

CR 84-237

# RULES CERTIFICATE

STATE OF WISCONSIN )  
 ) SS  
DEPT. OF INDUSTRY, )  
LABOR & HUMAN RELATIONS)

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MAR 25 1985  
3:40 pm  
Revisor of Statutes  
Bureau

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETINGS:

I, Howard S. Bellman, Secretary of the Department of Industry, Labor and Human Relations, and custodian of the official records of said department, do hereby certify that the annexed rule(s) relating to Explosive Materials were duly approved and adopted by this department on March 22, 1985.  
*(Subject)* *(Date)*

I further certify that said copy has been compared by me with the original on file in this department and that the same is a true copy thereof, and of the whole of such original.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the official seal of the department at 9:00 am in the city of Madison, this 22<sup>nd</sup> day of March A.D. 1985.

Howard S. Bellman  
Secretary

5-1-85

# ORDER OF ADOPTION

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MAR 25 1985

Revisor of Statutes  
Bureau

Pursuant to authority vested in the Department of Industry, Labor and Human Relations by section(s) 101.02 and 101.15, Stats., the Department of Industry, Labor and Human Relations hereby  creates;  amends;  repeals and recreates; and  repeals and adopts rules of Wisconsin Administrative Code chapter :

ILHR 7

(Number)

Explosive Materials

(Title)

The attached rules shall take effect on the first day of the month following publication in the Wisconsin Administrative Register, pursuant to section 227.026, Stats.

Adopted at Madison, Wisconsin, this 22<sup>nd</sup>  
day of March, A.D., 1985.

DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS

Howard S. Bellman

Secretary



# RULES in FINAL DRAFT FORM

Rule: Chapter ILHR 7

Relating to: Explosive Materials

Clearinghouse Rule No.: 84-237

An order to repeal chapter Ind 5; and to create chapter ILHR 7, relating to explosive materials.

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#### ANALYSIS OF PROPOSED RULES

The Division of Safety and Buildings within the department is responsible for adopting and enforcing rules relative to the protection of the life, health, safety and welfare of employes and frequenters in public buildings and places of employment. The current rules in chapter Ind 5 contain safety and health rules relative to explosive materials. The proposed rules consist of a complete revision of chapter Ind 5. Many technological changes have occurred since chapter Ind 5 was last revised in 1965, and the proposed rules reflect these changes. Some of the more significant changes in the proposed rules are as follows:

1. The scope is expanded to clarify those areas covered and those exempted.
2. The requirements for a blaster's license are revised to be more specific for the qualification required and activities permitted under each classification, and provisions are added for the revocation of a blaster's license.
3. New rules are added pertaining to recordkeeping of all sales, reporting of theft or lost, and selling only to authorized persons.
4. The provisions for the construction of magazines are completely revised and follow the requirements of the Federal Bureau of Alcohol, Tobacco and Firearms.
5. The requirements for blasting in communities are clarified. A permit is required for storage and use of any amount of explosives in a community, and the requirements for the use of blasting mats have been deleted.
6. Separation distances for the storage of explosives are expanded to include distances for the storage of low explosives and ammonium nitrate.
7. The requirements for the transportation of explosives are clarified, and a reference to the applicable rules of the state department of transportation has been added.
8. The requirements covering the use of explosives are revised to reflect technological advances in equipment and practices.
9. The provisions for the manufacture of blasting agents are updated and clarified.
10. A separate subchapter is added to cover in more detail the requirements for the storage and transportation of smokeless propellants and black powder.

The proposed rules were developed with the assistance of the following members of the Explosive Materials Code Advisory Committee:

- Peter F. Bayer, Society of Explosives Engineers
- R. Deane Boddorff, Institute of Makers of Explosives
- Darwin G. Cone, City of Milwaukee
- Fred C. Drury, Econex Incorporated
- Henry G. Fitzsimmons, Wausau Insurance Companies
- Prof. M.P. Gronbeck, U.W. Mining Engineering Department
- William J. Kraemer, Wisconsin Road Builders Association
- Ray A. Larson, Wisconsin Ready Mixed Concrete Association
- Richard C. Reiter, Wisconsin Fire Chief's Association

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Pursuant to the authority vested in the state of Wisconsin, Department of Industry, Labor and Human Relations by ss. 101.02 (1) and (15) (h) to (j) and 101.15, Stats., the department hereby repeals and recreates rules interpreting ss. 59.23 (10), 59.47 (10) and 101.15, Stats., as follows:

SECTION 1. Chapter Ind 5 is repealed.

SECTION 2. Chapter ILHR 7 is created to read:

CHAPTER ILHR 7  
EXPLOSIVE MATERIALS

Subchapter I  
General Requirements

ILHR 7.01 PURPOSE. The purpose of this chapter is to establish minimum safeguards to life, health and property by the adoption of reasonable and effective standards relating to explosive materials.

ILHR 7.02 SCOPE. (1) APPLICATION. Except as provided in sub. (2), the provisions of this chapter shall apply to the manufacture, use, storage, handling and intrastate transportation of explosive materials.

(2) EXEMPTIONS. The provisions of this chapter shall not apply to:

(a) Explosive materials while in the course of transportation via railroad, water, highway or air when the explosive materials are moving under the jurisdiction of, and in conformity with, regulations adopted by any federal department or agency;

(b) The laboratories of schools, colleges and similar institutions when confined to the purpose of instruction or research, or to explosive materials in the forms prescribed by the official United States Pharmacopeia or the National Formulary and used in medicines and medicinal agents;

(c) The emergency operations of any government including all departments, agencies and divisions thereof, if they are acting in their official capacity and in the proper performance of their duties or functions;

(d) Pyrotechnics commonly known as fireworks, including signaling devices such as flares and torpedoes;

(e) Small arms ammunition; and

(f) Gasoline, fertilizers and propellant-actuated power devices or tools.

ILHR 7.04 DEFINITIONS. (1) "Approved" means approval granted by the department.

(2) "Barricade" means natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures can not be seen when the trees are bare of leaves, or an artificial mound or revetted wall of earth, wood, concrete or other suitable materials a minimum thickness of 3 feet at the top.

(3) "Blaster" means any individual holding a valid blaster's license issued by the department.

(4) "Blasting" means any method of loosening, moving or shattering masses of solid matter by use of an explosive.

(5) "Blasting agent" means any explosive material or mixture, consisting of a fuel and oxidizer, intended for blasting, not otherwise classified as an explosive, if the material or mixture cannot be detonated by a No. 8 test detonator when unconfined.

(6) "Blasting cap" means a metallic capsule containing an initiating explosive and a base charge, open at the upper end to accept a section of safety fuse and used for initiating the primer or main charge.

(7) "Blasting mat" means a heavy mat of woven rope, steel wire, or chain, or a mat improvised from timber, poles, rubber tires or other approved materials, placed over loaded holes to minimize the amount of rock and other debris that might be thrown into the air.

(8) "Blasting operation" means any operation, enterprise or activity involving the use of blasting.

(9) "Cap-sensitive explosive material" means any explosive material that can be detonated by means of a No. 8 test detonator when unconfined.

(10) "Community" means a city, village or built-up inhabited area.

(11) "Crosscut" means a small passageway driven at right angles to the main entry to connect it with a parallel entry or air course.

(12) "Delay electric blasting cap" means an electric blasting cap with a timing element interposed between the ignition head and the detonating compound.

(13) "Department" means the department of industry, labor and human relations.

(14) "Detonator" means any device containing a detonating charge that is used for initiating detonation in an explosive. 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 non-electric instantaneous and delay blasting caps.

(15) "Drift" means a horizontal passage underground which follows the vein, as distinguished from a crosscut, which intersects it.

(16) "Electric blasting cap" means a blasting cap designed for, and capable of, initiation by means of an electric current.

(17) "Explosion" means the substantially instantaneous release of both gas and heat.

(18) "Explosive" means any chemical compound, mixture or device, the primary or common purpose of which is to function by explosion unless the compound, mixture or device is otherwise classified by the department by rule.

(19) "Explosive materials" means explosives, blasting agents and detonators. The term includes, but is not limited to, dynamite and other high explosives, slurries, emulsions, water gels, blasting agents, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord and igniters.

(20) "High explosives" means explosive materials which are characterized by a very high rate of reaction, high pressure development, and the presence of a detonation wave in the explosion.

(21) "Highway" means any public street, public alley or public road.

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

(23) "Low explosives" means explosive materials which are characterized by deflagration or a low rate of reaction and the development of low pressures. The term includes, but is not limited to black powder, safety fuses, igniters, igniter cords and fuse lighters.

(24) "Magazine" means any building, container or structure other than an explosives manufacturing building, of approved construction used for the storage of explosive materials.

(25) "No. 8 test detonator" means a detonator with 0.40 to 0.45 grams pentaerythritol tetranitrate (PETN) base charge pressed to a specific gravity of 1.4 grams/cubic centimeter (g/cc) and primed with standard weights of primer.

(26) "Non-electric delay blasting cap" means a detonator with an integral delay element used in conjunction with, and capable of being initiated by, a detonating impulse.

(27) "Operator" means the person who is responsible for a blasting operation at a blasting site.

(28) "Person" means any individual, corporation, company, association, firm, partnership, society or joint stock company.

(29) "Primer" means a capped fuse, electric detonator or any other detonating device inserted in or attached to a cartridge of explosive.

(30) "Railway" means any steam, electric, diesel-electric or other rail track system which carries passengers for hire.



(31) "Stemming" means the inert material, such as drill cuttings, used in the collar portion or elsewhere of a blast hole to confine the gaseous products of detonation.

ILHR 7.05 INSPECTIONS. (1) GENERAL REQUIREMENTS. The authorized inspectors of the department, upon presenting appropriate credentials to the owner, operator or agent in charge, may:

(a) Enter without delay and at reasonable times any factory, plant, establishment, construction site or other area, workplace or environment where work is performed by an employe of an employer; and

(b) Inspect and investigate during regular working hours and at other reasonable times, and within reasonable limits and in a reasonable manner, any place of employment and all pertinent conditions, structures, machines, apparatus, devices, equipment and materials therein, and to question privately any employer, owner, operator, agent or employe.

(2) REPRESENTATION. The inspector, before making an inspection, shall contact the employer or employer's representative who shall be given an opportunity to accompany the inspector during the physical inspection of any workplace under sub. (1).

Note: The department policy is not to give advance notice, but in the scheduling and in the act of inspecting it may not always be possible to avoid advance notice or to obtain accompaniment, but otherwise these rules will be diligently observed.

ILHR 7.06 FEES. Fees for the registration of blasters, safety inspections and petitions for variance shall be submitted as specified in ch. Ind 69.

ILHR 7.07 ENFORCEMENT. The provisions of this chapter shall be enforced by the department, or by municipal officials or other local officials who are required by law to enforce the administrative rules of the department.

ILHR 7.08 APPEALS. (1) APPEAL OF LOCAL ORDER. Any person affected by a local order which may be in conflict with a rule of the department may petition the department for a hearing on the grounds that the local order is unreasonable and in conflict with the rule of the department.

Note: Section 101.01 (1) (g), Stats., defines "local order" as any ordinance, order, rule or determination of any common council, board of aldermen, board of trustees or the village board, of any village or city, or the board of health of any municipality, or an order or direction of any official of such municipality, upon any matter over which the department has jurisdiction.

(2) PETITION OF ADMINISTRATIVE RULE. Pursuant to s. 227.015, Stats., any municipality, corporation or any 5 or more persons having an interest in an administrative rule may petition the department requesting the adoption, amendment or repeal of the rule.

ILHR 7.09 PETITION FOR VARIANCE. (1) PROCEDURE. The department shall consider and may grant a variance to an administrative rule upon receipt of a fee, a completed petition for variance form from the owner and, where applicable, a completed position statement from the chief of the local fire department, if an equivalency is established in the petition for variance which meets the intent of the rule being petitioned. The department may impose specific conditions in a petition for variance to promote the protection of the health, safety or welfare of the employes or the public. Violation of those conditions under which the variance is granted constitutes a violation of the rules of this chapter.

Note #1: Copies of the petition for variance (form SB-8) and the position statement (form SB-8A) are available at no charge from the Division of Safety and Buildings, P.O. Box 7969, Madison, Wisconsin 53707.

Note #2: Section 101.02 (6), Stats., outlines the procedure for submitting petitions to the department and the department procedures for hearing petitions.

(2) PETITION PROCESSING TIME. Except for priority petitions, the department shall review and make a determination on a petition for variance within 30 business days of receipt of all calculations, documents and fees required to complete the review. The department shall process priority petitions within 10 business days of receipt of the required items.

ILHR 7.10 PENALTIES. Penalties for violation of any provision in this chapter shall be assessed in accordance with s. 101.02 (12) and (13), Stats.

Note #1: Section 101.02 (13) (a), Stats., indicates penalties will be assessed against any employer, employe, owner or other person who fails or refuses to perform any duty lawfully enjoined, within the time prescribed by the department, for which no penalty has been specifically provided, or who fails, neglects or refuses to comply with any lawful order made by the department, or any judgment or decree made by any court in connection with ss. 101.01 to 101.25, Stats. For each such violation, failure or refusal, such employe, owner or other person must forfeit and pay into the state treasury a sum not less than \$10 nor more than \$100 for each violation.

Note #2: Section 101.02 (12), Stats., indicates that every day during which any person, persons, corporation or any officer, agent or employe thereof, fails to observe and comply with an order of the department will constitute a separate and distinct violation of such order.

ILHR 7.11 BLASTER'S LICENSE. (1) GENERAL REQUIREMENTS. (a) No person may prepare explosive charges or conduct blasting operations, and no employer may employ any person for these purposes, unless the person is 21 years of age and holds a valid blaster's license issued by the department after a determination of fitness by application and examination. The department shall issue the blaster's license within 15 business days after the applicant has successfully passed the examination.

(b) The applicant for a blaster's license shall be able to understand and give written and oral orders in the English language.

(c) Persons authorized to prepare explosive charges or conduct blasting operations shall comply with all provisions of this chapter, and shall use every reasonable precaution to insure the safety of co-workers and the general public. They shall not delegate the work of preparing explosive charges or conducting blasting operations to a person who does not hold a valid blaster's license, except under their direct supervision. A person not holding a valid blaster's license may act only as a helper.

(d) The licensing requirements in this subsection shall not apply to laboratory, transportation, manufacturing or dealer operations.

(e) The blaster shall not engage in blasting operations other than those indicated on the blaster's license. A copy of the license shall be carried by the blaster during blasting operations.

(f) Explosives shall be sold, given, delivered or transferred only to persons holding a valid blaster's license or authorized agents of concerns employing licensed blasters. This paragraph does not apply to handloading of small arms ammunition for personal use and not for resale.

(2) APPLICATION, EXAMINATION AND RENEWAL. (a) Application for a blaster's license or its renewal shall be made to the department on forms provided by the department.

Note: See appendix D for a sample copy of an application form.

(b) Examinations for the initial blaster's license shall be given at those times and places as determined by the department. A grade of 80% or greater shall be considered a passing grade.

(c) After the initial registration of the blaster's license, applications for renewal shall be made every 4 years. The renewal shall be issued upon successful completion of a qualifying examination.

Note: The qualifying examination for renewal is an open book exam mailed to each blaster who applies for license renewal.

(3) DENIAL AND REVOCATION. (a) A blaster's license may be denied or revoked by the department for any of the following reasons:

1. Violations of the provisions of this chapter;
2. Proof that the applicant or holder is charged with, is under indictment for, or has been convicted of, a felony or a misdemeanor, if the circumstances of the pending charge or the offense substantially relate to blasting operations;

3. The applicant or holder is a fugitive from justice;
4. The applicant or holder is an unlawful user of, or addicted to, alcohol, narcotics or drugs;
5. The applicant or holder has been adjudicated of mental incompetence by a court of law;
6. Proof that the applicant or holder advocates, or knowingly belongs to any organization or group that advocates violent overthrow of or violent action against any federal, state or local government;
7. Proof that the applicant or holder suffers from a mental or physical defect that would interfere with the safe handling of explosive materials;
8. Violation by the applicant or holder of any provision of any law or regulation relating to explosive materials, or proof that false information was willfully given or a misrepresentation was willfully made to obtain the license; and
9. Gross negligence, incompetence or misconduct in the practice or work allowed by the license.

(b) In any case where the department denies or revokes a license, the department shall notify the applicant or license holder in writing. The notice shall set forth the specific basis for the denial or revocation and state that upon written request a hearing before the department will be held within 10 business days after the date of the request.

(c) Within 15 business days after the hearing the department shall state its findings and conclusions in writing and transmit a copy to the applicant or former license holder.

(d) Upon notice of the revocation of any license the former license holder shall immediately surrender to the department the license and all copies thereof. The license revocation shall be for not less than one month nor for more than one year.

(e) Any person whose blaster's license has been revoked shall be required to submit an application and pass a qualifying examination, as prescribed in sub. (2) (a) and (b), before the license is reinstated.

(4) CLASSIFICATION. Blaster's licenses shall be classified as follows:

Note: Licenses are issued for the specific blasting activity permitted; i.e., a class 1a license is different from a class 1b, and so on.

(a) Class 1 - Limited or Basic. 1. The applicant for a class 1 license shall have completed at least 4 months of acting as a helper with a licensed blaster doing blasting, or equivalent qualifying experience approved by the department, and shall have passed a qualifying examination.

2. A holder of a class 1 license shall not be permitted to do blasting within communities nor within 500 feet of an inhabited building. Activities permitted for a holder of a class 1 license shall be as follows:

- a. Stumps, boulders, ice and frost.
- b. Concrete footings and foundations.
- c. Pole setting in muck or rock.
- d. Drainage ditching, beaver dams and pot holes.
- e. Well shooting using 10 pounds or less.
- f. Dimension stone.
- g. Seismic.
- h. Special, such as boiler tube plugging, fertilizer piles.

(b) Class 2 - Underground Blasting. 1. The applicant for a class 2 license shall have completed at least 4 months of acting as a helper with a licensed underground blaster doing blasting, or equivalent qualifying experience approved by the department, and shall have passed a qualifying examination.

2. Activities permitted for a holder of a class 2 license shall be as follows:

- a. Underground mining.
- b. Underground construction and tunneling.

(c) Class 3 - Surface Blasting. 1. The applicant for a class 3 license shall have completed at least 4 months of acting as a helper with a licensed class 3 or class 5 blaster doing blasting, or equivalent qualifying experience approved by the department, and shall have passed a qualifying examination.

2. A holder of a class 3 license shall not be permitted to do blasting within communities nor within 500 feet of an inhabited building. Activities permitted for a holder of a class 3 license shall be as follows:

- a. Quarry and open-pit mining.
- b. Road cuts.
- c. Trench blasting.
- d. Site excavation.

(d) Class 4 - Precision Blasting. 1. The applicant for a class 4 license shall have completed at least 4 months of acting as a helper with a licensed class 4 or class 5 blaster doing specialty blasting, or equivalent qualifying experience approved by the department, and shall have passed a qualifying examination.

2. A holder of a class 4 license may do blasting within communities or within 500 feet of an inhabited building. Activities permitted for a holder of a class 4 license shall be as follows:

- a. Quarry and open-pit mining.
- b. Road cuts.
- c. Trench blasting.
- d. Site excavation.
- e. Low-structure demolition under 15 feet in height.
- f. Underwater demolition and excavation.
- g. Well shooting.
- h. Special, such as silos.

(e) Class 5 - Specialized Blasting. 1. Requirements for a class 5 license shall consist of special qualifications and blasting experience as determined by the department, including blasting in communities, knowledge of the explosives code, and passing a qualifying exam.

2. Activities permitted for a holder of a class 5 license shall be as follows:

- a. High-structure demolition.
- b. Special.

ILHR 7.12 RECORDKEEPING, REPORTING AND DEALER OPERATIONS. (1) PERMITTED SALES. (a) Except as provided in par. (b), a person engaged in the business of dealing in explosive materials may sell, give, deliver or transfer only to persons holding a valid Wisconsin blaster's license or authorized agents of concerns employing licensed blasters.

(b) Black powder and smokeless propellants, for sportsmen's use may be purchased by persons not possessing a Wisconsin blaster's license.

(2) SALES RECORDS. (a) Explosive materials dealers shall keep a record of all sales involving explosive materials for 5 years. The records shall be made available to the department upon request.

(b) Invoices, sales slips, delivery tickets, receipts or similar papers representing individual transactions shall satisfy the requirements for records provided they include the signature of any receiver of the explosive materials.

(c) Records made and kept for compliance with regulations of the Federal Bureau of Alcohol, Tobacco and Firearms need not be duplicated to satisfy the requirements of this subsection.

(3) REPORTING THEFT OR LOSS. The theft or loss of explosive materials shall be reported to the local law enforcement agency.

Note: The Federal Bureau of Alcohol, Tobacco and Firearms requires reporting the theft or loss of any explosive materials within 24 hours by telephoning 1-800-424-9555.

Subchapter II  
Storage of Explosive Materials

Note: Sections ILHR 7.203 to 7.220 follow the storage requirements of subpart K of the Federal Bureau of Alcohol, Tobacco and Firearms. Section numbering corresponds with that used in 27 CFR Part 55.

ILHR 7.20 GENERAL STORAGE REQUIREMENTS. (1) NOTIFICATION. Any person storing explosive materials shall notify the local fire department and local law enforcement agency of the place, extent and manner of the storage.

(2) STORAGE PERMIT. Any person storing explosive materials in a community shall obtain written permission in advance from the department and the explosives shall be stored in an approved magazine. The department shall issue the explosive storage permit within 15 business days of receiving proof that the storage complies with the requirements of this chapter.

Note: See appendix E for a sample copy of an application form.

(3) MAGAZINE RESPONSIBILITY. Magazines shall be under the responsibility of a person at least 21 years of age and specifically appointed for the purpose. This person shall have possession of the keys of the magazine and shall be responsible for the safe storage of explosives contained in the magazine.

(4) SIGNS. Signs with the words EXPLOSIVES - KEEP OFF legibly printed in contrasting colors and in letters at least 3 inches in height and 1/4 inch in stroke, shall be posted and maintained at all times on the premises on which the magazines are located. Except for Type 3 magazines, the signs shall be located so that a bullet fired directly at them will not strike any magazine.

(5) INDOOR MAGAZINE LOCATIONS. Indoor magazines shall be located on the floor nearest the ground level, within 10 feet from an outside entrance, and at least 10 feet from another magazine.

ILHR 7.203 TYPES OF MAGAZINES. For the purposes of this chapter, there are 5 types of magazines. These types, together with the classes of explosive materials which may be stored in them, shall be as specified in subs. (1) to (5).

(1) TYPE 1 MAGAZINES. Type 1 magazines shall be permanent magazines for the storage of high explosives, subject to the limitations prescribed by ss. ILHR 7.206 and 7.213. Other classes of explosive materials may also be stored in Type 1 magazines.

(2) TYPE 2 MAGAZINES. Type 2 magazines shall be mobile and portable indoor and outdoor magazines for the storage of high explosives, subject to the limitations prescribed by ss. ILHR 7.206, 7.208 (2) and 7.213. Other classes of explosive materials may also be stored in Type 2 magazines.

(3) TYPE 3 MAGAZINES. Type 3 magazines shall be portable outdoor magazines for the temporary storage of high explosives while attended, subject to the limitations prescribed by ss. ILHR 7.206 and 7.213. Other classes of explosive materials may also be stored in Type 3 magazines.

Note: An example of a Type 3 magazine is a "day-box".



(4) TYPE 4 MAGAZINES. Type 4 magazines shall be magazines for the storage of low explosives, subject to the limitations prescribed by ss. ILHR 7.206 (2), 7.210 (2) and 7.213. Blasting agents may be stored in Type 4 magazines, subject to the limitations prescribed by ss. ILHR 7.206 (3), 7.211 (2) and 7.213. Detonators that will not mass detonate may also be stored in Type 4 magazines, subject to the limitations prescribed by ss. ILHR 7.206 (1), 7.210 (2) and 7.213.

(5) TYPE 5 MAGAZINES. Type 5 magazines shall be magazines for the storage of blasting agents, subject to the limitations prescribed by ss. ILHR 7.206 (3), 7.211 (2) and 7.213.

Note: Complete plans for all types of magazines are available from the U.S. Bureau of Mines, explosive manufacturers, and the Institute of Makers of Explosives.

ILHR 7.204 INSPECTION OF MAGAZINES. Any person storing explosive materials shall inspect their magazines at least every 7 calendar days. This inspection need not be an inventory, but shall be sufficient to determine whether there has been unauthorized entry or attempted entry into the magazines, or unauthorized removal of the contents of the magazines.

ILHR 7.205 MOVEMENT OF EXPLOSIVE MATERIALS. All explosive materials shall be kept in locked magazines meeting the requirements in this chapter unless the materials are in the process of manufacture; being physically handled in the operating process of a licensee or user; being used; or being transported to a place of storage or use by a licensee or permittee or by a person who has lawfully acquired explosive materials.

ILHR 7.206 LOCATION OF MAGAZINES. (1) HIGH EXPLOSIVES STORAGE. Outdoor magazines in which high explosives are stored shall be located no closer to inhabited buildings, passenger railways, public highways, or other magazines in which high explosives are stored, than the minimum distances specified in the table of distances for storage of explosive materials in s. ILHR 7.218.

(2) LOW EXPLOSIVES STORAGE. Outdoor magazines in which low explosives are stored shall be located no closer to inhabited buildings, passenger railways, public highways, or other magazines in which explosive materials are stored, than the minimum distances specified in the table of distances for storage of low explosives in s. ILHR 7.219. The distances shown in s. ILHR 7.219 shall not be reduced by the presence of barricades.

(3) BLASTING AGENTS STORAGE. (a) Outdoor magazines in which blasting agents in quantities of more than 50 pounds are stored shall be located no closer to inhabited buildings, passenger railways, or public highways than the minimum distances specified in the table of distances for storage of explosive materials in s. ILHR 7.218.

(b) Ammonium nitrate and magazines in which blasting agents are stored shall be located no closer to magazines in which high explosives or other blasting agents are stored than the minimum distances specified in the table of distances for the separation of ammonium nitrate and blasting agents in s. ILHR 7.220. However, the minimum distances for magazines in which explosives and blasting agents are stored from inhabited buildings, passenger railways, or public highways, shall not be less than the distances specified in the table of distances for storage of explosive materials in s. ILHR 7.218.

ILHR 7.207 CONSTRUCTION OF TYPE 1 MAGAZINES. A Type 1 magazine is a permanent structure, such as but not limited to, a building, an igloo or "Army-type structure", a tunnel, or a dugout. It shall be bullet-resistant, fire-resistant, weather-resistant, theft-resistant and ventilated.

(1) BUILDINGS. All Type 1 building magazines shall be constructed of masonry, wood, metal or a combination of these materials, and have no openings except for entrances and ventilation. The ground around building magazines shall slope away for drainage or other adequate drainage shall be provided. The construction of Type 1 building magazines shall comply with the requirements of pars. (a) to (k).

(a) Masonry Wall Construction. Masonry wall construction shall consist of brick, concrete, tile, cement block, or cinder block and be not less than 6 inches in thickness. Hollow masonry units used in construction shall have all hollow spaces filled with well-tamped, coarse, dry sand or weak concrete consisting of at least a mixture of one part cement and 8 parts of sand with enough water to dampen the mixture while tamping in place. Interior walls shall be constructed of, or covered with, a nonsparking material.

(b) Fabricated Metal Wall Construction. Metal wall construction shall consist of sectional sheets of steel or aluminum not less than number 14-gauge, securely fastened to a metal framework. Metal wall construction shall be either lined inside with brick, solid cement blocks or hardwood not less than 4 inches thick, or shall have at least a 6 inch sand fill between interior and exterior walls. Interior walls shall be constructed of, or covered with, a nonsparking material.

(c) Wood Frame Wall Construction. The exterior of outer wood walls shall be covered with iron or aluminum not less than number 26-gauge. An inner wall of, or covered with, nonsparking material shall be constructed so as to provide a space of not less than 6 inches between the outer and inner walls. The space shall be filled with coarse, dry sand or weak concrete.

(d) Floors. Floors shall be constructed of, or covered with, a nonsparking material and shall be strong enough to bear the weight of the maximum quantity to be stored. Use of pallets covered with a nonsparking material is considered equivalent to a floor constructed of or covered with a nonsparking material.

(e) Foundations Foundations shall be constructed of brick, concrete, cement block, stone, or wood posts. If piers or posts are used, in lieu of a continuous foundation, the space under the buildings shall be enclosed with not less than 26-gauge metal.

(f) Roof. Except for buildings with fabricated metal roofs, the outer roof shall be covered with no less than number 26-gauge iron or aluminum, fastened to at least 7/8-inch sheathing.

(g) Bullet-Resistant Ceilings or Roofs. Where it is possible for a bullet to be fired directly through the roof and into the magazine at such an angle that the bullet would strike the explosives within, the magazine shall be protected by one of the following methods:

1. A sand tray lined with a layer of building paper, plastic, or other non-porous material, and filled with not less than 4 inches of coarse, dry sand and located at the tops of inner walls covering the entire ceiling area, except that portion necessary for ventilation.

2. A fabricated metal roof constructed of 3/16-inch plate steel lined with 4 inches of hardwood. For each additional 1/16 inch of plate steel, the hardwood lining may be decreased one inch.

(h) Doors. All doors shall be constructed of not less than 1/4-inch plate steel and lined with at least 2 inches of hardwood. Hinges and hasps shall be attached to the doors by welding, riveting, or bolting with nuts on the inside of the door. Hinges and hasps shall be installed in such a manner that they cannot be removed when the doors are closed and locked.

(i) Locks. Each door shall be equipped with 2 mortise locks; 2 padlocks fastened in separate hasps and staples; a combination of a mortise lock and padlock; a mortise lock that requires 2 keys to open; or a three-point lock. Padlocks shall have at least 5 tumblers and a casehardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock or bar that cannot be actuated from the outside.

(j) Ventilation. Ventilation shall be provided to prevent dampness and heating of stored explosive materials. Ventilation openings shall be screened to prevent the entrance of sparks. Ventilation openings in side walls and foundations shall be offset or shielded for bullet-resistant purposes. Magazines having foundation and roof ventilators with the air circulating between the side walls and the floors and between the side walls and the ceiling shall have a wooden lattice lining or equivalent to prevent the packages of explosive materials from being stacked against the side walls and blocking the air circulation.

(k) Exposed Metal. No sparking material may be exposed to contact with the stored explosive materials. All ferrous metal nails in the floor and side walls, which might be exposed to contact with explosive materials, shall be blind nailed, countersunk, or covered with a nonsparking lattice work or other nonsparking material.

(2) IGLOOS, "ARMY-TYPE STRUCTURES", TUNNELS AND DUGOUTS. All Type 1 igloo, "Army-type structure", tunnel and dugout magazines shall be constructed of reinforced concrete, masonry, metal, or a combination of these materials. They shall have an earthmound covering of not less than 24 inches on the top, sides and rear unless the magazine meets the requirements of sub. (1) (g). Interior walls and floors shall be constructed of, or covered with, a nonsparking material. Magazines of this type shall also be constructed in conformity with the requirements of subs. (1) (d) and (1) (h) to (k).

ILHR 7.208 CONSTRUCTION OF TYPE 2 MAGAZINES. A Type 2 magazine is a box, trailer, semi-trailer, or other mobile facility.

(1) OUTDOOR MAGAZINES. (a) General. Outdoor Type 2 magazines shall be bullet-resistant, fire-resistant, weather-resistant, theft-resistant and ventilated. They shall be supported to prevent direct contact with the ground and, if less than one cubic yard in size, shall be securely fastened to a fixed object. The ground around outdoor magazines shall slope away for drainage or other adequate drainage shall be provided. When unattended, vehicular magazines shall have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods approved by the department. The construction of outdoor Type 2 magazines shall comply with the requirements of pars. (b) to (d).

(b) Exterior Construction. The exterior and doors shall be constructed of not less than 1/4-inch steel and lined with at least 2 inches of hardwood. Magazines with top openings shall have lids with water-resistant seals or which overlap the sides by at least one inch when in a closed position.

(c) Hinges and Hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting with nuts on the inside of the door. Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with 2 mortise locks; 2 padlocks fastened in separate hasps and staples; a combination of a mortise lock and a padlock; a mortise lock that requires 2 keys to open; or a three-point lock. Padlocks shall have at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock or bar that cannot be actuated from the outside.

(2) INDOOR MAGAZINES. (a) General. Indoor Type 2 magazines shall be fire-resistant and theft-resistant. They need not be bullet-resistant and weather-resistant if the buildings in which they are stored provide protection from the weather and from bullet penetration. No indoor magazine may be located in a residence or dwelling. The indoor storage of high explosives shall not exceed a quantity of 50 pounds. More than one indoor magazine may be located in the same building if the total quantity of explosive materials stored does not exceed 50 pounds. Except as provided in s. ILHR 7.213, detonators shall be stored in a separate magazine and the total quantity of detonators shall not exceed 5,000. The construction of indoor Type 2 magazines shall comply with the requirements of pars. (b) to (d).

(b) Exterior Construction. Indoor Type 2 magazines shall be constructed of wood or metal according to one of the following specifications:

1. Wood indoor magazines shall have sides, bottoms and doors constructed of at least 2 inches of hardwood and shall be well braced at the corners. They shall be covered with sheet metal of not less than number 26-gauge. Nails exposed to the interior of magazines shall be countersunk.

2. Metal indoor magazines shall have sides, bottoms and doors constructed of not less than number 12-gauge metal and shall be lined inside with a nonsparking material. Edges of metal covers shall overlap sides at least one inch.

(c) Hinges and Hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting with nuts on the inside of the door. Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with 2 mortise locks; 2 padlocks fastened in separate hasps and staples; a combination of a mortise lock and a padlock; a mortise lock that requires 2 keys to open; or a three-point lock. Padlocks shall have at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. Indoor magazines located in secure rooms that are locked as provided in this paragraph may have each door locked with one steel padlock, which need not be protected by a steel hood, having at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter, if the door hinges and lock hasp are securely fastened to the magazine. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock or bar that cannot be actuated from the outside.

(3) DETONATOR BOXES. Magazines for detonators in quantities of 100 or less shall have sides, bottoms and doors constructed of not less than number 12-gauge metal and lined with a nonsparking material. Hinges and hasps shall be attached so they cannot be removed from the outside. One steel padlock, which need not be protected by a steel hood, having at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter shall be sufficient for locking purposes

ILHR 7.209 CONSTRUCTION OF TYPE 3 MAGAZINES. A Type 3 magazine is a "day-box" or other portable magazine. It shall be fire-resistant, weather-resistant and theft-resistant. A Type 3 magazine shall be constructed of not less than number 12-gauge steel, lined with at least either 1/2-inch plywood or 1/2-inch Masonite-type hardboard. Doors shall overlap sides by at least one inch. Hinges and hasps shall be attached by welding, riveting, or bolting with nuts on the inside. One steel padlock, which need not be protected by a steel hood, having at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter is sufficient for locking purposes. Explosive materials shall not be left unattended in Type 3 magazines and shall be removed to Type 1 or 2 magazines for unattended storage.

ILHR 7.210 CONSTRUCTION OF TYPE 4 MAGAZINES. A Type 4 magazine is a building, igloo or "Army-type structure", tunnel, dugout, box, trailer, or a semitrailer or other mobile facility.

(1) OUTDOOR MAGAZINES. (a) General. Outdoor Type 4 magazines shall be fire-resistant, weather-resistant, and theft-resistant. The ground around outdoor magazines shall slope away for drainage or other adequate drainage shall be provided. When unattended, vehicular magazines shall have wheels removed or otherwise be effectively immobilized by kingpin locking devices or other methods approved by the department. The construction of outdoor Type 4 magazines shall comply with the requirements of pars. (b) to (d).

(b) Construction. Outdoor Type 4 magazines shall be constructed of masonry, metal-covered wood, fabricated metal, or a combination of these materials. Foundations shall be constructed of brick, concrete, cement block, stone, or metal or wood posts. If piers or posts are used, in lieu of a continuous foundation, the space under the building shall be enclosed with fire-resistant material. The walls and floors shall be constructed of, or covered with, a nonsparking material or lattice work. The doors shall be metal or solid wood covered with metal.

(c) Hinges and Hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting with nuts on the inside of the door. Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with 2 mortise locks; 2 padlocks fastened in separate hasps and staples; a combination of a mortise lock and a padlock; a mortise lock that requires 2 keys to open; or a three-point lock. Padlocks shall have at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock or bar that cannot be actuated from the outside.

(2) INDOOR MAGAZINES. (a) General. Indoor Type 4 magazines shall be fire-resistant and theft-resistant. They need not be weather-resistant if the buildings in which they are stored provide protection from the weather. No indoor magazine may be located in a residence or dwelling. The indoor storage of low explosives shall not exceed a quantity of 50 pounds. More than one indoor magazine may be located in the same building if the total quantity of explosive materials stored does not exceed 50 pounds. Detonators that will not mass detonate shall be stored in a separate magazine and the total number of electric detonators shall not exceed 5,000. The construction of indoor Type 4 magazines shall comply with the requirements of pars. (b) to (d).

(b) Construction. Indoor Type 4 magazines shall be constructed of masonry, metal-covered wood, fabricated metal, or a combination of these materials. The walls and floors shall be constructed of, or covered with, a nonsparking material. The doors shall be metal or solid wood covered with metal.

(c) Hinges and Hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting with nuts on the inside of the door. Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with 2 mortise locks; 2 padlocks fastened in separate hasps and staples; a combination of a mortise lock and padlock; a mortise lock that requires 2 keys to open; or a three-point lock. Padlocks shall have at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. Indoor magazines located in secure rooms that are locked as provided in this paragraph may have each door locked with one steel padlock, which need not be protected by a steel hood, having at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter, if the door hinges and lock hasp are securely fastened to the magazine. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock or bar that cannot be actuated from the outside.

ILHR 7.211 CONSTRUCTION OF TYPE 5 MAGAZINES. A Type 5 magazine is a building, igloo or "Army-type structure", tunnel, dugout, bin, box, trailer, or a semitrailer or other mobile facility.

(1) OUTDOOR MAGAZINE. (a) General. Outdoor Type 5 magazines shall be weather-resistant and theft-resistant. The ground around outdoor magazines shall slope away for drainage or other adequate drainage shall be provided. When unattended, vehicular magazines shall have wheels removed or otherwise be effectively immobilized by kingpin locking devices or other methods approved by the department. The construction of outdoor Type 5 magazines shall comply with the requirements of pars. (b) to (d).

(b) Construction. The doors shall be constructed of solid wood or metal.

(c) Hinges and Hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting with nuts on the inside of the door. Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with 2 mortise locks; 2 padlocks fastened in separate hasps and staples a combination of a mortise lock and a padlock; a mortise lock that requires 2 keys to open; or a three-point lock. Padlocks shall have at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. Trailers, semitrailers and similar vehicular magazines may, for each door, be locked with one steel padlock, which need not be protected by a steel hood, having at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter, if the door hinges and lock hasp are securely fastened to the magazine and to the door frame. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock or bar that cannot be actuated from the outside.

(2) INDOOR MAGAZINES. (a) General. Indoor Type 5 magazines shall be theft-resistant. They need not be weather-resistant if the buildings in which they are stored provide protection from the weather. No indoor magazine may be located in a residence or dwelling. Indoor magazines containing quantities of blasting agents in excess of 50 pounds are subject to the requirements of s. ILHR 7.206. The construction of indoor Type 5 magazines shall comply with the requirements of pars (b) to (d).

(b) Construction. The doors shall be constructed of wood or metal.

(c) Hinges and Hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting with nuts on the inside. Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with 2 mortise locks; 2 padlocks fastened in separate hasps and staples; a combination of a mortise lock and a padlock; a mortise lock that requires 2 keys to open; or a three-point lock. Padlocks shall have at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. Indoor magazines located in secure rooms that are locked as provided in this paragraph may have each door locked with one steel padlock, which need not be protected by a steel hood, having at least 5 tumblers and a case-hardened shackle of at least 3/8-inch diameter, if the door hinges and lock hasps are securely fastened to the magazine and to the door frame. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock or bar that cannot be actuated from the outside.

ILHR 7.212 SMOKING AND OPEN FLAMES. Smoking, matches, open flames and spark producing devices shall not be permitted in any magazine, within 50 feet of any outdoor magazine, or within any room containing an indoor magazine.

ILHR 7.213 QUANTITY AND STORAGE RESTRICTIONS. (1) MAXIMUM QUANTITIES. Explosive materials in excess of 300,000 pounds or detonators in excess of 20 million shall not be stored in one magazine unless approved by the department.

(2) DETONATOR STORAGE. Except as provided in pars. (a) and (b), detonators shall not be stored in the same magazine with other explosive materials.

(a) In a Type 4 magazine, detonators that will not mass detonate may be stored with electric squibs, safety fuse, igniters and igniter cord.

(b) In a Type 1 or Type 2 magazine, detonators may be stored with delay devices, electric squibs, safety fuse, igniters and igniter cord.

ILHR 7.214 STORAGE WITHIN TYPES 1, 2, 3 and 4 MAGAZINES. The following requirements shall apply to storage within Types 1, 2, 3 and 4 magazines.

(1) PLACEMENT WITHIN MAGAZINES. Explosive materials within a magazine shall not be placed directly against interior walls and shall be stored so as not to interfere with ventilation. To prevent contact of stored explosive materials with walls, a nonsparking lattice work or other nonsparking material may be used.

(2) INVENTORY AND INSPECTION. Containers of explosive materials shall be stored so that labels are visible. Stocks of explosive materials shall be stored so they can be easily counted and checked upon inspection.

(3) OPENING OF CONTAINERS. Except with respect to fiberboard or other non-metal containers, containers of explosive materials shall not be unpacked or repacked inside a magazine or within 50 feet of a magazine, and shall not be unpacked or repacked close to other explosive materials. Containers of explosive materials shall be closed while being stored.



(4) TOOLS. Tools used for opening or closing containers of explosive materials shall be of nonsparking materials, except that metal slitters may be used for opening fiberboard containers. A wood wedge and a fiber, rubber or wooden mallet shall be used for opening or closing wood containers of explosive materials. Metal tools other than nonsparking transfer conveyors shall not be stored in any magazine containing high explosives.

ILHR 7.215 HOUSEKEEPING. (1) CLEANING AND MAINTENANCE. Magazines shall be kept clean, dry, and free of grit, paper, empty packages and containers, and rubbish. Floors shall be regularly swept. Brooms and other utensils used in the cleaning and maintenance of magazines shall have no spark-producing metal parts, and may be kept in magazines. Floors stained by leakage from explosive materials shall be cleaned according to instructions of the explosives manufacturer.

(2) DETERIORATED EXPLOSIVES. When any explosive material has deteriorated it shall be destroyed in accordance with the advice or instructions of the manufacturer or distributor.

Note: Explosive materials are affected by age and storage conditions. Under extreme conditions explosive materials may deteriorate to the point where they are either unfit for use or unusually hazardous. If there is any question about the condition of an explosive material, the manufacturer or distributor should be consulted.

(3) AREA AROUND MAGAZINES. The area surrounding magazines shall be kept clear of rubbish, brush, dry grass, or trees, except live trees more than 10 feet tall, for not less than 25 feet in all directions. Volatile materials shall be kept a distance of not less than 50 feet from outdoor magazines. Living foliage which is used to stabilize the earthen covering of a magazine need not be removed.

ILHR 7.216 REPAIR OF MAGAZINES. (1) REMOVING EXPLOSIVES. Before repairing the interior of magazines, all explosive materials shall be removed and the interior cleaned. Before repairing the exterior of magazines, all explosive materials shall be removed if there exists any possibility that repairs may produce sparks or flame.

(2) STORING REMOVED EXPLOSIVES. Explosive materials removed from magazines under repair shall be placed in other magazines appropriate for the storage of those explosive materials, or placed a safe distance from the magazines under repair where they are to be properly guarded and protected until the repairs have been completed.

ILHR 7.217 LIGHTING. (1) SAFETY LIGHTS. Battery-activated safety lights or battery-activated safety lanterns may be used in explosives storage magazines.

(2) ELECTRIC LIGHTS. Electric lighting used in any explosives storage magazine shall meet the standards prescribed in ch. ILHR 16, for the conditions present in the magazine at any time. All electrical switches shall be located outside of the magazine and shall also meet the standards prescribed in ch. ILHR 16.

(3) RECORDKEEPING. Copies of invoices, work orders or similar documents which indicate the lighting complies with ch. ILHR 16, shall be available for inspection by the department.

ILHR 7.218 SEPARATION DISTANCES FOR STORAGE OF EXPLOSIVE MATERIALS. As specified in s. ILHR 7.206, outdoor magazines shall be located according to the distances specified in Table 7.218.

TABLE 7.218  
TABLE OF DISTANCES FOR STORAGE OF  
EXPLOSIVES

QUANTITY OF EXPLOSIVES		DISTANCES IN FEET							
		INHABITED BUILDINGS		PUBLIC HIGHWAYS WITH TRAFFIC VOLUME OF LESS THAN 3,000 VEHICLES/DAY		PASSENGER RAILWAYS - PUBLIC HIGHWAYS WITH TRAFFIC VOLUMES OF MORE THAN 3,000 VEHICLES/DAY		SEPARATION OF MAGAZINES	
Pounds Over	Pounds Not Over	Barri-caded	Unbarri-caded	Barri-caded	Unbarri-caded	Barri-caded	Unbarri-caded	Barri-caded	Unbarri-caded
2	5	70	140	30	60	51	102	6	12
5	10	90	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	318	636	39	78
1,200	1,400	450	900	170	340	336	672	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	45	90

QUANTITY OF EXPLOSIVES		DISTANCES IN FEET							
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	635	1,270	210	420	474	948	58	116
4,000	5,000	685	1,370	225	450	513	1,026	61	122
5,000	6,000	730	1,460	235	470	546	1,092	65	130
6,000	7,000	770	1,540	245	490	573	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	255	510	624	1,248	75	150
9,000	10,000	865	1,730	260	520	645	1,290	78	156
10,000	12,000	875	1,750	270	540	687	1,374	82	164
12,000	14,000	885	1,770	275	550	723	1,446	87	174
14,000	16,000	900	1,800	280	560	756	1,512	90	180
16,000	18,000	940	1,880	285	570	786	1,572	94	188
18,000	20,000	975	1,950	290	580	813	1,626	98	196
20,000	25,000	1,055	2,000	315	630	876	1,752	105	210
25,000	30,000	1,130	2,000	340	680	933	1,866	112	224
30,000	35,000	1,205	2,000	360	720	981	1,962	119	238
35,000	40,000	1,275	2,000	380	760	1,026	2,000	124	248
40,000	45,000	1,340	2,000	400	800	1,068	2,000	129	258
45,000	50,000	1,400	2,000	420	840	1,104	2,000	135	270
50,000	55,000	1,460	2,000	440	880	1,140	2,000	140	280
55,000	60,000	1,515	2,000	455	910	1,173	2,000	145	290
60,000	65,000	1,565	2,000	470	940	1,206	2,000	150	300
65,000	70,000	1,610	2,000	485	970	1,236	2,000	155	310
70,000	75,000	1,655	2,000	500	1,000	1,263	2,000	160	320
75,000	80,000	1,695	2,000	510	1,020	1,293	2,000	165	330
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000	170	340
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000	175	350
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000	180	360
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000	185	370
100,000	110,000	1,835	2,000	550	1,100	1,437	2,000	195	390
110,000	120,000	1,855	2,000	555	1,110	1,479	2,000	205	410
120,000	130,000	1,875	2,000	560	1,120	1,521	2,000	215	430
130,000	140,000	1,890	2,000	565	1,130	1,557	2,000	225	450
140,000	150,000	1,900	2,000	570	1,140	1,593	2,000	235	470

QUANTITY OF EXPLOSIVES		DISTANCES IN FEET							
150,000	160,000	1,935	2,000	580	1,160	1,629	2,000	245	490
160,000	170,000	1,965	2,000	590	1,180	1,662	2,000	255	510
170,000	180,000	1,990	2,000	600	1,200	1,695	2,000	265	530
180,000	190,000	2,010	2,010	605	1,210	1,725	2,000	275	550
190,000	200,000	2,030	2,030	610	1,220	1,755	2,000	285	570
200,000	210,000	2,055	2,055	620	1,240	1,782	2,000	295	590
210,000	230,000	2,100	2,100	635	1,270	1,836	2,000	315	630
230,000	250,000	2,155	2,155	650	1,300	1,890	2,000	335	670
250,000	275,000	2,215	2,215	670	1,340	1,950	2,000	360	720
275,000	300,000	2,275	2,275	690	1,380	2,000	2,000	385	770

(1) MULTIPLE MAGAZINES. Where 2 or more magazines are located on the same property, each magazine shall comply with the minimum distances specified in Table 7.218 from inhabited buildings, railways and highways. The magazines shall be separated from each other by not less than the distances specified for "Separation of Magazines".

(a) The magazine with the greater quantity of explosives shall govern the separating distance, except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of the cap magazine from magazines containing other explosives.

(b) If any 2 or more magazines are separated from each other by less than the specified "Separation of Magazines" distances, then the 2 or more magazines, as a group, shall be considered as one magazine, and the total quantity of explosives stored in the 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 distances specified from other magazines, inhabited buildings, railways and highways.

Note #1: All types of blasting caps in strengths through No. 8 cap should be rated at 1-1/2 pounds of explosives per 1,000 caps. For strengths higher than No. 8 cap, the manufacturer should be consulted.

Note #2: For quantity and distance purposes, detonating cord of 50 or 60 grains per foot should be calculated as equivalent to 9 pounds of high explosives per 1,000 feet. Heavier or lighter core loads should be rated proportionately.

(2) BARRICADED MAGAZINES. In using Table 7.218, a magazine shall be considered barricaded whenever:

(a) It is screened from an inhabited building or other magazine, either by natural features of the ground or by an artificial barricade of such height that a straight line drawn from the top of any sidewall of the magazine to any part of the building to be protected will pass through the intervening barricade; or

(b) It is screened from a railway or highway, either by natural features of the ground or by an artificial barricade of such height that a straight line drawn from the top of any sidewall of the magazine to a point 12 feet above the center of the railway or highway will pass through the intervening barricade.

(3) MINING LOCATIONS. Explosives magazines, except detonator magazines, shall not be located nearer than 200 feet from regular operating places of any mine or quarry, or from any mine shaft, tunnel or slope opening at the surface. Table 7.218 shall not apply at these places.

ILHR 7.219 SEPARATION DISTANCES FOR STORAGE OF LOW EXPLOSIVES. As specified in s. ILHR 7.206, outdoor magazines in which low explosives are stored shall be located according to the distances specified in Table 7.219.

TABLE 7.219  
SEPARATION DISTANCES FOR STORAGE OF  
LOW EXPLOSIVES

Quantity of Explosives in Pounds		Distances in Feet		
		From Inhabited Buildings	From Public Railways and Highways	From Above Ground Magazines
Over	Not Over			
0	1,000	75	75	50
1,000	5,000	115	115	75
5,000	10,000	150	150	100
10,000	20,000	190	190	125
20,000	30,000	215	215	145
30,000	40,000	235	235	155
40,000	50,000	250	250	165
50,000	60,000	260	260	175
60,000	70,000	270	270	185
70,000	80,000	280	280	190
80,000	90,000	295	295	195
90,000	100,000	300	300	200
100,000	200,000	375	375	250
200,000	300,000	450	450	300

ILHR 7.220 SEPARATION DISTANCES FOR AMMONIUM NITRATE AND BLASTING AGENTS.  
 As specified in s. ILHR 7.206, ammonium nitrate and blasting agents shall be located according to the distances specified in Table 7.220.

TABLE 7.220  
 SEPARATION DISTANCES OF AMMONIUM  
 NITRATE AND BLASTING AGENTS FROM  
 EXPLOSIVES OR BLASTING AGENTS

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



(1) EXPLOSION BY PROPAGATION. Table 7.220 specifies separation distances to prevent explosion of ammonium nitrate and ammonium nitrate-based blasting agents by propagation from nearby stores of high explosives or blasting agents referred to in the table as the donor. Ammonium nitrate, by itself, is not considered to be a donor when applying this table. Ammonium nitrate, ammonium nitrate-fuel oil or combinations thereof are acceptors. If stores of ammonium nitrate are located within the sympathetic detonation distance of explosives or blasting agents, one-half the mass of the ammonium nitrate shall be included in the mass of the donor.

(2) UNBARRICADED DISTANCES. When the ammonium nitrate or blasting agent or both is not barricaded, the distances shown in Table 7.220 shall be multiplied by 6. These distances allow for the possibility of high velocity metal fragments from mixers, hoppers, truck bodies, sheet metal structures, metal containers, and the like which may enclose the donor. Where explosives storage is in bullet-resistant magazines or where the storage is protected by a bullet-resistant wall, distances and barricade thicknesses in excess of those prescribed in Table 7.218 are not required.

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

(4) OTHER SEPARATION DISTANCES. For determining the distances to be maintained from inhabited buildings, passenger railways, and public highways, Table 7.218 shall be used.

ILHR 7.23 UNDERGROUND STORAGE OF EXPLOSIVES. (1) GENERAL REQUIREMENTS.

(a) Magazines shall be kept clean and dry, and empty containers and packing materials shall be removed from the mine at least once a week.

(b) Magazines shall be lighted from the outside, by portable safety storage battery lamps or by permanent interior lights provided with explosion-proof fixtures. Open flame lamps, matches, lighters and flame-producing devices shall not be carried into any explosives magazine. Smoking shall not be permitted while handling explosives.

(c) All unused explosive materials shall be returned to the approved storage locations immediately following loading of the holes.

(2) LOCATION. (a) Magazines for the underground storage of explosive materials shall be located at least 200 feet from any work shaft or connecting winze or raise.

(b) Detonators and other explosive materials shall not be stored in the same magazine. Detonator magazines shall be separated from other explosives magazines by at least 25 feet.

(c) Magazines shall not be adjacent to any power circuit other than lighting circuits, nor shall they be located so that accidental explosion of their contents would cut off the escape of persons working underground.

(d) All underground magazines shall be located and protected so as to prevent accidental impact from vehicles or falling objects, and shall be located out of the line of blasts.

(e) Underground magazines shall be located in separate rooms or drifts in which no person, other than powder personnel, are employed.

(f) When underground magazines are accessible through unlocked entrances, the magazines shall be locked.

(g) Any underground operation in which explosives are stored shall have at least 2 separate means of exit

(3) CONSTRUCTION. (a) Underground magazines used to store explosives or detonators shall be constructed with only nonsparking material inside and equipped with covers or doors.

(b) All underground magazines shall be visibly marked "EXPLOSIVES".

Subchapter III  
Transportation of Explosive Materials

ILHR 7.25 GENERAL TRANSPORTATION REQUIREMENTS. (1) GENERAL REQUIREMENTS. (a) Motor trucks or vehicles, when transporting explosive materials, shall be marked on both sides, front and rear with the applicable U.S. Department of Transportation placards.

(b) Explosive materials, other than blasting agents, shall not be carried in the same compartment with spark-producing metal tools or flammable or corrosive materials. All shipments of explosive materials shall comply with Wisconsin department of transportation regulations.

Note #1: Requirements for the transportation of explosives by motor vehicle are contained in ch. MVD 6.

Note #2: Shipments meeting the requirements of the U.S. Department of Transportation Hazardous Materials Regulations will be acceptable.

(c) Explosive materials may be transported on any truck or any semi-trailer attached to a tractor. Explosive materials shall not be transported in any "full" trailer or any form of "pole" trailer.

(d) Explosive materials shall be transported or conveyed in original outside boxes. A "full cover" type paper carton shall be considered equivalent to the original box when the cover is replaced and taped. Damaged cases shall be placed in boxes as specified in s. ILHR 7.208 (3) or in a daily supply box.

(e) Denotators may be transported on-site in the same motor vehicle with high explosives provided the detonators are packed in containers meeting the construction requirements for detonator boxes specified in s. ILHR 7.208 (3).

(f) Cases of explosive materials shall not be dropped, slid, or otherwise roughly handled.

(g) Explosive materials shall not be transported in any public vehicle carrying passengers for hire.

(2) TRANSPORTATION VEHICLES. (a) The vehicle used for transporting explosive materials shall have a tight floor. If there is any exposed sparking metal on the inside of the body, it shall be covered or protected with nonsparking material so that the explosive materials containers will not come in contact with the exposed sparking metal.

(b) Vehicles used for the transportation of explosive materials shall be clean and free from surplus oil and grease, shall have wiring completely insulated, fuel and exhaust lines free from leaks, and all necessary precautions shall be taken to prevent the vehicle from catching fire.

(c) In open vehicles transporting explosive materials on-site, a flame-retardant and moisture-proof tarpaulin may be used to cover the explosives and the sides of the body shall be high enough to prevent cases from falling off.

(3) FIRE EXTINGUISHERS. (a) Each motor vehicle used for transporting explosive materials shall be equipped with at least one fire extinguisher with a minimum rating of 10-B:C

(b) Fire extinguishers shall be an Underwriter's Laboratories listed type and shall be located on the power unit and properly maintained.

Note: These extinguishers are effective against ordinary truck fires but are not effective against fires involving explosive materials. Fires involving explosive materials should not be fought and the area should be evacuated as rapidly as possible.

(4) OPERATION OF TRANSPORTATION VEHICLES. (a) Motor vehicles transporting explosive materials shall be handled in a safe and careful manner.

(b) Vehicles transporting explosive materials shall be driven by competent drivers at least 21 years of age with a driver's license valid for the type of vehicle being driven. Drivers shall be familiar with all applicable federal, state and local regulations.

(c) No person may ride upon, drive, load or unload a vehicle transporting explosive materials while smoking or under the influence of intoxicants or drugs.

(d) Only necessary stops shall be made by motor vehicles loaded with explosive materials. A motor vehicle loaded with explosive materials shall not be left unattended unless it is parked in an area where unattended parking is specifically permitted. All extended stops in any community shall be reported to the local fire department which shall be consulted as to the safest parking location.

ILHR 7.26 TRANSPORTING UNDERGROUND. (1) TRAIN OR TRUCK. No explosive materials may be transported on underground locomotives but they may be transported in a mine car or in a truck, if carried in their original shipping containers or in other approved containers. No one but the train crew, driver or powder personnel may ride on a train or truck carrying explosive materials. One empty car with insulated couplings or an insulated bar shall be interposed between the locomotive and the powder car.

(2) SINKING SHAFTS. In sinking a shaft or winze, no other material may be carried on any cage, skip or bucket on which explosive materials are handled. Only those members of the crew needed for blasting may travel with the explosive materials or remain on the bottom while explosives are being lowered. Explosive materials may be handled only in their original shipping packages or in approved containers.

(3) LOWERING EXPLOSIVES. When lowering explosive materials for storage in underground magazines or transferring explosives from level to level, no person other than the attendant, may ride, nor may any other material be handled, in any cage or conveyance which is loaded with explosive materials. Detonators and other explosives shall not be lowered or hoisted together on any conveyance.

(4) AIR LOCKS. While explosives materials are being taken through air locks, no person other than the lock tender and the carrier may be permitted in the lock.

Subchapter IV  
Use of Explosive Materials

ILHR 7.30 GENERAL HANDLING AND USE OF EXPLOSIVES (1) GENERAL REQUIREMENTS.  
(a) Persons handling explosive materials shall possess a valid blaster's license or be supervised by a holder of a valid license.

(b) Persons shall not handle explosive materials while under the influence of intoxicants or drugs.

(c) When any blasting is done in congested areas or in close proximity to a structure, railroad, or highway or any other installation that may be damaged, precautions in the loading, delaying, initiation and confinement of each blast shall be exercised to prevent bodily injury and property damage and to minimize earth vibrations, air blasts and thrown fragments.

(d) Except for the purpose of lighting safety fuse, there shall be no smoking, open flames, sparks, or use of matches or lighters within 100 feet of the place where explosive charges are being prepared.

(e) Whenever blasting is being conducted in the vicinity of gas, electric, water, fire alarm telephone, telegraph and steam utilities, these utilities shall be notified.

Note: Section 182.0175 (2), Stats., states that advance notice of not less than 3 working days shall be provided.

(f) Explosive materials shall not be abandoned. If undetonated explosives are found, they shall be reported to and handled by a competent and experienced person.

Note: Although blasting agents are generally less sensitive to accidental initiation than other explosives, they are still an explosive and should be handled with the care and respect due these products. It should be remembered that in use they are virtually always combined with a cap sensitive explosive and the entire charge should be accorded the respect due the most sensitive element.

(2) BLAST SITE HANDLING REQUIREMENTS. (a) Explosive materials shall be handled in original shipping containers, approved covered wooden boxes or sacks provided for that purpose.

(b) Detonators, primers and other explosives shall be carried in separate containers when transported manually.

(c) After loading is completed, all surplus explosive materials shall be returned to an approved magazine.

(d) Explosive materials stacked near the blast hole shall not exceed the approximate amount required for the shot. Explosive materials shall not be placed where they may be struck by vehicles or subject to contact with live wires.

(e) After explosive materials are laid out on the blast pattern, the area shall be guarded against approach of vehicles and unauthorized persons until the shot is fired.

(f) Blast holes shall be cleared of obstructions before loading.

(g) Blast holes heated from drilling or enlarging shall not be loaded until they have cooled to less than 150 degrees Fahrenheit.

(h) In a tunnel or shaft, no blast hole may be loaded until a round of holes is completely drilled.

(3) FUME CLASS. Explosive materials used in underground blasting shall be fume class 1.

Note: Fume class 1 explosives produce less than 0.16 cubic feet of poisonous gases per 1-1/4 x 8" cartridge when detonated in the Bichel Gauge.

(4) TAMPING. (a) All tamping poles and connectors shall be constructed of wood or other nonsparking material, other than aluminum.

Note: Some nonsparking metals and some plastics are not safe for use as tamping poles because of the potential hazard from friction.

(b) During tamping of explosive materials, excessive ramming shall be avoided. The primer shall not be tamped.

(5) DRILLING. (a) Drilling into explosive materials or into any portion of a hole which at one time contained explosive materials shall not be allowed.

(b) Holes shall not be drilled where there is danger of intersecting a charged or misfired hole.

(6) PNEUMATIC LOADING. (a) All elements of pneumatic loading devices shall be electrically bonded together and a positive grounding device for the equipment shall be used to prevent the accumulation of static electricity. Water lines, air lines, rails or permanent electric grounding systems for other equipment shall not be used to ground pneumatic loading equipment.

(b) The hose or tube used in the pneumatic loading system to convey the blasting agent from the hopper into the borehole shall be of the semi-conductive type. The resistance of the hose or tube shall be not less than 5,000 ohms per foot nor more than 2 million ohms for the entire length.

Note: Periodic checks should be made of the hose or tube to assure that the resistance does not change to a value outside the safe operating limits.

(c) Plastic or other nonconductive sleeves or liners shall not be used in boreholes being loaded pneumatically unless a positive grounding method is used inside the liner.

(7) STEMMING. All blast holes in open work shall be stemmed to the collar or to a point which will confine the charge.

(8) HOUSEKEEPING. Empty explosive materials packaging shall be destroyed by burning at a distance of not less than 200 feet from magazines, dwellings and other structures. All persons shall retire to a place of safety as soon as the material is ignited.

Note: Local fire department authorities should be consulted regarding outdoor burning regulations.

ILHR 7.31 PREPARATION OF PRIMERS. (1) GENERAL. All primers shall be made as recommended by the manufacturer.

Note: The manufacturer's recommendations are found on "case inserts" in every case of explosives. Primers of adequate size and properties should be used to insure against misfires and incomplete detonations. Failure to use adequate priming not only results in poor performance, but also can cause copious quantities of toxic gases to be generated when the charge is fired.

(2) PREPARATION LOCATION. Except as provided in sub. (3), primers shall be made at the site just prior to loading in the borehole.

(3) UNDERGROUND OPERATIONS. For underground operations primers may be made up in the primer house immediately before use in the quantity needed for any one blast and carried to the face in an approved container.

ILHR 7.32 FIRING BLASTS WITH CAP AND FUSE. (1) PREPARING CAP AND FUSE DETONATORS. (a) Only an approved crimper shall be used for attaching the fuse to the blasting cap. The employer shall furnish and keep in accessible places, ready for use, crimpers in good repair. Capped fuses shall be made up only as required.

(b) Fuses shall not be capped with blasting caps in any magazine.

(2) BURNING RATE. The use of any fuse having a nominal burning rate of faster than one foot in 40 seconds shall be prohibited.

(3) LENGTH. The minimum fuse length for all blasts shall be 30 inches.

(4) SITE REQUIREMENTS (a) At least 2 persons shall be present at each location where cap and fuse blasting is done.

(b) The fuse shall not be lit before placing the primer in position.

(c) Cap and fuse shall not be used for firing mud cap charges unless the charges are separated sufficiently to prevent one charge from dislodging other shots in the vicinity.

(d) Cap and fuse shall not be used for blast initiation in communities, or on highways, or adjacent to highways open to traffic.

ILHR 7.33 FIRING BLASTS WITH ELECTRICITY. (1) INDUCED CURRENTS.

Precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by radar, radio transmitters, lightning, adjacent power lines, dust and snow storms, or other sources of induced current. The precautions shall include:

- (a) The suspension of all blasting operations and removal of persons from the blasting area during the approach and progress of an electric storm;
- (b) The posting of signs warning against the use of mobile radio transmitters on all roads within 350 feet of the blasting operations; and
- (c) Compliance with the requirements with regard to blasting in the vicinity of radio transmitters or power lines as specified in sub. (5).

Note: See Appendix C for further explanatory information.

(2) STRAY CURRENTS. (a) Before adopting any system of electrical firing, the blaster shall conduct a thorough survey for possible stray current, and if 50 milliamperes or more are detected, the stray current shall be eliminated before any holes are loaded. Periodic recheck surveys shall also be made.

Note: Alternate instruments or techniques that produce equivalent results will be acceptable.

- (b) The metallic exterior of electrical equipment shall be grounded with a resistance to ground of not more than one ohm.
- (c) Before introducing electric blasting caps to a blast, all portable or temporary electric circuits within 50 feet of the blast site shall be de-energized.

(3) ELECTRIC CIRCUIT REQUIREMENTS. (a) Before stemming holes, electric blasting caps shall be tested for circuit continuity with a blasting galvanometer or other approved instrument. In case a cap wire is broken, a new primer shall be inserted or an alternate method of initiation shall be employed. Except for circuit testing, the leg wires shall be kept short-circuited until they are connected into the blast circuit.

(b) All blast circuits shall be tested with a blasting galvanometer or other approved instrument before firing.

(c) All electric blasting caps fired in a single blast shall be made by the same manufacturer.

(d) Where electric haulage is used, all rail bonds shall be properly maintained and all rails and pipe lines shall be cross-bonded and grounded.

(e) The entire firing circuit shall be insulated and no electrical ground shall be permitted. All parts of the blasting circuit shall be protected from accidental contact with power lines, pipelines or other sources of stray current.



(f) All connections shall be made progressively from the blast holes back to the source of firing current. The leading wire shall remain shorted and not be connected to the blasting machine or other source of current until the blast is to be fired.

(g) Power sources shall be suitable for the number of electric blasting caps to be fired and for the type of circuits used.

(h) Blasting machines shall be tested periodically to insure their ability to develop their rated capacity. If defective, they shall not be used.

(i) Only insulated leading wire of adequate current-carrying capacity shall be used.

(4) POWER CIRCUIT FIRING. (a) When firing with a power circuit, a firing switch shall always be used. This switch shall be locked in the "open" or "off" position at all times except when firing a blast. It shall be designed so that the firing lines are short-circuited when the switch is in the "open" or "off" position.

(b) The firing switch box shall be kept locked except when blasting and no person may have access to it except the blaster

(c) On the power side of the switch, at least a 5-foot lightning gap shall be provided which shall be closed by a jumper immediately prior to the time of firing.

(d) No electric firing may be done with a power line voltage of less than 110 volts nor more than 480 volts.

(5) RADIO FREQUENCY HAZARDS. (a) Electric blasting caps shall not be stored or transported in the vicinity of an operating radio transmitter unless they are in their original package or coiled as specified by the manufacturer. If not in their original package, they shall be kept in a closed metal container.

(b) When electric blasting caps are used or handled in the vicinity of a known operating radio transmitter, the requirements as specified in Tables 7.33-1 to 7.33-6 shall be followed.

Note: These tables were taken from the Institute of Makers of Explosives safety library publication no. 20, "Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Electric Blasting Caps", and were derived from analytical "worst-case" calculations. They are based on an assumed 40-milliwatt no-fire level of commercial blasting caps. See Appendix C for further explanatory information.

(c) When it is not possible to determine if the requirements of Tables 7.33-1 to 7.33-6 can be met, the following test or other approved test shall be conducted to determine if a radio frequency hazard exists. A #48 or #49 radio pilot lamp shall be inserted into a blasting test circuit in place of the electric detonator. If any glow is observed in the lamp, electrical firing shall not be used.

Table 7.33-1  
Recommended Distances for Commercial  
AM Broadcast Transmitters  
0.535 to 1.605 MHz

Transmitter Power (1) (Watts)	Minimum Distance (Feet)
Up to 4,000	750
4,001 to 5,000	850
5,001 to 10,000	1,200
10,001 to 25,000	2,000
25,001 to 50,000 (2)	2,800
50,001 to 100,000	3,900
100,001 to 500,000	8,800

- (1) Power delivered to antenna.
- (2) 50,000 watts is the maximum power of U.S. broadcast transmitters in this frequency range.

Table 7.33-2  
Recommended Distances for Transmitters up to  
30 MHz (Excluding AM Broadcast) Calculated  
for a Specific Loop Pickup Configuration (1)(2)

Transmitter Power (3) (Watts)	Minimum Distance (Feet)
Up to 100	750
101 to 500	1,700
501 to 1,000	2,400
1,001 to 5,000	5,500
5,001 to 50,000	17,000
50,001 to 500,000 (4)	55,000

- (1) Based on the configuration where the loop is placed in the plane of the transmitting antenna, using 20.8 MHz, which is the most sensitive frequency.
- (2) This table should be applied to International Broadcast Transmitters in the 10-25 MHz range.
- (3) Power delivered to antenna.
- (4) Maximum for International Broadcast.

Table 7.33-3  
Recommended Distances of Mobile Transmitters  
Including Amateur and Citizens' Band

Minimum Distance (Feet)

Transmitter (1) Power (Watts)	MF	HF	VHF		VHF	UHF
	1.6 to 3.4 MHz Industrial	28 to 29.7 MHz Amateur	35 to 36 MHz Public Use	42 to 44 MHz Public Use	144 to 148 MHz Amateur	150.8 to 161.1 MHz Public Use
Up to 10	40	100	40		15	10
11 to 50	90	220	90		35	20
51 to 100	125	310	130		50	30
101 to 180(2)					65	40
181 to 250	200	490	205		75	45
251 to 500(3)			290			
501 to 600(4)	300	760	315		115	70
601 to 1,000(5)	400	980	410		150	90
1,001 to 10,000(6)	1,250		1,300			

Citizens Band, Class D Transmitters, 26.96-27.41 MHz

Type	Recommended Minimum Distance	
	Hand-Held	Vehicle Mounted
Double Sideband - 4 watts maximum transmitter power	5 ft.	15 ft.
Single Sideband - 12 watts peak envelope power	20 ft.	60 ft.

- (1) Power delivered to antenna.
- (2) Maximum power for two-way mobile units in VHF (150.8 or 161.6 MHz range) and for two-way mobile and fixed station units in UHF (450 to 460 MHz range).
- (3) Maximum power for major VHF two-way mobile and fixed station units in 35 to 44 MHz range.
- (4) Maximum power for two-way fixed station units in VHF (150.8 to 161.6 MHz range).
- (5) Maximum power for amateur radio mobile units.
- (6) Maximum power for some base stations in 42 to 44 MHz band and 1.6 to 1.8 MHz band.

Table 7.33-4  
Recommended Distances for VHF TV  
and FM Broadcasting Transmitters

Effective Radiated Power (Watts)	Minimum Distance (Feet)	
	Channels 2 to 6 and FM	Channels 7 to 13
Up to 1,000	1,000	750
1,001 to 10,000	1,800	1,300
10,001 to 100,000(1)	3,200	2,300
100,001 to 316,000(2)	4,300	3,000
316,001 to 1,000,000	5,800	4,000
1,000,001 to 10,000,000	10,200	7,400

- (1) Maximum power channels 2 to 6 and FM - 100,000 watts.  
(2) Maximum power channels 7 to 13 - 316,000 watts.

Table 7.33-5  
Recommended Distances from  
UHF TV Transmitters

Effective Radiated Power (Watts)	Minimum Distance (Feet)
Up to 10,000	600
10,001 to 1,000,000	2,000
1,000,001 to 5,000,000(1)	3,000
5,000,001 to 100,000,000	6,000

- (1) Maximum power channels 14 to 83 - 5,000,000 watts.

Table 7.33-6  
Recommended Distances from  
Maritime Radionavigational Radar

Service	Effective Radiated Power (Watts)	Minimum Distance (Feet)
Small Pleasure Craft	Up to 500	20
Harbor Craft, River Boats	501 to 5,000	50
Large Commercial Shipping	5,001 to 50,000	300

ILHR 7.34 BLAST WARNINGS AND SHELTER. (1) SURFACE BLASTING WARNINGS. (a) Before any surface blast is fired, a prearranged, audible, distinctive warning signal shall be sounded. Automotive or truck horns shall not be used as warning signals. Except as provided in par. (b), all persons shall retire to a safe sheltered area away from the blast site.

(b) If shelters are not available, persons shall retire to a safe distance not less than 500 feet away from the blast site.

(c) All access roads or travelways shall be guarded before the warning signal is given and all personnel shall remain in a place of safety until the "all clear" signal has been authorized by the blaster in charge. Where highways or buildings are located within the danger zone, employes shall be sent to warn the public when shots are to be fired. The warning shall be accomplished by waving a red flag or by using a sign with the words "STOP - BLASTING" printed in letters approximately 3 inches high.

(2) UNDERGROUND BLASTING WARNINGS. (a) Persons about to fire underground blasts shall cause warning to be given in every direction, and all entrances to the place where the blasts are to be fired shall be manned or barricaded.

(b) All persons shall retire to a safe distance from the face of a tunnel being blasted.

(c) Persons shall not be permitted to retire to a dead-end drift or crosscut in selecting shelter from fly rock and blasting gases.

(d) Whenever blasting is being done in a tunnel at points likely to break through to where other persons are at work, the foreman shall, before any holes are loaded, give warning of danger to all persons who may be working where the blasts may break through, and shall not allow any holes to be charged until a warning is acknowledged and persons are removed.

(3) SPECIAL BLASTING OPERATIONS. (a) When chambering blast holes, persons shall retire to not less than 75 feet from the collar of the hole.

(b) When blasting in a building, the charge shall be properly designed, placed and covered if necessary to prevent damage to persons or property. Passageways shall be guarded manually. Warnings shall be sounded and persons shall retire to a sheltered place. Guards shall not be required to use flags or signs.

ILHR 7.35 BLASTING IN COMMUNITIES. (1) BLASTER REQUIREMENTS. When blasting operations are conducted in communities, the shots shall be designed and initiated by a properly licensed Class 4 or 5 blaster.

(2) LOCAL REGULATIONS. Blasting operations in communities shall comply with all local regulations.

(3) NOTIFICATIONS. Any person conducting blasting operations in a community shall notify the department, the local fire department and the local law enforcement agency of the time and location of the blast. Notification to the department shall be made on forms provided by the department.

Note: See appendix F for a sample copy of a notification form.

ILHR 7.36 PRECAUTIONS AFTER BLAST. (1) FUMES. Blasting areas shall not be re-entered after firing until concentrations of smoke, dust and fumes have been reduced to safe limits.

(2) WAITING PERIOD. (a) When multiple cap and fuse shots are fired, the blaster shall determine the length of the waiting period before any person is permitted in the blast area. When a misfire is known or suspected when using cap and fuse no person may enter the area for at least one hour.

(b) When electric blasting caps are fired and a misfire is known or suspected, no person other than the blaster may enter the area for at least 30 minutes.

(c) When using miniaturized detonating cord systems or gas initiated systems and a misfire is known or suspected, no person other than the blaster may enter the area for at least 30 minutes.

(d) Before resuming operations, the blaster shall examine the area for mis-fired shots and unexploded or burning explosive materials. In case burning explosive materials are observed, no attempt may be made to extinguish them and persons shall retire to a safe place and remain there at least one hour.

(3) HANDLING MISFIRES. The handling of misfires shall be attempted only by blasters thoroughly experienced with this work. Whenever a blaster experienced with handling misfires is not available, the manufacturer shall be consulted for further advice.

ILHR 7.37 BLASTING LOG. (1) GENERAL. A blasting log shall be required for each blast fired.

(2) FILING AND AVAILABILITY. All blasting logs shall be kept on file by the blaster for a minimum period of 3 years, and shall be made available to the department upon request.

(3) INFORMATION. Each blasting log shall contain at a minimum the following items of information:

- (a) Name and license number of blaster in charge of the blast;
- (b) Blast location;
- (c) Date and time of blast;
- (d) Weather conditions at time of blast;
- (e) Diagram of blast layout;
- (f) Number of holes;
- (g) Hole depth and diameter;
- (h) Spacing;
- (i) Furden;
- (j) Maximum holes per delay;
- (k) Maximum pounds of explosives per delay;
- (l) Depth of stemming used;
- (m) Total pounds of explosives used;
- (n) Distance to nearest inhabited building not owned by operator; and
- (o) Type of initiation used.

Subchapter V  
Manufacture of Explosive Materials

ILHR 7.40 MANUFACTURE OF HIGH EXPLOSIVES. High explosives manufacturing operations shall be conducted in accordance with methods approved by the department.

Note: Manufacturing procedures recommended by the Institute of Makers of Explosives are generally acceptable.

ILHR 7.41 FIXED LOCATION MIXING OF BLASTING AGENTS. Buildings and other facilities used for mixing of blasting agents at a fixed location shall comply with the requirements of this section.

(1) LOCATION OF MIXING PLANT. Plants for mixing blasting agents shall be isolated from inhabited buildings, passenger railroads and public highways in accordance with the Table of Distances for Storage of Explosives as specified in s. ILHR 7.218. Separation distances for ammonium nitrate and blasting agents from explosives or blasting agents shall be in accordance with s. ILHR 7.220.

(2) FUEL STORAGE. All fuel storage facilities shall be separated from the mixing plant and located so that the fuel will drain away from the mixing plant should rupture of the tank occur, or diked in a manner to contain the tank contents in case of rupture.

Note: See ch. Ind 8 for complete requirements pertaining to flammable and combustible liquids.



(3) LAYOUT OF MIXING PLANT. The layout of the mixing plant shall provide separation between the raw ammonium nitrate, manufacturing operations, and the storage of finished product.

(4) MIXING PLANT CONSTRUCTION. (a) Mixing plants shall be constructed of noncombustible materials or of sheet metal on wood studs.

(b) The plant shall be properly vented with vents equipped with spark-arresting screens.

(c) The floor of the mixing plant shall be of concrete or of other approved nonabsorbent material.

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

Note: See chs. ILHR 50-64 for complete building and heating, ventilating and air conditioning requirements. Complete requirements for automatic fire suppression systems are also contained in these chapters.

(5) MIXING PLANT HEAT. Heat for the mixing plant shall be provided from a source outside the building, except that space heaters which do not depend on a combustion process within the heating unit may be used if they are properly installed and maintained and are located no closer than 30 inches from raw materials and finished product.

(6) ELECTRICAL EQUIPMENT. All electrical equipment located in the mixing plant shall conform with the requirements of ch. ILHR 16 for installation in a hazardous area.

ILHR 7.42 MOBILE MIXING VEHICLES. (1) PROHIBITED USE. Mobile mixing vehicles shall not be used for mixing of blasting agents while on public highways.

(2) VEHICLE CONSTRUCTION. (a) The body of the mixing vehicle shall be constructed of noncombustible materials.

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

(3) MIXING EQUIPMENT. All moving parts of the mixing system shall be designed to prevent heat buildup. Shafts or axles which contact the product shall have outboard bearings with a one-inch minimum clearance between the bearings and the outside of the product container.

(4) VEHICLE OPERATION. (a) Motor vehicles transporting blasting agent materials shall be handled in a safe and careful manner.

(b) Vehicles transporting blasting agent materials shall be driven by competent drivers at least 21 years of age with a driver's license valid for the type of vehicle being driven. Drivers shall be familiar with all applicable federal, state and local regulations.

(c) No person may ride upon, drive, load or unload a vehicle transporting blasting agent materials while smoking or under the influence of intoxicants or drugs.

(d) When transporting detonators or other explosive materials, mobile mixing vehicles shall comply with subch. III.

ILHR 7.43 BLASTING AGENT MIXING EQUIPMENT. (1) MIXER DESIGN. (a) The design of the blasting agent mixer shall minimize the possibility of frictional heating, compaction and especially confinement. All surfaces shall be accessible for easy cleaning.

(b) The frame of the mixer and all other permanently located handling equipment shall be electrically bonded together and connected to an effective electrical ground.

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

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

(2) MIXER CONSTRUCTION. (a) Mixing and packaging equipment shall be constructed of materials which are compatible with ammonium nitrate and with the fuel being used in the blasting agent mix.

(b) Zinc, galvanized metals and copper shall not be used.

Note: Zinc and galvanized metals tend to promote and accelerate decomposition of ammonium nitrate. Copper causes corrosion problems in the presence of ammonium nitrate.

ILHR 7.44 MIXING PLANT OPERATION. (1) HOUSEKEEPING. (a) The mixing and packaging equipment and areas shall be cleaned and maintained properly to prevent accumulation of raw ingredients and finished product. Discarded empty ammonium nitrate bags shall be disposed of daily in a safe manner.

Note: The corrosive and irritating effects of ammonium nitrate, fuel oil or other blasting agent ingredients should be recognized and corrective action taken where a need is indicated.

(b) The area surrounding the mixing and packaging operation shall be kept free of rubbish, dry grass, weeds or other combustible material for at least 25 feet in all directions.

(2) SMOKING AND OPEN FLAMES. Smoking, matches, spark-producing devices, firearms and open flames shall not be permitted inside of or within 100 feet of the mixing and packaging operation. Signs to this effect shall be posted at entrances to the mixing and packaging areas.

(3) REPAIRS AND ALTERATIONS. Welding or gas cutting operations shall not be permitted in the mixing or storage areas while any blasting agent or ammonium nitrate is present. The area shall be cleaned or washed free of all ammonium nitrate and blasting agent before any welding or gas cutting operations are started.

Note: Where feasible, equipment should be removed for repairs or alterations.

(4) PERSONNEL LIMITATIONS. A limit shall be established on the number of personnel who may be in the mixing and packaging area at any one time, and this limitation shall be posted at entrances to the mixing and packaging areas.

(5) PRODUCTION LIMITATIONS. No more than one day's production of blasting agent shall be permitted in the mixing and packaging area at any one time.

(6) LABELING. All cartridges, bags or other containers of blasting agents shall be labeled to indicate their contents. Ammonium nitrate bags shall not be re-used as containers for blasting agents unless they are clearly relabeled so that no mistake can be made regarding their contents.

ILHR 7.45 BLASTING AGENT COMPOSITION. (1) LIQUID FUELS. (a) Unless otherwise approved by the department, no liquid fuel with a flashpoint lower than 125 degrees Fahrenheit may be used in the blasting agent mix.

Note: More volatile fuels such as gasoline offer no significant advantages in blasting and tend to increase the possibility of a vapor explosion and fire.

(b) Crude oil and crankcase drainings shall not be used.

Note: Crude oil and crankcase drainings may contain low flashpoint constituents or gritty particles which could increase the sensitivity of the blasting agent.

(2) MIX PROPORTIONS. (a) The fuel oil content of the blasting agent shall be approximately 5.7% by weight. This proportion shall be maintained within a reasonable production tolerance.

(b) If other hydrocarbon fuels are used, an oxygen-balanced proportion shall be maintained. If solid fuels are used, they shall be chosen and handled so as to minimize the possibility of dust explosions.

(3) EXPERIMENTAL MIXES. (a) Unusual compositions or combinations of ingredients shall not be attempted except under the supervision of personnel competent by education and experience to evaluate the possibility of new hazards and unless the operation is equipped to determine the sensitivity of the resultant product.

(b) Metal powders, sulfur, perchlorates and explosive substances such as nitroglycerine, TNT and other high explosives, shall not be used to sensitize ammonium nitrate unless the standards of high explosive manufacturing operations are met.

(c) Peroxides and chlorates shall not be used in blasting agent formulations.

(4) CAP SENSITIVITY. The cap sensitivity of the mix shall be checked at regular intervals. If any change is made in mixing proportions, character of ingredients or mixing procedure, another cap sensitivity test shall be made immediately.

(5) MANUAL MIXING. Manual mixing of blasting agents at the blast site is allowed provided the applicable provisions of this chapter are met.

Subchapter VI  
Smokeless Propellants  
and Black Powder

ILHR 7.55 TRANSPORTATION OF SMOKELESS PROPELLANTS. (1) PRIVATE VEHICLE TRANSPORTATION. (a) Quantities of smokeless propellants not exceeding 25 pounds, in manufacturer's original shipping containers, may be transported in a private vehicle.

(b) Quantities of smokeless propellants exceeding 25 pounds but not exceeding 50 pounds, transported in a private vehicle, shall be transported in a portable magazine having wood walls of at least one-inch nominal thickness.

(c) Transportation of more than 50 pounds of smokeless propellants in a private vehicle shall be prohibited.

(2) COMMERCIAL TRANSPORTATION. (a) Commercial shipments of smokeless propellants in quantities not exceeding 100 pounds are classified for transportation purposes as flammable solids when packaged in manufacturer's original shipping containers, and shall be transported accordingly.

(b) Commercial shipments of smokeless propellants exceeding 100 pounds or not packaged in manufacturer's original shipping containers, shall be transported according to the regulations for explosive materials.

ILHR 7.56 STORAGE OF SMOKELESS PROPELLANTS. (1) GENERAL. Smokeless propellants shall be stored in manufacturer's original shipping containers.

(2) RESIDENTIAL STORAGE. Smokeless propellants in quantities not exceeding 25 pounds may be stored in manufacturer's original shipping containers in residences. Quantities exceeding 25 pounds, but not exceeding 50 pounds, may be stored in residences if kept in a wooden box or cabinet having walls of at least one-inch nominal thickness.

(3) COMMERCIAL DISPLAY. Not more than 25 pounds of smokeless propellants, in containers of one-pound maximum capacity, may be displayed in commercial establishments.

(4) COMMERCIAL STORAGE. Commercial stocks of smokeless propellants shall be stored as specified in pars. (a) to (d).

(a) Quantities exceeding 25 pounds, but not exceeding 100 pounds, shall be stored in portable wooden boxes having walls of at least one-inch thickness.

(b) Quantities exceeding 100 pounds but not exceeding 800 pounds, shall be stored in nonportable storage cabinets having walls of at least one-inch thickness. Not more than 400 pounds may be stored in any one cabinet and cabinets shall be separated by a distance of at least 25 feet or by construction having at least one-hour fire-resistive rating.

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

1. The warehouse or storage room shall be accessible only to authorized personnel;
2. Smokeless propellant shall be stored in nonportable storage cabinets having wood walls at least one-inch thick and having shelves with no less than 3 feet separation between shelves;
3. No more than 400 pounds may be stored in any one cabinet;
4. Cabinets shall be located against walls of the storage room or warehouse with at least 40 feet between cabinets;
5. Separation between cabinets may be reduced to 20 feet if barricades twice the height of the cabinets are attached to the wall, midway between each cabinet. The barricades shall extend at least 10 feet outward, shall be firmly attached to the wall, and shall be constructed of 1/4-inch boiler plate, 2-inch thick wood, brick, or concrete block;
6. Smokeless propellant shall be separated from materials classified as flammable liquids, flammable solids, and oxidizing materials by a distance of 25 feet or by construction having at least a one-hour fire-resistive rating; and
7. The building shall be protected by an automatic fire sprinkler system as specified in s. ILHR 52.015 (3) (g).

(d) Smokeless propellants not stored according to pars. (a), (b) and (c) shall be stored in a Type 4 magazine constructed and located according to the provisions of subch. II.

ILHR 7.57 TRANSPORTATION OF BLACK POWDER. Black powder shall be transported in manufacturer's original shipping containers in accordance with subch. III.

Note: The department will accept methods conforming with the U.S. Department of Transportation regulations.

ILHR 7.58 STORAGE OF BLACK POWDER. (1) GENERAL. Black powder shall be stored in manufacturer's original shipping containers.

(2) RESIDENTIAL STORAGE. Black powder in quantities not exceeding 5 pounds may be stored in residences if in manufacturer's original shipping containers and stored in a wooden box or cabinet having walls of at least one-inch nominal thickness.

(3) COMMERCIAL DISPLAY Not more than one pound of black powder may be displayed in commercial establishments.

(4) COMMERCIAL STORAGE. (a) Commercial stocks in a building in quantities not exceeding 50 pounds shall be stored in a Type 4 indoor magazine.

(b) Commercial stocks in quantities exceeding 50 pounds shall be stored in a Type 4 outdoor magazine.

(5) COMBINED STORAGE. If smokeless propellants are stored in the same magazine with black powder, the total quantity shall not exceed that permitted for black powder.

Appendix A

PREVENTION OF ACCIDENTS IN  
THE USE OF EXPLOSIVE MATERIALS

The prevention of accidents in the use of explosive materials is a result of careful planning and observing the best known practices. The user must remember that a powerful force is being dealt with and that various devices and methods have been developed to assist in directing this force. The user must realize that this force, if misused, may either kill or injure both oneself and one's fellow workers.

It is obviously impossible to include warnings or approved methods for every conceivable situation. A list of suggestions to aid in avoiding the more common causes of accidents is set forth in Appendix B. Information pertaining to explosive materials is available in the Institute of Makers of Explosives Safety Library publications listed below. Copies of these publications may be obtained by writing the Institute of Makers of Explosives, 1575 Eye Street, N.W., Suite 550, Washington, D.C. 20005, or from the explosive materials supplier.

- Construction Guide for Storage Magazines (No. 1)
- American Table of Distances (No. 2)
- Suggested Code of Regulations for the Manufacture, Transportation, Storage, Sale, Possession and Use of Explosive Materials (No. 3)
- Do's and Don'ts (No. 4)
- Glossary of Industry Terms (No. 12)
- Safety in the Transportation, Storage, Handling and Use of Explosive Materials (No. 17)
- Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Electric Blasting Caps (No. 20)
- IME Standard for the Safe Transportation of Class C Detonators (Blasting Caps) in a Vehicle with Certain Other Explosives (No. 22)

## Appendix B

### SAFETY RECOMMENDATIONS

These "Do's and Don'ts" are from publication number 4 adopted by the Institute of Makers of Explosives, December, 1983. These instructions and warnings can also be found on "Case Inserts" in every case of explosives.

#### GENERAL

- \* DO control explosive materials, which have been removed from a magazine, to prevent possession by children or other unauthorized persons.
- \* DON'T allow any source of ignition within 100 feet of a blast area (except approved means for lighting safety fuse) or within 50 feet of a magazine or vehicle containing explosive materials.
- \* DON'T expose explosive materials to excessive impact, friction, electrical impulse or heat from any source, including flame-producing devices.
- \* DON'T fight fires in explosive materials. Remove all personnel to a safe location immediately and guard the area against intruders.
- \* DON'T shoot into explosive materials, magazines, or vehicles loaded with explosive materials.
- \* DON'T allow children or unauthorized persons near explosive materials.
- \* DON'T use explosive materials that appear to be deteriorated or damaged.

#### WHEN TRANSPORTING EXPLOSIVE MATERIALS

- \* DON'T park vehicles containing explosive materials in areas which are congested or where people congregate.
- \* DO load and unload explosive materials carefully.
- \* DO transport explosive materials in accordance with federal, state and local laws and regulations.

#### WHEN STORING EXPLOSIVE MATERIALS

- \* DO locate magazines in the most isolated places available. They should be separated from each other, and from inhabited buildings, highways, and passenger railways by distances not less than those recommended in the Institute of Makers of Explosives Safety Library Publication No. 2, entitled "American Table of Distances".



- \* DO post "EXPLOSIVES - KEEP OFF" signs conspicuously near magazines. These signs should be located so that a bullet passing through them at right angles cannot strike a magazine.
- \* DO store explosive materials only in a magazine which is clean, dry, well-ventilated, reasonably cool, properly located, substantially constructed, securely locked, weather-resistant, fire-resistant, and theft-resistant and, when required by the nature of the material, bullet- and missile-resistant.
- \* DON'T store explosive materials in wet or damp places, with flammable or other hazardous materials, or near sources of excessive heat.
- \* DON'T store detonators in the same package or magazine with other explosive materials.
- \* DO store only explosive materials and blasting accessories in magazines.
- \* DO consult your supervisor, or the manufacturer if you have no supervisor, if explosive materials appear to be deteriorated or have stained the floor of a magazine.
- \* DON'T allow combustible material to accumulate within 25 feet of a magazine.

#### WHEN USING EXPLOSIVE MATERIALS

- \* DON'T use any explosive materials unless completely familiar with safe procedures for their use, or under the direction of competent, experienced persons.
- \* DO design each blast to avoid excessive air blast, ground vibration and fly rock in accordance with applicable federal, state and local laws and regulations.
- \* DON'T allow metallic slitters to come in contact with any metallic fasteners when opening packages of explosive materials.
- \* DO close partially used packages of explosive materials.
- \* DON'T carry explosive materials on your person.
- \* DON'T insert anything except safety fuse in a blasting cap.
- \* DON'T use any explosive materials that have been water-soaked even if they appear to be dried out.
- \* DO consult your supervisor for instructions when handling explosive materials during the approach of an electrical storm. This applies to both surface and underground operations.
- \* DON'T handle explosive materials during an electrical storm. All persons should retire to a place of safety.
- \* DON'T attempt to investigate the contents of a detonator or try to pull the wires, fuse, or detonating cord out of any detonator or delay device.

WHEN PREPARING THE PRIMER

- \* DO make up primers in accordance with established methods. Make sure that the detonator is completely encased in the explosive and so secured that in loading no tension will be placed on the wires, safety fuse or detonating cord at the point of entry into the detonator.
- \* DON'T force a detonator into an explosive material. Insert the detonator completely into a hole made with a punch designed for that purpose. The detonator should point toward the desired direction of detonation.
- \* DON'T attempt to punch any explosive material that has become very hard or frozen.
- \* DO use the first cartridge in the borehole as the primer cartridge where 2-inch or less diameter cartridges are being used.
- \* DON'T use a primer or booster if the hole is too small for the detonator. Never attempt to enlarge the hole.
- \* DON'T make up primers in a magazine or near other large quantities of explosive materials and DON'T make more than are necessary for immediate needs.

WHEN DRILLING AND LOADING

- \* DO carefully examine the surface or face before drilling to determine the possible presence of unfired explosive materials. Never drill into explosive materials or into any hole that has contained explosive materials.
- \* DO check each borehole carefully to assure it is in safe condition for loading.
- \* DON'T force explosive materials into a borehole.
- \* DO avoid placing any unnecessary part of the body over or in front of the borehole when loading, tamping and stemming.
- \* DON'T slit, drop, deform, tamp or abuse the primer and DON'T drop another cartridge directly on the primer.
- \* DON'T load a borehole that contains any hot or burning materials. Temperatures in excess of 150° F. (66° C.) are dangerous.
- \* DON'T spring a borehole near holes loaded with explosive materials.
- \* DON'T stack more explosive materials than are needed near working areas during loading.
- \* DO recognize the possibility of static electrical hazards from pneumatic loading and take adequate precautionary measures.

WHEN TAMPING

- \* DON'T tamp the primer. DON'T tamp explosive materials with metallic devices except for jointed poles with nonferrous metal connectors. Avoid violent tamping.
- \* DON'T kink or damage safety fuse, detonating cord, plastic tubing or wires of detonators when tamping.
- \* DON'T tamp any explosive material that has been removed from its cartridge.

WHEN BLASTING ELECTRICALLY

- \* DO test all electric blasting cap circuits for continuity and proper resistance, using only a blasting circuit test instrument designed for that purpose.
- \* DON'T attempt to fire electric blasting caps with more or less current than recommended by the manufacturer.
- \* DO keep the electric cap wires or lead wires disconnected from the power source and short-circuited until ready to fire.
- \* DON'T use electric blasting caps made by different manufacturers in the same circuit, or caps of different style or function even if made by the same manufacturer, unless such use is approved by the manufacturer.
- \* DO be sure that all wire ends are clean before connecting.
- \* DON'T load any boreholes near electric power lines, unless the firing line, including the electric blasting cap wires, is anchored or so short that it cannot reach the power lines.
- \* DON'T have electric wires or cables near electric blasting caps or other explosive materials except at the time and for the purpose of firing the blast.
- \* DO keep the firing circuit completely insulated from ground or other conductors.
- \* DON'T uncoil the wires or use electric blasting caps in the vicinity of radio-frequency transmitters. Consult the manufacturer or the Institute of Makers of Explosives Safety Library Publication No. 20, "Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Electric Blasting Caps."
- \* DON'T use or uncoil the wires of electric blasting caps during electric or dust storms or near any other source of large charges of static electricity.

WHEN BLASTING WITH DETONATING CORD

- \* DO select detonating cord that has the characteristics consistent with correct blasting methods and the type of explosive materials being used.
- \* DO handle detonating cord with the same respect given other explosive materials.
- \* DO avoid damaging detonating cord prior to firing.
- \* DO cut the line of detonating cord from the spool before loading the remainder of the explosive materials.
- \* DO make tight connections in accordance with established methods. Cord-to-cord connections should be made only where the detonating cord is dry.
- \* DO avoid loops, sharp kinks or angles that direct the cord back toward the oncoming line of detonation.
- \* DON'T attach detonators to detonating cord until everything is in readiness for the blast.
- \* DO attach detonators to detonating cord with tape or by methods recommended by the manufacturer. The detonators should always be pointed toward the desired direction of detonation.

WHEN BLASTING WITH NONELECTRIC BLASTING CAPS

General

- \* DO follow manufacturer's instructions and warnings. Emphasize proper hook-up procedures and safety precautions.
- \* DO discontinue operations in surface blast areas during electric storms.
- \* DON'T hold nonelectric leads during firing; personal injury or death may result.
- \* DON'T use the tubing leads or detonating cord leads for any purpose other than that intended by the manufacturer.

Miniaturized Detonating Cord System

- \* DO use explosives that are insensitive to initiation by the miniaturized detonating cord lead.
- \* DON'T join 2 lengths of miniaturized detonating cord. It will not propagate through such connections.

Gas Initiated System

- \* DON'T smoke or allow open flame within 25 feet of blasting machines designed for gas initiated nonelectric blasting caps.

- \* DO stay away from the blast area after connections are made ready for firing, unless the entire system has been properly purged and disconnected from the primary source of ignition.
- \* DON'T kink tubing. Use tube protectors or special boosters designed for this system.

#### Shock Tube System

- \* DON'T trim heat seals from the shock tube ends. Moisture entry will cause failure.
- \* DON'T join lengths of shock tube. It will not propagate through such connections.

#### WHEN BLASTING WITH SAFETY FUSE

- \* DON'T use lengths of safety fuse less than 3 feet. Know the burning speed of the safety fuse by conducting a test burn and make sure you have time to reach safety after lighting.
- \* DO handle safety fuse carefully to avoid damaging the covering. In cold weather, warm before using to avoid cracking the waterproofing.
- \* DON'T cut safety fuse until you are ready to insert it into a blasting cap. Cut off an inch or 2 to insure a dry end. Cut safety fuse squarely across with a clean sharp blade. Seat the safety fuse lightly against the cap charge and avoid twisting after it is in place.
- \* DO crimp blasting caps only with a cap crimper designed for the purpose.
- \* DON'T light safety fuse until sufficient stemming has been placed over the explosive material to prevent excessive heat or sparks from coming into contact with the explosive material.
- \* DON'T hold other explosive materials in the hands when lighting safety fuse.
- \* DON'T drop primer with lighted safety fuse down borehole.
- \* DON'T use safety fuse in agricultural blasting.
- \* DON'T use matches, cigarette lighters, cigarettes, pipes, cigars, carbide lamps or other unsafe methods to ignite safety fuse.
- \* DO use only equipment or devices especially designed to light safety fuse.
- \* DO use only ignitercord with thermalite connectors for multiple-fuse ignition.
- \* DO use only hot-wire lighters, pull-wire lighters or thermalite connectors for single-fuse ignition.
- \* DO use the "buddy system" when lighting safety fuse - one lights the fuse, the other times and monitors.

IN UNDERGROUND WORK

- \* DO use permissible explosive materials in flammable, gassy or dusty atmospheres when required by applicable federal, state and local laws and regulations.
- \* DON'T store excessive supplies of explosive materials in an underground mine.

BEFORE AND AFTER FIRING

- \* DON'T fire a blast without a positive signal from the one in charge.
- \* DO make certain that all persons, vehicles, equipment and surplus explosive materials are in a safe place, that all access routes into the blast area have been posted with guards, and that adequate warning has been sounded.
- \* DON'T fire (the shot) from a position in front of the blast.
- \* DO comply with existing federal, state and local laws and regulations for safe fume levels before returning to blast area.
- \* DON'T attempt to investigate a misfire too soon. Follow federal, state and local laws and regulations.
- \* DON'T drill, bore, or pick out any explosive material that has misfired. Misfires should be handled only by or under the direction of a competent and experienced person, and then only in compliance with any applicable federal, state and local laws and regulations.

EXPLOSIVE MATERIALS DISPOSAL

- \* DO dispose of or destroy explosive materials in accordance with approved methods. Consult your supervisor, or the manufacturer if you have no supervisor.
- \* DON'T leave explosive materials or their packaging where children, unauthorized persons or livestock can get them.
- \* DON'T allow any explosive materials packaging to be burned in a confined space or to be reused.

WHEN SEISMIC PROSPECTING

- \* DO place the detonator and/or primer near the top of the explosive column. If dynamite is used, punch a hole for and insert the detonator midway in the side of the top cartridge or in the top of the second cartridge. When side-priming, wrap suitable tape around the cartridge so the cap cannot come out. Use the capwell on cartridges having this feature.
- \* DO make certain that the explosive material is secured at a safe depth in the hole. Use shot hole anchors if needed.

- \* DO securely anchor any casing if there is a possibility it might blow out of the borehole.
- \* DON'T approach any explosive materials that have been thrown out of the borehole until it is determined that they are not burning.

RECOMMENDATIONS FOR MINIMIZING  
THE HAZARDOUS GAS PRODUCTS  
FROM USE OF EXPLOSIVE MATERIALS

- \* DO use the largest-diameter cartridge that is compatible with the job.
- \* DON'T use explosive materials that appear to be deteriorated or damaged.
- \* DON'T load more explosive material than is necessary to do the job properly.
- \* DON'T add combustible materials to the explosive load.
- \* DO avoid all conditions that may cause the explosive material to burn rather than detonate.
- \* DO always use water-resistant explosive materials in wet work and fire the blast as soon as practicable after loading.
- \* DO use noncombustible materials where stemming is required.
- \* DO spray the muckpile with water in accordance with federal, state and local laws and regulations.

HEALTH AND SAFETY RECOMMENDATIONS

Handling and Use

- \* DON'T allow ingestion, food contamination, prolonged skin exposure, contact with eyes, or prolonged inhalation of dust or vapors from explosive materials. DO flush areas of contact with large quantities of water.
- \* DON'T reuse packaging from explosive materials.
- \* DON'T attempt to produce "home-made" explosives materials or alter the composition of explosive materials.
- \* DON'T remove the explosive materials from the package unless it is designed for use in that manner.
- \* DON'T strike or attempt to take apart detonators, primers, boosters or any explosive material.
- \* DO avoid exposure to excessive noise from blasting in accordance with applicable federal, state or local laws and regulations.

Storage and Transportation

- \* DO provide adequate magazine ventilation in accordance with applicable federal, state or local laws and regulations.
- \* DON'T exceed instructions of your supervisor or, if you have no supervisor, with manufacturer's recommendations for storage time and temperature.
- \* DO clean up spills promptly in accordance with manufacturer's recommendations.

After Blast

- \* DO assume toxic fumes are present from all blasts or burning explosive materials.
- \* DO comply with applicable federal, state and local laws and regulations for safe fume levels before returning to blast area.



Appendix C

SAFETY GUIDE

FOR THE PREVENTION OF  
RADIO FREQUENCY RADIATION HAZARDS  
IN THE USE OF ELECTRIC BLASTING CAPS

These recommendations are from publication number 20, adopted September, 1981 by the Institute of Makers of Explosives.

Purpose and Scope

This guide is intended to provide a basis for assessing the hazards associated with initiation of commercial electric blasting caps by radio frequency (RF) energy by indicating safe distances from commercial RF sources.

The statements in this booklet apply solely to commercial electric blasting caps manufactured in the United States. They do not apply to military electric firing devices. They are based on competent analysis and research and are believed to be accurate. However, no guarantee of their applicability is made because we cannot cover every possible application nor anticipate every variation encountered in the use of electric blasting caps.

Occasionally, situations develop where adherence to the tables of safe distances as stipulated in this booklet becomes an operational handicap. Or, situations develop which are so unusual as not to be covered in this booklet. In these instances, we recommend that competent experts be consulted to evaluate each particular situation. These experts will have the ability to make field measurements at the blasting site so that the RF hazard can be evaluated.

Introduction

Radio-Frequency (RF) transmitters, which include AM and FM radio, television and radar, create powerful electromagnetic fields, decreasing in intensity with distance from the transmitter antenna. Tests have demonstrated that electric blasting cap wires, under certain circumstances, may pick up enough electric energy from such fields to cause caps to explode.

Magnitude of the RF Energy Hazard

From a practical standpoint, the possibility of a premature explosion of electrical blasting caps due to RF energy is extremely remote.

The annual consumption of electric blasting caps in the continental United States is approximately 100,000,000 and they are used in every section of the country. To date, there have been a few authenticated cases of a cap being fired accidentally by RF pickup on the wires. Investigation showed that even these cases would not have happened if tables of distances had been adhered to. This long-term experience and also numerous tests indicate that if proper precautions are taken, such as adherence to the tables of distances, the probability of an accidental firing is extremely remote.

#### RF Initiation

The usual method for firing an electric blasting cap is to apply electric energy from a blasting machine, power line or other source of electric power to the open ends of the cap wires or the blasting circuits. The electric current then flows through the wires to the cap and the very small resistance wires inside the cap heats the primary explosive to the burning-explosion temperature.

If the electric blasting cap wires are in a strong RF field (near a transmitter that is radiating RF power), the usual unshielded leg wires or circuit wires, whether connected to a blasting machine or not, or shunted (short-circuited ends) or not shunted (open ends), will act as an antenna similar to that on a radio or TV set. This antenna will absorb RF energy from the transmitter RF field and the electric current produced in the cap wires will flow into the cap.

In certain cases, depending on the strength of the RF field and the antenna configuration formed by the blasting cap wires and its orientation, sufficient RF energy may be induced in the wires to fire the electric blasting cap.

#### RF Sources Presenting Hazards to Blasting Operations

Commercial amplitude-modulated (AM) broadcast transmitters (0.535 to 1.605 Megahertz) are potentially the most hazardous. This is because they combine high power and low enough frequency so that there is little loss of RF energy in the lead wires.

Frequency-modulated (FM) and TV transmitters are unlikely to create a hazardous situation. Although their power is extremely high and antennas are horizontally polarized, the high-frequency currents are rapidly attenuated in cap or lead wires. These RF sources usually employ antennas on top of high towers. This has an additional effect of reducing the electromagnetic field at ground level.

Mobile radio must be rated as a potential hazard because, although its power is low, it can be brought directly into a blasting area.

Citizens Band (CB) radios are an unusual problem for several reasons:

- (1) There are millions of units being used by the general public.

- (2) Their operating frequency is in the range that is considered to be worst-case for typical electric blasting circuits; and
- (3) Some irresponsible operators use illegal linear amplifiers to increase their transmission range.

Safe distances are recommended for the FCC approved, double sideband (4 watts maximum output power) and single sideband (12 watts peak envelope power) units in Table 7.33-3 in this chapter. It is not possible to specify safe distances for the illegal units because they do not operate within established FCC limits that can be used for making definitive worst-case assumptions.

Federal regulations require the posting of signs within 1,000 feet of construction sites warning that two-way radios should be turned off because of blasting. Observance of the posted signs will provide the necessary degree of safety if the units are a maximum of 200 watts peak power. It is recommended, therefore, that all CB operators obey posted signs and turn off their units in observance of posted warnings or if they know that there are blasting operations in the area.

There may be instances where the use of two-way radios will increase the overall safety of a blasting operation by providing instantaneous voice communications between the shotfirer and personnel at remote locations guarding the approaches to the blast area. When two-way radios are used for this purpose, the minimum separations specified in Table 7.33-3 for a particular transceiver (frequency and power) should be maintained.

There is little possibility that sources of RF energy such as microwave relay will ever constitute a practical problem. They are all characterized by one or more of the following:

- (1) Location in areas where blasting is unlikely;
- (2) Very high frequency; and
- (3) Restricted radiation patterns.

In the vicinity of high power radar installations, blasting should not be conducted within the beam because of the high effective radiated power of these units resulting from the use of high-gain antennas.

Radio-frequency transmitters used in underground mining operations could present a hazardous situation. Because of the uncertainties of RF absorption and scattering within mine tunnels, the potential hazard can only be evaluated with the aid of consultants.

### RF Pickup Circuits

For the radio frequencies used in AM radio broadcasting and mobile operation, cap and lead-wire layouts can act as RF circuits (receiving antennas).

One sensitive RF pickup circuit that might be encountered in electric blasting operations is the dipole circuit. The most hazardous conditions exist when:

- (1) The circuit wiring and/or electric blasting cap leg wires are elevated several feet off the ground;
- (2) The length of this wiring is equal to one-half the wavelength of the radio wave or some multiple of it; and
- (3) The electric cap is located at a point where the RF current in the circuit wiring is at a maximum. An example of this circuit is where the wiring is equal to a half wavelength and the electric blasting cap is located at the center.

Another hazardous situation, similar to the dipole antenna, occurs when the electric cap is at one end of wiring which:

- (1) Is elevated in the air;
- (2) Has a length equivalent to one-quarter the radio wavelength or an odd multiple of it; and
- (3) Is grounded to earth through the electric cap.

Radio wavelengths in feet are approximately obtained by dividing 1,000 by the frequency in megahertz. Both of these circuits require that the lead or cap wires be suspended above the ground, a situation not usually found in blasting operations. Both antennas achieve their maximum current pickup when they are:

- (1) Parallel to a horizontal transmitting antenna, FM, TV or amateur radio; or
- (2) Pointed toward a vertical antenna, AM, mobile, etc.

Another sensitive RF pickup circuit and one commonly encountered in blasting operations is the loop circuit. The loop circuit is sensitive to the magnetic portion of the electromagnetic wave. In general, the larger the loop area, the greater the RF current pickup. The loop orientation for maximum pickup results when it is placed in the plane of the transmitting antenna. The loop configuration was selected for calculations deriving safe distance tables for AM broadcast transmitters and mobile transmitters, both employing vertical antennas.

In general, loop areas can be reduced by picking up both lead wires as in a duplex wire circuit and making wire splices as close to the ground as possible.

#### General Precautions to be Followed

The following list of precautions will further increase safety and reduce hazards associated with conducting electric blasting operations near RF energy sources.

- 1 - When blasting electrically at a fixed location, such as a quarry, make sure that there are no radio transmitters located closer to the blasting site than the applicable separation recommended. Be on the look-out for the installation of new transmitters. Check them out before they go into service to insure that they will not pose a hazard to the blasting operation.

When planning to blast electrically at a new location, as in construction work, inspect the area for RF transmitters before blasting is started. This will permit securing technically qualified assistance, if necessary, in planning proper blasting procedures to minimize any RF hazard.

- 2 - KEEP MOBILE TRANSMITTERS AWAY FROM BLAST SITES. Place adequate signs to remind operators to turn off transmitters when at the blast site. If two-way radios are used to provide instantaneous communication between the shot-firer and personnel guarding the approaches to the blast area, the minimum separation specified in Table 7.33-3 for the type transceiver used, should be maintained.
- 3 - Use the higher frequency bands. 450-470 MHz, for mobile transmitters if there is a choice. RF pickup is less efficient at these frequencies than at the lower frequencies.
- 4 - Avoid large loops in blasting wiring by running lead wires parallel to each other and close together (preferably twisted pairs)
- 5 - If loops are unavoidable, keep them small and orient them broadside towards the transmitting antenna.
- 6 - Keep wires on the ground in blasting layouts. Bare connecting points should be elevated slightly to prevent current leakage.
- 7 - Keep all lead lines out of the beam of directional devices such as radar or microwave relay stations.

#### Military RF Installations

Military transmitters are becoming very numerous, and they cover the frequency range from kilohertz to thousands of megahertz, often having extremely large power outputs.

Because of the nature of military work, much is classified for security reasons. Installations may vary from day to day and multiple transmitters may cause the energy to be pyramided in a particular location. If blasting must be done in the vicinity of military areas, it is strongly recommended that the officer in charge of the military establishment be contacted and the blasting schedule explained. Such cooperation will be the best protection. Presenting IME publication No. 20 to the military authorities will enable them to assist in determining whether or not the blasting operation will be safe from RF hazards.

#### Transportation

All available evidence indicates that radio frequency is not a hazard in the transportation of electric blasting caps so long as they are in their original containers. This is because the wires are then coiled or folded in a manner which provides highly effective protection against current induction. Furthermore, almost all truck bodies and freight cars are made of metal and this virtually eliminates the penetration of RF energy.

If vehicles equipped with radio transmitters are used in transporting electric blasting caps to or from a job, it is recommended that:

- (1) The caps be carried in a closed metal box; and
- (2) The transmitter be turned off when the caps are either being put into or taken out of the box.

To protect against shock and friction, the metal box should be lined with a soft material such as wood or sponge rubber.

A practice which is considered to be a valuable backup to the above-noted procedures is for the radio to be disconnected from the power source whenever caps are being placed in or removed from the vehicle. This practice could also be carried out whenever the vehicle is in close proximity to a blast pattern using electrical caps. The physical disconnection will prevent those occurrences where a person uses the radio strictly out of habit, without thinking about the fact that one shouldn't be doing so at that particular moment.

#### Radio Frequency Sources and Definitions

A partial list of RF sources is given in Table C-1 and standard definitions related to radio frequency sources are given in Table C-2.

TABLE C-1

 RADIO TRANSMITTING STATIONS  
 (Partial List)

Type	Frequency (Megahertz)	Wavelength (Feet)	Maximum Transmitter Power (Watts)	Reference Table for Safe Distance
<b>Commercial</b>				
Standard Broadcast (AM)	0.535-1.605 (540-1,600 KHz)	1820-615	50,000	7.33-1
Frequency Modulation (FM)	88-108	11.2-9.1	550,000 <sup>(1)</sup>	7.33-4
Television (Channels 2 to 6)	54-88	18.2-11.2	100,000 <sup>(1)</sup>	7.33-4
Television (Channels 7 to 13)	174-216	5.6-4.5	316,000 <sup>(1)</sup>	7.33-4
Television (Channels 14 to 83)	470-890	2.1-1.1	5,000,000 <sup>(1)</sup>	7.33-5
<b>Amateur</b>				
160-Meter Band	1.8-2.0	545-490	1,000	7.33-2
80-Meter Band	3.5-4.0	280-246	1,000	7.33-2
40-Meter Band	7.0-7.3	140-135	1,000	7.33-2
20-Meter Band	14.0-14.4	70.0-68.2	1,000	7.33-2
15-Meter Band	21.10-21.25	46.3-46.0	1,000	7.33-2
Citizens' Band	26.96-27.23	36.6-36.0	5	7.33-3
10-Meter Band	28.0-29.7	35.1-33.0	1,000	7.33-3 Mobile or
10-Meter Band	28.0-29.7	35.1-33.0	1,000	7.33-2 Fixed
6-Meter Band	50.0-54.0	19.7-18.2	1,000	7.33-3
2-Meter Band	144-148	6.8-6.65	1,000	7.33-3
1-1/4-Meter Band	220-225	4.46-4.36	1,000	7.33-3 Use 150.0 161.6 MHz Column

(Also others scattered in the range 420 to 30,000 megahertz.)

(1) Maximum effective radiated power.

100

TABLE C-1 (Continued)

RADIO TRANSMITTING STATIONS  
(Partial List)

Type	Frequency (Megahertz)	Wavelength (Feet)	Maximum Transmitter Power (Watts)	Reference Table for Safe Distance
Two-Way Communications				
HF Range Central Station	25-50	39-20	500	7.33-2
Mobile Unit	25-50	39-20	500	7.33-3
VHF Range Central Station	148-174	6.6-5.6	600	7.33-3
Mobile Unit	148-174	6.6-5.6	180	7.33-3
UHF Range Central Station	450-470	2.2-2.1	180	7.33-3
Mobile Unit	450-470	2.2-2.1	180	7.33-3
LF Range (Aviation)	0.2-0.4	5,000-2,500	2,000	7.33-1
HF Range (Aviation)	4-23	250-44	50,000	7.33-2
VHF Range (Aviation)	118.0-135.9	8.3-7.2	50	(100 ft.)
UHF Range (Aviation)	225-500	4.4-2.0	100	(50 ft.)
Radio Telegraph	6-23	164-43	50,000	7.33-2
Microwave Relay	2,000-12,000	0.5-0.08	50	*
Navigational Aids				
Radio Range Beacon ("A"- "N")	0.200-0.415	5,000-2,400	600	7.33-1
Loran	1.8-2.0	545-490	1,000,000 peak; 3,000 avg. )	*
VOR-ILS (Aviation)	108-118	9.0-8.3	200	*
Shoran	290-320	4.7-3.1	25,000 peak; 1,000 avg. )	*
Long-Range Radar (Nonmilitary)	1,300-1,350	0.77-0.74	1,000,000 peak; 100,000 avg. )	**
10-cm. Radar (Nonmilitary)	2,700-2,900	0.37-0.34	750,000 peak; 1,000 avg. )	7.33-6
3-cm. Radar (Nonmilitary)	10,000	0.10	50,000 peak	7.33-6

\*See material under RF Sources Presenting Hazards to Blasting Operations.

\*\*Hazardous within one mile - Consult local authority.



TABLE C-2

TABLE OF DEFINITIONS

A number of these definitions have been abstracted from FCC regulations.

(1) Broadcasting Service

"A radio communication service in which the transmissions are intended for direct reception by the general public".

(2) International Broadcast Service

A service "whose transmissions are intended to be received directly by the general public in foreign countries."

(3) Amateur Service

"A service of . . . intercommunications and technical investigations carried on by . . . duly authorized persons interested in radio technique."

(4) Citizens Band Radio

"A radio communication service of fixed, land, and mobile stations intended for personal or business radio communication, radio signaling, (and) control of remote objects or devices."

(5) Maritime Services

Services intended for maritime radio communication and including fixed stations, land stations, and mobile stations on land and on board ships.

(6) Aviation Services

Services of fixed and land stations and mobile stations on land and on board aircraft "primarily for the safe expeditions, and economical operation of aircraft".

(7) Mobile Service

"A service of radio communication between mobile and land stations, or between mobile stations".

Mobile Station

"A station in the mobile service intended to be used while in motion or during halts at unspecified points."

Land Station

"A station in the mobile service not intended to be used while in motion."

(8) Fixed Service

"A service of radio communication between specified fixed points."

Fixed Station

A station in the fixed service.

(9) Standard Frequency Terms and Bands

1 Megahertz, MHz = 1,000,000 cycles per second	
Medium Frequency Band - MF	0.3-3 MHz
High Frequency Band - HF	3-30 MHz
Very High Frequency Band - VHF	30-300 MHz
Ultra High Frequency Band - UHF	300-3,000 MHz

Appendix D

BLASTER'S LICENSE APPLICATION  
FORM

The following application form (SB-4514) is referred to in section ILHR 7.11 (2). Copies of this form may be obtained at no charge from the Division of Safety and Buildings, P.O. Box 7969, Madison, Wisconsin 53707.

DEPARTMENT OF INDUSTRY,  
LABOR AND HUMAN RELATIONS  
Safety and Buildings Division  
P.O. Box 7969  
Madison, WI 53707

BLASTER'S LICENSE APPLICATION

DO NOT WRITE IN THIS SPACE		
1. LICENSE NO.	2. EFFECTIVE DATE	3. EXPIRATION DATE
4. GRADED SATISFACTORY FOR CLASS		

INSTRUCTIONS:  
 o Please type or print  
 o Complete and sign application  
 o Bring the completed application to the blasting license test site of your choice

5. SOCIAL SECURITY NUMBER	6. APPLICANT NAME (LAST, FIRST, MIDDLE)	7. HOME PHONE NUMBER

8. STREET ADDRESS	CITY	COUNTY	STATE	ZIP CODE

9. DATE OF BIRTH	10. HEIGHT	11. WEIGHT	12. SCHOOL LAST ATTENDED	13. GRADE COMPLETED

14. NAME OF COUNTY SHERIFF (ATTACH CHARACTER REFERENCE FROM SHERIFF)

15. NAMES AND ADDRESSES OF TWO REFERENCES, WHO WILL ATTEST TO YOUR BLASTING EXPERIENCE. ONE REFERENCE MUST BE A WISCONSIN LICENSED BLASTER.

16. CHECK THE BOXES FOR THE CLASS AND CIRCLE THE LETTER WHICH IS KEYED TO THE SPECIFIC BLASTING ACTIVITY FOR WHICH YOU ARE APPLYING. (See Explosives Material Code ILHR 7).

<input type="checkbox"/> V Specialized Blasting A B	<input type="checkbox"/> III Surface Blasting A B C D	<input type="checkbox"/> I Limited or Basic Blasting A B C D E F G H
<input type="checkbox"/> IV Precision Blasting A B C D E F G H	<input type="checkbox"/> II Underground Blasting A B	

17. PRESENT EMPLOYER	18. EMPLOYER PHONE NO.

19. DESCRIBE ALL BLASTING EXPERIENCE AND ANY SPECIAL BLASTING TRAINING COURSES COMPLETED. (attach additional sheets, if needed)

NAME AND ADDRESS OF EMPLOYERS FOR WHOM YOU HAVE BLASTED	DATES		CLASS OF BLASTING	ACTUAL BLASTING TIME		
	START	END		YEARS	MONTHS	WEEKS

20. I CERTIFY THAT THE INFORMATION CONTAINED IN THIS FORM IS CORRECT AND TRUE.

APPLICANT SIGNATURE	DATE	BLASTING EXAMINER SIGNATURE	DATE

Appendix E

APPLICATION FOR STORAGE  
OF  
EXPLOSIVES IN A COMMUNITY

The following form (SBD-6772) is referred to in section ILHR 7.20 (2). Copies of this form may be obtained at no charge from the Division of Safety and Buildings, P.O. Box 7969, Madison, Wisconsin 53707



ILHR 7.04 - DEFINITION

"LOW EXPLOSIVES" means explosive materials which can be caused to deflagrate when confined. The term includes, but is not limited to black powder, smokeless propellant, safety fuses, igniters, igniter cords and fuse lighters.

"HIGH EXPLOSIVES" means explosives which are characterized by a very high rate of reaction, high pressure development, and the presence of a detonation wave in the explosion.

"BLASTING AGENT" means any explosive material or mixture, consisting of a fuel and oxidizer, intended for blasting, not otherwise classified as an explosive, provided that the material or mixture cannot be detonated by a No. 8 test detonator when unconfined.

"DETONATOR" means any device containing a detonating charge that is used for initiating detonation in an explosive. 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.

ILHR 7.203 TYPES OF MAGAZINES. For the purposes of this chapter, there are 5 types of magazines. These types, together with the classes of explosive materials which may be stored in them, shall be as specified in subs. (1) to (5).

(1) TYPE 1 MAGAZINES. Type 1 magazine shall be permanent magazines for the storage of high explosives, subject to the limitations prescribed by ss. ILHR 7.206 and 7.213. Other classes of explosive materials may also be stored in Type 1 magazines.

(2) TYPE 2 MAGAZINES. Type 2 magazines shall be mobile and portable indoor and outdoor magazines for the storage of high explosives, subject to the limitations prescribed by ss. ILHR 7.206, 7.208 (2) and 7.213. Other classes of explosive materials may also be stored in Type 2 magazines.

(3) TYPE 3 MAGAZINES. Type 3 magazines shall be portable outdoor magazines for the temporary storage of high explosives while attended, subject to the limitations prescribed by ss. ILHR 7.206 and 7.213. Other classes of explosives materials may also be stored in Type 3 magazines.

NOTE: An example of a type 3 magazine is a "day-box".

(4) TYPE 4 MAGAZINE. Type 4 magazines shall be magazines for the storage of low explosives, subject to the limitations prescribed by ss. ILHR 7.206 (2), 7.210 (2) and 7.213. Blasting agents may be stored in Type 4 magazines, subject to the limitations prescribed by ss. ILHR 7.206 (3), 7.211 (2) and 7.213. Detonators that will not mass detonate may also be stored in Type 4 magazines, subject to the limitations prescribed by ss. ILHR 7.206 (1), 7.210 (2) and 7.213.

(5) TYPE 5 MAGAZINES. Type 5 magazines shall be magazines for the storage of blasting agents, subject to the limitations prescribed by ss. ILHR 7.206 (3), 7.211 (2) and 7.213.

NOTE: Complete plans for all types of magazines are available from the U.S. Bureau of Mines, explosive manufacturers, and the Institute of Makers of Explosives.

Appendix F

NOTICE OF BLASTING  
IN A COMMUNITY

The following form (SBD-7336) is referred to in section ILHR 7.35 (3). Copies of this form may be obtained at no charge from the Division of Safety and Buildings, P.O. Box 7969, Madison, Wisconsin 53707.



NOTICE OF BLASTING IN COMMUNITY

Industry, Labor & Human Relations  
 Safety & Buildings Division  
 Mine Safety Section  
 201 E. Washington Ave.  
 P.O. Box 7969 Madison, Wi 53707  
 Phone: (608) 266-7529

Complete and Send Original to Safety & Buildings.  
 Send one copy to your local fire department.  
 Retain one copy for your files.

PLEASE PRINT OR TYPE

Date Submitted:		Community of:	
Prime Contractor Name		Blasting Contractor Name	
Street Address		Street Address	
City, State, Zip		City, State, Zip	
Phone (Include area code)		Phone (Include area code)	
Fire Department Contact Name		Name of Blaster in charge on job site	
City	Phone	WI Blaster's License No.	Class.
Estimated Blasting Start Date:		Estimated Blasting Finish Date:	
Name and Address of insurance carrier providing blasting coverage on this job:			
Type of Project:		Location where explosive used:	
Estimated Distance To:	Nearest inhabited building:	Type of building:	Nearest public highway:
Typical overburden type:		Estimated depth of overburden:	
Type of Matting to be used:			
Typical drilling pattern:		Typical hole diameter:	Estimated hole depth:
Delay system proposed:	Estimated maximum lbs. per delay	Estimated lbs. and type of explosives on job site at given time:	
I will comply with Wis. Admin. Code Chapter ILHR 7. (Explosive Materials) FAILURE TO ADHERE TO THE ADMIN. RULES MAY BE CAUSE FOR REVOCATION OF BLASTERS LICENSE			
Signature of Blaster or Authorized Representative			Date