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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)

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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 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 igniter cord 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" explosive 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.

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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 wire 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 lookout 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 shotfirer 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 in 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
Commercial				
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(1)	7.33–4
Television (Channels 2 to 6)	54–88	18.2–11.2	100,000(1)	7.33–4
Television (Channels 7 to 13)	174–216	5.6–4.5	316,000(1)	7.33–4
Television (Channels 14 to 83)	470–890	2.1–1.1	5,000,000(1)	7.33–5
Amateur				
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 only
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
1¼–Meter Band	220–225	4.46–4.36	1,000	7.33–3 Use 150.8–161.6 MHz Column
(Also others scattered in the range 420 to 30,000 megahertz.)				
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

(1) Maximum effective radiated power.
* 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 Bank—UHF	300–3,000 MHz

Chapter Comm 7

APPENDIX E
APPLICATION FOR STORAGE OF EXPLOSIVES IN A COMMUNITY

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

REQUEST FOR STORAGE OF
EXPLOSIVES IN A COMMUNITY

Complete one form for EACH magazine
Return all copies to Safety & Buildings Div.

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

PLEASE PRINT OR TYPE

Blasting Contractor Name, Street Address, City, State, Zip Code	Describe Magazine Location
Blasting Contractor Phone No. (area code) ( )	Estimated Storage Period From TO
Name of Person In Charge of Magazine	Fire Department Contact Name
Street Address, City, State, Zip / Phone No. (area code)	City / Phone No. (area code)
Type Of Material To Be Stored:	Magazine Is: ☐ Barricaded ☐ Unbarricaded
MAXIMUM QUANITITY TO BE STORED: (Definition-Per ILHR 7.04 (See back of form) ☐ Low Explosives - #lbs_____ ☐ High Explosives - #lbs_____ ☐ Blasting Agent - #lbs_____ ☐ Detonators - #of _____	TYPE OF MAGAZINE: (Per ILHR 7.203 (See back of form) ☐ Type 1 ☐ Type 2 ☐ Type 4 ☐ Type 5

Distance To:	Nearest Inhabited Building	Nearest Public Highway	Any Other Magazine

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 STORAGE PERMIT.

Signature of Person In Charge of Magazine or Authorized Representative Date

DEPARTMENT ACTION	Conditions:
☐ CONDITIONAL APPROVAL	
☐ APPROVAL	
☐ DENIAL	
Date_____	PERMIT MUST BE STORED IN MAGAZINE

SBD-6772 (R.02/85)

Chapter Comm 7

APPENDIX F
NOTICE OF BLASTING IN A COMMUNITY

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

Notice Of Blasting In Community

Wisconsin Department of Industry, Labor and Human Relations
Safety and 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.
Send one copy to your local law enforcement office.
Retain one copy for your files.

PRINT OR TYPE

Date Submitted		Community Name	County
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 Contractor 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:	1. Nearest Inhabited Building Type of Building:		2. Nearest Public Highway
Typical Overburden Type		Estimated Depth of Overburden	
Type of Matting Used			
Typical Drilling Pattern		Typical Hole Diameter	Estimated Hole Depth
Proposed Delay System	Estimated Max 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

Blasters Signature _____ Date Signed _____
Or Authorized Representatives

SBD-7336 (R 08/92)

SAFETY & BUILDINGS COPY