matter, trash, debris and stones heavier than 10 pounds or longer than 6 inches in diameter. Compaction and surface preparation shall be provided to maintain structural integrity and to prevent erosion. Where cohesive material are not used, as in sandy soil, the earth cover over magazines shall be finished with materials that ensure structural integrity.
  2. The earth fill or earth cover between earth-covered magazines shall be either solid or sloped in accordance with the requirements of other construction features. There shall be a minimum of 2 feet of earth cover maintained over the top of each magazine. The cover shall have a slope of 2 to 1 horizontal to vertical.
- **c.** Restricted to articles, including articles packaged for shipment, that are not regulated as an explosive by Bureau of Alcohol, Tobacco and Firearms (ATF) regulations, or to unpacked articles used in process operations that do not propagate a detonation or deflagration between articles.
- **d.** Linear interpolation between tabular values is not applicable.
- **e.** D shall be a minimum of 50 feet.
Committee Statement: The Committee modified the scope of the new Chapter to just Manufacturing and Testing as Assembly is part of the definition for manufacturing. The preliminary review and editing of this proposal was accomplished by a Task Group within the Committee. As part of that review, the proposed Table 3.3 was expanded based upon input from the industry. The Committee added some annex material to support the requirements. The modifications to the proposed text satisfy the intent of the submitter. The Committee has proposed this to be included as a new Chapter 5 with the remaining chapters to be renumbered as required.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 8 Negative: 7

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

BARRETT: The proposed changes would create a new chapter on explosives manufacturer, with accompanying definitions and annexes. Explosives manufacturing is regulated by OSHA's Process Safety Management, a performance-oriented standard which allows flexibility between products and processes which achieve both safety and productivity. This flexibility could be lost upon implementation of this standard as written. The development in conjunction with the hazardous materials community is important. This is a substantial undertaking that would require a survey and collaboration of the industry, most of whom have not been consulted.

Parts 5.2.4 through 5.2.5.3 of the submitter's proposal are centered on the assembly or remanufacture of explosive devices, and are not appropriate for the manufacture of explosives. For example, a manufacturing process may not include waste receptacles, the waste may be washed down a drain to a collection system. Spilled material is not cleaned up immediately, it is a part of the process and may be washed down daily. Shipping containers are not removed daily, they are reused.

Part 5.2.6 is inappropriate. Maintenance can be done to varying degrees with explosives present in a building. A building may be very large with several operations included, e.g., manufacture of ammunition, and it would be an unnecessary burden to shut down all the operations. Relative to Section 5.2.5.9, definitions are not necessary for all operations, and may require significant additional expense. The types of tests specified are not necessarily appropriate. Distance between process building is highly contingent on the product and process.

DANHIN: This chapter is oriented toward a specific industry and does not reflect other explosives manufacturing industries. I am concerned that the classification methodology is not practical because the process changes can occur daily or weekly depending on the customer needs for many manufacturing applications. In addition, the chapter is too detailed. It is better to recommend or require that a detailed hazards analysis or evaluation be implemented by the manufacturer. In this way, the manufacturer will be required to identify the hazards and provide effective corrective actions. I recommend that the chapter set up criteria for acceptable identification and quantification of in-process hazards rather than telling them how to do it. I will be happy to help changing this chapter to make it broad enough, but it should first be simplified.

DICKINSON: The March 4-3, 2004 meeting in Baltimore, Maryland to discuss requested changes to NFPA Code 495 was a dramatic departure from previous meetings in that the scope of proposed changes was a large increase from previous meetings. It was also apparent to me that the discussion was concerned that not all committee members had seen the proposal for the manufacturing chapter additions/changes prior to the meeting. During the meeting, as I became aware of the magnitude of this proposal and its scope, I tried to resolve what the effect on the explosives manufacturing industry, in total, would be. Delegation by Mr. S. Smith, Services, Inc. (SMS) was informative and probably is needed in some form. However, as he represents a client who manufactures items for the airbag industry, a limited niche of the explosives industry, I can not vote affirmative for his proposal until I am sure the entire industry will be better served by these changes. To do this I strongly believe comments from other interested explosives industry representatives should be solicited. My background in reviewing DoD explosives contractors provides experience with a range of small to large to basic producers to deconstruction operations. These will all be affected in different ways, by this proposal which was promulgated by a process-oriented standard. It is not the intent of the proposed standard to control the hazards, but the hazards will be recognized and controlled by the manufacturing facility personnel are required to identify the hazards and provide effective corrective actions. I recommend that the chapter set up criteria for acceptable identification and quantification of in-process hazards rather than telling them how to do it. I will be happy to help changing this chapter to make it broad enough, but it should first be simplified.

In conclusion, a negative vote is cast to allow for a more comprehensive study of the proposal that has significant consequences. It is believed the proposal will be accepted in some form at a future date.

HOPLER: X.2 7.3 Portable electrical devices (for example approved flashlights and bar code readers) are approved in many explosives handling areas. X.3.3 Delete “inhabited buildings, public highways, and passenger railways.” This is an Interplan table.

KOSANE: 1. I am not opposed to the development of such a new chapter. However, at this time I do not believe that there is sufficient representation on the Explosives Committee from many of the sectors of the industry that would be seriously affected by this new chapter. Input from a broader cross-section of the industry should first be sought and then utilized in the process of developing this new chapter.

2. The industry is already required to meet OSHA’s Process Safety Management requirements. In some respects the new chapter restricts manufacturing from the range of options developed under the structure of PSM in collaboration with the workers directly affected.

PRESCOTT: I generally agree with these provisions with the exception shown below:

Section X.2.7.3 - This limitation on portable electric devices and flashlights does not take into account what goes on in the real world. This standard should allow for permissible devices and methods of lighting such as approved flashlights.

Section X.3.3 - It is my understanding that the committee agreed to delete the word “charges” because it might cause confusion.

Section X.3.3 - The phrase “inhabited buildings, public highways, and passenger railways” should be removed. Separation distances are defined in Table 8.4.1.

VAN DUZER: Requirements in the proposed new chapter are not consistent with industry standards for the manufacture of our members’ products.

Specifically, Sections 5.2.6 and 5.2.9 are inappropriate. The industry is already required to meet OSHA’s Process Safety Management requirements. In some respects the new chapter restricts manufacturing from the range of options developed under the structure of PSM in collaboration with the workers directly affected.

Comment on Affirmative:

DOWLING: Basically I concur with this proposal but take exception to a particular provision which instigates the negative ballot.

Section X.3.3 - The phrase “inhabited buildings, public highways, and passenger railways” should be removed. Separation distances are defined in Table 8.4.1.

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every shift. Safety is adequately maintained by requiring waste receptacles be emptied as needed.

Delete X.2.7.3. Portable electrical devices are not inherently unsafe in an explosives manufacturing area and there is no justification for banning them. Any potential portable electrical device hazards would be addressed in the company’s Process Safety Management. A ban on portable electrical devices may create safety and security hazards by hampering communications or preventing new technology from entering the workplace.

The term “ incompatible materials” as used in Section X.2.11 should be defined. This term is not defined in the standard and could be interpreted in many different ways leading to inconsistent enforcement.

Delete Section X.3.1.1. This is an excessive burden to place on the manufacturer for little gain. Physical hazards may be more adequately assessed by other tests or analysis.

Delete the word “changes” and change “ explosive” to “ explosives” in Section X.3.3. My notes of the meeting indicate this was agreed to by the committee because the word “ charges” introduces ambiguity.

Delete the phrase “inhabited buildings, public highways, and passenger railways” in Section X.3.3. Operating buildings should be separated from inhabited buildings, public highways, and passenger railways at the distances shown in Table 8.4.1. The public should be afforded equal protection from magazines as from operating buildings.

Delete note (c) in Table X.3.3(a). This would require that a building with no explosives in it could be no closer than 60 ft to a building with high explosives in it. This is not necessary to maintain safety and is not a recognized industry standard.

The reference to the ATf in Table X.3.3(b) should be corrected to include “ Explosives”.

Delete note (c) in Table X.3.3(b). This would require that a building with no explosives in it could be no closer than 30 ft to a building with low explosives in it. This is not necessary to maintain safety and is not a recognized industry standard.

Delete the first “and” in Table X.3.3(c) note (b)(1).

Delete note (c) in Table X.3.3(c). This would require that a building with no explosives in it could be no closer than 50 ft to a building with Division 1.4 explosives in it. This is not necessary to maintain safety and is not a recognized industry standard.

The intent of Section X.3.4.4 escapes me and should be clarified. Section X.4.5 refers to the “ Mechanical Code”. I am not user what this reference is and it should be clarified.

Add the phrase “ above the limits in applicable federal, state, and local regulations” at the end of the sentence. The proposed text could be too restrictive.

Insert the phrase “ hazardous levels” after the term “ accumulation of” and then delete “ a” in Section X.4.5.1. This clarifies the intent to control dangerous levels of static, not all static. Control of all static electricity would be impractical.

Delete the phrase “ to a tested design” in Section X.5.2.2.1. Since shielding is unique to an application, this could be interpreted to mean that all shields must be tested and that modeling or engineering calculations are not acceptable.

Also, there is no criteria for what the testing must show.

Insert the phrase “ cleanup” after the word “ construction” in Section X.5.5.3. This ensures proper tools are used for this activity as well.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

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Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

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SANTIS: The reference to the ATF should be corrected to include “ Explosives”.

Ballot Results: 
Affirmative: 14  Negative: 1
Ballot Not Returned:  3

Explanations of Negative:

DICKINSON: See my Explanation of Negative on 495-1 ( Log #CP1).

Comment on Affirmative

SANTIS: The reference to the ATF should be corrected to include “ Explosives”.
3.xx Operating building. A building occupied in conjunction with the manufacture, transportation, storage, or use of explosive materials. Operating buildings are separated from one another with the use of intraplant or intraline distances.

3.xx Mass detonating explosives. High explosives, black powder, certain propellants, certain pyrotechnics, and other similar explosives, alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, to severe concussion or impact, to the impulse of an initiating agent, or to the effect of a considerable discharge of energy from without. Such an explosion is expected to cause severe structural damage to adjacent objects. Explosive propagation is able to occur immediately to other items of ammunition and explosives stored in close proximity to and that is not protected from the initially exploding pile with a time interval short enough so that two or more quantities shall be considered as one for quantity-distance (Q-D) purposes.

3.xx Operating line. A group of buildings, facilities, or workstations so arranged as to permit performance of the steps in the manufacture of an explosive or in the loading, assembly, modification, and maintenance of ammunition or devices containing explosive materials.

3.xx Quantity-Distance (Q-D). The quantity of explosive material and separation distance relationships providing protection. These relationships are based on levels of risk considered acceptable for the stipulated exposures and are tabulated in the appropriate Q-D Tables. The separation distances specified afford less than absolute safety.

3.xx.1 Minimum separation distance (DD). The minimum separation distance between adjacent buildings occupied in conjunction with the manufacture, transportation, storage, or use of explosive materials. With a few exceptions for specific materials, existing NFPA 495 is limited regarding requirements for manufacturing and operational activities.

3.xx.2 Intraline distance (IL) or Intraplant distance (IPD). The distance to be maintained between any two operating buildings on an explosives manufacturing site at least one of which contains or is designed to contain explosive materials. Prior to the establishment of a magazine or other building that was the minimum separation distance that the buildings contains explosive materials and the other building does not.

3.xx.3 Inhabited building distance (IBD). The minimum separation distance between an operating building or magazine containing explosive materials and an inhabited building or site boundary, also known as the inhabited building distance.

3.xx.4 Intermagazine distance (IMD). The minimum separation distance between magazines.

3.xx.5 Public traffic route (PTR). The minimum separation distance between any public street, road, highway, navigable stream, or passenger railroad that is used for through traffic by the general public and a magazine or operating line.

3.xx Day box. A portable magazine designed to hold explosive materials constructed in accordance with the requirements for a Type 3 magazine as defined and classified in Chapter 8.

Substantiation: A new chapter has been proposed for inclusion into NFPA 495 to provide fundamental requirements affecting the manufacture of explosive materials. Section 65.9.1 of NFPA 1-UCF refers to NFPA 495 and 498 for requirements surrounding the manufacture, transportation, storage, sale, and use of explosive materials. With the few exceptions for specific materials, existing NFPA 495 is limited regarding requirements for manufacturing and operational activities. During the recent revisions to NFPA 1, the Uniform Fire Code was absorbed into NFPA 1 and an effort was made to correlate provisions in NFPA 1 with the subjects addressed by other NFPA material specific standards when possible. UFC Article 77 establishes minimum separation distances that are not transferred into Chapter 16 when NFPA 1-UFC was drafted, deferring at the time to NFPA 495 for requirements. Under policies promulgated by the Standards Council technical provisions that are found in NFPA 1 are to be extracted from the special hazards standards when the provisions in the standards address the items of concern. On the other hand, when the standards do not address the concern, there is latitude on the part of the NFPA 1 Technical Committee to draft requirements accordingly.

It is appropriate that the NFPA 495 Technical Committee apply its collective expertise to address the needs of the public regarding the use of explosive materials in manufacturing operations, thereby providing a uniform approach to the NFPA 1-UFC Technical Committee. Changes have been proposed to NFPA 495 that are patterned after the framework found within the 1997 Edition of the UFC. The technical content of the proposed changes have been derived in concept and to some degree in content from the following sources:


The 1997 UFC was used as the basis to develop the requirements regulating explosive materials found with the International Fire Code, Chapter 3. One of the advantages of the NFPA standards process over that used by the other model codes is the ability to provide the user with ancillary reference material and explanatory text by way of the use of an informational Annex, and changes have been proposed to add information to the Annexes of NFPA 495 accordingly. Definitions from Division 1.1 through Division 1.4 have been transferred at the time materials have been identified, consistent with those used by the DOT/UN regulations as well as with the Department of Defense (DOD). Building sitting is determined based on the hazards of the materials employed consistent with the Federal definitions. The user can either assume that the explosive material represents a mass explosion hazard, or test use can be used to demonstrate that the material is other than a mass explosion hazard.

The typical manufacturing operation may have materials that range in hazard from Division 1.1, 1.3 or 1.5. End products that are manufactured may also include Division 1.2, 1.6 and/or 1.4 articles or materials. The quantities of materials in each of the hazard classes may vary depending on the process.

Classification for “in-process” hazard classification is based on the use of test methodologies that are well accepted by those in the industry and those involved in the assessment of the hazards of these materials using DOT/UN criteria. Although the intent of the DOT protocol has been to determine the hazards from a shipping perspective, the same classifications are used by the DOD to establish safety criteria that affect operating buildings. The term “in-process” has been used to differentiate the hazards of materials that are not in a shipping configuration from those that are packaged as finished goods.

The material provided for inclusion in Annex E was developed by Safety Management Services, Inc., (SMS) under contract with TRW’S Occupant Safety Systems, Inc. (TRW), released to the public, and first published as a reference standard to the Uniform Fire Code with a set of local amendments made by the City of Mesa, Arizona in 1999. The protocol has been subjected to peer review by both public and private entities, including manufacturers of explosive materials that were building the protocol, by those engaged in “in-process” operations, most notably those who were being regulated by this jurisdiction, including Talley Defense Systems, SDI, TRW, Boeing, and others. The technical work has been improved as it has evolved, and it is now referenced in Annex E. Providing a standardized approach to hazard classification for materials employed in “in-process” operations promotes uniformity in approach in the use of the code by code officials, building owners and designers alike. Building sitting is based on the use of the appropriate quantity-distance tables (Q-D), which is established either by testing or by assuming a worst case classification of a mass explosion hazard.

The following table has been prepared to provide the reader with a cross reference material to expedite the understanding of the basis for the proposed changes.

See tables on pages 19-22.

Committee Meeting Action: Accept in Principle in Part Changes to Chapter 3

2.3.19.1.4 High Explosive (material). Explosive material that can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

2.3.19.2.2 Low Explosive (material). Explosive material which can be caused to detonate when confined.

3.3.1 Hazardous material. A chemical or substance that is a physical hazard or health hazard as defined and classified in NFPA 1, whether the material is in usable or waste condition.

3.3.1.1 Physical Hazard Material. A chemical or substance classified as a combustible liquid, combustible fiber, explosive, flammable cryogen, flammable solid, or oxidizer; oxidizing cryogen, pyrophoric, unstable (reactive), or water reactive material in accordance with the definitions set forth in this code or in NFPA 1.

3.3.1.2 Health Hazard Material. A chemical or substance classified as a toxic, highly toxic, or corrosive material in accordance with the definitions set forth in NFPA 1.

3.3 Net Explosive Weight (NEW). The weight of explosive material expressed in pounds. The net explosive weight is the aggregate amount of explosive material contained within buildings, magazines, structures or portions thereof, used to establish quantity-distance relationships.

3.xx Operating building. A building occupied in conjunction with the manufacture, transportation, storage, or use of explosive materials.

3.xx Mass detonating explosives. High explosives, black powder, certain propellants, certain pyrotechnics, and other similar explosives, alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, to severe concussion or impact, to the impulse of an initiating agent, or to the effect of a considerable discharge of energy from without. Such an explosion is expected to cause severe structural damage to adjacent objects. Explosive propagation is able to occur immediately to other items of ammunition and explosives stored in close proximity to and that is not protected from the initially exploding pile with a time interval short enough so that two or more quantities shall be considered as one for quantity distance (Q-D) purposes.
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Materials are required to be classified as to hazard by both the building code and the fire prevention code. Materials manufactured, or “in-process” must be classified based on the in-process hazards. Annex information is provided to substantiate the approach used.

If testing is not used to establish the in-process hazard classification then the material must be considered to be a mass explosion hazard.

Last sentence from IBC Section 415.3.1. The provision is necessary for buildings that are operating at minimum distances under the control of the O-D tables.

Footnote c establishes a minimum distance imposed. This distance allows one to drop the distances otherwise required by NFPA 5000 in Section 34.3.3.3 (in need of revision as well).

Footnote a correlates table with DOD Footnote b DOD footnote 1 Footnote c DOD footnote 2 Footnote d relief from distances otherwise imposed by NFPA 5000

Footnote e relief from distances otherwise imposed by NFPA 5000.
<table>
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<td>X.3.4.2</td>
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<td>If up to 50 pounds can be located in an indoor magazine, it is reasonable to assume that the same 50 pounds can be stored in a magazine within the Q-D circle in close proximity to the operating building.</td>
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<tr>
<td>X.3.4.3</td>
<td>New</td>
<td>Magazines with quantities greater than 50 pounds are required to be moved to magazine distances.</td>
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<td>X.3.4.4</td>
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<td>Accounts for a combination of indoor and outdoor magazines located within the Q-D circle.</td>
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### Changes to Chapter 3

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<td>NFPA 1:3.3.130.7</td>
<td>Several new definitions have been added to Chapter 3 to correlate the terminology used by those engaged in the storage and manufacture of explosive materials as well as with the regulators of these materials, including the Department of Defense (DOD). The terms that have been added are consistent with terminology used by the DOD and the Institute of Makers of Explosives (IME), albeit there are subtle differences with respect to DOD to account for application to commercial operations.</td>
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The term “Quantity-Distance (Q-D)” is the relationship between a quantity of explosive material and the minimum separation distances required. The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials. The term “Quantity-Distance” (Q-D) is used synonymously with “intraplant distance,” although there are differences applied on military sites for the purpose of separating different operating lines. For example, on military sites it is common to separate operating lines by the inhabited building distance. On the other hand, on commercial sites it is common to separate multiple product lines within an associated building group and to separate the various buildings within the group by intraplant distances (IPD). By equating the terms IPD and ILD commercial uses are provided with a level of protection that is designed to address building safety that is not product specific, but is designed to address the explosive nature of materials involved.

The use of the acronyms and their attendant definitions will aid the regulatory and design community alike by bringing a consistent set of terminologies to the code.

The sub-elements of the definition include terms that typically appear (or should appear) on building and site plans that are used to confirm that the siting for the structure used to contain the explosive material (building or magazine) is properly located. Acronyms, e.g., IBD, ILD, IMD, etc. are typically used to describe the distance used to separate the explosives from receptors such as inhabited buildings, public traffic or transportation routes (highways), other storage (magazines) and the like. Definitions have been provided and correlated with tables to be used for distance determination. The use of the acronyms and their attendant definitions will aid the regulatory and design community alike by bringing a consistent set of terminologies to the code.

Note: New definitions have been added to Chapter 3 to correlate the terminology used by those engaged in the storage and manufacture of explosive materials as well as with the regulators of these materials, including the Department of Defense (DOD). The terms that have been added are consistent with terminology used by the DOD and the Institute of Makers of Explosives (IME), albeit there are subtle differences with respect to DOD to account for application to commercial operations. The term “Quantity-Distance (Q-D)” is the relationship between a quantity of explosive material and the minimum separation distances required. The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials. The term “Quantity-Distance” (Q-D) is used synonymously with “intraplant distance,” although there are differences applied on military sites for the purpose of separating different operating lines. For example, on military sites it is common to separate one operating line from another by the inhabited building distance. On the other hand, on commercial sites it is common to produce multiple product lines within an associated building group and to separate the various buildings within the group by intraplant distances (IPD). By equating the terms IPD and ILD commercial uses are provided with a level of protection that is designed to address building safety that is not product specific, but is designed to address the explosive nature of materials involved.

The term “Quantity-Distance (Q-D)” is the relationship between a quantity of explosive material and the minimum separation distances required. The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials. The term “Quantity-Distance” (Q-D) is used synonymously with “intraplant distance,” although there are differences applied on military sites for the purpose of separating different operating lines. For example, on military sites it is common to separate one operating line from another by the inhabited building distance. On the other hand, on commercial sites it is common to produce multiple product lines within an associated building group and to separate the various buildings within the group by intraplant distances (IPD). By equating the terms IPD and ILD commercial uses are provided with a level of protection that is designed to address building safety that is not product specific, but is designed to address the explosive nature of materials involved.

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The term “Quantity-Distance (Q-D)” is the relationship between a quantity of explosive material and the minimum separation distances required. The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials. The term “Quantity-Distance” (Q-D) is used synonymously with “intraplant distance,” although there are differences applied on military sites for the purpose of separating different operating lines. For example, on military sites it is common to separate one operating line from another by the inhabited building distance. On the other hand, on commercial sites it is common to produce multiple product lines within an associated building group and to separate the various buildings within the group by intraplant distances (IPD). By equating the terms IPD and ILD commercial uses are provided with a level of protection that is designed to address building safety that is not product specific, but is designed to address the explosive nature of materials involved.
### Changes to Chapter 4

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### Changes to Annex A

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<td>NFPA 5000:A.3.3.340.4 paragraph 2 and</td>
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<td>following items 1 through 6.</td>
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### Changes to Annex E

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explosive or in the loading, assembly, modification, and maintenance of ammu-
nition or devices containing explosive materials.

3.3x Quantitative-Distance (Q-D). The quantity of explosive material and sepa-
rated distance relationships providing protection. These relationships are based on
levels of risk that could lead to unacceptable for the stipulated exposures and are tab-
ulated in the appropriate Q-D Tables. The separation distances specified afford
less than absolute safety.

3.3.1 Minimum separation distance (D 0) The minimum separation dis-
tance between adjacent buildings-occupied or utilized in conjunction with the
manufacture, storage, or use of explosive materials where one of
the buildings contains explosive materials and the other building does not.

3.3.2 Intrusive distance (ID) or Intrapedal distance (IDP). The distance
to be maintained between any two operating buildings on an explosives manu-
facturing site at least one of which contains or is designed to contain explo-
sives or the distance between a magazine and an operating building.

3.3.3 Inhabited building distance (IBD) The minimum separation dis-
tance between an operating building or magazine containing explosive materi-
als and an inhabited building or site boundary, also known as the inhabited-
building-distance.

3.3.4 Inter-magazine distance (IMD). The minimum separation distance
between magazines.

3.3.5 Public traffic route (PTR). The minimum separation distance
between any public street, road, highway, navigable stream, or passenger rail-
road that is used for through traffic by the general public and a magazine or opera-
tional buildings.

3.3.6 Day box. A portable magazine designed to hold explosive materials con-
structed in accordance with the requirements for a Type 3 magazine as defined
and classified in Chapter 6.

Committee Statement: The Committee rejected the proposed definitions for
High Explosive, Low Explosive, and Mass Detonating Explosives as they are
not used in the code. The Committee rejected the proposed definition for Day
Box, but added a new definition for Day Box based upon the IME and ATF
definition, see Committee Proposal 495-10 (Log #CP47). The other changes to
these definitions accepted by the Committee are editorial for clarification.

Number Eligible to Vote: 18 Ballot Results: Affirmative: 8 Negative: 7

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:
BARRITT: See my explanation of Negative on 495-4 (Log #5).
DANH: Any additions to this chapter due to Chapter 5 input should be stricken
until Chapter 5 can be written to address the whole explosives industry.
DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).
HOPLER: 3.3.19.2 Low explosives deflagrate whether confined or unconfined.
KOSANKE: See my Explanation of Negative on 495-2 (Log #5).
PRESCOTT: I generally agree with these provisions with the exception shown below:
It is my understanding that the committee voted against the definitions as
shown on the ballot for High and Low Explosives.
I would urge the terms be defined in a manner that has been used by
industry and accepted by regulatory agencies for many years.
Altering definitions carries with it the risk that it will cause confusion which
could jeopardize safety and create confusion in legal interpretations.
The definitions should read as follows:
High Explosive - Explosives which are characterized by a very high rate of
reaction, high pressure development and the presence of a detonation wave in
the explosive.
Low Explosive - Explosives which are characterized by a very low rate of
reaction, low pressure development and the presence of a deflagration wave in
the explosive.

Low Explosive - Explosives which are characterized by deflagration or low
rate of reaction and the development of low pressure.

VAN DZUER: If 495-4 (Log #5) is not adopted, there is no need for the addi-
tional definitions contained in 495-8 (Log #7) to be introduced.

Comment on Affirmative
DOWLING: Basically I concur with this proposal but take exception to a par-
ticular provision which instigates the negative ballot.
The definitions for High Explosive and Low Explosive were rejected by the
Committee. These definitions reappear in 495-53 (Log #8). Recommend that
definitions be as follows:
High Explosive - Explosives which are characterized by a very high rate of
reaction, high pressure development and the presence of a detonation wave in
the explosive.
Low Explosive - Explosives which are characterized by deflagration or low rate
of reaction and the development of low pressure.

Rationale: These definitions for High Explosive and Low Explosive have been
accepted by industry and regulatory agencies for many years. To change these
definitions without compelling reasons would, I fear, cause concern among
litigators.
SANTIS: Delete the definition of D0. This would not be needed if note (c) is
removed from Tables X.3.3(a-c).

495-9 Log# CP2 EXP-AAA Final Action: Accept in Principle in Part
(Chapter 3 Definitions (GOT))

Submitter: Technical Committee on Explosives
Recommendation: Adopt the preferred definitions from the NFPA Glossary
of Terms for the following terms:
Flash Point (preferred) NFPA 30, 2000 ed.
The minimum temperature at which a liquid or a solid emits vapor sufficient to
form an ignitable mixture with air near the surface of the liquid or the solid.
Flash Point (secondary) NFPA 495, 2001 ed.
The lowest temperature at which vapors from a volatile combustible substance
ignite in air when exposed to flame.
Any material that will maintain combustion under specified environmental con-
ditions.
Fuel (secondary) NFPA 495, 2001 ed.
Any substance that reacts with the oxygen in the air or with the oxygen yielded
by an oxidizer to produce combustion.
Highway (preferred) NFPA 502, 2001 ed.
Any paved facility on which motor vehicles travel.
Highway (secondary) NFPA 495, 2001 ed.
Any public street, public alley, or public road.
Magazine (preferred) NFPA 1124, 1998 ed.
Any building or structure, other than an explosives manufacturing building,
approved for the storage of explosive materials.
Magazine (secondary) NFPA 495, 2001 ed.
A building or structure, other than an explosives manufacturing building,
approved for the storage of explosive materials.

Oxidizing Material (preferred) NFPA 115, 1999 ed.
Any material that readily yields oxygen or other oxidizing gas or that reacts
chemically to oxidize combustible materials.
Oxidizing Material (secondary) NFPA 495, 2001 ed.
Any solid or liquid that readily yields oxygen or other oxidizing gas or that
readily reacts to oxidize combustible materials.

Sufficiently protected to prevent the penetration of rain, snow, and wind-driven
sand, dirt, or dust under all operating conditions.
Construction designed to offer reasonable protection against weather.

Substantiation: Adoption of preferred definitions will assist the user by pro-
viding consistent meaning of defined terms throughout the National Fire
Codes.

Committee Meeting Action: Accept in Principle in Part
The Committee accepted the preferred definition for Flash Point as follows:
Flash Point (preferred) NFPA 30, 2000 ed.
The minimum temperature at which a liquid or a solid emits vapor sufficient to
form an ignitable mixture with air near the surface of the liquid or the solid.
The Committee rejected the use of the preferred definitions for Fuel, Highway,
Magazine, Oxidizing Material, and Weather Resistant.
The Committee modified the secondary definition of Weather Resistant as fol-
ows:
Weather Resistant. Construction designed to offer reasonable protection against weather.

Committee Statement: The Committee rejected Fuel because it is less techni-
cally accurate for use in this code.
The Committee modified Highway to Public Highway; see Committee
Proposal 495-19 (Log #CP12).
The Committee rejected the use of the definitions of Emergency, Flash Point,
Order, and Weather Resistant.

The Committee modified the secondary definition of Weather Resistant as fol-
ows:
Weather Resistant. Construction designed to offer reasonable protection against weather.

Committee Meeting Action: Accept
The Committee accepted the preferred definition as follows:
Flash Point (preferred) NFPA 30, 2000 ed.
The minimum temperature at which a liquid or a solid emits vapor sufficient to
form an ignitable mixture with air near the surface of the liquid or the solid.
The Committee rejected the use of the preferred definitions for Fuel, Highway,
Magazine, Oxidizing Material, and Weather Resistant.
The Committee modified the secondary definition of Weather Resistant as fol-
ows:
Weather Resistant. Construction designed to offer reasonable protection against weather.

Committee Statement: The Committee rejected Fuel because it is less techni-
cally accurate for use in this code.
The Committee modified Highway to Public Highway; see Committee
Proposal 495-19 (Log #CP12).
The Committee rejected the use of the definitions of Emergency, Flash Point,
Order, and Weather Resistant.

The Committee modified the secondary definition of Weather Resistant as fol-
ows:
Weather Resistant. Construction designed to offer reasonable protection against weather.

Committee Meeting Action: Accept

Flash Point (preferred) NFPA 30, 2000 ed.
The minimum temperature at which a liquid or a solid emits vapor sufficient to
form an ignitable mixture with air near the surface of the liquid or the solid.
Flash Point (secondary) NFPA 495, 2001 ed.
The lowest temperature at which vapors from a volatile combustible substance
ignite in air when exposed to flame.
Any material that will maintain combustion under specified environmental con-
ditions.
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chemically to oxidize combustible materials.
Oxidizing Material (secondary) NFPA 495, 2001 ed.
Any solid or liquid that readily yields oxygen or other oxidizing gas or that
readily reacts to oxidize combustible materials.

Sufficiently protected to prevent the penetration of rain, snow, and wind-driven
sand, dirt, or dust under all operating conditions.
Construction designed to offer reasonable protection against weather.

Substantiation: Adoption of preferred definitions will assist the user by pro-
viding consistent meaning of defined terms throughout the National Fire
Codes.
Report on Proposals — Copyright, NFPA

Submitter: Technical Committee on Explosives

Recommendation: Add a definition for “electronic detonator” to read as follows:

3.3.x Electronic Detonator. A detonator that utilizes stored electrical energy as a means of powering an electronic timing delay element/module and that provides initiation energy for firing the base charge.

Substantiation: See the Committee Proposals that introduce this term into the requirements. It needs to be defined as it will now be used in the code.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-12 Log# CP18 EXP-AAA Final Action: Accept

(3.3. No. 8 Test Detonator)

Submitter: Technical Committee on Explosives

Recommendation: Add a definition for “No. 8 Test Detonator” to read as follows:

3.3.x No. 8 Test Detonator. A detonator with 0.40 to 0.45 grams PETN base charge pressed to a specific gravity of 1.4 g/cc and primed with standard weights of primer, depending on manufacturer.

Substantiation: The term is used in the definition of a cap-sensitive explosive material and must be defined.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-13 Log# CP11 EXP-AAA Final Action: Accept

(3.3 Nonsparking Metal)

Submitter: Technical Committee on Explosives

Recommendation: Add a definition for “nonsparking metal”:

3.3.x Nonsparking Metal. A metal that resists producing a spark when impacted with tools, rock, or hard surfaces.

Substantiation: The term is used in the standard and must be defined.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-14 Log# CP15 EXP-AAA Final Action: Accept

(3.3 Primary Explosive (New))

Submitter: Technical Committee on Explosives

Recommendation: Add a definition for “primary explosive” as follows:

3.3.x Primary Explosive. A sensitive explosive such as lead azide which detonates by simple ignition from such means as spark, flame, impact, friction, or other primary heat sources of appropriate magnitude.

Substantiation: This is a new term introduced in proposed changes regarding nonsparking materials and it should be defined.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-15 Log# CP16 EXP-AAA Final Action: Accept

(3.3 Slurry (New))

Submitter: Technical Committee on Explosives

Recommendation: Add a definition for “slurry” as follows:

3.3.x Slurry. An explosive material containing substantial portions of a liquid, oxidizers and fuel, plus a thicker.

Substantiation: slurries are different than water gels and should be recognized as such.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-16 Log# CP6 EXP-AAA Final Action: Accept

(3.3.4 Binary Explosive)

Submitter: Technical Committee on Explosives

Recommendation: Modify the definition of “binary explosive” as follows:

3.3.4 Binary Explosive. A blasting explosive formed by mixing or combining two precursor chemicals, phosphoric materials (e.g., for example ammonium nitrate and nitromethane).

Substantiation: According to the US Bureau of Mines mining dictionary, the term phosphoric means “giving explosive properties to a compound”. Additionally, the term “precursor chemical” has been accepted as the standard term for these materials.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-17 Log# CP7 EXP-AAA Final Action: Accept

(3.3.7 Blaster)

Submitter: Technical Committee on Explosives

Recommendation: Modify the definition of “blaster” at 3.3.7 as follows:

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

Add a definition for “blaster-in-charge” to read:

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

Substantiation: There is a need to define both these terms since the standard refers to both within.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-18 Log# CP10 EXP-AAA Final Action: Accept

(3.3.18 Emulsion Explosive)

Submitter: Technical Committee on Explosives

Recommendation: Modify the definition of “emulsion explosive” to read:

3.3.18 Emulsion Explosive. An explosive material consisting of a slurry of substantial amounts of oxidizer, ammonium nitrate, dissolved in water droplets surrounded by an immiscible fuel, oil-like material, or droplets of an immiscible fuel surrounded by water containing substantial amounts of oxidizer.

Substantiation: The current definition is technically incorrect, since it does not necessarily consist of a slurry.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

Comment on Affirmative

KASEMET'S: Emulsion explosives are water-in-oil emulsions. The new second half of the definition adds oil-in-water emulsions. Although there are oil-in-water emulsions, e.g., mayonnaise, they have no benefit in explosives formulations. They have less water resistance; they crystallize faster. If we keep the definition as is we should at least add stabilized by a surfactant (or emulsifier).

495-19 Log# CP12 EXP-AAA Final Action: Accept

(3.3.28 Highway)

Submitter: Technical Committee on Explosives

Recommendation: Modify the term “highway” to “public highway” and change the definition to read:

3.3.28 Public Highway. Any road, street, or way, whether on public or private property, open to public travel. Any public street, public alley, or public road.

3.3.28 Public Highway. “Open to public travel” means that the road section is available, except during scheduled periods, extreme weather or emergency conditions, passable by four-wheel standard passenger cars, and open to the general public for use without restrictive gates, prohibitive signs, or regulation other than restrictions based on size, weight, or class of registration. Toll plazas of public toll roads are not considered restrictive gates.

Substantiation: This would make the definition consistent with the DOT and the IME. Any other definition might be considered an infringement on IME’s
4.1.4.1 Prior to manufacturing, assembling, testing or loading of explosives, the authority having jurisdiction shall be furnished with the information required in Sections 4.1.4.1.1 through 4.1.4.1.5.

Prior to manufacturing, assembling, testing or loading of explosives, the authority having jurisdiction shall be furnished with the information required in Sections 4.1.4.1.1 through 4.1.4.1.5. The exact location of the place of manufacture, transportation routes including highways and railroads.

Explanation of Negative:
DICKINSON: See my Explanation of Negative on 495-1 (Log #CPI).

495-20 Log# CP13 EXP-AAA Final Action: Accept
(3.3.22 Manufacturing)

Submitter: Technical Committee on Explosives
Recommendation: Modify the definition of “manufacturing” to read:
3.3.22 Manufacturing. Mixing, blending, extruding, assembling articles outside the blast site, dissassembling, chemical synthesis, and other functions involved in making a product or device that is intended to explode.

Substantiation: This makes it clear that assembling a detonator and booster at the hole is not manufacturing.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 11 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

495-21 Log# CP14 EXP-AAA Final Action: Accept
(3.3.39 Plosophoric Materials)

Submitter: Technical Committee on Explosives
Recommendation: Replace the term “plosophoric materials” with the term “precursor chemicals” but keep the same definition.

3.3.39 Plosophoric Materials. Precursor Chemicals. Two or more unmixed, commercially manufactured prepackaged chemical ingredients (including oxidizers, flammable liquids or solids, or similar ingredients) that are not classified as explosives but that, where mixed or combined, form a blasting explosive.

Substantiation: According to the US Bureau of Mines mining dictionary, the term plosophoric means “giving explosive properties to a compound”. Additionally, the term “precursor chemical” has been accepted as the standard term for these materials.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 13 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:
DICKINSON: See my Explanation of Negative on 495-1 (Log #CPI).

495-22 Log# CP17 EXP-AAA Final Action: Accept
(3.3.58 Water Gel)

Submitter: Technical Committee on Explosives
Recommendation: Modify the definition of “water gel” to read:
3.3.58 Water Gel. An explosive material or blasting agent that contains substantial portions of water, oxidizers and fuel, plus a crosslinking agent.

Substantiation: The current definition is technically incorrect.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:
DICKINSON: See my Explanation of Negative on 495-1 (Log #CPI).

Comment on Affirmative
KASEMETS: Water gels and slurries 495-15 (Log #CP16) both have thickeners. Water gels also have a crosslinking agent.

495-25 Log# 9 EXP-AAA Final Action: Accept in Principle
(Chapter 4)

Submitter: Larry Fleur , Fleur, Inc.
Recommendation: Add the following changes to Chapter 4:
4.1.4.1 Prior to manufacturing, assembling, testing or loading of explosives,
technical work has been improved as it has evolved, and it is now referenced in Annex E. Providing a standardized approach to hazard classification for materials employed in “in-process” operations promotes uniformity in approach in the use of the code by code officials, building owners and designers alike. Building siting is based on the use of the appropriate quantity-distance tables (Q-D), which is established either by testing or by assuming a worst case classification of a mass explosion hazard.

The following table has been prepared to provide the reader with a cross-reference material to expedite the understanding of the basis for the proposed changes.

See tables on pages 27-30.

Committee Meeting Action: Accept

Changes to Chapter 4 - Add the following new text after existing 4.1.4 and renumber as necessary.

4.1.4.1 Prior to manufacturing, assembling, or testing or loading of explosives, ammunition, or blasting agents, the authority having jurisdiction shall be furnished with the information required in 4.1.4.1.1 through 4.1.4.1.5.

4.1.4.1.1 The exact location of the place of manufacture or testing.

4.1.4.1.2 The type and net explosive weight of explosives, ammunition, blasting agents, smoked or unsmoked, or tested and the in-process classification of the materials to be used.

4.1.4.1.3 A plot of the operating premises with the operating buildings, indicated in which greater than 1 pound (0.45 kg) of explosives is to be manufactured, used, tested or stored.

4.1.4.1.4 The plot plan shall be dimensioned so as to accurately portray the size of each operating building and its location relative to barricades, storage, magazines, property lines, inhabited buildings and public transportation routes - including highways and railways.

4.1.4.1.5 The authority having jurisdiction shall be provided with information from hazard assessments as required by process safety management (PSM). A.4.1.4.1.5 Process safety management should be according to US Department of Labor-OSHA, 29 CFR 1910.119, Process Safety Management regulations.

Committee Statement: The Committee made minor editorial changes to the proposed text and added a new requirement linking the information furnished about the facility and processes required by the AHJ with the OSHA Process Safety Management regulations since much of the same information is developed as part of that standard of practice and should be shared with the AHJ.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-42 Log# CP18 EXP-AAA Final Action: Accept

(4.1.2)

Submitter: Technical Committee on Explosives

Recommendation: Revise 4.1.2 as follows:

4.1.2 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

siting is based on the use of the appropriate quantity-distance tables (Q-D), which is established either by testing or by assuming a worst case classification of a mass explosion hazard.

The following table has been prepared to provide the reader with a cross-reference material to expedite the understanding of the basis for the proposed changes.

See tables on pages 27-30.

Committee Meeting Action: Accept

Changes to Chapter 4 - Add the following new text after existing 4.1.4 and renumber as necessary.

4.1.4.1 Prior to manufacturing, assembling, or testing or loading of explosives, ammunition, or blasting agents, the authority having jurisdiction shall be furnished with the information required in 4.1.4.1.1 through 4.1.4.1.5.

4.1.4.1.1 The exact location of the place of manufacture or testing.

4.1.4.1.2 The type and net explosive weight of explosives, ammunition, blasting agents, smoked or unsmoked, or tested and the in-process classification of the materials to be used.

4.1.4.1.3 A plot of the operating premises with the operating buildings, indicated in which greater than 1 pound (0.45 kg) of explosives is to be manufactured, used, tested or stored.

4.1.4.1.4 The plot plan shall be dimensioned so as to accurately portray the size of each operating building and its location relative to barricades, storage, magazines, property lines, inhabited buildings and public transportation routes - including highways and railways.

4.1.4.1.5 The authority having jurisdiction shall be provided with information from hazard assessments as required by process safety management (PSM). A.4.1.4.1.5 Process safety management should be according to US Department of Labor-OSHA, 29 CFR 1910.119, Process Safety Management regulations.

Committee Statement: The Committee made minor editorial changes to the proposed text and added a new requirement linking the information furnished about the facility and processes required by the AHJ with the OSHA Process Safety Management regulations since much of the same information is developed as part of that standard of practice and should be shared with the AHJ.

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-25 Log# CP19 EXP-AAA Final Action: Accept

(4.1.7)

Submitter: Technical Committee on Explosives

Recommendation: Revise 4.1.7 as shown:

4.1.7 A person intending to engage in business as an importer, dealer, or user of in-explosive materials shall obtain a federal license in accordance with Title 18, United States Code, “Organized Crime Control Act of 1970,” in Chapter 40.

Substantiation: This would be consistent with the Safe Explosives Act.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).
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Table X.3.3(a)

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<tr>
<td>a</td>
<td>DOD 4145.26-M Table C6.12</td>
<td>In pertinent part up to 300,000 pounds. Footnote c establishes a minimum distance imposed. This distance allows one to drop the distances otherwise required by NFPA 5000 in Section 34.3.3.3 (in need of revision as well).</td>
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<tr>
<td>b</td>
<td>DOD 4145.26-M Table C6.111</td>
<td>Footnote a – UFC Footnote b DOD footnote 1 Footnote c DOD footnote 2 Footnote d relief from distances otherwise imposed by NFPA 5000</td>
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<tr>
<td>c</td>
<td>DOD 4145.26-M Table C6.112</td>
<td>Footnote a correlates table with DOD Footnote b correlates in part with footnote 2 of DOD; correlates with IFC. Footnote d – self explanatory Footnote e relief from distances otherwise imposed by NFPA 5000</td>
</tr>
<tr>
<td>d</td>
<td>UFC 704.10</td>
<td>Footnote establishes limit of 50 pounds for high explosives in magazines allowed to be stored indoors thereby setting up the case. It is common for magazines to be used in conjunction with manufacturing operations where the magazine holds operational quantities of materials or material that is staged for production. The quantities in these in-process magazines is limited by the following sections.</td>
</tr>
<tr>
<td>Section</td>
<td>Reference</td>
<td>Comments</td>
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<tr>
<td>X.3.4.1</td>
<td>UFC:7702.3.10</td>
<td>If up to 50 pounds can be located in an indoor magazine, it is reasonable to assume that the same 50 pounds can be stored in a magazine within the Q-D circle in close proximity to the operating building.</td>
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<tr>
<td>X.3.4.2</td>
<td>New</td>
<td>Magazines with quantities greater than 50 pounds are required to be moved to magazine distances.</td>
</tr>
<tr>
<td>X.3.4.3</td>
<td>New</td>
<td>Accounts for a combination of indoor and outdoor magazines located within the Q-D circle.</td>
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<td>X.4.1.1</td>
<td>New</td>
<td>Reference to the building code.</td>
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<td>X.4.1.2</td>
<td>See also UFC Section 7704.2.1 items 1 and 4.</td>
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<td>X.4.3.1</td>
<td>IME:3.2.18</td>
<td>Modified to correlate in concept with NEC 250-90 (and related sections) and 250-100.</td>
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<td>General reference to appropriate construction code.</td>
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<td>3.3.19.1</td>
<td>NFPA 5000:3.3.340.4.1</td>
<td>Currently approved for publication in the 2004 IFC</td>
</tr>
<tr>
<td>3.3.19.2</td>
<td>NFPA 5000:3.3.340.4.2</td>
<td>Several new definitions have been added to Chapter 3 to correlate the terminology used by those engaged in the storage and manufacture of explosive materials as well as with the regulators of these materials including the Department of Defense (DOD). The terms that have been added are consistent with terminology used by the DOD and the Institute of Makers of Explosives (IME), albeit there are subtle differences with respect to DOD to account for application to commercial operations. The term “intra = within the line” is used synonymously with “intraplant distance,” although there are differences applied on military sites for the purpose of separating different operating lines. For example, on a military site it is common to separate one operating line from another by the inhabited building distance. On the other hand on commercial sites it is common to produce multiple product lines within an associated building group and to separate the various buildings within the group by intraplant distances (IPD). By equating the terms IPD and ILD commercial uses are provided with a level of protection that is designed to address building safety that is not product specific, but is designed to address the explosive nature of materials involved. The term “Quantity-Distance (Q-D)” is the relationship between a quantity of explosive material and the minimum separation distances required. The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials. Section 4.1.5 authorizes the code official to limit the quantity of explosives at any given location. The limitations on quantity are typically derived based on the location where the explosives are to be located. The distances required vary depending on the sensitivity of the receptor. Distances are generally greater where the public or those not engaged in the manufacturing process are involved. The sub-elements of the definition include terms that typically appear (or should appear) on building and site plans that are used to confirm that the siting for the structure used to contain the explosive material (building or magazine) is properly located. Acronyms, e.g., IBD, ILD, IMD, etc. are typically used to describe the distance used to separate the explosives from receptors such as inhabited buildings, public traffic or transportation routes (highways), other storage (magazines) and the like. Definitions have been provided and correlated with tables to be used for distance determination. The use of the acronyms and their attendant definitions will aid the regulatory and design community alike by bringing a consistent set of terminologies to the code.</td>
</tr>
<tr>
<td>3.3.19.3</td>
<td>NFPA 5000:3.3.340.4.3</td>
<td>Notwithstanding the tabular distance established by the Q-D tables integral to the explosives industry there are occasions where ancillary buildings are needed to be constructed that do not contain explosive materials per se, where the ancillary building will encroach on the building containing explosive materials. D1 is a fire separation distance, and not unlike that used by the building code to determine the location of “detached buildings.” As the buildings regulated by the Q-D tables are required to be detached a minimum fire separation distance is established. This distance is noted in the proposed tables X.3.3(a) through X.3.3(c) with 50 feet established as the minimum for buildings containing materials with mass fire and fire hazards, and 60 feet established as the minimum for buildings containing materials with mass explosive hazards. From a practical standpoint the D1 distances will apply only to facilities where the explosive quantities are near the minimums as the distances are increased rapidly with increases in material content.</td>
</tr>
<tr>
<td>3.3.19.4</td>
<td>NFPA 5000:3.3.340.4.4</td>
<td>Several new definitions have been added to Chapter 3 to correlate the terminology used by those engaged in the storage and manufacture of explosive materials as well as with the regulators of these materials including the Department of Defense (DOD). The terms that have been added are consistent with terminology used by the DOD and the Institute of Makers of Explosives (IME), albeit there are subtle differences with respect to DOD to account for application to commercial operations. The term “intra = within the line” is used synonymously with “intraplant distance,” although there are differences applied on military sites for the purpose of separating different operating lines. For example, on a military site it is common to separate one operating line from another by the inhabited building distance. On the other hand on commercial sites it is common to produce multiple product lines within an associated building group and to separate the various buildings within the group by intraplant distances (IPD). By equating the terms IPD and ILD commercial uses are provided with a level of protection that is designed to address building safety that is not product specific, but is designed to address the explosive nature of materials involved. The term “Quantity-Distance (Q-D)” is the relationship between a quantity of explosive material and the minimum separation distances required. The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials. Section 4.1.5 authorizes the code official to limit the quantity of explosives at any given location. The limitations on quantity are typically derived based on the location where the explosives are to be located. The distances required vary depending on the sensitivity of the receptor. Distances are generally greater where the public or those not engaged in the manufacturing process are involved. The sub-elements of the definition include terms that typically appear (or should appear) on building and site plans that are used to confirm that the siting for the structure used to contain the explosive material (building or magazine) is properly located. Acronyms, e.g., IBD, ILD, IMD, etc. are typically used to describe the distance used to separate the explosives from receptors such as inhabited buildings, public traffic or transportation routes (highways), other storage (magazines) and the like. Definitions have been provided and correlated with tables to be used for distance determination. The use of the acronyms and their attendant definitions will aid the regulatory and design community alike by bringing a consistent set of terminologies to the code.</td>
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<td>3.3.19.5</td>
<td>NFPA 5000:3.3.340.4.5</td>
<td>Notwithstanding the tabular distance established by the Q-D tables integral to the explosives industry there are occasions where ancillary buildings are needed to be constructed that do not contain explosive materials per se, where the ancillary building will encroach on the building containing explosive materials. D1 is a fire separation distance, and not unlike that used by the building code to determine the location of “detached buildings.” As the buildings regulated by the Q-D tables are required to be detached a minimum fire separation distance is established. This distance is noted in the proposed tables X.3.3(a) through X.3.3(c) with 50 feet established as the minimum for buildings containing materials with mass fire and fire hazards, and 60 feet established as the minimum for buildings containing materials with mass explosive hazards. From a practical standpoint the D1 distances will apply only to facilities where the explosive quantities are near the minimums as the distances are increased rapidly with increases in material content.</td>
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## Changes to Chapter 4

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## Changes to Annex A

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<td>Flow chart</td>
<td>Flow chart from paper by Thaddeus C. Speed referenced for inclusion in Annex E.</td>
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<td>NFPA 5000:A.3.3.340.4 paragraph 2 and following items 1 through 6.</td>
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<td>IME:1.3</td>
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## Changes to Annex E

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<td>References added to substantiate information included in proposed new chapter</td>
<td>As noted</td>
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8.4.2 Blasting agent manufacturing plants and storage of blasting agents and ammonium nitrate shall be located in compliance with the American Table of Distances (ATD, Table 8.4.1) in regards to their proximity to inhabited buildings, public highways, and passenger railways. If magazine locations are closer to each other than specified in the Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents (SDT, Table 8.4.2) they shall be used to determine if propagation may occur and if so, the quantities shall be added together when determining distances in the ATD, as well as with the American Table of Distances.

B.1.5 One point should be emphasized: the distances in the table are for determining the minimum separation of stores to prevent propagation between stores. Separation distances less than those in the table are allowed, but in such situations, the total quantity in the stores is not to be significantly less than from high explosives. The American Table of Distances shall be used for separation from inhabited buildings, passenger railways, and public highways. When determining the adjusted site quantity for the ATD, since the blast effect from ANFO or other blasting agents is not significantly less than from high explosives, the total quantity is used. However, the blast effect is not modified significantly by barricades. The American Table of Distances for unbarricaded stores provides an additional factor of safety and should be used.

Substantiation: Several code officials have recently expressed frustration with interpreting the requirements of the ATD and the SDT. Most commonly, code officials mistakenly apply Table 8.4.2 as a requirement, i.e. magazines cannot be located closer than the distances in the table. These modifications do not change the standard, but should clarify its use.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-30 Log# 1 EXP-AAA Final Action: Accept in Principle in Part (7.1.3.2 (New ))

Recommendation: Add a new 7.1.3.2 to read:
7.1.3.2 Before a permit is issued to use explosive materials, the applicant shall file with the authority having jurisdiction a corporate surety bond in the principal sum of $1,000,000 or a public liability insurance policy for the same amount for the purpose of the payment of damages to persons or property which arise from, or are caused by, the conduct of an act authorized by the permit upon which a judicial judgment results. The authority having jurisdiction is authorized to specify a greater or lesser amount when in the authority having jurisdiction’s opinion, conditions at the location of use indicate a greater or lesser amount is required.

Exception: Government entities shall be exempt from this bond requirement.

Committee Statement: The Committee modified the submitter’s recommendation language because various jurisdictions have insurance requirements that may vary from the prescriptive limits recommended by the proponent. In addition, there are small quantities of explosives utilized, including special industrial explosive devices, which do not necessarily warrant such insurance liability requirements. The Committee moved the accepted new text to Chapter 4, in Section 4.2, which currently deals with Permit Requirements, where this proposed language seems to be better located. The Committee also did not add an exception, which meets the Manual of Style practices.

Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-31 Log# CP2 EXP-AAA Final Action: Accept (7.1.8)

Submitter : Technical Committee on Explosives
Recommendation: Revise the existing requirement as shown and delete the exception to 7.2.3.
7.2.3 Vehicles used for transporting frictional spark sensitive explosive materials such as black powder and primary explosives shall have no exposed spark-producing surface on the inside of the cargo body. Exception: This requirement shall not apply to vehicles transporting blasting agents and explosive materials.

Substantiation: Nonsparking requirements have virtually no impact on the safety of today’s explosives. However rare situations where nonsparking requirements are appropriate are preserved.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-32 Log# CP23 EXP-AAA Final Action: Accept (7.2.3)

Submitter : Technical Committee on Explosives
Recommendation: Revise the existing requirement as shown and delete the exception to 7.2.3.
7.2.3 Vehicles used for transporting frictional spark sensitive explosive materials such as black powder and primary explosives shall have no exposed spark-producing surface on the inside of the cargo body. Exception: This requirement shall not apply to vehicles transporting blasting agents and explosive materials.

Substantiation: Nonsparking requirements have virtually no impact on the safety of today’s explosives. However rare situations where nonsparking requirements are appropriate are preserved.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-33 Log# CP24 EXP-AAA Final Action: Accept (7.2.6)

Submitter : Technical Committee on Explosives
Recommendation: Modify the fire extinguisher requirement in 7.2.6 as follows:
7.2.6 Each motor vehicle used for transporting explosive materials shall be equipped with at least two fire extinguishers, each with a rating of at least 4-A: 40-B:C. Each motor vehicle used for transporting explosive materials shall be equipped with two extinguishers in accordance with Table 7.2.6.

Substantiation: The current standard is technically incorrect since “combining” fire extinguisher ratings is not supported by the UL or NFPA. A rating of 4-A:40-B:C is consistent with the selection criteria in NFPA 10, Standard for Portable Fire Extinguishers. Two standards exist for trucks less than 14,000 lb GVW and one for trucks over 14,000 lb GVW is impractical. The proposed change would be consistent with the current recommendations of the IME in SLP-3 and SLP-14.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).
Add a new Table 8.4.1(b) Low Explosives.

Recommendation: Add a metric equivalent table for Table 8.4.1 to be based upon IME metric equivalent table.

Substantiation: The code contains other metric equivalents, therefore there should be a metric equivalent of the ATD table.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative:
DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

Revise Note 11 of Table 8.4.1 to be consistent with the IME. Any other definition might be considered an infringement on IME's copyright on Table 8.4.1.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative:
DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

Add a new paragraph 7.3.5 to read as follows:

7.3.5 Vehicles transporting Division 1.4, 1.5 or 5.1 materials shall be attended unless its driver is performing duties that are incident and necessary to the driver’s duties as the operator of the vehicle and the Division 1.4, 1.5 or 5.1 materials and vehicle are secured from unauthorized access or use.

Substantiation: This maintains adequate security of these materials while still allowing common carrier shipments of explosives.
Report on Proposals — Copyright, NFPA

495-42 Log# CP31 EXP-AAA Final Action: Accept (Table 8.4.2 Note 3)
Submitter: Technical Committee on Explosives
Recommendation: Modify Note Table 8.4.2 as follows:
Note 3: The distances in the table apply to ammonium nitrate and ammonium nitrate based materials that show “negative (+) result in the UN Test Series 2. Gap Test and show “positive” (+) result in the UN Test Series 1 Gap Test, that were the ignitability test prescribed in the definition of ammonium nitrate—fertilizer promulgated by the Fertilizer Institute ammonium nitrate. Ammonium nitrate and ammonium nitrate based materials that are DOT hazard Class 1 sensitive shall be stored at separation distances determined by the American Table of Distances, failing to pass and test shall be stored at separation distances determined by the authority having jurisdiction.
Substantiation: TFI has withdrew their standard and will not support it. The IME has adopted this replacement criteria.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-43 Log# CP32 EXP-AAA Final Action: Accept (8.7.3)
Submitter: Technical Committee on Explosives
Recommendation: Revise the existing text as shown:
8.7.3 Magazine doors shall be kept locked.
Exception: Magazine doors shall be permitted to be unlocked during placement or removal of explosives — during inspection or if no explosives are in the magazine.
Substantiation: The changes clarify the intent of this requirement; some people think that a magazine must be locked even when it is empty.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-44 Log# CP33 EXP-AAA Final Action: Accept (8.7.10)
Submitter: Technical Committee on Explosives
Recommendation: Revise the existing text as shown:
8.7.10 Tools used for opening containers of frictional spark sensitive explosive materials such as black powder and primary explosives shall be constructed of nonsparking material.
Exception is not changed.
Substantiation: Nonsparking requirements have virtually no impact on the safety of today’s explosives, however rare situations where nonsparking requirements are appropriate are preserved.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-45 Log# CP34 EXP-AAA Final Action: Accept (9.1.10)
Submitter: Technical Committee on Explosives
Recommendation: Revise the existing text as shown:
9.1.10 Nonsparking tools shall be used for opening any package or container of frictional spark sensitive explosive materials such as black powder and primary explosives.
No change to the exception.
Substantiation: Nonsparking requirements have virtually no impact on the safety of today’s explosives, however rare situations where nonsparking requirements are appropriate are preserved.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-46 Log# CP35 EXP-AAA Final Action: Accept (9.1.12)
Submitter: Technical Committee on Explosives
Recommendation: Revise the existing text as shown:
9.1.12 Where blasting is done in a congested area or in close proximity to a structure, railway, or highway, or any other installation that could be affected, special precautions shall be taken to prevent damage and to minimize earth vibrations and air blast effects and hazards from toxic fumes. Blasting mats or other protective devices shall be used to prevent fragments from being thrown.
Substantiation: The standard should address one of the leading causes of injury from blasting near structures.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-47 Log# CP37 EXP-AAA Final Action: Accept (9.3)
Submitter: Technical Committee on Explosives
Recommendation: Revise 9.3.3 and 9.3.4 as shown:
9.3.3 Where electric detonators are used, stray current tests shall be made as frequently as necessary. Maximum stray current shall not exceed 0.05 ampere through a 1-ohm resistor, measured at the blast site. Nonelectric or electronic initiating systems shall be used unless corrective action is taken to reduce the stray current below the limits indicated in this paragraph.
9.3.4 Electric or electronic detonators of different brands shall not be used in the same firing circuit.
Substantiation: Electronic detonators are safe to use as well as nonelectric detonators. The requirement in 9.3.4 is a standard warning from all manufacturers.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-48 Log# CP36 EXP-AAA Final Action: Accept (9.3.2)
Submitter: Technical Committee on Explosives
Recommendation: Revise 9.3.2 as shown:
9.3.2 Where a safety fuse is used, the burning rate shall be determined and in no case shall fuse lengths of less than 3-feet or with a burn time less than 120 seconds be used. The detonator shall be attached securely to the fuse with a standard ring-type cap crimper.
Substantiation: Without a minimum length specification, it is impossible to determine through visual inspection whether an adequate burn time will be achieved.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY
Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-49 Log# CP38 EXP-AAA Final Action: Accept (9.4, 9.5)
Submitter: Technical Committee on Explosives
Recommendation: Revise 9.4.1 as shown:
9.4.1 No person shall return to the blast area until permitted to do so by the blaster— in-charge.
9.4.2 The Blaster In-Charge shall allow sufficient time for smoke and fumes to dissipate and for dust to settle before returning to the blast site.
9.4.3 The Blaster In-Charge shall inspect the entire blast site for misfires before allowing other personnel to return to the blast area.
9.5.1 Where a misfire is found, the Blaster In-Charge shall provide the proper safeguards for excluding all personnel from the blast area. Misfires shall be reported to the supervisor immediately.
Substantiation: The change made in 9.4.1, 9.4.3 and 9.5.1 to “blaster-in-charge” is necessary because the duty described in each requirement is the responsibility of the Blaster-In-Charge and not the blaster. The change in 9.4.2 indicates the duty of the blaster.
Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
12.3 Use. shall not introduce a hazard due to chemical incompatibility.

9.5.4 Where there are misfires using cap and fuse, all personnel shall stay clear of the blast site for at least 1 hour.

9.5.5 Where there are misfires using other nonelectric detonators (i.e., other than cap and fuse) or using electric detonators, all personnel shall stay clear of the blast site for at least 30 minutes. Whenever there is a misfire, all personnel shall remain at a safe distance for at least 15 minutes (30 minutes if electronic or cap and fuse initiation is used).

Substantiation: Current standard is inconsistent with MSHA and IME, but is consistent with OSHA. OSHA points to NFPA 495 as justification for their wait times. Since OSHA has initiated a rulemaking, the Committee should review the proposed rulemaking when published and comment as appropriate to OSHA recommending this change.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative: DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

Recommendation: Changes to Annex A

A.3.1.1 Insert flow diagram and text here.

A.3.3.19 to be revised as follows:

Paragraph 1 of the existing annex note to remain as printed. Add the following text beginning with a new paragraph as follows:

The former classification system used by the U.S. Department of Transportation (DOT) included the terms high explosive and low explosive, as further defined in A.3.3.19.1 and 3.3.19.2. These terms remain in use by the U.S. Bureau of Alcohol, Tobacco and Firearms (BATF). Explosive materials classified as hazard Class 1 are further defined under the current system applied by DOT. Compatibility group letters are used in concert with division numbers to specify further limitations on each division noted. For example, the letter G (as in 1.1G) identifies substances or articles that contain a pyrotechnic substance and similar materials. UN/DOT Class 1 Explosives are further defined as follows:

(1) Division 1.1 explosives are explosives that are a mass explosion hazard, which is a hazard that instantaneously affects almost the entire load.

(2) Division 1.2 explosives are explosives that are a projection hazard but not a mass explosion hazard.

(3) Division 1.3 explosives are explosives that are a mass hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.

(4) Division 1.4 explosives are explosives that pose a minor explosion hazard and meet both of the following criteria:

(a) The explosive effects are largely confined to the package, and no projection of fragments of appreciable size or range is to be expected.

(b) An external fire cannot cause virtually instantaneous explosion of almost the entire contents of the package.

(5) Division 1.5 explosives are very insensitive explosives that are comprised of substances that are a mass explosion hazard, but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.
A.3.3.19.1 High Explosive (material). A high explosive material is characterized by a reaction rate that is greater than the speed of sound. Examples of high explosives are black powder, safety fuses, igniters, igniter cords, fuse lighters, fireworks (Class B, Special), and propellants (Class B, Solid Propellants).

A.3.3.19.2 Low Explosive (Material). A low explosive material is characterized by a reaction rate that is less than the speed of sound. Examples of low explosives are black powder, safety fuses, igniters, igniter cords, fuse lighters, fireworks (Class B, Special), and propellants (Class B, Solid Propellants).

A.X.3.1 Accept the proposed change to add the following annex material for new x.3.1 (Proposal 495-4 (Log#5)) as shown:

Section 65.9.1 of NFPA 1-UFC refers to NFPA 495 and 498 for requirements surrounding the manufacture, transportation, storage, sale, and use of explosive materials. With a few exceptions for specific materials, existing NFPA 495 is limited regarding requirements for manufacturing and operational activities. During the recent revisions to NFPA 1, the Uniform Fire Code was absorbed into NFPA 1 and an effort was made to correlate provisions in NFPA 1 with the subjects addressed by other NFPA material specific standards when possible. UFC Article 77 contains provisions affecting the manufacturing process that were not transferred into Chapter 16 when NFPA 1-UFC was drafted, deferring at the time to NFPA 495 for requirements. Under policies promulgated by the Standards Council technical provisions that are found in NFPA 1 are to be extracted from the special hazards standards when the provisions in the standards address the items of concern. On the other hand, when the standards do not address the concern, there is latitude on the part of the NFPA 1 Technical Committee to draft requirements accordingly.

It is appropriate that the NFPA 495 Technical Committee apply its collective expertise to address the needs of the public regarding the use of explosive materials in manufacturing operations, thereby providing the needed guidance to the NFPA 1-UFC Technical Committee. Changes have been proposed to NFPA 495 that are patterned after the framework found within the 1997 Edition of the UFC. The technical content of the proposed changes have been derived in concept and to some degree in content from the following sources:


The test protocol provided for inclusion in Annex A was developed by Safety Management Services, Inc., (SMS) under contract with TRW’s Occitant Safety Systems, Inc. (TRW), released to the public, and first published as a reference standard to the Uniform Fire Code with a set of local amendments made by the City of Mesa, Arizona in 1994. The protocol has been reviewed by a number of entities, including those that were being regulated by this jurisdiction including Talley Defense Systems, SDI, TRW, Boeing, and others. The technical work has been improved as it has evolved, and it is now referenced in Annex E. Providing a standardized approach to hazard classification for materials employed in “in-process” operations promotes uniformity in approach in the use of the code by code officials, building owners and designers alike. Building sitting is based on the use of the appropriate quantity-distance tables (Q-D), which is established either by testing or by assuming a worst case classification of a mass explosion hazard.

The following table has been prepared to provide the reader with a cross reference to expedite the understanding of the basis for the proposed changes.

<table>
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<th>See tables on pages 36-39.</th>
<th>Committee Meeting Action: Accept in Principle in Part Changes to Annex A and Annex D.</th>
<th>Accept the proposed change to add the following annex material for new x.3.1 (Proposal 495-4 (Log#5)) as shown:</th>
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<td>A.X.3.1 Tests required for finished goods containing explosive materials in a packaged form suitable for shipment or storage have been established by the U.S. Department of Transportation (DOT) and the Bureau of Alcohol, Tobacco and Firearms (ATF). The tests established for the purposes of shipment do not consider key elements that must be examined in a manufacturing situation. The condition, state, quantity or configuration of the material may vary within the hazards of the material may vary accordingly. It is not unusual for the finished materials manufactured to carry a different classification from those of the raw materials used, or the classification assigned as those materials move throughout the manufacturing process. A classification methodology is needed that recognizes the hazards commensurate with the application to the variable physical conditions as well as the potential variation due to the configuration in which the material is found throughout the manufacturing process. Do not insert the flow diagram as new annex material A.X.3.1.1.</td>
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<td>A.X.3.1.1 Revise A.X.3.19 as follows: Paragraph 1 of the existing annex note to remain as printed. Add the following text: See also Annex D. Do not add definitions for High Explosive and Low Explosive (material). Revise Annex D.2(4) as shown:</td>
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<td>(4) Division 1.4, Explosives that present a minor explosion hazard. The explosive hazards are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause a virtually instantaneous explosion of almost the entire contents of the package.</td>
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<td>Committee Statement: The flow diagram presented in this proposal does not address all applicable situations and decisions encountered in industry practice. The Committee addressed the reference to the DOT classifications for test explosives through action on Committee Proposal 495-54 (Log #CP45) revising the definition for explosives and introducing the Class 1 Explosives divisions. The Committee also modified the Division 1.4 definition in Annex A by including the updated definition from the DOT regulations in 49 CFR 173.58.</td>
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### X.3.1
- **Reference**: NFPA 1:60.1.5
- **Comments**: Materials are required to be classified as to hazard by both the building code and the fire prevention code. Materials manufactured, or “in-process” must be classified based on the in-process hazards. Annex information is provided to substantiate the approach used.

### X.3.1.1
- **New**: Annex information is provided. Also see discussion in IFC Appendix E Section E102.1.1

### X.3.1.2
- **New**: If testing is not used to establish the in-process hazard classification then the material must be considered to be a mass explosion hazard.

### X.3.3.1
- **Reference**: NFPA 1-UFC:60.1.5
- **Comments**: See UFCA Appendix VI-F, Section 1.

### X.3.3.1.1
- **New**: Annex information is provided. Also see discussion in IFC Appendix E Section E102.1.1

### X.3.3.1.2
- **New**: If testing is not used to establish the in-process hazard classification then the material must be considered to be a mass explosion hazard.

### Table X.3.3(a)
- **Reference**: DOD 4145.26-M Table C6.12
- **Comments**: Footnote c establishes a minimum distance imposed. This distance allows one to drop the distances otherwise required by NFPA 5000 in Section 34.3.3.3 (in need of revision as well).

### Table X.3.3(b)
- **Reference**: DOD 4145.26-M Table C6.111
- **Comments**: Footnote a – UFC; Footnote b DOD footnote 1; Footnote c DOD footnote 2; Footnote d relief from distances otherwise imposed by NFPA 5000.

### Table X.3.3(c)
- **Reference**: DOD 4145.26-M Table C6.112
- **Comments**: Footnote a correlates with DOD; Footnote b – self explanatory; Footnote d relief from distances otherwise imposed by NFPA 5000.

### X.3.4
- **Reference**: UFC 7/04.5
- **Comments**: Last sentence from IBC Section 415.3.1. The provision is necessary for buildings that are operating at minimum distances under the control of the Q-D tables.
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<tr>
<td>X.3.4.1</td>
<td>UFC:7702.3.10</td>
<td>If up to 50 pounds can be located in an indoor magazine, it is reasonable to assume that the same 50 pounds can be stored in a magazine within the Q-D circle in close proximity to the operating building.</td>
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<tr>
<td>X.3.4.2</td>
<td>New</td>
<td>Magazines with quantities greater than 50 pounds are required to be moved to magazine distances.</td>
</tr>
<tr>
<td>X.3.4.3</td>
<td>New</td>
<td>Accounts for a combination of indoor and outdoor magazines located within the Q-D circle.</td>
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<tr>
<td>X.4.1</td>
<td>New</td>
<td>Reference to the building code.</td>
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<td>X.4.1.1</td>
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<td>See also UFC Section 7704.2.1 items 1 and 4.</td>
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<tr>
<td>3.3.19.1</td>
<td>NFPA 5000:3.3.340.1</td>
<td>Several new definitions have been added to Chapter 3 to correlate the terminology used by those engaged in the storage and manufacture of explosive materials as well as with the regulations of these materials including the Department of Defense (DOD). The terms that have been added are consistent with terminology used by the DOD and the Institute of Makers of Explosives (IME), albeit there are subtle differences with respect to DOD to account for application to commercial operations.</td>
</tr>
<tr>
<td>3.3.19.2</td>
<td>NFPA 5000:3.3.340.2</td>
<td>The term &quot;Quantity-Distance (Q-D)&quot; is the relationship between a quantity of explosive material and the minimum separation distances required. The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials.</td>
</tr>
<tr>
<td>3.3.19.3</td>
<td>NFPA 5000:3.3.340.3</td>
<td>The use of Quantity-Distance (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials.</td>
</tr>
<tr>
<td>3.3.19.4</td>
<td>NFPA 5000:3.3.340.4</td>
<td>Notwithstanding the tabular distance established by the Q-D tables integral to the explosives industry there are occasions where ancillary buildings are needed to be constructed that do not contain explosive materials per se, where the ancillary building will encroach on the building containing explosive materials. Distance is a fire separation distance, and not unlike that used by the building code to determine the location of &quot;detached buildings.&quot; As the buildings regulated by the Q-D tables are required to be detached a minimum fire separation distance is established. This distance is noted in the proposed tables X.3.3(a) through X.3.3(c) with 50 feet established as the minimum for buildings containing materials with mass fire and fire hazards, and 60 feet established as the minimum for buildings containing materials with mass explosive hazards. From a practical standpoint the DOD distances will apply only to facilities where the explosive quantities are near the minimums as the distances are increased rapidly with increases in material content.</td>
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<td>Currently approved for publication in the 2004 IFC</td>
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<td>3.xx Intra-building distance</td>
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<td>DOD 4145.26-MULTI1.1.61</td>
<td>Currently approved for publication in the 2004 IFC</td>
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</table>

The sub-elements of the definition include terms that typically appear (or should appear) on building and site plans that are used to confirm that the siting for the structure used to contain the explosive material (building or magazine) is properly located. Acronyms, e.g., IBD, ILD, IMD, etc. are typically used to describe the distance used to separate the explosives from receptors such as inhabited buildings, public traffic or transportation routes (highways), other storage (magazines) and the like. Definitions have been provided and correlated with tables to be used for distance determination. The use of the acronyms and their attendant definitions will aid the regulatory and design community alike by bringing a consistent set of terminologies to the code.

Notwithstanding the tabular distance established by the Q-D tables integral to the explosives industry there are occasions where ancillary buildings are needed to be constructed that do not contain explosive materials per se, where the ancillary building will encroach on the building containing explosive materials. A distance is a fire separation distance, and not unlike that used by the building code to determine the location of "detached buildings." As the buildings regulated by the Q-D tables are required to be detached a minimum fire separation distance is established. This distance is noted in the proposed tables X.3.3(a) through X.3.3(c) with 50 feet established as the minimum for buildings containing materials with mass fire and fire hazards, and 60 feet established as the minimum for buildings containing materials with mass explosive hazards. From a practical standpoint the DOD distances will apply only to facilities where the explosive quantities are near the minimums as the distances are increased rapidly with increases in material content.

| NFPA 495 | Copyright, NFPA | 495-38 |
## Changes to Chapter 4

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## Changes to Annex A

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<td>A.X.3.3.19</td>
<td>NFPA 5000:A.3.3.340.4 paragraph 2 and following items 1 through 6</td>
<td>Flow chart from paper by Thaddeus C. Speed referenced for inclusion in Annex E.</td>
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<td>A.3.3.19.1</td>
<td>IME:1.3</td>
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## Changes to Annex E

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<td>References added to substantiate information included in proposed new chapter</td>
<td>As noted</td>
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Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

BARRETT: See my Explanation of Negative on 495-4 (Log #5).
DANIEL: See my Explanation of Negative on 495-4 (Log #5).
DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).
HÖPLER: A.3.3.19.1 and A.3.3.19.2 Reaction rates are greater or less than the speed of sound in the medium (the explosive) involved.
KOSANKE: See my Explanation of Negative on 495-4 (Log #5).
PRESCOTT: See my Explanation of Negative on 495-4 (Log #5).
VON ROSEN: A more complete table exists in the UN Manual of Tests and Criteria. I see no reason why the UN table cannot be adopted instead, this would make 495 more complete, and supportable. I see no reason why we need to develop a new table of our own.

Comment on Affirmative

DOWLING: See my Affirmative on Comment on 495-8 (Log #7).
SANTIS: Delete the last two sentences of Section A.X.3.1.1(4). My notes of the meeting indicate this was agreed to by the committee because the sentences repeat previously mentioned details.

495-54 Log# CP45 EXP-AAA Final Action: Accept (A.3.3.19 Explosive)

Submitter: Technical Committee on Explosives
Recommendation: Revise the Annex material for the definition of explosive by adding the following text to the beginning of A.3.3.19 and retain the existing text following this new text:

A.3.3.19 Explosives in Class 1 are divided in six divisions as follows:
Division 1.1 consists of explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously.
Division 1.2 consists of explosives that have a projection hazard but not a mass explosion hazard.
Division 1.3 consists of 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 consists of explosives that present a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.
Division 1.51 consists of very insensitive explosives. This division is comprised of substances which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.
Division 1.62 consists of extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles which contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

1. The probability of transition from burning to detonation is greater when large quantities are transported in a vessel.
2. The risk from articles of Division 1.6 is limited to the explosion of a single device.

Substantiation: This additional information is based upon US Department of Transportation (D.O.T.) regulations in 49 CFR 173.50.

Committee Meeting Action: Accept

Number Eligible to Vote: 18

Ballot Results: Affirmative: 14 Negative: 1

Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:

DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-55 Log# 6 EXP-AAA Final Action: Accept in Part (Annex E)

Submitter: Larry Fluer , Fluer, Inc.
Recommendation: Changes to Annex E

E.2.5 Informational References add the following:


Add a new section E.2.6 as follows:
E.2.6 United Nations.


Substantiation:

A new chapter has been proposed for inclusion into NFPA 495 to provide fundamental requirements affecting the manufacture of explosive materials. Section 65.9.1 of NFPA 1-UFC refers to NFPA 495 and 498 for requirements surrounding the manufacture, transportation, storage, sale, and use of explosive materials. With a few exceptions for specific materials, existing NFPA 495 is limited regarding requirements for manufacturing and operational activities. During the recent revisions to NFPA 1, the Uniform Fire Code was absorbed into NFPA 1 and an effort was made to correlate provisions in NFPA 1 with the subjects addressed by other NFPA material specific standards when possible. UFC Article 77 contains provisions affecting the manufacturing process that were not transferred into Chapter 16 when NFPA 1-UFC was drafted, deferring at the time to NFPA 495 for requirements. Under policies promulgated by the Standards Council technical provisions that are found in NFPA 1 are to be extracted from the special hazards standards when the provisions in the standards address the items of concern. On the other hand, when the standards do not address the concern, there is latitude on the part of the NFPA 1 Technical Committee to draft requirements accordingly. It is appropriate that the NFPA 495 Technical Committee apply its collective expertise to address the needs of the public regarding the use of explosive materials in manufacturing operations, thereby providing the needed guidance to the NFPA 1-UFC Technical Committee. Changes have been made to NFPA 495 that are patterned after the framework found within the 1997 Edition of the UFC. The technical content of the proposed changes have been derived in concept and to some degree in content from the following sources:


The 1997 UFC was used as the basis to develop the requirements regulating explosive materials found within the International Fire Code, Chapter 33. One of the advantages of the NFPA standards process over that used by the other model codes is the ability to provide the user with ancillary reference material and explanatory text by way of the use of an informational Annex, and changes have been proposed to add information to the Annexes of NFPA 495 accordingly. Definitions for Division 1.1 through 1.6 materials have been provided, consistent with those used by the DOT/UN regulations as well as with the Department of Defense (DOD). Building siting is determined based on the hazards of the material employed consistent with the Federal definitions. The user can either assume that the explosive material represents a mass explosion hazard, or testing can be used to demonstrate that the material is other than a mass explosion hazard.

The typical manufacturing operation may have materials that range in hazard from Division 1.1, 1.3 or 1.5. End products that are manufactured may also include Division 1.2, 1.6 and/or 1.4 articles or materials. The quantities of materials in each of the hazard classes may vary depending on the process.

Classification for “in-process” hazard classification is based on the use of test methodologies that are well accepted by those in the industry and those involved in the assessment of the hazards of these materials using DOT/UN criteria. Although the intent of the DOT protocol has been to determine the hazards from a shipping perspective, the same classifications are used by the DOD to establish safety criteria that affect operating buildings. The term “in-process” has been used to differentiate the hazards that are not in a shipping configuration from those that are packaged as finished goods.

The test protocol provided for inclusion in Annex A was developed by Safety Management Services, Inc., (SMS) under contract with TRW’s Occupant Safety Systems, Inc. (TRW), released to the public, and first published as a reference standard to the Uniform Fire Code with a set of local amendments made by the City of Mesa, Arizona in 1999. The protocol has been subjected to peer review by a number of entities, including those that were being regulated by this jurisdiction including Talley Defense Systems, SDI, TRW, Boeing, and others. The technical work has been improved as it has evolved, and it is now referenced in Annex A. Providing a standardized approach to hazard classification for materials employed in “in-process” operations promotes uniformity in approach in the use of the code by code officials, building owners and designers alike. Building siting is based on the use of the appropriate quantity-distance tables (Q-D), which is established either by testing or by assuming a worst case classification of the material as a mass explosion hazard.

The following table has been prepared to provide the reader with a cross-reference material to expedite the understanding of the basis for the proposed changes.

See tables on pages 41-45.

Committee Meeting Action: Accept in Part

Changes to Annex E

E.2.5 Informational References add the following:

Add a new section E.2.6 as follows:
E.2.6 United Nations.

“Recommendations of the Transport of Dangerous Goods, Model Regulations.”
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<td>See UFC Appendix VI-F Section 1.</td>
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<td>X.2.3</td>
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<td>In pertinent part up to 300,000 pounds.</td>
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<td>X.2.3.1</td>
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<td>Footnote c establishes a minimum distance imposed. This distance allows one to drop the distances otherwise required by NFPA 5000 in Section 34.3.3.3 (in need of revision as well).</td>
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<td>X.3.1</td>
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<td>Last sentence from IBC Section 415.3.1. The provision is necessary for buildings that are operating at minimum distances under the control of the Q-D tables.</td>
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<td>Title only</td>
<td>Footnote d correlates with IFC.</td>
</tr>
<tr>
<td>X.3.4</td>
<td>Title only</td>
<td>Footnote e correlates with IFC.</td>
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Table X.3.3(a) DOD 4145.26-M Table C6.12

Table X.3.3(b) DOD 4145.26-M Table C6.111

Table X.3.3(c) DOD 4145.26-M Table C6.112

X.3.4 UFC:7702.3.10

UFC establishes limit of 50 pounds for high explosives in magazines allowed to be stored indoors thereby setting up the case. It is common for magazines to be used in conjunction with manufacturing operations where the magazine holds operational quantities of materials or material that is staged for production. The quantities in these in-process magazines is limited by the following sections.
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<td>X.3.4.1</td>
<td>UFC:7702.3.10</td>
<td>If up to 50 pounds can be located in an indoor magazine, it is reasonable to assume that the same 50 pounds can be stored in a magazine within the Q-D circle in close proximity to the operating building.</td>
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<tr>
<td>X.3.4.3</td>
<td>New</td>
<td>Magazines with quantities greater than 50 pounds are required to be moved to magazine distances.</td>
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<tr>
<td>X.3.4.4</td>
<td>New</td>
<td>Accounts for a combination of indoor and outdoor magazines located within the Q-D circle.</td>
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<td>X.4</td>
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<td>Reference to the building code.</td>
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<td>DOD 4145.26-MDL1.1.91</td>
<td>Several new definitions have been added to Chapter 3 to correlate the terminology used by those engaged in the storage and manufacture of explosive materials as well as with the regulators of these materials including the Department of Defense (DOD). The terms that have been added are consistent with terminology used by the DOD and the Institute of Makers of Explosives (IME), albeit there are subtle differences with respect to DOD to account for application to commercial operations.</td>
</tr>
</tbody>
</table>

The term "Quantity-Distance (Q-D)" is the relationship between a quantity of explosive material and the minimum separation distances required. The use of "Quantity-Distance" (Q-D) relationships to establish building siting is a fundamental used in the planning and occupancy of buildings used to contain explosive materials. Section 4.1.5 authorizes the code official to limit the quantity of explosives at any given location. The limitations on quantity are typically derived based on the location where the explosives are to be located. The distances required vary depending on the sensitivity of the receptor. Distances are generally greater where the public or those not engaged in the manufacturing process are involved.

The sub-elements of the definition include terms that typically appear (or should appear) on building and site plans that are used to confirm that the siting for the structure used to contain the explosive material (building or magazine) is properly located. Acronyms, e.g., IBD, ILD, IMD, etc. are typically used to describe the distance used to separate the explosives from receptors such as inhabited buildings, public traffic or transportation routes (highways), other storage (magazines) and the like. Definitions have been provided and correlated with tables to be used for distance determination. The use of the acronyms and their attendant definitions will aid the regulatory and design community alike by bringing a consistent set of terminologies to the code.

Notwithstanding the tabular distance established by the Q-D tables integral to the explosives industry there are occasions where ancillary buildings are needed to be constructed that do not contain explosive materials per se, where the ancillary building will encroach on the building containing explosive materials. D is a fire separation distance, and not unlike that used by the building code to determine the location of "detached buildings." As the buildings regulated by the Q-D tables are required to be detached a minimum fire separation distance is established. This distance is noted in the proposed tables X.3.3(a) through X.3.3(c) with 50 feet established as the minimum for buildings containing materials with mass fire and fire hazards, and 60 feet established as the minimum for buildings containing materials with mass explosion hazards. From a practical standpoint the D distances will apply only to facilities where the explosive quantities are near the minimums as the distances are increased rapidly with increases in material content.

### Definitions

<table>
<thead>
<tr>
<th>Definition</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached Building</td>
<td>DOD 4145.26-MDL1.1.3E</td>
</tr>
<tr>
<td>Inhabited Building</td>
<td>DOD 4145.26-MDL1.1.3E</td>
</tr>
<tr>
<td>Intramagazine distance</td>
<td>Currently approved for publication in the 2004 IFC</td>
</tr>
<tr>
<td>Public traffic route</td>
<td>DOD 4145.26-MDL1.1.58</td>
</tr>
<tr>
<td>Day box</td>
<td>Currently approved for publication in the 2004 IFC</td>
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</tbody>
</table>

The term "Quantity-Distance (Q-D)" is the relationship between a quantity of explosive material and the minimum separation distances required.
## Changes to Chapter 4

<table>
<thead>
<tr>
<th>Section</th>
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<tbody>
<tr>
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## Changes to Annex A

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<tr>
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<tr>
<td>A.X.3.1.1</td>
<td>IFC Appendix E.102.1.1</td>
<td>In pertinent part.</td>
</tr>
<tr>
<td>A.3.3.19</td>
<td>NFPA 5000:A.3.3.340.4 paragraph 2 and following items 1 through 6.</td>
<td>Flow chart from paper by Thaddeus C. Speed referenced for inclusion in Annex E.</td>
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<tr>
<td>A.3.3.19.1</td>
<td>IME:1.3</td>
<td>Note: Annex information is lacking in NFPA 5000</td>
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<td>A.3.3.19.2</td>
<td>NFPA 5000:A.3.3.340.4.2</td>
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## Changes to Annex E

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<thead>
<tr>
<th>Section</th>
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<th>Comments</th>
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<tbody>
<tr>
<td>References added to substantiate information included in proposed new chapter</td>
<td>As noted</td>
<td></td>
</tr>
</tbody>
</table>
Report on Proposals — Copyright, NFPA


Committee Statement: The reference to the report by Thaddeus Speed is not included in Annex A, so a reference to it in the document is not required.

Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:
DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).

495-56 Log# CP41 EXP-AAA Final Action: Accept
(Annex E)

Submitter : Technical Committee on Explosives
Recommendation: Update the references in Annex E as shown:
E.1.2.2 IME Publication. Institute of Makers of Explosives, 1120 Nineteenth St., NW, Suite 310, Washington, DC 20036-3605.
E.2.2 IME Publications. Institute of Makers of Explosives, 1120 Nineteenth St., NW, Suite 310, Washington, DC 20036-3605.
38) — E.2.5 Informational References.
Substantiation: The changes were editorial to indicate the current editions of the references in Annex E.

Committee Meeting Action: Accept
Number Eligible to Vote: 18
Ballot Results: Affirmative: 14 Negative: 1
Ballot Not Returned: 3 CONKLING, FRY, HAY

Explanation of Negative:
DICKINSON: See my Explanation of Negative on 495-1 (Log #CP1).
Chapter 1 Administration

1.1 Scope. This code shall apply to the manufacture, transportation, storage, sale, and use of explosive materials.

1.2 Purpose. This code is intended to provide reasonable safety in the manufacture, storage, transportation, and use of explosive materials.

1.3 Application.

1.3.1 This code shall not apply to the transportation of explosive materials where under the jurisdiction of the U.S. Department of Transportation (DOT). It shall apply, however, to state and municipal supervision of compliance with “Hazardous Materials Regulations,” U.S. DOT 49 CFR 100–199.

1.3.2 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.

1.3.3 This code shall not apply to the manufacture of explosive materials under the jurisdiction of the U.S. Department of Defense. This code also shall 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.

1.3.4 This code shall not apply to pyrotechnics such as flares, fuses, and railway torpedoes. It also shall not apply to fireworks and pyrotechnic special effects as defined in NFPA 1123, Code for Fireworks Display; NFPA 1124, Code for the Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnic Articles; and NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience.

1.3.5 This code shall not apply to model and high power rocketry as defined in NFPA 1122, Code for Model Rocketry; NFPA 1125, Code for the Manufacture of Model Rocket and High Power Rocket Motors; and NFPA 1127, Code for High Power Rocketry.

1.3.6 This code shall not apply to the use of explosive materials in medicines and medicinal agents in the forms prescribed by the United States Pharmacopoeia or the National Formulary.

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

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

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

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

1.5 Equivalency. Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this code.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

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

Chapter 2 Referenced Publications

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

2.1.1 NFPA Publications. National Fire Protection Association, 1 Battery March Park, Quincy, MA 02169-7471.


2.1.2 Other Publications.

2.1.2.1 Fertilizer Institute Publication. The Fertilizer Institute, Union Center Plaza, 820 First Street, NE, Suite 430, Washington, DC 20002.

Definition and Test Procedures for Ammonium Nitrate Fertilizer, November 1964.

2.1.2.2 IME Publication. Institute of Makers of Explosives, 1120 19th St., NW, Suite 310, Washington, DC 20036–3605.


Title 18, United States Code, Chapter 40, “Importation, Manufacture, Distribution and Storage of Explosive Materials.”


Title 18, United States Code, Chapter 44, “Gun Control Act of 1968.”


Chapter 3 Definitions

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

3.2 NFPA Official Definitions.

3.2.1 Approved. Acceptable to the authority having jurisdiction.

3.2.2 Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

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

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

3.3.2 Ammonium Nitrate. A chemical compound represented by the formula \( \text{NH}_4\text{NO}_3 \).

3.3.3 ANFO (Ammonium Nitrate Fuel Oil Mixture). A blasting agent (Explosive 1.5D) that contains no essential ingredients other than prilled ammonium nitrate and fuel oil.

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

3.3.5 Blast Site. The area where explosive material is handled during loading of the blasthole, including 15.2 m (50 ft) in all directions from the perimeter formed by loaded holes.

3.3.6 Blaster. A person qualified to assist in the loading and firing of a blast.

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

3.3.8 Blasting Agent. A material or mixture intended for blasting that meets the requirements of the DOT “Hazardous Materials Regulations,” as set forth in Title 49, Code of Federal Regulations, Parts 173.56, 173.57, and 173.58, Explosive 1.5D.

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

3.3.10 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.

3.3.11 Bullet-Resistant Construction. Refers to magazine walls or doors, constructed to resist penetration of a bullet of 150-grain M2 ball ammunition having a nominal muzzle velocity of 824 mps (2700 fps) when fired from a 0.30-caliber rifle from a distance of 30.5 m (100 ft) perpendicular to the wall or door.

3.3.12 Composite Propellant. A mixture consisting of an elastomer-type fuel and an oxidizer used in gas generators and rocket motors.

3.3.13 Day Box. A Type 3 magazine.

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

3.3.15 Detonator. Any device containing an initiating or primary explosive that is used for initiating detonation.

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

3.3.17 Electronic Detonator. A detonator that utilizes stored electrical energy as a means of powering an electronic timing delay element/module and that provides initiation energy for firing the base charge.

3.3.18 Explosive. Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion.

3.3.19 Binary Explosive. A blasting explosive formed by mixing or combining two precursor chemicals, for example ammonium nitrate and nitromethane.

3.3.20 Emulsion Explosive. An explosive material containing substantial amounts of oxidizer dissolved in water droplets surrounded by an immiscible fuel or droplets of an immiscible fuel surrounded by water containing substantial amounts of oxidizer.

3.3.21 Primary Explosive. A sensitive explosive such as lead azide, which detonates by simple ignition from such means as spark, flame, impact, friction, or other primary heat sources of appropriate magnitude.

3.3.22 Two-Component Explosive. See 3.3.18, Binary Explosive.

3.3.23 Explosive-Actuated Device. Any tool or special mechanized device that is actuated by explosive materials.

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

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

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

3.3.27 Reserved.

3.3.28 Reserved.

3.3.29 Inhabited Building. Any building or structure regularly used in whole or part as a place of human habitation.

3.3.30 Reserved. [ROP 495-8]

3.3.31 Reserved. [ROP 495-8]

3.3.32 Reserved. [ROP 495-8]

3.3.33 Magazine. A building or structure, other than an explosives manufacturing building, approved for the storage of explosive materials. [1124, 2003]

3.3.34 Manufacturing. Mixing, blending, extruding, assembling articles outside the blast site, disassembling, chemical synthesis, and other functions involved in making a product or device that is intended to explode.

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

3.3.36 Reserved.

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

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

3.3.39 Reserved. [ROP 495-8]

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

3.3.41 Nonsparking Metal. A metal that resists producing a spark when impacted with tools, rock, or hard surfaces.

3.3.42 Reserved. [ROP 495-8]

3.3.43 Reserved. [ROP 495-8]

3.3.44 Reserved. [ROP 495-8]

3.3.45 Oxidizing Material. Any solid or liquid that readily yields oxygen or other oxidizing gas or that readily reacts to oxidize combustible material.
3.3.46 Person. An individual, a firm, a copartnership, a corporation, a company, an association, or a joint-stock association, including any trustee, receiver, assignee, or personal representative thereof. [5000, 2003]

3.3.47 Reserved.

3.3.48 Plywood. Exterior grade plywood.

3.3.49 Precursor Chemicals. Two or more unmixed, commercially manufactured prepackaged chemical ingredients (including oxidizers, flammable liquids or solids, or similar ingredients) that are not classified as explosives but that, where mixed or combined, form a blasting explosive.

3.3.50 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.

3.3.51* Propellant. An explosive that normally functions by deflagration and is used for propulsion purposes.

3.3.52* 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.

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

3.3.54* Public Highway. Any road, street, or way, whether on public or private property, open to public travel.

3.3.55 Reserved.

3.3.56 Reserved.

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

3.3.58* Semiconductive Hose. Any hose with an electrical resistance sufficient to limit the flow of stray electric currents to safe levels, yet not high enough to prevent the relaxation of static electric charges to ground.

3.3.59 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.

3.3.60* Shock Tube. A small diameter plastic tube used for initiating detonators.

3.3.61 Slurry. An explosive material containing substantial portions of a liquid, oxidizers and fuel, plus a thickener.

3.3.62* Small Arms Ammunition. Any shotgun, rifle, or pistol cartridge and any cartridge for propellant-actuated devices.

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

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

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

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

3.3.67* Steel. General purpose, hot- or cold-rolled, low carbon steel.

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

3.3.69* Water Gel. An explosive material that contains substantial portions of water, oxidizers, and fuel, plus a crosslinking agent.

3.3.70 Weather Resistant. Construction designed to offer protection against weather.

Chapter 4 Security and Safety of Explosive Materials

4.1 Basic Requirements.

4.1.1 Response to Fires.

4.1.1.1 No attempt shall be made to fight a fire that cannot be contained or controlled before it reaches explosive materials.

4.1.1.2 In such cases, all personnel shall be evacuated immediately to a safe location, and the area shall be guarded from entry by spectators or intruders.

4.1.2 Fire Department Notification.

4.1.2.1 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. 4.1.2.2 Such notification shall be made verbally before the end of the day on which storage of the explosive materials commenced and in writing within 48 hours from the time such storage commenced.

4.1.3 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.

4.1.3.1 The requirement in 4.1.3 shall not apply to hand loading of small arms ammunition prepared for personal use and not for resale.

4.1.4 The manufacture of explosive materials shall be prohibited where such manufacture presents an undue hazard to life or property.

4.1.4.1 Prior to manufacturing or testing of explosives, ammunition, or blasting agents, the authority having jurisdiction shall be furnished with the following information:

1. The exact location of the place of manufacture or testing

2. The type and net explosive weight of explosives ammunition, blasting agents to be manufactured or tested, and the in-process classification of the materials to be used

3. A plot plan of the operating premises with the operating buildings indicated in which greater than (0.45 kg) 1 lb of explosives is to be manufactured, used, tested or stored.

4. The plot plan dimensioned so as to accurately portray the size of each operating building and its location relative to barricades, storage magazines, property lines, inhabited buildings, and public transportation routes.

5. Information from hazard assessments as required by process safety management (PSM)

4.1.5 The authority having jurisdiction shall be permitted to restrict the quantity of explosive materials that is handled at any location.

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

4.1.6.1 The requirement in 4.1.6 shall 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.”

4.1.7 A person intending to engage in business as an importer, manufacturer, dealer, or user of explosive materials shall obtain a federal license in accordance with Title 18, United States Code, Chapter 40, “Organized Crime Control Act of 1970.”

4.1.8 The requirements contained in Chapter 4 are intended to supplement existing federal laws and regulations, therefore, any person who possesses a license or permit under Title 18, United States Code, Chapter 40, that property covers the activities of such person shall not be required to obtain a permit under this chapter.

4.1.9 Warning Signs.

4.1.9.1 All normal access roads to explosive storage magazines shall be posted with the following warning sign:

DANGER
NEVER FIGHT EXPLOSIVE FIRES
EXPLOSIVES ARE STORED ON THIS SITE
CALL

4.1.9.2 The sign shall be weather-resistant with a reflective surface and lettering at least 50 mm (2 in.) high.

4.1.10 Transportation Placards.

4.1.10.1 Placards required by the Department of Transportation regulations in 49 CFR 172, Subpart F, for the transportation of blasting agents (Division 1.5 materials) shall be displayed on all Type 5 magazines that contain blasting agents (Division 1.5 materials).

4.1.10.2 Emptied Type 5 magazines (including over-the-road trailers) that have previously contained packaged blasting agents (Division 1.5 materials) shall not be required to display placards.

4.2 Permit Requirements.

4.2.1 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 correct permit.

4.2.2 Explosive materials shall not be sold, given, delivered, or transferred to any person not possessing a valid permit.
4.3 Permit Classes.

4.3.1 Permit to Use. Before a person conducts an operation or activity that uses explosive materials, that person shall obtain a permit to use, which provides authorization to purchase, possess, store, and use such materials.

4.3.2 Permit to Blast. Before a person supervises and performs the loading and firing of explosive materials, that person shall obtain the appropriate permit to blast, as specified in Table 4.3.2.

### Table 4.3.2 Classifications for Permit to Blast

<table>
<thead>
<tr>
<th>Class</th>
<th>Category</th>
<th>All phases of blasting in agricul</th>
<th>Special blasting as described on</th>
<th>Seismic</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>General aboveground</td>
<td>All phases of blasting operations in quarries, open pit mines, and aboveground construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>General underground</td>
<td>All phases of blasting operations in underground mines, shafts, tunnels, and drifts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Demolition</td>
<td>All phases of blasting in demoli</td>
<td>projects</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Seismic</td>
<td>All phases of blasting in seismic prospecting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Agriculture</td>
<td>All phases of blasting in agriculture, but limited to not more than 22.7 kg (50 lb) per blast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Special</td>
<td>Special blasting as described on the permit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.4 Requirements for Blaster’s Permit.

4.4.1 The applicant for an initial permit to supervise and perform the loading and firing of explosive materials, as specified in 4.3.2, shall demonstrate training and experience in the use of explosive materials in the class authorized by the specific permit for which application is made.

4.4.2 Each applicant shall pass a qualifying examination that shall be administered in written or oral format, 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.

4.4.3 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.

4.4.4 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.

4.4.5 Any person whose permit to blast has lapsed for a period of 1 year or longer shall be required to pass a qualifying examination as a condition of renewal of the permit.

4.5 Posting of Permits.

4.5.1 Permit to Use. A copy of the permit shall be posted at each place of operation.

4.5.2 Permit to Blast. A copy of the permit shall be carried by the permit holder during blasting operations.

4.6 Permit Restrictions.

4.6.1 No permit shall be permitted to be assigned or transferred.

4.6.2 No permit shall be issued to a person under 21 years old.

4.8.1 Records.

4.8.1.1 A holder of a permit to use shall keep a record of all transactions or operations involving explosive materials.

4.8.2 An accumulation of invoices, sales slips, delivery tickets or receipts, or similar records representing individual transactions shall be considered to satisfy the requirements for record keeping, provided they include the signature of the receiver of the explosive materials.

4.8.3 Daily Records.

4.8.3.1 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.

4.8.3.2 Such records shall be retained for 5 years and shall be made available to the issuing authority upon request.

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

4.8.5* 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.

4.8.6 Accidents involving explosive material that cause a lost-time injury or property damage shall be reported immediately to the authority having jurisdiction.
6.2 Fixed Location Mixing.

6.2.1 Buildings or other facilities used for mixing blasting agents shall be located, in relation to inhabited buildings, passenger railroads, and public highways, in accordance with the American Table of Distances. (See Table 9.4.1.)

6.2.2 Distance Separating Inhabited Buildings.

6.2.2.1 In determining the distance separating inhabited buildings, passenger railroads, or public highways from potential explosions, the sum of all masses that could propagate (i.e., are closer than the distances specified in Table 9.4.2) from either individual or combined donor masses shall be included.

6.2.2.2 However, where ammonium nitrate is included, only 50 percent of its weight shall be used due to its reduced blast effect.

6.2.3 Buildings used for the mixing of blasting agents shall comply with the requirements of 6.2.3.1 through 6.2.3.6, unless otherwise specifically approved by the authority having jurisdiction.

6.2.3.1 Buildings shall be constructed of noncombustible materials or of sheet metal on wood studs.

6.2.3.2 Floors.

6.2.3.2.1 Floors shall be of concrete or other noncombustible material.

6.2.3.2.2 They shall be constructed without open floor drains and without piping into which molten materials could flow and become confined in the event of fire.

6.2.3.3 All fuel oil storage facilities shall be separated from the mixing building and located so that the oil drains away from the mixing plant building if the tank ruptures.

6.2.3.4 The mixing building shall be well ventilated.

6.2.3.5 Heat.

6.2.3.5.1 Heating units that do not depend on the combustion of fuel shall be permitted to be used within the mixing building where correctly designed and located.

6.2.3.5.2 All direct sources of heat shall be provided exclusively from units located outside of the mixing building.

6.2.3.6 Internal Combustion Engines.

6.2.3.6.1 Internal combustion engines used to generate electrical power shall be located outside of the mixing building or shall be ventilated and isolated by a fire barrier wall having a fire resistance rating of not less than 1 hour.

6.2.3.6.2 The engine exhaust system shall be located so that any spark emission cannot endanger any materials in or adjacent to the mixing building.

6.2.4 Equipment used for mixing blasting agents shall comply with the requirements of 6.2.4.1 through 6.2.4.3.

6.2.4.1 Mixing Equipment Design.

6.2.4.1.1 The design of the mixer shall minimize the possibility of frictional heating, compaction, and confinement.

6.2.4.1.2 All bearings and drive assemblies shall be mounted outside the mixer and protected against the accumulation of dust.

6.2.4.1.3 All surfaces shall be accessible for cleaning.

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

6.2.4.3 Flow of Fuel.

6.2.4.3.1 Means shall be provided to prevent the flow of fuel oil to the mixer in case of fire.

6.2.4.3.2 In gravity flow systems, an automatic spring-loaded shutoff valve with a fusible link shall be installed.

6.2.5 The requirements of 6.2.5.1 through 6.2.5.6 shall apply where mixing and handling blasting agent compositions.

6.2.5.1 Oxidizers of small particle size, such as crushed ammonium nitrate prills or fines, shall be handled with special care, due to the possibility of their greater sensitivity.

6.2.5.2 Flash Points.

6.2.5.2.1 No hydrocarbon liquid fuel with a flash point lower than that of No. 2 fuel oil [i.e., 51.7°C (125°F) minimum or legal minimum] shall be used.

6.2.5.2.2 Fuel oils with flash points no lower than 37.8°C (100°F) shall be permitted to be used at ambient air temperatures below 7.2°C (45°F).

6.2.5.3 Reclaimed crankcase oil shall be permitted to be used, provided each new supply of oil is checked for its compliance with 6.2.5.2.

6.2.5.4 Material Handling.

6.2.5.4.1 Metal powders, such as aluminum, shall be kept dry and shall be stored in containers or bins that are moisture-resistant and weathertight.

6.2.5.4.2 Solid fuels shall be handled so that dust explosion hazards are minimized.

6.2.5.5 Peroxides or chlorates shall not be used.

6.2.5.6 The requirements of 6.2.5.3, 6.2.5.4, and 6.2.5.5 shall not apply to compositions that have been tested, classified, and approved by the Associate Administrator for Hazardous Materials Safety in accordance with the provisions of 49 CFR.

6.2.6 All electrical switches, controls, motors, and lights located in the mixing room shall comply with NFPA 70, National Electrical Code, Article 502, except for electrical wiring and equipment located outside the mixing building.

6.2.7 The frame of the mixer and all other equipment that is used shall be electrically bonded and grounded.

6.2.8 Safety precautions at mixing plants shall include the following requirements:

1. Floors shall have no drains or piping into which molten materials could flow and become confined during a fire.

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

3. The entire building shall be cleaned thoroughly on a regular basis to prevent the excessive accumulation of dust.

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

5. Firearms shall be permitted to be carried by authorized guards where approved by the authority having jurisdiction.

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

7. Empty ammonium nitrate bags shall be disposed of daily in a safe manner.

8. No welding or open flames shall be permitted in or around the mixing or storage area, except where the equipment and the area have been completely washed down and all oxidizing material has been removed.
6.3 Bulk Mixing and Delivery Vehicles.

6.3.1 Application.

6.3.1.1 The provisions of Section 6.3 shall apply to all bulk mixing and delivery vehicles.

6.3.1.2 The requirements of 6.2.5 also shall apply to bulk delivery and mixing vehicles.

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

1. The body shall be constructed of noncombustible materials.
2. Vehicles used to transport bulk, premixed blasting agents shall have covered bodies.
3. All moving parts of the mixing system shall be designed so that heat buildup is prevented.
4. Shafts or axles that make contact with the product shall have outboard bearings with a minimum 25.4 mm (1 in.) clearance between the bearings and the outside of the product container.
5. Attention shall be given to clearance on all moving parts.
6. The bulk delivery vehicle shall be strong enough to carry the load without difficulty and shall be in good mechanical condition.

6.3.3 Operation of bulk delivery vehicles shall comply with the following requirements:

1. Vehicles transporting blasting agents shall be driven by and shall be in the charge of only those drivers who are at least 21 years old, who are capable, careful, and reliable, and who possess a valid motor vehicle operator’s license.
2. Drivers shall be familiar with all traffic regulations, applicable federal and state regulations pertaining to explosive materials, and the requirements of this code.
3. The vehicle operator shall be trained in the safe operation of the vehicle and shall be knowledgeable of its mixing, conveying, and related equipment.
4. The operator shall be familiar with the commodities being delivered and the general procedures for handling emergencies.
5. 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.
6. Vehicles transporting blasting agents shall be in safe operating condition at all times.
7. No person shall smoke, carry matches or any flame-producing device, or carry any firearms while in or around bulk vehicles affecting the mixing, transfer, or down-the-hole loading of blasting agents at or near the blasting site.
8. Caution shall be exercised in moving the vehicle within the blasting area to avoid driving the vehicle over or dragging hoses over firing lines, cap wires, or explosive materials.
9. The driver shall obtain the assistance of a second person to guide the driver’s movements while moving the vehicle.
10. Material shall not be mixed while in transit.

6.3.4 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:

1. A positive grounding device shall be used to prevent the accumulation of static electricity.
2. A semiconductive discharge hose shall be used.
3. A qualified person shall evaluate all systems to determine that they dissipate static electricity under potential field conditions.

6.3.5 Repairs to bulk delivery vehicles shall comply with the following requirements:

1. 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 washed down completely.
2. 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 13 mm (0.51 in.) diameter opening.

6.4 Bulk Storage Bins.

6.4.1 The bin shall be a Type 5 magazine and shall be waterproof.

6.4.2 The bin, including supports, shall be constructed of compatible materials and shall be 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.

6.4.3 Discharge Gate.

6.4.3.1 The bin discharge gate shall be designed to provide a closure tight enough to prevent leakage of the stored product.

6.4.3.2 Provision also shall be made for locking the discharge gate.

6.4.4 Bin-loading manways or access hatches shall be hinged or otherwise attached to the bin and shall be designed to allow locking.

6.4.5 Conveyors.

6.4.5.1 Any electrically driven conveyors for loading or unloading bins shall comply with the requirements of NFPA 70, National Electrical Code.

6.4.5.2 They shall be designed to minimize damage from corrosion.

6.4.6 Bins containing blasting agents shall be located in accordance with Table 9.4.1 with respect to inhabited buildings, passenger railroads, and public highways.

6.4.7 Bins containing blasting agents shall be located in accordance with Table 9.4.1 and Table 9.4.2 with respect to the storage of other blasting agents or explosives.

6.4.8 Bins containing ammonium nitrate shall be separated from the storage of blasting agents and explosives in accordance with Table 9.4.2.

6.4.9 Good housekeeping shall be maintained in the vicinity of any bin containing ammonium nitrate or other blasting agent.

6.4.9.1 This housekeeping shall include keeping weeds and other combustible materials cleared within 7.63 m (25 ft) of the bin.

6.4.9.2 Accumulations of spilled product shall be prevented.

6.5 Storage of Blasting Agents and Supplies.

6.5.1 Blasting agents and oxidizers used for the mixing of blasting agents shall be stored in accordance with the following requirements:

1. Blasting agents or ammonium nitrate stored with other explosive materials shall be stored in accordance with the requirements of Section 6.5.
2. The total mass of the blasting agents and one-half of the mass of ammonium nitrate shall be included where computing the total quantity of explosive materials for determining separation distance requirements.
3. Blasting agents stored entirely separate from other explosive materials shall be stored in a Type 5 magazine or a magazine of higher classification (i.e., lower number).
4. Magazines in which blasting agents are stored shall be constructed so that there are no open floor drains or piping into which molten materials can flow and become confined in the event of fire.
5. Semitrailer and trailer vans used for highway or on-site transportation of blasting agents shall be permitted to be used for temporary storage of these materials, provided they are located in accordance with Table 9.4.1 with respect to inhabited buildings, passenger railroads, and public highways, and in accordance with Table 9.4.2 with respect to each other.
6. Trailers and semitrailers shall be provided with substantial means for locking, and the doors shall be kept locked.
7. Where stocks of blasting agents are actually being placed or removed, the doors of trailers and semitrailers shall not be required to be locked.

6.5.2 Piles of ammonium nitrate and warehouses containing ammonium nitrate shall be separated from readily combustible fuels.
6.5.3 Caked oxidizer, either in bags or in bulk, shall not be loosened by blasting.

6.5.4 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.

6.6 Transportation of Packaged Blasting Agents.

6.6.1 Where blasting agents are transported in the same vehicle with other explosive materials, all the requirements of Chapter 8 shall be met.

6.6.2 Vehicles Transporting Blasting Agents.

6.6.2.1 Vehicles transporting blasting agents shall be driven by and shall be in the charge of only those drivers who are at least 21 years old, who are capable, careful, and reliable, and who possess a valid motor vehicle operator’s license.

6.6.2.2 The driver shall be familiar with state vehicle and traffic laws.

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

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

6.6.5 No person shall transport or carry any blasting agents on any public vehicle carrying passengers for hire.

6.6.6 Vehicles transporting blasting agents shall be in safe operating condition at all times.

6.6.7 Where 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.

6.6.8 Vehicles used for transporting blasting agents on public highways shall be placarded in accordance with U.S. Department of Transportation regulations.

6.7 Use of Blasting Agents. Persons using blasting agents shall comply with all applicable requirements of Chapters 4 and 10.

Chapter 7 Water Gel, Slurry, and Emulsion Explosive Materials

7.1 Scope. Water gels, slurries and emulsions classified as Division 1.1D or Division 1.5D explosives in accordance with U.S. Department of Transportation regulations shall be manufactured, transported, stored, and used as specified by this code, except where otherwise specified in this chapter.

7.2 Fixed Location Mixing.

7.2.1 Buildings or other facilities used for mixing water gels, slurries, or emulsions shall be located in accordance with Table 9.4.1 with respect to inhabited buildings, passenger railroads, and public highways.

7.2.1.1 In determining the distances separating highways, railroads, and inhabited buildings from potential explosions, as specified in Table 9.4.1, the sum of all masses that can propagate (i.e., that lie at distances less than those specified by Table 9.4.2) from either individual or combined donor masses shall be included.

7.2.1.2 However, where ammonium nitrate is required to be included, only one-half of its mass shall be used because of its reduced blast effects.

7.2.2 Buildings used for the mixing of water gels, slurries, or emulsions shall comply with the following requirements, except where otherwise specifically approved by the authority having jurisdiction:

1. Buildings shall be constructed of noncombustible materials or of sheet metal on wood studs.

2. Floors shall be of concrete or other noncombustible material.

3. Floors shall be constructed without open floor drains and without piping into which molten materials could flow and become confined in the event of fire.

4. 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.

5. The mixing building shall be well ventilated.

6. Heating units that do not depend on the combustion of fuel shall be permitted to be used in the mixing building, where correctly designed and located.

7. Direct-fired heating units shall be located outside of the mixing building.

8. 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 ventilated.

9. The engine exhaust system shall be located so that any sparks emission cannot endanger any materials in or adjacent to the mixing building.

7.2.3 The ingredients used in water gels, slurries, or emulsions shall comply with the following requirements:

1. Ingredients classified as explosives shall be stored as required by Chapter 9.

2. Nitrate-water solutions shall be stored in tank cars, tank trucks, or fixed tanks without quantity-distance limitations.

3. Spills or leaks that could contaminate combustible materials shall be cleaned immediately.

4. Metal powders, such as aluminum, shall be kept dry and shall be stored in containers or bins that are moisture resistant or weathertight.

5. Ingredients shall not be stored with incompatible materials.

6. Peroxides or chlorates shall not be used.

7.2.4 Mixing equipment shall meet the following requirements:

1. The design of the processing equipment, including mixing and conveying equipment, shall be compatible with the materials being handled.

2. The equipment shall be designed to minimize frictional heating, compaction, overloading, and confinement.

3. Equipment and handling procedures shall be designed to prevent the introduction of foreign objects or material.

4. Mixers, pumps, valves, and related equipment shall be designed to allow regular and periodic flushing, cleaning, dismantling, and inspection.

5. All electrical equipment and wiring shall comply with NFPA 70, National Electrical Code.

6. Electric motors and generators shall be provided with overload protection devices.

7. All motors, generators, proportioning devices, and all other electrical enclosures shall be bonded.

8. The grounding conductor to all such equipment shall be effectively bonded to the service-entrance ground connection and to all equipment ground connections in order to provide a continuous path to ground.

7.2.5 Mixing facilities shall meet the following requirements:

1. The mixing, loading, and ingredient transfer areas where residues and spilled materials can accumulate shall be kept safe.

2. A cleaning and collection system shall be provided for dangerous residues.

3. A visual inspection of the mixing, conveying, and electrical equipment shall be made daily to ensure that all equipment is in good operating condition.

4. A program of systematic maintenance shall be carried out on a regular schedule.

5. Heating units that do not depend on the combustion of fuel shall be permitted to be used within the confines of the processing building or area, provided they are equipped with temperature and safety controls and provided they are located away from combustible materials and finished product.

7.3 Bulk Mixing and Delivery Vehicles.

7.3.1 Vehicle design shall meet the following requirements:

1. Vehicles used for bulk transportation of water gels shall meet the requirements of Chapter 8 and Section 6.6.

2. Where electrical 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.

3. Processing equipment shall comply with 7.2.3 and 7.2.4.
8.1.7.1 Explosive materials shall not be transferred from one vehicle to another without informing the local authority having jurisdiction.

8.1.7.2 In the event of breakdown or collision, the local authority having jurisdiction shall be notified promptly to help safeguard such emergencies.

8.1.7.3 Explosive materials shall be transferred from the disabled vehicle to another only where qualified supervision is provided.

8.1.8 Detonators shall not be transported in the same vehicle with other Class 1 materials (Class A or Class B explosives), except as permitted by the U.S. Department of Transportation in 49 CFR 177.835(g).

8.2 Transportation Vehicles.

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

8.2.2 Where 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.

8.2.3 Vehicles used for transporting frictional spark-sensitive explosive materials such as black powder and primary explosives shall have no exposed spark-producing surface inside of the cargo body.

8.2.4 The floors of transportation vehicles shall be tight.

8.2.5 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.

8.2.6 Each motor vehicle used for transporting explosive materials shall be equipped with at least two fire extinguishers, each with a rating of at least 4-A: 40-B:C.

8.2.6.1 Only listed fire extinguishers shall be used.

8.2.6.2 Fire extinguishers shall be designed, constructed, and maintained to allow a visual determination that extinguishers are fully charged.

8.2.6.3 Extinguishers shall be located where they are accessible for immediate use.

8.2.6.4 Extinguishers shall be examined and recharged periodically according to manufacturers’ recommendations.

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

8.2.7 Transporting Explosive Materials.

8.2.7.1 A motor vehicle used for transporting explosive materials shall be inspected to determine that it is in proper condition.

8.2.7.2 The following items shall be verified:

(1) The fire extinguisher is filled and in working order.

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

(3) The chassis, motor, oil pan, and body undersides are reasonably clean and free of excess oil and grease.

(4) The fuel tank and fuel lines are secure and free of leaks.

(5) The brakes, lights, horn, windshield wipers, and steering apparatus are functioning.

(6) The tires are inflated to the correct pressure and free of defects.

(7) The vehicle is in the proper condition in every other respect and is acceptable for handling explosive materials.

8.2.8 Tire Maintenance.

8.2.8.1 Flat or overheated tires shall be removed from the vehicle immediately.

8.2.8.2 After removal, the tire shall be placed far enough from the vehicle so that a spontaneous ignition of the tire does not endanger the vehicle or its cargo.

8.2.8.3 The tire shall be cooled below the danger of ignition, and the problem shall be corrected before it is replaced on the vehicle.

8.3 Operation of Transportation Vehicles.

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

8.3.2.1 The driver of a vehicle transporting explosive materials on public highways shall be not less than 21 years old.

8.3.2.2 The driver shall be familiar with traffic regulations, applicable federal and state regulations concerning explosive materials, and the provisions of this chapter.

8.3.3 No vehicle transporting explosive materials shall be parked before reaching its destination, even while attended, on any public street adjacent to or in proximity to any bridge, tunnel, dwelling, building, or place where people work, congregate, or assemble except under emergency conditions.

8.3.4 Every motor vehicle transporting any quantity of Division 1.1, 1.2, or 1.3 materials shall, at all times, be attended by a driver or other qualified representative of the motor carrier operating the vehicle.

8.3.5 Vehicles transporting Division 1.4, 1.5, or 5.1 materials shall be attended unless its driver is performing duties that are incident and necessary to the driver’s duties as the operator of the vehicle and the Division 1.4, 1.5, or 5.1 materials and vehicle are secured from unauthorized access or use.

8.3.6 Attended Vehicle Requirements.

8.3.6.1 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 when the vehicle is within his/her field of vision and the driver can reach it quickly and without interference.

8.3.6.2 “Attended” also shall mean that the driver or attendant is awake, alert, and not engaged in other duties or activities that could divert attention from the vehicle.

8.3.6.3 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.

8.3.6.4 The attendant shall be familiar with the vehicle assigned and shall be provided with the training, necessary means, and authorization to move the vehicle where required.

8.3.6.4.1 This requirement shall not apply where communication with public officers or representatives of the shipper, carrier, or consignee who are absent from the vehicle to obtain food or provide for physical comfort is necessary.

8.3.6.4.2 A vehicle carrying explosive materials shall be permitted to be left unattended, provided it is parked in an area where such parking is permitted, such as an area meeting the requirements of NFPA 498, Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives.

8.3.7 No spark-producing metal or tools, oils, matches, firearms, electric storage batteries, flammable materials, acids, oxidizers, or corrosives shall be carried in the cargo body of any motor vehicle transporting explosive materials, except where permitted by the U.S. Department of Transportation “Hazardous Materials Regulations.”

8.3.8 Vehicle Routing.

8.3.8.1 Vehicles transporting explosive materials shall avoid congested areas and heavy traffic.

8.3.8.2 Where routes through congested areas have been designated by the authority having jurisdiction, such routes shall be followed.

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

Chapter 9 Aboveground Storage of Explosive Materials

9.1 Scope.

9.1.1 Explosive materials shall be kept in magazines meeting the requirements of this chapter.

9.1.2 This chapter shall not apply to the storage of small arms ammunition, propellant-actuated cartridges, small arms ammunition primers, and smokeless propellants. (See Chapter 14.)

9.2 Basic Requirements.

9.2.1 All explosive materials not in the process of manufacture, transportation, or use shall be kept in storage magazines.

9.2.2 Ammonium nitrate shall be permitted to be stored in the same magazine with blasting agents.

9.2.2.1 Ammonium nitrate and blasting agents shall be permitted to be stored in the same magazine with other explosive materials. (See 9.2.2.)

9.2.2.2 Where ammonium nitrate is stored in the same magazine with blasting agents, the magazine shall be designed for the storage of blasting agents.

9.2.2.3 Where ammonium nitrate is stored in the same magazine with explosives or with explosives and blasting agents, the magazine shall be designed for the storage of explosives.

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

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

9.2.4 Explosive materials classified as Division 1.1 or Division 1.2 by the U.S. Department of Transportation shall be stored in Type 1, 2, or 3 magazines.

9.2.5 Black powder shall be permitted to be stored in a Type 4 magazine or a magazine of higher classification (i.e., lower type number).

9.2.6 Division 1.5 explosive materials (blasting agents) shall be permitted to be stored in a Type 5 magazine or a magazine of higher classification (i.e., lower type number).

9.3 Classification and Use of Magazines.

9.3.1 Outdoor magazines shall be classified and used in accordance with Table 9.3.1(a) and Table 9.3.1(b).

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*Over-the-road trucks or semitrailers used for temporary storage as Type 4 or Type 5 magazines shall not be required to be fire resistant or ventilated.
†Each door of a mobile Type 5 magazine shall be equipped with at least one five-tumbler padlock having a 9.5 mm (3/8 in.) case-hardened shackle. The lock shall not be required to be hooded.

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9.3.2 Indoor magazines used for the storage of 22.7 kg (50 lb) 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.

9.4 Location of Magazines.

9.4.1 All outdoor magazines other than Type 3 shall be located to comply with the American Table of Distances for Storage of Explosives (ADT) as shown in Table 9.4.1 or the Table of Distances for Storage of Low Explosives, as applicable. (See 27 CFR 555 for the Table of Distances for Low Explosives.)

9.4.1.1 Indoor or outdoor magazines utilized in conjunction with operating buildings shall be in accordance with the requirements of 5.3.3 and 5.3.4 as applicable.
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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 Title 18, United States Code, Chapter 40, “Importation, Manufacture, Distribution and Storage of Explosive Materials,” is issued at least annually by the Director of the Bureau 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 1000 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, and 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 where unconfined.
Note 4: "Detonator" means any device containing any initiating or primary explosive that is used for initiating detonation. A detonator may not be permitted to 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 1 1/2 lb (0.7 kg) of explosives per 1000 caps. Note 5: For strengths higher than No. 8 cap, the manufacturer should be consulted.
Note 6: "Magazine" means any building, structure, or container, other than an explosives manufacturing building, approved for the storage of explosive materials.
Note 7: "Natural barricade" means natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that need protection cannot be seen from the magazine when the trees are bare of leaves.
Note 8: "Artificial barricade" means an artificial mound or revetted wall of earth of a minimum thickness of 3 ft (0.9 m).
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, but does not include any building or structure occupied in connection with the manufacture, transportation, storage, or use of explosive materials.
Note 10: "Railway" means any steam, electric, or other railroad or railway that carries passengers for hire.
Note 11: "Public Highway" means any road, street, or way, whether on public or private property, open to public travel.
Note 12: Where two or more storage magazines are located on the same property, each magazine shall 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 with regard to the spacing of said detonator magazines from magazines containing other explosive materials. If any two or more magazines are separated from each other by less than the specified "separation of magazines" distances, such magazines, as a group, shall be considered as one magazine, and the total quantity of explosive materials stored in such group shall be treated as if stored in a single magazine located on the site of any magazine of the group, and shall comply with the minimum specified distances 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 generally is not necessary for commercial enterprises.
Note 14: This table applies only to the manufacture and permanent storage of commercial explosive materials. It is not applicable to the 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: Where a manufacturing building on an explosive materials plant site is designed to contain explosive materials, the building shall be located at a distance 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 9.4.2.2 Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents

<table>
<thead>
<tr>
<th>Donor Weight</th>
<th>Minimum Separation Distance of Acceptor when Barricaded (ft)</th>
<th>Minimum Thickness of Artificial Barricades (in.)</th>
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<tbody>
<tr>
<td>Pounds Over</td>
<td>Ammonium Nitrate</td>
<td>Blasting Agent</td>
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<tr>
<td>Pounds Not Over</td>
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</table>

For SI unit, 1 lb = 0.454 kg, 1 ft = 0.305 m, 1 in. = 2.54 cm.

**Notes:**

1. Recommended separation distances are 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 where 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, 1⁄2 the mass of the ammonium nitrate shall be included in the mass of the donor.

2. For determining the distances to be maintained from inhabited buildings, passenger railways, and public highways, Table 8.4.1, the American Table of Distances for Storage of Explosives, shall be used.

Where the ammonium nitrate or blasting agent, or both, 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 that could enclose the donor. Where storage is in bullet-resistant magazines 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. For construction of bullet-resistant magazines, see Annex C.

Earth, sand dikes, or enclosures filled with the prescribed minimum thickness of earth or sand shall be permitted to be used as artificial barricades. Natural barricades, such as hills or timber of sufficient density that the surrounding exposures that need protection cannot be seen from the donor when the trees are bare of leaves, also shall be permitted to be used.

The distances in the table apply to ammonium nitrate and ammonium nitrate based materials that show "negative" (-) result in the UN Test Series 2 Gap Test and show "positive" (+) result in the UN Test Series 1 Gap Test. Ammonium nitrate and ammonium nitrate based materials that are DOT hazard Class 1 sensitive shall be stored at separation distances determined by the American Table of Distances.

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.

Definition and Test Procedures for Ammonium Nitrate Fertilizer, Fertilizer Institute, November 1964.
9.4.3 Tables.

9.4.3.1 The separation distances provided by the American Table of Distances (Table 9.4.1) or the Table of Recommended Separation Distances (Table 9.4.2), or both, shall be used to determine minimum separation of storage facilities for explosives, blasting agents, and ammonium nitrate.

9.4.3.2 The tables to be used shall be as specified in Table 9.4.3.2.

<table>
<thead>
<tr>
<th>Type of Donor</th>
<th>Type of Acceptor</th>
<th>Table</th>
<th>Distances Listed Under</th>
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<td>Explosives</td>
<td>Explosives</td>
<td>ATD</td>
<td>Separation of magazines</td>
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<tr>
<td>Explosives</td>
<td>Ammonium nitrate</td>
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<td>Ammonium nitrate</td>
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<tr>
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<td>Ammonium nitrate</td>
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<td>Ammonium nitrate</td>
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</table>

9.4.4 Indoor Magazine Location — General Requirements.

9.4.4.1 An indoor magazine shall be located only on a floor that has an entrance at or a ramp to grade level.

9.4.4.2 An indoor magazine shall be located no more than 3 m (10 ft) from the entrance.

9.4.4.3 An indoor magazine shall be located as approved by the authority having jurisdiction to facilitate rapid removal in an emergency.

9.4.5 Magazine Location.

9.4.5.1 Two magazines shall be permitted to be located in the same building, provided one magazine is used solely for the storage of detonators in quantities not exceeding 5000.

9.4.5.2 A distance of 3 m (10 ft) shall be maintained between the magazines.

9.4.6 Notification of Authorities.

9.4.6.1 Any person who stores explosive materials shall notify the authority having jurisdiction for fire safety in the locality in which the explosive materials are being stored of the type, magazine capacity, and location of each site where such explosive materials are stored.

9.4.6.2 Such notification shall be made orally before the end of the day on which storage of the explosive materials commenced and in writing within 48 hours from the time such storage commenced.

9.4.7 Type 3 magazines shall be located as far away as practicable from neighboring inhabited buildings, railways, highways, and other magazines.

9.4.8 Type 3 magazines shall be attended where explosive materials are stored within.

9.4.9 All explosive materials shall be removed to appropriate storage magazines for unattended storage at the end of the work day.

9.4.10 Two Type 3 magazines shall be permitted to be located at a blasting site, provided one magazine is used solely for the storage of detonators.

9.4.11 A Type 5 magazine shall not be located in a residence or dwelling.

9.5 Magazine Construction — Basic Requirements.

9.5.1 Magazines shall be constructed to comply with Section 9.5 or in a manner substantially equivalent to the requirements for safety and security embodied in Section 9.5.

9.5.2 The ground in the vicinity of a magazine shall be graded so that water drains away from the magazine.

9.5.3 Heated magazines shall be heated by either hot water radiant heating within the magazine building or by indirect warm air heating.

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

9.5.5 Magazine heating systems shall meet the following requirements:

1. 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.

2. The surface temperature of the coils shall not exceed 74°C (165°F).

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

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

5. 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.

6. 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.

7. All electrical switch-gear shall be located at least 7.6 m (25 ft) from the magazine.

8. Any fuel-fired heating source for the hot water or steam shall be separated from the magazine by a distance of not less than 7.6 m (25 ft).

9. The area between the heating unit and the magazine shall be cleared of all combustible material.

10. Explosive materials stored in magazines shall be arranged so that uniform circulation of air is ensured.

9.5.6 Electric Lighting.

9.5.6.1 Electric lighting, electric safety flashlights, or electric safety lanterns shall be permitted to be used within a magazine.

9.5.6.2 The installation of electric lighting shall meet the following requirements:

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

2. Disconnects, fuses, and circuit breakers shall be protected by a voltage surge arrester capable of handling 2500 amperes for 0.1 second.

3. All wiring from switches, both inside and outside the magazine, shall be installed in rigid conduit.

4. Wiring leading to the magazine shall be installed underground.

5. Conduit and light fixtures inside the magazine shall be protected from physical damage by guards or by their location.

6. Light fixtures shall be enclosed to prevent sparks or hot metal from falling onto the floor or onto material stored in the magazine.

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

8. Magazines containing explosive materials that could release flammable vapors shall have wiring and fixtures that meet the requirements of NFPA 70, National Electrical Code, Article 501.

9. Lights inside magazines shall not be left on while the magazine is unattended.

9.5.7 There shall be no exposed ferrous metal on the interior of a magazine, except for Type 5 magazines, where it has the potential to contact packages of explosives.

9.6 Magazine Construction — Requirements for Specific Types.

9.6.1 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 as follows:

1. Walls and doors shall be bullet resistant and shall be constructed in accordance with any of the specifications in Annex C.

2. The roof shall be permitted to be constructed of any type of structurally sound materials that are or have been made fire resistant on the exterior.

3. 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, the roof or the ceiling shall be of bullet-resistant construction.

4. The foundation shall be permitted to be of masonry, wood, or metal and shall be enclosed completely.

5. A wood foundation enclosure shall be covered on the exterior with metal of not less than 26-gauge thickness.

6. Openings to provide cross ventilation shall not be required to be enclosed.

7. The floor shall be constructed of wood or other suitable material.

8. Floors constructed of materials that could cause sparks shall be covered with a nonsparking surface, or the packages of explosive materials shall be placed on pallets of nonsparking material.
9.6.2 Type Indoor Magazines. A Type 2 magazine shall be portable or mobile, except for those that are constructed for use within a building and are designed to be unattended while in use.

9.6.2.1 Type 2 Indoor Magazines. A Type 2 magazine shall be constructed in accordance with the provisions of 9.6.1(1), or shall have a metal exterior with an inner door meeting the requirements for Type 5 outdoor magazines.

9.6.2.2 Type 2 Indoor Magazines. A Type 2 magazine shall not be required to be weather resistant.

9.6.2.2.1 The walls and roof or ceiling shall be constructed in accordance with the provisions of 9.6.1(1), 9.6.1(2), and 9.6.1(3).

9.6.2.2.2 Doors of Type 2 magazines shall be of metal, constructed in accordance with the provisions of 9.6.1(1), or shall have a metal exterior with an inner door meeting the provisions of 9.6.1(1).

9.6.2.2.3 Floors of Type 2 magazines shall be constructed of ferrous metal covered with a nonsparking surface.

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

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

9.6.2.2.6 Magazines of less than 0.766 m³ (1 yd³) shall be fastened securely to a fixed object to prevent theft of the entire magazine.

9.6.2.2.7 Hinges, hasps, locks, and locking hardware shall comply with 8.6.1(7).

9.6.2.2.8 Padlocks on vehicular magazines shall not be required to be protected by steel hoods.

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

9.6.2.3 Type 2 Indoor Magazines.

9.6.2.3.1 The magazine shall have substantial wheels or casters to facilitate its removal from the building in case of emergency.

9.6.2.3.2 The cover of the magazine shall have substantial strap hinges and a means for locking.

9.6.2.3.3 The magazine shall be kept locked with a five-tumbler padlock or its equivalent.

9.6.2.3.4 The magazine shall be permitted to be unlocked during placement or removal of explosive materials.

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

9.6.2.3.6 Type 2 indoor magazines constructed of wood shall have sides, bottoms, and covers or doors constructed of 51 mm (2 in.) hardwood that are well braced at corners.

9.6.2.3.7 The magazines shall be covered with sheet metal of not less than 26 gauge.

9.6.2.3.8 Nails exposed to the interior of the magazines shall be countersunk.

9.6.2.3.9 Type 2 indoor magazines constructed of metal shall be of 12-gauge sheet metal and shall be lined with a nonsparking material.

9.6.2.3.10 The edges of metal covers shall overlap the side by at least 25.4 mm (1 in.).
9.7.2 All magazines containing explosive materials shall be opened and
inspected at maximum intervals of three days to determine whether there has
been unauthorized or attempted entry into the magazines or whether there has
been unauthorized removal of the magazines or their contents.

9.7.3 Magazine doors shall be kept locked, except that magazine doors shall
be permitted to be unlocked during placement or removal of explosives, during
inspection, or if no explosives are in the magazine.

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

9.7.5 Where explosive materials are removed from the magazine for use, the
oldest stock shall be used first.

9.7.6 Corresponding grades and brands of explosive materials shall be stored
together so that brand and grade markings are readily visible.

9.7.7 All stocks shall be stored in a manner that allows them to be easily
counted and checked.

9.7.8 Containers of explosive materials shall be piled in a stable manner and
laid flat with the top side up.

9.7.9 Use of Open Containers – Basic Requirements.

9.7.9.1 Open containers of explosive materials shall be closed securely before
being returned to a magazine.

9.7.9.2 No container without a closed lid shall be permitted to be stored in the
magazine.

9.7.9.3 Only fiberboard containers shall be permitted to be opened in the
magazine.

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

9.7.11 Tools used for opening containers of frictional spark-sensitive explosive
materials such as black powder and primary explosives shall be constructed of
nonsparking material.

9.7.12 Metal slitters shall be permitted to be used for opening fiberboard
containers.

9.7.13 Magazines shall be used exclusively for the storage of explosive
materials, blasting materials, and blasting accessories.

9.7.14 Metal tools other than nonferrous transfer conveyors shall not be stored
in a magazine containing explosives or detonators.

9.7.15 Ferrous metal conveyors shall be protected by a coat of paint shall be
permitted to be stored within a magazine.

9.7.16 Magazine Housekeeping.

9.7.16.1 Magazine floors shall be regularly swept and kept clean, dry, and free
of grit, paper, empty packages, and rubbish.

9.7.16.2 Brooms and other cleaning utensils shall not have any spark-producing
metal parts.

9.7.16.3 Sweepings from magazine floors shall be disposed of in accordance
with the manufacturers’ instructions.

9.7.17 Where 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 contact the
manufacturer for assistance immediately.

9.7.18 Magazine floors stained with nitroglycerine or other liquid shall be
cleaned in accordance with the manufacturers’ instructions.

9.7.19 Before making repairs to the interior of a magazine, all explosive
materials shall be removed and the floor shall be cleaned.

9.7.20 In making repairs that could result in sparks or fire to the exterior of a
magazine, all explosive materials shall be removed.

9.7.21 Storage of Explosive Materials During Magazine Repair.

9.7.21.1 Explosive materials removed from a magazine undergoing repair shall
be placed either in another magazine or at a safe distance from the magazine.

9.7.21.2 Explosive materials removed from a magazine undergoing repair shall
be guarded and protected properly.

9.7.21.3 Upon completion of the repairs, explosive materials removed from a
magazine undergoing repair shall be returned to the magazine promptly.

9.8 Miscellaneous Safety Precautions.

9.8.1 Smoking, matches, open flames, spark-producing devices, and firearms
shall not be permitted inside of or within 15.25 m (50 ft) of a magazine, except
for firearms carried by authorized guards.

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

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

9.8.4 Handling of Explosive Material from Misfires.

9.8.4.1 Explosive materials recovered from blasting misfires shall be stored in
a separate magazine until disposal instructions have been received from the
manufacturer.

9.8.4.2 Such explosive materials then shall be disposed of in the manner
recommended by the manufacturer.

9.8.4.3 Detonators recovered from blasting misfires shall not be reused.

9.8.5 Signs.

9.8.5.1 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.”

9.8.5.2 Such signs shall be located to minimize the possibility that a bullet shot
at the sign hits the magazine.

9.8.6 When packaged blasting agents (Division 1.5 materials) are stored in
an over-the-road trailer Type 5 storage magazine, the trailer shall be placarded
with approved U.S. Department of Transportation placards for Division 1.5
explosives (blasting agents) until the trailer is empty.

Chapter 10 Use of Explosive Materials for Blasting

10.1 Basic Requirements.

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

10.1.2 Explosive materials shall be protected from unauthorized possession and
shall not be abandoned.

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

10.1.3.1 Loading and firing shall be performed or supervised only by a person
possessing a blaster’s permit.

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

10.1.4 No explosive materials shall be located or stored where they have the
potential to be exposed to flame, excessive heat, sparks, or impact.

10.1.4.1 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.

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

10.1.4.3 No person within 15.25 m (50 ft) of any location where explosives are
being handled or used shall carry any matches, open light, or other fire or flame,
except for approved devices for lighting safety fuses.

10.1.5 No person under the influence of intoxicating beverages, narcotics, or
other dangerous drugs shall be permitted to handle explosive materials.

10.1.6 Response to Fires.

10.1.6.1 No attempt shall be made to fight a fire that cannot be contained or
controlled before it reaches explosive materials.

10.1.6.2 In such cases, all personnel shall be evacuated immediately to a safe
location, and the area shall be guarded from entry by spectators or intruders.

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

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

10.1.9 Partial reels of detonating cord shall not be required to be kept in closed
containers, unless transported over public highways.
10.1.10 Containers of explosive materials, except for explosive materials in fiberboard containers, shall not be opened in any magazine or within 15.25 m (50 ft) of any magazine.

10.1.11 Nonsparking tools shall be used for opening any package or container of frictional spark-sensitive explosive materials such as black powder or primary explosives, except that metal slitters shall be permitted to be used for opening fiberboard containers.

10.1.12 No blasting operation shall be performed in a manner contrary to the instructions of the manufacturer of the explosive materials being used.

10.1.13 Where blasting is done in a congested area or in close proximity to a structure, railway, or highway, or any other installation that could be affected, special precautions shall be taken to prevent damage and to minimize earth vibrations, air blast effects, and hazards from toxic fumes.

10.1.14 Blasting mats or other protective devices shall be used to prevent fragments from being thrown.

10.1.15 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.

10.1.16 Surface blasting operations shall be conducted during daylight hours only, except where approved by the authority having jurisdiction.

10.1.17 Where blasting is conducted in the vicinity of utility lines or rights-of-way, the blaster shall notify the representatives of the utilities at least 24 hours in advance of blasting, specifying the location and the intended time of such blasting.

10.1.17.1 Verbal notice shall be confirmed with written notice.

10.1.17.2 In an emergency situation, the time limit given in 10.1.17 shall be permitted to be waived by the authority having jurisdiction.

10.1.18 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.

10.1.18.1 These precautions shall include the following:

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

(2)* Observance of the latest recommendations with regard to blasting in the vicinity of radio transmitters or power lines.

(3) The discontinuance of surface use, underground use, and handling of explosive materials during the approach of and for the duration of an electrical storm.

(4) Consideration to the fact that lightning has been known to follow steel piping, and conductive ore into underground mines.

10.1.18.2 During the approach of and for the duration of an electrical storm, all personnel shall move to a safe location.

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

10.2 Preblast Operations.

10.2.1 Blast Site.

10.2.1.1 During the time that holes are being loaded or are loaded with explosive materials, blasting agents, or detonators, the blast site shall be off limits to all but those persons authorized to engage in the drilling and loading operations or who are otherwise authorized to enter the site.

10.2.1.2 The blast site shall be guarded or barricaded and posted.

10.2.2 Drill holes shall be large enough to allow free insertion of cartridges of explosive materials.

10.2.2.1 Drill holes shall not be collared in bootleg or in holes that previously contained explosive materials.

10.2.2.2 Holes shall not be drilled where there is a danger of intersecting another hole containing explosive material.

10.2.3 All drill holes shall be inspected and cleared of any obstruction before loading.

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

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

(2) A semiconductive discharge hose shall be used.

(3) A qualified person shall evaluate all systems to ensure that they dissipate static charges under field conditions.

10.2.5 Tamping shall be performed only with wooden rods or approved plastic poles having no exposed metal parts.

10.2.5.1 Nonsparking metal connectors shall be permitted to be used on jointed tamping poles.

10.2.5.2 Violent tamping shall be avoided.

10.2.5.3 The primer shall not be tamped at any time.

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

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

10.3 Initiating Blasts.

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

10.3.2 Safety Fuse.

10.3.2.1 Where safety fuse is used, the burning rate shall be determined and in no case shall fuse lengths of less than 3 ft or with a burn time less than 120 seconds be used.

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

10.3.3 Stray Current Control.

10.3.3.1 Where electric detonators are used, stray current tests shall be made as frequently as necessary.

10.3.3.2 Maximum stray current shall not exceed 0.05 ampere through a 1-ohm resistor, measured at the blast site.

10.3.3.3 Nonelectric or electronic initiating systems shall be used unless corrective action is taken to reduce the stray current below the limits indicated in 10.3.3.2.

10.3.4 Electric or electronic detonators of different brands shall not be used in the same firing circuit.

10.3.5 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.

10.3.6 All electrically initiated blasts shall be made by using blasting machines suitable for the circuitry being fired.

10.3.7 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.

10.3.8 Primers shall not be assembled closer than 15.25 m (50 ft) from any magazine.

10.3.9 Primers shall be assembled only when and as necessary for immediate needs.

10.3.7.3 Adequate priming shall be used.

10.3.7.4 If any uncertainty exists regarding the amount of priming necessary, the manufacturer shall be consulted.

10.3.7.5 Primers shall be assembled only at the time of use and as close to the blast site as conditions allow.

10.3.7.6 Where using nonelectric initiation systems, all of the following shall apply:

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

(2) The initiation system shall be used in accordance with the manufacturers’ instructions.

(3) The blaster in charge shall conduct a visual check after blast hookup.
(4) The blast layout shall be tested for continuity as recommended by
the manufacturer where using a system that can be tested for
continuity.

(5) A double trunk line or closed-loop hookup shall be used where judged
to be necessary by the blaster in charge.

10.3.8 Only the person making the lead line connections or the blaster in charge
shall fire the blast.

10.3.8.1 All connections shall be made progressively from the borehole back to
the initiation point.

10.3.8.2 Blasting lead lines shall remain shunted (shorted) and shall not be
corrupted to the blasting machine or other source of current until the blast is to
be fired.

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

10.4 Procedures after Blasting.

10.4.1 No person shall return to the blast area until permitted to do so by the
blaster-in-charge.

10.4.2 Blasters shall allow sufficient time for smoke and fumes to dissipate and
for dust to settle before returning to the blast site.

10.4.3 The blaster-in-charge shall inspect the entire blast site for misfires before
allowing other personnel to return to the blast area.

10.5 Misfires.

10.5.1 Where a misfire is found, the blaster-in-charge shall provide the proper
safeguards for excluding all personnel from the blast area.

10.5.2 Misfires shall be reported to the supervisor immediately.

10.5.3 No additional work, other than that necessary to remove the hazard,
shall be performed, and only those persons needed to do such work shall remain
at the blast site.

10.5.4 No attempt shall be made to extract explosive materials from a misfired
hole.

10.5.4.1 A new primer shall be inserted, and the hole shall be reblasted.

10.5.4.2 Where reblasting presents a hazard, the explosive materials shall be
permitted to be washed out with water, or, where the misfire is under water,
blown out with air.

10.5.5 Whenever there is a misfire, all personnel shall remain at a safe distance
for at least 15 minutes (30 minutes if electronic or cap and fuse initiation is
used).

10.5.6 Misfires shall be the responsibility of the person in charge of the blasting
operation.

10.5.7 Where a misfire is suspected, all initiating circuits (electric or
nonelectric) shall be traced carefully and a search made for unexploded charges.

10.5.8 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.

10.6 Disposal of Explosive Materials.

10.6.1 Empty containers and paper and fiber packing materials that previously
contained explosive materials shall be disposed of or reused in an approved
manner.

10.6.2 All personnel shall remain at a safe distance from the disposal area.

10.6.3 All explosive materials that are obviously deteriorated or damaged
shall not be used and shall be destroyed in accordance with the requirements of
9.7.17 and 9.7.18.

10.6.4 Destroying Explosives.

10.6.4.1 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 contacted for assistance
immediately.

10.6.4.2 The manufacturers’ advice shall be followed without deviation.

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11.1 Ground Vibration.

11.1.1 At all blasting operations, the maximum ground vibration at any
dwelling, public building, school, church, or commercial or institutional
building adjacent to the blasting site shall not exceed the limitations specified in
Table 11.1.1, except as otherwise authorized or restricted by the authority
having jurisdiction.

**Table 11.1.1 Peak Particle Velocity Limits**

<table>
<thead>
<tr>
<th>Distance from Blasting Site</th>
<th>Maximum Allowable Peak Particle Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>ft</td>
</tr>
<tr>
<td>0–91.4</td>
<td>0–300</td>
</tr>
<tr>
<td>91.4–1524</td>
<td>301–5000</td>
</tr>
<tr>
<td>1525 and over</td>
<td>5001 and over</td>
</tr>
<tr>
<td>5001 and over</td>
<td>79</td>
</tr>
</tbody>
</table>

*Peak particle velocity shall be measured in three mutually perpendicular
directions, and the maximum allowable limits shall apply to each of
these measurements.

11.1.2 Frequency Versus Particle Velocity Graphs.

11.1.2.1 In lieu of Table 11.1.1, a blasting operation shall have the option to use
the graphs shown in either Figure 11.1.2.1(a) or Figure 11.1.2.1(b) to limit peak
particle velocity based on the frequency of the blast vibration.

11.1.2.2 If either graph in Figure 11.1.2.1(a) or Figure 11.1.2.1(b) is used to
limit vibration levels, the methods for monitoring vibration and calculating
frequency shall be approved by the authority having jurisdiction.

**EXISTING FIGURE 11.1.2.1(a) Frequency vs. Particle Velocity Graph.**

**EXISTING FIGURE 11.1.2.1(b) Maximum Allowable Particle Velocity vs.
Blast Vibration Frequency Graph.**

11.1.3 Scaled Distance Equations. Unless a blasting operation uses a
seismograph to monitor a blast to ensure compliance with Table 11.1.1 or
Figure 11.1.2.1(a) or Figure 11.1.2.1(b), or has been granted special permission
by the authority having jurisdiction to utilize a modified scaled distance factor,
the operation shall comply with the scaled distance equations shown in Table
11.1.3.

**Table 11.1.3 Scaled Distance Equations**

<table>
<thead>
<tr>
<th>Distance from Blasting Site</th>
<th>Scaled Distance Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>ft</td>
</tr>
<tr>
<td>0 to 91.4</td>
<td>0 to 300</td>
</tr>
<tr>
<td>91.4 to 1524</td>
<td>301 to 5000</td>
</tr>
<tr>
<td>1525 and over</td>
<td>5001 and over</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
(1) W equals the maximum weight of explosives in pounds (or kilograms)
that can be detonated per delay interval of 8 milliseconds or longer.
(2) D equals the distance in feet (or meters) from the blast to the nearest
building adjacent to the blasting site.

To convert English units of scaled distances (ft/lb
2
) to metric units (m/
2
), divide by a factor of 2.21.

11.1.4 Where the blasting operation considers the scaled distance equations of
Table 11.1.3 as being too restrictive, the operation shall have the right to
petition the authority having jurisdiction to utilize a modified scaled distance equation.

11.1.4.1 Such a petition shall demonstrate that the use of the modified scaled
distance equation would not cause predicted ground vibration that exceeds the
peak particle velocity limits specified in Table 11.1.1.

11.1.4.2 Any petition for modification of the scaled distance equations of
Table 11.1.3 shall be substantiated thoroughly by seismograph recordings to show that
the limitations of Table 11.1.1 cannot be exceeded.


11.2 Airblast. Airblast at the location of any dwelling, public building, school, church, or commercial or institutional building that is not owned, leased, or contracted by the blasting operation, or on property for which the owner has not provided a written waiver to the blasting operation, shall not exceed the maximum limits specified in Table 11.2.

<table>
<thead>
<tr>
<th>Lower Frequency of Measuring System</th>
<th>Measurement Level (decibels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 Hz or lower — flat response</td>
<td>134 peak</td>
</tr>
<tr>
<td>2 Hz or lower — flat response</td>
<td>92 peak</td>
</tr>
<tr>
<td>C Weighted — slow response</td>
<td>95 peak</td>
</tr>
</tbody>
</table>

* Only where approved by the authority having jurisdiction.

11.3 Flyrock.

11.3.1 Flyrock traveling in the air or along the ground shall not be cast from the blast site in an uncontrolled manner that could result in personal injury or property damage.

11.3.2 Flyrock shall not be propelled from the blast site onto property not contracted by the blasting operation or onto property for which the owner has not provided a written waiver to the blasting operation.

11.3.3 Where blasting operations do not conform to 11.3.1 and 11.3.2, the authority having jurisdiction shall require that special precautions be employed to reduce or control flyrock.

Chapter 12 Explosive Materials at Piers and Railway, Truck, and Air Terminals

12.1 Basic Requirements.

12.1.1 Railway Cars.

12.1.1.1 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.

12.1.1.2 The requirement in 12.1.1.1 shall be permitted to be waived in an emergency with the approval of the authority having jurisdiction.

12.1.2 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.

12.1.3 Every railway car containing explosive materials that has reached its destination, or has stopped in transit so it no longer is considered in interstate commerce, shall remain placarded in accordance with U.S. Department of Transportation regulations.

12.1.4 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 and isolated as far as practicable and in such a manner that they can be removed easily and quickly.

12.1.5 Truck terminals for explosives vehicles shall meet the requirements of NFPA 498, Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives.

12.2 Notifications. A consignee, having been notified that a shipment of explosives is in any carrier, shall remove the explosives within 48 hours, excluding Saturdays, Sundays, and holidays, to a storage area meeting the requirements of this code.

12.3 Facilities for Trailer-on-Flatcar and Container-on-Flatcar. Rail shipments of explosives by trailer-on-flatcar (TOFC) or container-on-flatcar (COFC) shall meet the following requirements:

1. Shipments by TOFC or COFC shall be unloaded at a nonagency station only where a consignee is present to receive them or where properly locked and secure storage facilities are available.

2. If delivery cannot be made, the shipment shall be taken to the next or nearest agency station for delivery.

3. Carriers shall require the consignee to remove TOFC and COFC shipments from the carrier’s property within 48 hours after notice of arrival, excluding Saturdays, Sundays, and holidays.

4. If the trailers or containers are not so removed, the carrier shall dispose of the shipment immediately by means of storage, disposal, or, where necessary for safety, destruction under the supervision of a competent person.

5. If storage is required to comply with 12.3(3), it shall be located in an interchange lot meeting the requirements of Chapters 4 and 5 of NFPA 498, Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives, or in a location that provides equivalent safety to the public.

6. Where local conditions make the acceptance, transportation, or delivery of explosive materials unusually hazardous, applicable local restrictions shall be imposed by the carrier.

7. All rail carriers shall report complete information on their restrictions regarding the acceptance, delivery, or transportation of explosive materials over any portion of their lines to the Bureau of Explosives of the Association of American Railroads for publication by the Bureau.

8. Where shipping explosives, regularly scheduled days for receiving trailers and containers for shipment shall be assigned wherever it is practicable to do so.

9. To enable the carrier to provide suitable flatcars for the shipment of Division 1.1 or Division 1.2 explosives, the shipper shall give the carrier at least 24 hours notice of the shipments and their destinations.

10. Where a regularly scheduled day has been appointed for receipt of trailers and containers for shipment, the notice required by Section 12.3(9) shall be permitted to be waived by the carrier, and in such cases, the shipments shall be delivered on the assigned days in time to allow inspection, billing, and loading on that day.

11. 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, excluding Saturdays, Sundays, and holidays, except that where biweekly or weekly service is provided, shipments shall be forwarded on the next train.

12. The Bureau of Explosives of the Association of American Railroads shall be consulted by rail carriers to determine that the storage facility required by Section 12.3(3) is safe, adequate, and complies with Chapter 4 of NFPA 498, Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives.

13. Cars loaded with explosive materials shall be placed so that they are safe from all probable danger from fire — they shall not be placed under bridges or overhead highway crossings, or in or alongside passenger sheds or stations.

12.4 Designation of Facilities. The local authority having jurisdiction shall have the authority to designate the location for, and limit the quantity of, explosive materials that are loaded, unloaded, reloaded, or temporarily retained at any facility within the jurisdiction.

Chapter 13 Precursor Chemicals

13.1 Basic Requirements.

13.1.1 Mixed or combined precursor chemicals shall be transported, stored, and used in the same manner as explosive materials. (See Chapters 4, 8, 9, and 10.)

13.1.2 For transportation and storage, individual packages of each precursor component shall be packaged in separate shipping containers in compliance with the U.S. Department of Transportation, 49 CFR, 100–199, “Hazardous Materials Regulations.”

13.2 Storage.

13.2.1 Precursor Components.

13.2.1.1 Precursor components shall be stored in separate locked containers.

13.2.1.2 If any component possesses a hazard classification, it shall be stored in a location and manner appropriate to its hazard class.

13.2.2 Precursor Chemicals.

13.2.2.1 Precursor chemicals shall be permitted to be stored in the same magazine with explosive materials, provided their total weight is included in the weight of explosives permitted in the magazine in order to comply with the quantity-distance requirements of Table 9.4.1.

13.2.2.2 Storage shall not introduce a hazard due to chemical incompatibility.

13.3 Use.

13.3.1 Where precursor chemicals are mixed or combined at the point of use, the procedures recommended by the manufacturer shall be followed strictly.

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

13.3.2.1 The requirement in 13.3.2 shall be permitted to be waived, provided the extra explosive material produced can be handled and stored as such.
13.4 Record Keeping and Reporting.

13.4.1 Dealers in precursor chemicals shall record all transactions on appropriate federal, state, and local forms, as required for transactions with explosive materials.

13.4.2 Thefts of precursor chemicals during transportation, storage, and use shall be reported to the authority having jurisdiction, as required for thefts of explosive materials.

13.4.3 Licenses.

13.4.3.1 Dealers in precursor chemicals shall require that all purchasers possess a license or permit to use explosive materials.

13.4.3.2 The license or permit number shall be recorded with other records of the sale.

Chapter 14 Small Arms Ammunition and Primers, Smokeless Propellants, and Black Powder Propellants

14.1 Basic Requirements.

14.1.1 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 the U.S. Department of Transportation, 49 CFR 100–199, “Hazardous Materials Regulations.”

14.1.2 This chapter shall apply to the users and distribution channels of small arms ammunition, small arms primers, smokeless propellants, and black powder.

14.1.3 This chapter shall not apply to in-process storage and intraplant transportation during manufacture.

14.1.4 This chapter shall apply to the transportation and storage of small arms ammunition and components.

14.1.5 This chapter shall not apply to safety procedures in the use of small arms ammunition and components.

14.1.6 The bulk repackaging of small arms ammunition, primers, smokeless propellants, or black powder propellants shall not be performed in retail stores.

14.2 Small Arms Ammunition.

14.2.1 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.

14.2.2 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 the limitations of the storage facility and by public safety regulations.

14.2.3 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 4.6 m (15 ft) or by a fire partition having a fire resistance of at least 1 hour.

14.2.4 Small arms ammunition shall not be stored together with Division 1.1, Division 1.2, or Division 1.3 Explosives, except where the storage facility is suitable for the storage of explosive materials.

14.2.5 Damaged Ammunition.

14.2.5.1 Small arms ammunition that has been exposed to fire or has been damaged by exposure to water shall not be returned to commercial channels for reasons of consumer safety.

14.2.5.2 The manufacturer shall be contacted to obtain recommendations for the disposal of damaged ammunition.

14.3 Smokeless Propellants.

14.3.1 Quantities of smokeless propellants not exceeding 11.3 kg (25 lb) in shipping containers approved by the U.S. Department of Transportation shall be permitted to be transported in a private vehicle.

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

14.3.3 Transportation of more than 22.7 kg (50 lb) of smokeless propellants in a private vehicle shall be prohibited.

14.3.4 Commercial shipments of smokeless powder for small arms that has been classified in Division 1.3 shall be permitted to be reclassified as Division 4.1 flammable solid for transportation purposes for shipment by motor vehicle, rail car, vessel, or cargo-only aircraft, subject to the conditions stated in the U.S. Department of Transportation 49 CFR 173.171, “Hazardous Materials Regulations.”

14.3.5 Commercial shipments of smokeless propellants exceeding 45.4 kg (100 lb) or not packaged in accordance with the regulations cited in 14.3.4 shall be transported in accordance with the U.S. Department of Transportation regulations for Class B propellant explosives.

14.3.6 Smokeless propellants shall be stored in shipping containers specified by U.S. Department of Transportation “Hazardous Materials Regulations.”

14.3.7 Quantities.

14.3.7.1 Smokeless propellants intended for personal use in quantities not exceeding 9.1 kg (20 lb) shall be permitted to be stored in original containers in residences.

14.3.7.2 Quantities exceeding 9.1 kg (20 lb), but not exceeding 22.7 kg (50 lb), shall be permitted to be stored in residences where kept in a wooden box or cabinet having walls of at least 25.4-mm (1-in.) nominal thickness.

14.3.8 Not more than 22.7 kg (50 lb) of smokeless propellants, in containers of a 0.45-kg (1-lb) maximum capacity, shall be displayed in commercial establishments.

14.3.9 Commercial stocks of smokeless propellants shall be stored as follows:

1. Quantities exceeding 22.7 kg (50 lb), but not exceeding 45.4 kg (100 lb), shall be stored in portable wooden boxes having walls of at least a 25.4-mm (1-in.) thickness.

2. Quantities exceeding 45.4 kg (100 lb), but not exceeding 363 kg (800 lb), shall be stored in nonportable storage cabinets having walls of at least a 25.4-mm (1-in.) thickness.

3. Not more than 181 kg (400 lb) shall be permitted to be stored in any one cabinet, and cabinets shall be separated by a distance of at least 7.63 m (25 ft) or by a fire partition having a fire resistance of at least 1 hour.

4. Quantities exceeding 363 kg (800 lb), but not exceeding 2268 kg (5000 lb), shall be permitted to be stored in a building, provided the following requirements are met:

(a) The warehouse or storage room shall not be accessible to unauthorized personnel.

(b) Smokeless propellant shall be stored in nonportable storage cabinets having wood walls of at least 25.4-mm (1-in.) thickness and having shelves with no more than 0.92 m (3 ft) of separation between shelves.

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

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

(e) The separation between cabinets shall be permitted to be reduced to 6.1 m (20 ft) where barricades twice the height of the cabinets are attached to the wall, midway between each cabinet.

(f) The barricades shall extend at least 3 m (10 ft) outward, shall be firmly attached to the wall, and shall be constructed of 6.4 mm (1/4 in.) boiler plate, 51-mm (2-in.) thick wood, brick, or concrete block.

(g) 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 7.63 m (25 ft) or by a fire partition having a fire resistance of at least 1 hour.

(h) The building shall be protected by an automatic sprinkler system installed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

(5) Smokeless propellants not stored in accordance with 14.3.9(1), (2), (3), and (4) shall be stored in a Type 4 magazine constructed and located in accordance with Chapter 9.

14.4 Black Powder.

14.4.1 Black powder shall be transported in accordance with the U.S. Department of Transportation Regulations. (See also Chapter 8.)

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

14.4.3 Black powder intended for personal use in quantities not exceeding 9.1 kg (20 lb) shall be permitted to be stored in residences where kept in the original containers and stored in a wooden box or cabinet having walls of at least a 25.4-mm (1-in.) nominal thickness.
A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials, nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction. The phrase “authority having jurisdiction” is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.6 Blast Site. A minimum of 9.1 m (30 ft) of clearance is required if the perimeter of loaded holes is marked and separated from nonblast site areas by a barrier. The word “barrier” means an object or objects that separates, keeps apart, or demarcates in a conspicuous manner by means of cones, a warning sign, or tape. The 9.1 m (30 ft) distance requirements, as applicable, apply in all directions along the full depth of the blasthole. In underground mines, at least 4.6 m (15 ft) of a solid rib, pillar, or broken rock can be substituted for the 9.1 m (30 ft) distance.

A.3.3.9 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. Blasting agents are 1.5D materials, and tests required to classify these materials are specified in the U.S. Department of Transportation, “Hazardous Materials Regulations,” 49 CFR 173.56, 173.57, and 173.58.

A.3.3.12 Bullet-Resistant Construction. Tests to determine bullet resistance are to be conducted on test panels or empty magazines. The panels or magazines are to resist penetration of five out of five shots placed independently of each other in an area at least 0.9 m × 0.9 m (3 ft × 3 ft). If hardwood or softwood is used, its water content is not to exceed 15 percent. Where a magazine roof or ceiling is required to be bullet resistant, it should be constructed of materials comparable to the sidewalls or of other materials that can withstand the penetration of bullets fired at an angle of 45 degrees from perpendicular.

A.3.3.13 Bullet-Sensitive Explosive Material. The test material is at a temperature of 21°C to 24°C (70°F to 75°F) and is placed against a 12.7 mm (1/2 in.) steel plate.

A.3.3.14 Cap-Sensitive Explosive Material. A No. 8 blasting cap contains 0.40 to 0.45 g of PETN (pentaerythritol tetranitrate) base charge pressed into an aluminum shell having a bottom thickness not greater than 0.8 mm (0.03 in.) to a specific gravity of not less than 1.4 g/cc and primed with standard weights of primer, in accordance with the manufacturers’ specifications.

A.3.3.18 Detonator. A detonator is not permitted to 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 the instantaneous and delay types, detonators for use with safety fuses, detonating cord delay connectors, and nonelectric detonators of the instantaneous and delay types that consist of a detonating cord, a shock tube, or any other replacement for electric wire legs.

A.3.3.22 Explosive. Explosives in Class 1 are divided in six divisions as follows:

1. Division 1.1 consists of explosives that have a mass explosion hazard. A mass explosion is one that affects almost the entire load instantaneously.
2. Division 1.2 consists of explosives that have a projection hazard but not a mass explosion hazard.
3. Division 1.3 consists of 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.
4. Division 1.4 consists of explosives that present a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.
(5) Division 1.5 consists of very insensitive explosives. (The probability of
transition from burning to detonation is greater when large quantities are
transported in a vessel.) This division is comprised of substances that have a
mass explosion hazard but are so insensitive that there is very little probability
of initiation or of transition from burning to detonation under normal conditions
of transport.

(6) Division 1.6 consists of extremely insensitive articles that do not have a
mass explosive hazard. (The risk from articles of Division 1.6 is limited to
the explosion of a single device.) This division is comprised of articles that
contain only extremely insensitive detonating substances and that demonstrate a
negligible probability of accidental initiation or propagation.

A list of explosives determined to be within the scope of Title 18, United States
Code, Chapter 40, is published at least annually by the Bureau of Alcohol,
Tobacco, and Firearms, U.S. Department of the Treasury. The classification of
explosives described in the “Hazardous Materials Regulations” of the U.S.
Department of Transportation is provided in Annex F. These regulations were
revised in 1991. 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 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 U.S. Department

A.3.3.23 Explosive-Actuated Device. The term does not include propellant-
actuated devices (see 3.3.59, Propellant-Actuated Device). Examples of
explosive-actuated devices are jet-tappers and jet perforators.

A.3.3.26 Fire Extinguisher Rating. Ratings are set forth in NFPA 10,
Standard for Portable Fire Extinguishers.

A.3.3.27 Fire Resistant. For exterior walls of magazines constructed of wood,
this is defined as the fire resistance equivalency provided by sheet metal of
not less than 26 gauge.

A.3.3.28 Flash Point. See also NFPA 30, Flammable and Combustible Liquids
Code.

A.3.3.34 Inhabited Building. 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.

A.3.3.51 Oxidizing Material. See NFPA 430, Code for the Storage of Liquid
and Solid Oxidizers.

A.3.3.58 Propellant. It is classified by the U.S. Department of Transportation,
“Hazardous Materials Regulations” as 1.1 (Class A) or 1.3 (Class B), depending
on its susceptibility to detonation.

A.3.3.59 Propellant-Actuated Device. A propellant-activated device is 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.

A.3.3.61 Public Highway. “Open to public travel” means that the road section
is available, except during scheduled periods, extreme weather, or emergency
conditions, passable by four-wheel standard passenger cars, and open to the
general public for use without restrictive gates, prohibitive signs, or regulation
other than restrictions based on size, weight, or class of registration. Toll plazas
of public toll roads are not considered restrictive gates.

A.3.3.65 Semicontinuous Hose. Any hose having a resistance of no more than
2.0 megohms over its entire length and a resistance of no less than 3280 ohms/
m (1000 ohms/ft) meets this definition.

A.3.3.67 Shock Tube. It contains only a limited quantity of reactive material
so that the energy that is transmitted through the tube by means of a detonation
wave is guided through and confined within the walls of the tube.

A.3.3.69 Small Arms Ammunition. This definition does not include military
ammunition containing bursting charges or incendiary, tracer, spotting, or
pyrotechnic projectiles.

A.3.3.73 Special Industrial Explosive Material. The high explosives used
include dynamite, TNT (trinitrotoluene), PETN (pentaerythritol tetranitrate),
and RDX (cyclotrimethylene-trinitramine).

A.3.3.75 Steel. Examples of steel can be found in ASTM A 1008, Standard
Specification for Steel, Sheet, Cold-Rolled, Carbon, Structured, High-Strength
Low Alloy and High Strength Low Alloy with Improved Formability, or
equivalent.

A.3.3.78 Water Gel. Water gels (or slurries) are manufactured with varying
degrees of sensitivity to initiation and are classified as Division 1.1D or 1.5D
Explosives, as appropriate. Water gels can be sensitized by a material that itself
is classified as an explosive material, such as TNT or smokeless powder, or they
cannot contain any ingredient classified as an explosive. Water gels in this latter
category are sensitized using metals such as aluminum or using other fuels.
C.1 Derivation of Table.

C.1.1 The Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents is shown in Table 9.4.2.2.

C.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 then was applied to the American Table of Distances for Storage of Explosives (see Table 9.4.1) to produce the table of recommended separation distances for ammonium nitrate and blasting agents from stores of high explosives or other blasting agents.

C.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 the need for modification of the table. However, 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, yielded ratios of unbarricaded to barricaded distances of 4.2 to 7.4. This averaged to a factor of approximately 6, which was taken to be appropriate. Therefore, unbarricaded stores of AN or ANFO not in bullet-resistant magazines should have six times the separation distances of barricaded stores.

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

\[ S = K \sqrt[3]{W} \]

This equation allowed the comparison of 726.4 kg (1600 lb) dynamite acceptors with 2451.6 kg (5400 lb) 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 thereby reducing the distance for barricaded AN to one-sixth the corresponding distance for explosives. The corresponding reduction for ANFO was 0.6.

C.1.5 One point should be emphasized: the distances in the table are for the separation of stores only. Since the blast effect from ANFO is not significantly less than from high explosives, the American Table of Distances still should 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 not modified significantly by barricades. The American Table of Distances for unbarricaded stores provides an additional factor of safety and should be used.

C.2 Guide to Use of the Table.

C.2.1 A sketch of the location of all potential donor and acceptor materials together with the maximum mass of material to be permitted in that vicinity should be made. (Potential donors are high explosives, blasting agents, and combinations of masses of detonating materials. Potential acceptors are high explosives, blasting agents, and ammonium nitrate.)

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

The calculation of the weighted distance from combined masses is as follows:

\[ D = \frac{M_1 + M_2 + \ldots + M_n}{\sum M_i} \]

where:

- \( M_i \) are donor masses to be combined.
- \( D \) is the distance from the edge of potential acceptors.
- \( M_1 \) is a potential acceptor mass.
- \( D_{12} \) is the distance from \( M_1 \) to \( M_2 \) (edge to edge).
- \( D_{13} \) is the distance from \( M_1 \) to \( M_3 \) (edge to edge), and so forth.

To find the weighted distance \( D \) from combined masses to \( M_1 \), the products of the individual masses and distances are added and the total is divided by the sum of the masses, as follows:

\[ D = \frac{\sum (M_i \times D_i)}{\sum M_i} \]

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

C.2.3 In determining the distances separating highways, railroads, and inhabited buildings from potential explosions (see Table 9.4.1), the sum of all masses that can propagate (i.e., lie at distances less than those prescribed in the table) from either individual or combined donor masses is included. However, where the ammonium nitrate is to be included, only 50 percent of its weight should 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 9.4.1.)

C.2.4 When all or part of a potential acceptor comprise Division 1.1 and Division 1.2 Explosives, as defined in DOT regulations, storage should be in bullet-resistant magazines. Safe distances to stores in bullet-resistant magazines can be obtained from the intermagazine distances prescribed in the American Table of Distances.

C.2.5 Barricades are not to have line-of-sight openings between potential donors and acceptors that allow blast or missiles to move directly between masses. (See Table C.2.5(a), Table C.2.5(b), and Figure C.2.5.)
Table C.2.5(b) Propagation Possibility — With Barricade

<table>
<thead>
<tr>
<th>Potential Donor</th>
<th>Potential Acceptor</th>
<th>Distance on Site (ft)</th>
<th>Table Distance, Minimum Required (ft)</th>
<th>Propagation Possible?</th>
</tr>
</thead>
<tbody>
<tr>
<td>M₂ (2500 lb)</td>
<td>M₁</td>
<td>20</td>
<td>6 × 3.1 = 192</td>
<td>No</td>
</tr>
<tr>
<td>M₃ (80,000 lb)</td>
<td>M₁</td>
<td>20</td>
<td>6 × 10.1 = 606</td>
<td>Yes</td>
</tr>
<tr>
<td>Combined M₂ + M₃ (82,500 lb)</td>
<td>M₁</td>
<td>49</td>
<td>30</td>
<td>No</td>
</tr>
</tbody>
</table>

For SI units, 1 lb = 0.454 kg, 1 ft = 0.305 m.
M₁: 100,000 lb Fertilizer AN prills (maximum).
M₂: 2500 lb ANFO (maximum).
M₃: 80,000 lb ANFO (maximum).
D₁₂: 20 ft.
D₂₃: 20 ft.
D₁₃: 50 ft.

Note: No other stores on site; a 1.2-m (4-ft) thick earth barricade exists at B (see Figure B.2.5).

Compute weighted distance to combined mass by equation 1:

\[
\text{Weighted Distance} = \frac{M₁ \times D₁ + M₂ \times D₂ + M₃ \times D₃}{M₁ + M₂ + M₃}
\]

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 C.2.3.

\[
100,000 \times 50\% = \frac{50,000}{2,500} = 20,000 \text{ lb} \quad \text{or} \quad \frac{80,000}{37,455 \text{ lb}} = 21,300 \text{ lb}
\]

In accordance with the American Table of Distances, the required separation distance from an inhabited building (unbarricaded) is 2000 ft.
The maximum amount of blasting agent to be considered for public protection at this site is the sum of M₂ plus M₃, or 37,455 kg (82,500 lb). In accordance with the American Table of Distances, the required separation distance from an inhabited building (unbarricaded) is 610 m (2000 ft). Where a natural or artificial barricade protects the building, the required distance is 528 m (1730 ft).

Annex D Magazine Construction

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

D.1 Magazines constructed in accordance with the following minimum specifications are approved as bullet resistant (as defined in Chapter 3). All steel and wood dimensions are actual thickness; concrete block and brick dimensions are nominal.

D.2 Steel Exterior. A steel exterior should consist of the following:

1. 15.9 mm (5/8 in.) steel with an interior lining of nonsparking material
2. 12.7 mm (1/2 in.) steel with an interior lining of plywood at least 9.5 mm (3/8 in.) thick
3. 9.5-mm (3/8 in.) steel lined with one of the following:
   a. 50.8 mm (2 in.) of hardwood
D.3 Fire-Resistant Exterior. The exterior of any type of fire-resistant material that is structurally sound can be permitted to be constructed with the following:

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

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

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

D.4 Masonry Exterior. The exterior can be permitted to be constructed with the following:

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

(2) Standard 203.2 mm (8 in.) solid brick

(3) 203.2 mm (8 in.) solid concrete

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

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

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


These regulations cover the classification, packaging, and shipping of explosives (including blasting agents), oxidizers (ammonium nitrate), flammable liquids, and flammable solids.

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

It is likely that the most important change for the user of explosive materials is the elimination of the Class A, B, and C Explosives and Blasting Agents. Under the UN recommendations, all explosive materials are placed under Class 1 Explosives. Class 1 is made up of six divisions that represent the characteristics of the properties and hazards of a particular explosive. The breakdown of Class 1 Explosives into its six divisions is provided in Section E.2.

E.2 Class 1 Explosives. Class 1 Explosives are divided as follows:

(1) Division 1.1 — Explosives that present a mass explosion hazard.

(2) Division 1.2 — Explosives that present a projection hazard but not a mass explosion hazard.

(3) Division 1.3 — Explosives that present a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.

(4) Division 1.4 — Explosive devices that present a minor explosion hazard, no device shall contain more than 25 g (0.9 oz) of a detonating material.

(5) Division 1.5 — Very insensitive explosives that present a mass...
(6) Division 1.6 — Extremely insensitive articles that do not 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.

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 related storage of explosives and to prevent an increase in hazard that could result if certain types of explosives are stored or transported together.

Compatibility groups and classification codes for the various types of explosives are provided in Table E.2(a) as follows:

(1) Compatibility groups and classification codes for substances and articles described in the first column.

(2) The number of classification codes that are possible within each explosive division.

Altogether, there are 35 possible classification codes for explosives in Table E.2(a).
E.3 UN Classification/Former DOT System. Division 1.1 through Division 1.6 are as follows:

1. Division 1.1 Class A Explosives — Dynamite, cast boosters, cap sensitive emulsions, water gels and slurries, Class A detonators
2. Division 1.2 Class A or Class B Explosives — Generally ammunition or materials that present a projection hazard
3. Division 1.3 Class B Explosives — Generally propellants or explosives that present a fire hazard but not a mass detonation hazard
4. Division 1.4 Class C Explosives — Class C detonators, safety fuse, and other Class C explosives
5. Division 1.5 Blasting Agent — ANFO, noncap-sensitive emulsions, water gels, slurries, and packaged blasting agents
6. Division 1.6 No Applicable Class — Currently no commercial explosives contained in Division 1.6

In the UN system, oxidizers and organic peroxides form Class 5 Explosives. 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 these criteria and tests it can be determined initially whether the material is an explosive and, if so, the hazard division to which it belongs.

In addition to the class and division number, every explosive under the UN recommendations has a proper shipping name and a four-digit identification number. Shipping cases are required to show the proper shipping name and the identification number.

Annex F Informational References

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

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

NFPA 77, Recommended Practice on Static Electricity, 2000 edition.

F.1.2 Other Publications.

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

F.1.2.2 IME Publication. Institute of Makers of Explosives, 1120 Nineteenth Street, NW, Suite 310, Washington, DC 20036-3605.


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


F.2.2 IME Publications. Institute of Makers of Explosives, 1120 Nineteenth Street, NW, Suite 310, Washington, DC 20036-3605.

F.3 UN Classification/Former DOT System. Division 1.1 through Division 1.6 are as follows:

1. Division 1.1 Class A Explosives — Dynamite, cast boosters, cap sensitive emulsions, water gels and slurries, Class A detonators
2. Division 1.2 Class A or Class B Explosives — Generally ammunition or materials that present a projection hazard
3. Division 1.3 Class B Explosives — Generally propellants or explosives that present a fire hazard but not a mass detonation hazard
4. Division 1.4 Class C Explosives — Class C detonators, safety fuse, and other Class C explosives
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F.1.2.2 IME Publication. Institute of Makers of Explosives, 1120 Nineteenth Street, NW, Suite 310, Washington, DC 20036-3605.


Title 18, United States Code, Chapter 40, “Importation, Manufacture, Distribution and Storage of Explosive Materials.”

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


F.2.2 IME Publications. Institute of Makers of Explosives, 1120 Nineteenth Street, NW, Suite 310, Washington, DC 20036-3605.


F.2.2.1 Videos.

“Don’t Touch,” pertaining to blasting cap safety.

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

“Safe Storage of Explosive Material.”

F.2.2.2 Posters. Assorted posters pertaining to blasting cap safety, emergency responses, and other important safety issues.

F.2.3 SAAMI Educational Materials. Sporting Arms and Ammunition Manufacturers’ Institute, Inc., Flintlock Ridge Office Center, 11 Mile Hill Road, Newtown, CT 06470-2359.

“Sporting Ammunition and the Firefighter” (video).


F.2.6 Other References.


E.3 References for Extracts. (Reserved)