WARNINGS AND INSTRUCTIONS
for
CONSUMERS
IN TRANSPORTING, STORING, HANDLING, AND USING EXPLOSIVE MATERIALS

March 2000
Incorporates all changes through May 2004
<table>
<thead>
<tr>
<th>MEMBER COMPANIES</th>
<th>NELSON BROTHERS, INC.</th>
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<tbody>
<tr>
<td>ACCURATE ENERGETIC SYSTEMS, LLC McEwen, Tennessee</td>
<td>Birmingham, Alabama</td>
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<tr>
<td>ALLIANT TECHSYSTEMS Radford, Virginia</td>
<td>NITROCHEM, LLC Tamaqua, Pennsylvania</td>
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<tr>
<td>AUSTIN POWDER COMPANY Cleveland, Ohio</td>
<td>NOBEL INSURANCE SERVICES Dallas, Texas</td>
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<td>BAKER ATLAS Houston, Texas</td>
<td>ORICA Englewood, Colorado</td>
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<td>DAVEYFIRE, INC. Walnut Creek, California</td>
<td>OWEN OIL TOOLS, INC. Fort Worth, Texas</td>
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<td>DOUGLAS EXPLOSIVES, INC. Philipsburg, Pennsylvania</td>
<td>R&amp;R TRUCKING, INC. Duenweg, Missouri</td>
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<td>DYNO NOBEL, INC. Salt Lake City, Utah</td>
<td>SCHLUMBERGER Sugar Land, Texas</td>
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<td>EL DORADO CHEMICAL COMPANY St. Louis, Missouri</td>
<td>SLURRY EXPLOSIVE CORP. Oklahoma City, Oklahoma</td>
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<td>THE ENSIGN-BICKFORD COMPANY Simsbury, Connecticut</td>
<td>SENEX EXPLOSIVES, INC. Cuddy, Pennsylvania</td>
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<td>ETI CANADA, INC. North Bay, Ontario</td>
<td>ST. LAWRENCE EXPLOSIVES CORP. Adam’s Center, New York</td>
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<td>GOEX, INC. Doyline, Louisiana</td>
<td>TERRA DINAMICA, LLC Granby, Connecticut</td>
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<tr>
<td>D.C. GUELICH EXPLOSIVES COMPANY Clearfield, Pennsylvania</td>
<td>TALLEY DEFENSE SYSTEMS, INC. Mesa, Arizona</td>
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<tr>
<td>HITECH, INC. East Camden, Arkansas</td>
<td>TRADESTAR CORP. West Jordan, Utah</td>
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<td>INGERSOLL-RAND COMPANY Garland, Texas</td>
<td>TREAD CORP. Roanoke, Virginia</td>
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<tr>
<td>JET RESEARCH CENTER Alvardo, Texas</td>
<td>TRW VEHICLE SAFETY SYSTEMS Mesa, Arizona</td>
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<td>MINING SERVICES INTERNATIONAL Sandy, Utah</td>
<td>VET’S EXPLOSIVES, INC. Torrington, Connecticut</td>
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<tr>
<td>MP ASSOCIATES Ione, California</td>
<td>VIKING EXPLOSIVES &amp; SUPPLY, INC. Rosemount, Minnesota</td>
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<td>W.A. MURPHY, INC. El Monte, California</td>
<td>ASSOCIATE STATUS: FEDERATION OF EUROPEAN EXPLOSIVES MANUFACTURERS Steveson, Ayrshire, Scotland</td>
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</table>
The Institute of Makers of Explosives (IME) is the safety association of the commercial explosives industry in the United States and Canada. The primary concern of IME is the safety and security of employees, users, the public, and environment in the manufacture, transportation, storage, handling, use, and disposal of explosive materials used in blasting and other essential operations.

Founded in 1913, IME was created to provide technically accurate information and recommendations concerning commercial explosive materials and to serve as a source of reliable data about their use. Committees of qualified representatives from IME member companies developed this information and a significant portion of their recommendations are embodied in regulations of state and federal agencies.

The Institute's principal committees are: Environmental Affairs; Legal Affairs; Safety and Health; Technical; and Transportation and Distribution.
No portion of this document may be reproduced or disseminated, by any means, without written permission from the Institute of Makers of Explosives.
References to Electronic Detonators in this Publication

DEFINITIONS

**DETONATOR**: …The term includes, but is not limited to, *electronic detonators* and electric blasting caps of instantaneous…

WARNINGS AND INSTRUCTIONS

EXPLOSIVE MATERIALS COVERED IN THIS BOOKLET

Electronic, Electric and Nonelectric Detonators

**USING EXPLOSIVE MATERIALS: GENERAL INSTRUCTIONS FOR PRIMERS**

**PREPARING THE PRIMER**

*ALWAYS* use cartridges and/or boosters that are physically compatible with the specific detonator design.

**MAKING PRIMERS WITH ELECTRIC OR ELECTRONIC DETONATORS**

Figures 1 through 4. Recommended method of making primer with… and electric or electronic detonators.

**USING EXPLOSIVE MATERIALS: ELECTRIC INITIATION**

**PREPARING THE ELECTRIC BLASTING CIRCUIT**

*NEVER* mix electric detonators and electronic detonators in the same blast, even if these are made by the same manufacturer, unless such use is approved by the manufacturer.

*NEVER* use test equipment and blasting machines that are designed for electronic detonators with electric detonators.
USING EXPLOSIVE MATERIALS:
   ELECTRONIC INITIATION

ALWAYS follow manufacturer’s warning and instructions, especially hook-up procedures and safety precautions.

ALWAYS fire electronic detonators with the equipment and procedures recommended by the manufacturer.

ALWAYS verify the detonator system integrity prior to initiation of a blast.

ALWAYS keep the firing circuit completely insulated from ground or other conductors.

ALWAYS use the wires, connectors, and coupling devices specified by the manufacturer.

ALWAYS follow the manufacturer’s instructions when aborting a blast. Wait a minimum of 30 minutes before returning to a blast site after aborting a blast unless the manufacturer provides other specific instructions.

ALWAYS clear the blast area of personnel, vehicles, and equipment prior to hooking up to the firing device or blast controller.

ALWAYS keep detonator leads, coupling devices, and connectors protected.

ALWAYS keep wire ends, connectors, and fittings clean and free from dirt or contamination prior to connection.

ALWAYS follow manufacturer’s instructions for system hook-up for electronic detonators.

ALWAYS follow manufacturer’s recommended practices to protect electronic detonators from electromagnetic, RF, or other electrical interference sources.

ALWAYS protect electronic detonator wires, connectors, coupling devices, shock tube, or other components from mechanical abuse and damage.

ALWAYS ensure the blaster in charge has control over the blast site throughout the programming, system charging, firing, and detonation of the blast.
ALWAYS use extreme care when programming delay times in the field to ensure correct blast designs. Incorrect programming can result in misfires, flyrock, excessive airblast, and vibration.

NEVER mix electronic detonators and electric detonators in the same blast, even if they are made by the same manufacturer, unless such use is approved by the manufacturer.

NEVER mix electronic detonators of different types and/or versions in the same blast, even if they are made by the same manufacturer, unless such use is approved by the manufacturer.

NEVER mix or use electronic detonators and equipment made by different manufacturers.

NEVER use test equipment and blasting machines designed for electric detonators with electronic detonators.

NEVER use equipment or electronic detonators that appear to be damaged or poorly maintained.

NEVER attempt to use blasting machines, testers, or instruments with electronic detonators that are not specifically designed for the system.

NEVER attempt to cut and splice leads unless specifically recommended by the manufacturer.

NEVER make final hook-up to firing device or blast controller until all personnel are clear of the blast area.

NEVER load boreholes in open work near electric power lines unless the firing lines and detonator wires are anchored or are too short to reach the electric power lines.

NEVER handle or use electronic detonators during the approach and progress of an electrical storm. Personnel must be withdrawn from the blast area to a safe location.

NEVER use electronic detonator systems outside the manufacturer’s specified operational temperature and pressure ranges.

NEVER test or program an electronic detonator in a booster, cartridge, or other explosive component (Primer Assembly) before it has been deployed in the borehole or otherwise loaded for final use.

NEVER hold an electronic detonator while it is being tested or programmed.
USING EXPLOSIVE MATERIALS:  
AFTER BLAST PROCEDURES  

**MISFIRES**

**ALWAYS** wait a minimum of 30 minutes with electronic detonator misfires unless the manufacturer recommends additional time before returning to the blast area.

**ALWAYS** deal with misfires of electronic detonator systems in accordance with the manufacturer’s recommended procedures. (Electronic detonator systems may vary widely in design and application).
NOTICE

Effective October 1, 1991 (voluntary compliance as of January 1, 1991), many of the U.S. Department of Transportation’s (USDOT) proper shipping names and all classifications have been changed for domestic transportation. Although this system is now in effect, there were certain transition dates established to allow a smooth flow into the distribution channels.

The following two charts provide: (1) a comparison of the old and new classifications for explosives; and (2) the transition periods for use of the new names and classifications. When you read through the Institute of Makers of Explosives’s (IME) Safety Library Publications (SLPs) please remember to refer to these charts to ensure compliance with applicable regulations:

**CHART 1**

<table>
<thead>
<tr>
<th>OLD CLASSIFICATION</th>
<th>CURRENT CLASSIFICATION</th>
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<tbody>
<tr>
<td>Class A Explosives</td>
<td>Division 1.1 or 1.2</td>
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<tr>
<td>Class B Explosives</td>
<td>Division 1.2 or 1.3</td>
</tr>
<tr>
<td>Class C Explosives</td>
<td>Division 1.4</td>
</tr>
<tr>
<td>Blasting Agents</td>
<td>Division 1.5</td>
</tr>
<tr>
<td>(No Applicable Class)</td>
<td>Division 1.6</td>
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**CHART 2**

<table>
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<th>TRANSITION PERIODS</th>
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<tr>
<td>1 October 1991</td>
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<tr>
<td>All new explosives must be classified under the new regulations.</td>
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<tr>
<td>1 October 1993</td>
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<tr>
<td>Mandatory compliance with new classification and hazard communication requirements (except placarding).</td>
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<tr>
<td>1 October 1994</td>
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<tr>
<td>Mandatory use of new (UN) placards, except DOT placards may be used for domestic highway transportation. Package manufacturers will only be permitted to make non bulk packaging which meet United Nations performance standards.</td>
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<tr>
<td>1 October 1996</td>
</tr>
<tr>
<td>Mandatory use of performance oriented packaging standards (UN) for non bulk packaging.</td>
</tr>
<tr>
<td>1 October 2001</td>
</tr>
<tr>
<td>Mandatory use of UN placards for all modes of transportation.</td>
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</table>
DEFINITIONS

The words “DETONATOR” and “BLASTING CAP” shall be considered interchangeable and synonymous in this document.

**BLASTING AGENT:** An explosive material which meets prescribed criteria for insensitivity to initiation.

For storage, Title 27, Code of Federal Regulations (CFR), Section 55.11 defines a blasting agent as any material or mixture, consisting of fuel and oxidizer intended for blasting, not otherwise defined as an explosive: Provided, that the finished product, as mixed for use or shipment, cannot be detonated by means of a No. 8 test blasting cap (detonator) when unconfined. (Bureau of Alcohol, Tobacco, and Firearms Regulation.)

For transportation, Title 49 CFR Section 173.50, defines Class 1, Division 1.5 (blasting agent) as a substance which has a mass explosion hazard but is so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

**BOOSTER:** An explosive charge, usually of high strength and high detonation velocity, designed to be used in the explosive initiation sequence between an initiator or primer and the main charge.

**DETONATOR:** Any device containing an initiating or primary explosive that is used for initiating detonation in another explosive material. A detonator may not contain more than 10 grams of total explosives by weight, excluding ignition or delay charges. The term includes, but is not limited to, electronic detonators, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuse, detonating cord delay connectors, and nonelectric instantaneous and delay blasting caps which use detonating cord, shock tube, or any other replacement for electric leg wires. Unless specifically classified otherwise, detonators are classified 1.1 (Class A explosives).

**EXPLOSIVE MATERIALS:** These include explosives, blasting agents, and detonators. The term includes, but is not limited to, dynamite and other high explosives; slurries, emulsions, and water gels; black powder and pellet powder; initiating explosives; detonators (blasting caps); safety fuse; squibs; detonating cord; igniter cord; and igniters.
A list of explosive materials determined to be within the coverage of 18 U.S.C. Chapter 40, Importation, Manufacture, Distribution, and Storage of Explosive Materials, is issued at least annually by the Director of the Bureau of Alcohol, Tobacco and Firearms of the Department of the Treasury.

The U.S. Department of Transportation classifications of explosive materials used in commercial blasting operations are not identical with the statutory definitions of the Organized Crime Control Act of 1970, Title 18 U.S.C., Section 841. To achieve uniformity in transportation the definitions of the U.S. Department of Transportation in Title 49 Code of Federal Regulations parts 1-999 subdivides these materials into:

<table>
<thead>
<tr>
<th>DIVISION</th>
<th>Description</th>
<th>Class</th>
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<tr>
<td>1.1</td>
<td>Mass exploding</td>
<td>A</td>
</tr>
<tr>
<td>1.2</td>
<td>Projection hazard</td>
<td>A or B</td>
</tr>
<tr>
<td>1.3</td>
<td>Fire hazard, minor blast or projection hazard</td>
<td>B</td>
</tr>
<tr>
<td>1.4</td>
<td>Minor explosion hazard – Not mass detonating</td>
<td>C</td>
</tr>
<tr>
<td>1.5</td>
<td>Insensitive explosives. Very little probability of initiation or transition from burning to detonation during transport</td>
<td>Blasting</td>
</tr>
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</table>

**EXPLOSIVE:** Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion.

**MAGAZINE:** Any building, structure, or container, other than an explosives manufacturing building, approved for the storage of explosive materials.

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

**SAFETY FUSE:** A flexible cord containing solid flammable materials by which fire or flame is conveyed at a continuous and uniform rate from the point of ignition to a cut end. A fuse detonator is usually attached to that end, although safety fuse may be used without a detonator to ignite material such as deflagrating explosives.

**SHOCK TUBE:** A small diameter plastic tube used for initiating detonators. It contains only a limited amount of reactive material so that the energy that is transmitted through the tube by means of a detonation wave is guided through and confined within the walls of the tube.
WARNINGS AND INSTRUCTIONS

Warnings and Instructions for Transporting, Storing, Handling, and Using Explosive Materials.

WARNING: READ THIS BOOKLET BEFORE USING ANY EXPLOSIVE MATERIAL

PREVENTION OF ACCIDENTS IN THE TRANSPORTATION, STORAGE, HANDLING, AND USE OF EXPLOSIVE MATERIALS

The misuse of any explosive material can kill or injure you or others.

Prevention of accidents depends on careful planning and the use of proper procedures.

This booklet is designed to help you use explosive materials safely.

GENERAL WARNINGS

All explosive materials are dangerous and must be carefully transported, handled, stored, and used following proper safety procedures or under competent supervision.

ALWAYS follow Federal, State, and local laws and regulations.

ALWAYS lock up explosive materials and keep from children and unauthorized persons.

ADDITIONAL INFORMATION MATERIALS ON SAFETY OF EXPLOSIVES

The Institute of Makers of Explosives publishes a number of publications on safety. Refer to page 35 of this booklet for a complete list.

EXPLOSIVE MATERIALS COVERED IN THIS BOOKLET

High Explosives and Permissible Explosives
Electronic, Electric, and Nonelectric Detonators
Safety Fuse
Detonating Cord
Blasting Agents
Slurries, Water Gels, and Emulsions
Primers and Boosters
QUESTIONS ON THE USE OF EXPLOSIVE MATERIALS

THESE WARNINGS AND INSTRUCTIONS CANNOT COVER EVERY SITUATION WHICH MIGHT OCCUR. IF YOU HAVE ANY QUESTIONS ON THE USE OF AN EXPLOSIVE MATERIAL, CONTACT YOUR SUPERVISOR OR THE MANUFACTURER.

LOST OR STOLEN EXPLOSIVES

Call the Bureau of Alcohol, Tobacco and Firearms (BATF) at 1-800-800-3855.

STORING EXPLOSIVE MATERIALS

LOCATION OF MAGAZINES

ALWAYS separate magazines from other magazines, inhabited buildings, highways, and passenger railways. See IME Safety Library Publication No. 2, American Table of Distances.

ALWAYS post normal access roads to explosive storage magazines with the following warning sign:

DANGER!
NEVER FIGHT EXPLOSIVE FIRES
EXPLOSIVES ARE STORED ON THIS SITE
CALL (Emergency phone number)

(This sign shall be weather resistant with a reflective surface and lettering at least 2” (50 mm) high. The first two lines shall be in red lettering and the remaining printing in black).

NEVER allow combustible material to accumulate within 25 feet of the magazine.

NEVER allow any lighters, matches, open flame, or other sources of ignition or volatile materials within 50 feet of the magazine.

NEVER attempt to make any repairs to the inside or outside of a magazine containing explosive materials.
CONSTRUCTION OF MAGAZINES

ALWAYS be sure magazines are solidly built and securely locked in accordance with Federal regulations, to protect from weather, fire, and theft. Protect from penetration by bullets and missiles, as required by the classification of the explosive material.

ALWAYS keep the inside of the magazine clean, dry, cool, and well ventilated.

ALWAYS post clearly visible “EXPLOSIVES – KEEP OFF” signs outside of the magazine. Locate signs so that a bullet passing directly through them cannot hit the magazine.

CONTENTS OF MAGAZINES

ALWAYS clean up spills promptly. Follow manufacturer’s directions.

ALWAYS store only explosive materials and other approved blasting materials and accessories in a magazine.

ALWAYS rotate stocks of explosive materials so the oldest material in the magazine is used first. Consult with the manufacturer to assure that the recommended storage time for the explosive materials is being followed.

NEVER store detonators with other explosive materials.

NEVER use explosive materials which seem deteriorated. Before using, consult your supervisor or the manufacturer.

NEVER exceed recommended storage conditions and temperatures for explosive materials. Check with your supervisor or the manufacturer.

NEVER perform any type of operation in a magazine other than inspection, inventory, or bringing in or taking out explosive materials.

TRANSPORTING EXPLOSIVE MATERIALS

ALWAYS keep matches, lighters, open flame, and other sources of ignition at least 50 feet away from parked vehicles carrying explosive materials.

ALWAYS follow Federal, State, and local laws and regulations concerning transportation.
ALWAYS load and unload explosive materials carefully.

NEVER park vehicles containing explosive materials close to people or congested areas.

NEVER leave a vehicle containing explosive material unattended.

**HANDLING EXPLOSIVE MATERIALS**

**GENERAL**

ALWAYS use permissible explosive materials in flammable, gassy, or dusty atmospheres when required by applicable Federal, State, and local laws and regulations.

ALWAYS keep explosive materials away from children, unauthorized persons and livestock.

NEVER use explosive materials unless completely familiar with safe procedures or under the direction of a qualified supervisor.

NEVER handle explosive materials during the approach of an electrical storm. Find a safe location away from the explosive materials. When a storm is approaching, consult your supervisor. This applies to both surface and underground operations.

NEVER fight fires involving explosive materials. Remove yourself and all other persons to a safe location and guard the area.

NEVER put explosive materials in the pockets of your clothing.

**PACKAGING**

ALWAYS close partially used packages of explosive materials.

ALWAYS store explosives in their original package.

NEVER touch metal fasteners with metal slitters when opening packages of explosive materials.

NEVER mix different explosives in the same package.

NEVER remove explosive material from its package unless designed to be used in that manner.
PROTECTING EXPLOSIVE MATERIALS

ALWAYS insure that there are no foreign objects, loose powder, or moisture in a fuse detonator before inserting the safety fuse.

ALWAYS avoid the use of “shot breaks” to prevent premature initiation or damage of the initiation system. If “shot breaks” must be used, all loaded holes should be considered in determining the size of the blast area.

NEVER insert anything into a fuse detonator except safety fuse.

NEVER use explosive materials that have been water soaked, even if they now appear to be dried out.

NEVER investigate the contents of a detonator.

NEVER pull wires, safety fuse, shock tube, coupling device, plastic tubing, or detonating cord out of any detonator or delay device.

NEVER take apart, or alter the contents of any explosive materials.

NEVER expose explosive materials to sources of heat exceeding 150°F or to open flame, unless such materials or procedures for their use have been recommended for such exposure by the manufacturer.

NEVER strike explosive materials with, or allow them to be hit by, objects other than those required in loading.

NEVER subject explosive materials to excessive impact or friction.

NEVER allow loaded firearms in the vicinity of, nor shoot near, explosive materials, magazines or vehicles loaded with explosive materials.

USING EXPLOSIVE MATERIALS: DRILLING, LOADING, AND TAMPPING

GENERAL

ALWAYS keep accurate and complete records of all blasts. Blast records shall include the names of the blaster-in-charge and crew, the exact blast site location, the weather conditions, site-specific loading and geologic data, vibration compliance data, a sketch of the blast site, and the blaster’s signature.
DRILLING

ALWAYS check for unfired explosive materials on surface or face before drilling.

NEVER drill into explosive materials, or into a blasthole that has contained explosive materials.

NEVER start a drill hole in a bootleg.

LOADING

ALWAYS inspect the highwall and crest conditions before loading.

ALWAYS check each borehole to assure it is safe for loading.

ALWAYS load the face holes in such a manner that you can see the crest at all times.

ALWAYS take precautions during pneumatic loading to prevent the accumulation of static electric charges.

NEVER place any parts of the body in front of the borehole except those required for the loading, tamping, or stemming operations.

NEVER force explosive materials into a borehole.

NEVER load a borehole containing hot or burning material. Temperatures above 150° F could be dangerous.

NEVER spring a borehole near other holes loaded with explosive materials.

NEVER stack more explosive materials than needed near working areas during loading.

NEVER drop large diameter, rigid cartridges [4 inch (102 mm) or larger] directly on the primer.

TAMPING

NEVER tamp a primer or explosive material removed from its cartridge.

NEVER tamp explosive materials with metallic devices, except jointed non-sparking poles with nonferrous metal connectors.

NEVER tamp violently.
NEVER kink or damage safety fuse, detonating cord, shock tube, plastic tubing, coupling devices, or wires of detonators when tamping.

**USING EXPLOSIVES MATERIALS: GENERAL INSTRUCTIONS FOR PRIMERS**

**GENERAL**

NEVER prepare more primers than immediately needed.

NEVER prepare primers in a magazine or near large quantities of explosive materials.

NEVER slit, drop, twist or tamp a primer.

**PREPARING THE PRIMER**

ALWAYS insert the detonator completely into a hole in the explosive material made with a non-sparking punch designed for that purpose, or in the cap well of a manufactured booster.

ALWAYS secure the detonator within the primer.

ALWAYS point the detonator in the direction of the main explosive charge.

ALWAYS secure the detonator to a primer cartridge so that no tension is placed on the leg wires, safety fuse, shock tube, plastic tubing, or detonating cord at the point of entry into the detonator.

ALWAYS be certain the detonator is fully inserted in the primer cartridge or booster and does not protrude from it.

ALWAYS use cartridges and/or boosters that are physically compatible with the specific detonator design.

NEVER use a cast primer or booster if the hole for the detonator is too small.

NEVER enlarge a hole in a cast primer or booster to accept a detonator.

NEVER punch explosive material that is very hard or frozen.

NEVER force or attempt to force a detonator into explosive material.
LOADING THE BOREHOLE

ALWAYS use the first cartridge in the borehole as the primer cartridge where two inch diameter or smaller cartridges are used.

NEVER drop large diameter, rigid cartridges [4 inch (102 mm) or larger] directly on the primer.

MAKING PRIMERS WITH ELECTRIC OR ELECTRONIC DETONATORS

SMALL DIAMETER CARTRIDGES (Less than four inches in diameter) – Figure 1

Step 1: Punch a hole straight into one end of cartridge.

Step 2: Insert the detonator into the hole.

Step 3: Tie leg wires around the cartridge using a half-hitch.

NEVER pull the wires too tightly. This may break them or damage the insulation.

Figure 1: Recommended method of making primer with small diameter cartridge and electric or electronic detonators.
**LARGE DIAMETER CARTRIDGES** (Four inches and larger in diameter) – Figure 2

Step 1: Punch a slanting hole from the center of one end of the cartridge coming out through the side two or more inches from the end.

Step 2: Fold over the leg wires about 12 inches from the detonator to form a sharp bend.

Step 3: Push the folded wires through the hole starting at the end of the cartridge and coming out through the side.

Step 4: Open the folded wires and pass the loop over the other end of the cartridge.

Step 5: Punch another hole straight into the end of the cartridge beside the first, insert the detonator into this hole, and take up all the slack in the wires.

**Figure 2:** Recommended method of making primer with large diameter cartridge and electric or electronic detonators.
CAST BOOSTERS – Figure 3

ALWAYS follow the manufacturer’s recommendation for the attachment and use of detonators with cast or manufactured boosters.

Figure 3: Recommended method of making primer with cast booster and electric or electronic detonators.

PLASTIC FILM CARTRIDGES – Figure 4

Figure 4: Recommended method of making primer with plastic film cartridge and electric or electronic detonators.

MAKING PRIMERS WITH FUSE OR NONELECTRIC DETONATORS

SIDE PRIMING METHOD – Figure 5

Step 1: Punch a hole in the side of the cartridge. Make the hole deeper than the length of the detonator and pointed downward rather than across the cartridge.
Step 2: Insert the detonator.

Step 3: Tape the safety fuse, shock tube, or plastic tubing to the cartridge to prevent the detonator from being pulled out of the cartridge.

Figure 5: Recommended method of making primer using the side priming method.

REVERSE PRIMING METHOD – Figure 6 and Figure 7

Step 1: Punch a hole straight into one end of the cartridge. Make the hole deeper than the length of the detonator.

Step 2: Insert the detonator.

Step 3: Fold back the fuse, shock tube, or plastic tubing over the end so that it lies along the length of the cartridge.

Step 4: Tape the fuse, shock tube, or plastic tubing to the cartridge.

CAUTION: If miniaturized detonating cord is used, the explosives must be insensitive to initiation by the detonating cord for this method to work.
Figure 6: Recommended method for making primer by reverse priming method.

**PLASTIC FILM CARTRIDGE PRIMER** – Figure 7

Figure 7: Recommended method of making primer with plastic film cartridge and fuse or nonelectric detonator.

**MAKING PRIMERS WITH DETONATING CORD**

**DETONATING CORD WITH CAST BOOSTERS** – Figure 8

**ALWAYS** follow manufacturer’s recommendations for using detonating cord with cast or manufactured boosters.
MISCELLANEOUS TYPES OF PRIMERS

ALWAYS follow manufacturer’s recommendations for preparation of primers not covered elsewhere in these recommendations.

USING EXPLOSIVE MATERIALS:

GENERAL PRECAUTIONS

PROTECTING YOURSELF

ALWAYS keep explosive materials away from food, eyes, or skin. Flush areas of contact with large quantities of water.

ALWAYS avoid exposure to excessive noise from blasting. Comply with Federal, State, and local laws and regulations.

ALWAYS fire the shot from a position outside the blast area (away from where flyrock might occur), or if necessary to be in the blast area, from an adequate blast shelter that provides protection from flying material.

ALWAYS remain in a position away from the blast area until postblast fumes, dusts, or mists have subsided.
NEVER handle any explosive materials or position yourself near any explosive materials when initiating a blast.

NEVER fire the shot from in front of the blast.

NEVER breathe dust or vapors from explosive materials.

PROTECTING OTHERS

ALWAYS clear the immediate area of persons.

ALWAYS post guards to prevent access to the blast area.

ALWAYS sound adequate warning prior to the blast.

ALWAYS use a blasting mat or other protective means when blasting close to residences or other occupied buildings or other locations where injury to persons or damage to property could occur as a result of flyrock.

NEVER fire a blast without a positive signal from the person in charge.

NEVER permit anyone to handle explosive materials or position themselves near explosive materials when a blast is to be initiated.

PROTECTING THE BLAST AREA

ALWAYS clear the immediate area of vehicles, equipment, and extra explosive materials.

ALWAYS design a blast to avoid excessive air blast, ground vibration, and flyrock. Comply with Federal, State, and local laws and regulations.

ALWAYS clear the blast area of all personnel prior to testing the circuit when using a blasting machine that is a combination firing unit and circuit tester.

NEVER allow any source of ignition within 50 feet of a blast site except approved safety fuse lighters.
USING EXPLOSIVE MATERIALS:  
ELECTRIC INITIATION

PREPARING THE ELECTRIC BLASTING CIRCUIT

ALWAYS test the circuit for **continuity** and proper **resistance**, using a blasting galvanometer or an instrument specifically designed for testing electric detonators and circuits containing them.

ALWAYS fire electric detonators with **firing currents** in the range recommended by the manufacturer.

ALWAYS keep electric detonator wires or lead wires **disconnected** from the power source and shunted until ready to test or fire.

ALWAYS keep the firing circuit completely **insulated** from ground or other conductors.

ALWAYS be sure that all **wire ends** are clean before connecting.

NEVER use any instruments, such as electrician’s meters, that are not specifically designed for testing blasting circuits or detonators. Such meters produce sufficient electrical energy to prematurely initiate electric detonators which can result in injury or death.

NEVER mix electric detonators made by **different manufacturers** in the same circuit.

NEVER mix electric detonators of **different types** in a circuit, even if made by the same manufacturer, unless such use is approved by the manufacturer.

NEVER use aluminum wire in a blasting circuit.

NEVER make final hookup to power source until all personnel are clear of the blast area.

NEVER mix electric detonators and electronic detonators in the same blast, even if these are made by the same manufacturer, unless such use is approved by the manufacturer.

NEVER use test equipment and blasting machines that are designed for electronic detonators with electric detonators.
PROTECTING AGAINST EXTRANEOUS ELECTRICITY

ALWAYS check for stray current.

NEVER load boreholes in open work near electric power lines unless the firing lines and detonator wires are anchored or are too short to reach the electric power lines.

NEVER handle or use electric detonators;
   a) when stray currents are present,
   b) during electrical storms,
   c) if static electricity is present.


NEVER have electric power wires or cables near electric detonators or other explosive materials except at the time and for the purpose of firing the blast.

NEVER open blasting machines or handle batteries near electric detonators.

USING EXPLOSIVE MATERIALS: DETONATING CORD INITIATION

ALWAYS use a detonating cord matched to the blasting methods and type of explosive materials being used.

ALWAYS handle detonating cord as carefully as other explosive materials.

ALWAYS cut the detonating cord from the spool before loading the rest of the explosive material.

ALWAYS use a sharp knife, razor blade, or instrument designed for cutting detonating cord.

ALWAYS make tight connections, following manufacturer’s directions.

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ALWAYS attach detonators to detonating cord with tape or methods recommended by the manufacturer.

ALWAYS point the detonators toward the direction of detonation – Figure 9.

Figure 9: Methods for attaching detonators to detonating cord

ALWAYS attach the cord initiating detonator at least six inches from the cut end of the detonating cord.

ALWAYS use a suitable booster to initiate wet detonating cord.

ALWAYS use surface delay connectors designed for use with detonating cord.
NEVER make loops, kinks, or sharp angles in the cord which might direct the cord back toward the oncoming line of detonation.

NEVER damage detonating cord prior to firing.

NEVER attach detonators for initiating the blast to detonating cord until the blast area has been cleared and secured for the blast.

NEVER use damaged detonating cord.

NEVER cut detonating cord with devices such as scissors, plier type cutters, cap crimpers, or similar instruments.

**USING EXPLOSIVE MATERIALS:**

**NONELECTRIC INITIATION**

**GENERAL**

ALWAYS follow manufacturer’s warnings and instructions, especially hookup procedures and safety precautions.

ALWAYS discontinue operations during the approach and progress of electrical storms.

NEVER hold nonelectric leads during firing. This may cause injury or death.

NEVER use tubing or detonating cord leads for any purpose other than that specified by the manufacturer.

**MINIATURIZED DETONATING CORD SYSTEM**

ALWAYS use explosives that are insensitive to initiation by the miniaturized detonating cord.

NEVER join two sections of miniaturized detonating cord. A detonation will not pass through such a connection.

**GAS INITIATED SYSTEM**

ALWAYS stay away from the blast area after connections are prepared for firing, unless the entire system is properly purged and disconnected from the primary ignition source.
ALWAYS use tube protectors or specially designed boosters.

NEVER kink tubing.

NEVER smoke or allow open flame within 50 feet of blasting machines used for gas initiated systems.

**SHOCK TUBE SYSTEM**

ALWAYS insure that shock tubing connections to detonating cord are at right angles to prevent angle cut-offs.

ALWAYS avoid situations where initiation system components can become entangled in machines, equipment, vehicles, or moving parts thereof.

ALWAYS lead shock tube to the hole in a straight line and keep it taut.

ALWAYS follow the manufacturer’s recommendations when cutting and splicing lead-in trunkline shock tube.

ALWAYS un-hook surface delay connectors prior to handling a misfire.

ALWAYS protect surface delay connectors from unintended energy sources such as: impact from falling rock, impact from tract vehicles or other mobile equipment, drilling equipment, flame, friction, electrical discharge from power lines, static electricity, and lightning.

NEVER drive any vehicles over shock tube.

NEVER tie together two lengths of shock tubing. An initiation signal will not pass through a knotted connection.

NEVER pull, stretch, kink, or put tension on a shock tube such that the tube could be caused to break or otherwise malfunction.

NEVER hook-up any surface delay connector before you are ready to fire the blast.

NEVER hook-up a surface delay connector to its own shock tube.
NEVER leave an un-hooked surface delay connector in close proximity to the shock tube of a loaded blast hole.

NEVER remove the detonator from a surface delay connector block.

NEVER attempt to initiate detonating cord with a surface delay connector designed for the initiation of shock tube only.

**USEING EXPLOSIVE MATERIALS: ELECTRONIC INITIATION**

ALWAYS follow manufacturer’s warning and instructions, especially hook-up procedures and safety precautions.

ALWAYS fire electronic detonators with the **equipment** and **procedures** recommended by the manufacturer.

ALWAYS verify the detonator system integrity prior to initiation of blast.

ALWAYS keep the firing circuit completely insulated from ground or other conductors.

ALWAYS use the wires, connectors and coupling devices **specified** by the manufacturer.

ALWAYS follow the manufacturer’s instructions when aborting a blast. Wait a minimum of 30 minutes before returning to a blast site after aborting a blast unless the manufacturer provides other specific instructions.

ALWAYS clear the blast area of personnel, vehicles and equipment prior to hooking up to the firing device or blast controller.

ALWAYS keep detonator leads, coupling devices and connectors protected until ready to test or fire the blast.

ALWAYS keep wire ends, connectors, and fittings clean and free from dirt or contamination prior to connection.

ALWAYS follow manufacturer’s instructions for system hook-up for electronic detonators.
ALWAYS follow manufacturer’s recommended practices to protect electronic detonators from electromagnetic, RF, or other electrical interference sources.

ALWAYS protect electronic detonator wires, connectors, coupling devices, shock tube, or other components from mechanical abuse and damage.

ALWAYS ensure the blaster in charge has control over the blast site throughout the programming, system charging, firing, and detonation of the blast.

ALWAYS use extreme care when programming delay times in the field to ensure correct blast designs. Incorrect programming can result in misfires, flyrock, excessive airblast, and vibration.

NEVER mix electronic detonators and electric detonators in the same blast, even if they are made by the same manufacturer, unless such use is approved by the manufacturer.

NEVER mix electronic detonators of different types and/or versions in the same blast, even if they are made by the same manufacturer, unless such use is approved by the manufacturer.

NEVER mix or use electronic detonators and equipment made by different manufacturers.

NEVER use test equipment and blasting machines designed for electric detonators with electronic detonators.

NEVER use equipment or electronic detonators that appear to be damaged or poorly maintained.

NEVER attempt to use blasting machines, testers, or instruments with electronic detonators that are not specifically designed for the system.

NEVER attempt to cut and splice leads unless specifically recommended by the manufacturer.

NEVER make final hook-up to firing device or blast controller until all personnel are clear of the blast area.

NEVER load boreholes in open work near electric power lines unless the firing lines and detonator wires are anchored or are too short to reach the electric power lines.
NEVER handle or use electronic detonators during the approach and progress of an electrical storm. Personnel must be withdrawn from the blast area to a safe location.

NEVER use electronic detonator systems outside the manufacturer’s specified operational temperature and pressure ranges.

NEVER test or program an electronic detonator in a booster, cartridge, or other explosive component (Primer Assembly) before it has been deployed in the borehole or otherwise loaded for final use.

NEVER hold an electronic detonator while it is being tested or programmed.

**USING EXPLOSIVE MATERIALS: FUSE DETONATOR AND SAFETY FUSE INITIATION**

**GENERAL**

ALWAYS handle fuse carefully to avoid damaging the covering. In cold weather, warm slightly before using to avoid cracking the waterproofing.

ALWAYS know the burning speed of the safety fuse by conducting a test burn of the fuse in use to make sure you have time to reach safety after lighting.

NEVER use lengths of safety fuse less than three feet.

NEVER insert anything but safety fuse in the open end of fuse-type detonator.

NEVER use fuse which has been kinked, bent sharply, or handled roughly in such a manner that the powder train may be interrupted.

**STEPS FOR ASSEMBLING FUSE DETONATOR AND FUSE**

Step 1: Wait until you are ready to insert fuse into fuse detonators before cutting it.

Step 2: Cut off an inch or two to insure a dry end.
Step 3: Measure correct length of fuse from roll and cut squarely across with a fuse cutter designed for this purpose; not a knife.

Step 4: Visually inspect inside of detonator for foreign material or moisture; if wet or if foreign matter cannot be removed by pouring, do not use the detonator. Dispose of detonator in an approved manner.

Step 5: Put the safety fuse gently against the powder charge.

Step 6: Crimp the end of the fuse detonator where the fuse enters using a cap crimper.

**ALWAYS** cut off an inch or two to insure a dry end. Cut fuse squarely across with the proper tool designed for this purpose; not a knife.

**ALWAYS** seat the fuse lightly against the detonator charge and avoid twisting after it is in place.

**ALWAYS** insure that the detonator is securely crimped to the fuse.

**ALWAYS** use waterproof crimp or waterproof the fuse-to-detonator joint in wet work.

**ALWAYS** use cap crimpers to crimp to detonator to the safety fuse.

**NEVER** twist the fuse inside the detonator.

**NEVER** use a knife or teeth for crimping.

**NEVER** use an open fuse detonator for a booster.

**NEVER** cut fuse until you are ready to insert it into the detonator.

**NEVER** crimp detonators by any means except a cap crimper designed for the purpose.

**NEVER** attempt to remove a detonator from the fuse it is crimped to.

**LIGHTING SAFETY FUSE**

Step 1: Make sure you can reach a safe location after lighting with sufficient time before initiation.
Step 2: Place sufficient stemming over the explosive material to protect it from fuse-generated heat and sparks.

Step 3: Have a partner before lighting the fuse. One person should light the fuse, and the other should time and monitor the burn.

Step 4: Light the safety fuse, using a specially designed lighter.

Single-fuse ignition hot wire lighters, pull-wire lighters or thermalite connectors.

Multiple-fuse ignition igniter cord with thermalite connectors.

ALWAYS light fuse with a fuse lighter designed for the purpose.

ALWAYS use the “buddy system” when lighting safety fuse – one lights the fuse, the other times and monitors.

NEVER light fuse until sufficient stemming has been placed over the explosive to prevent sparks from coming into contact with the explosive.

NEVER hold explosives in hands when lighting fuse.

NEVER drop or load a primer with a lighted safety fuse into a borehole.

NEVER use safety fuse in agricultural blasting.

NEVER use matches, cigarette lighters, cigarettes, pipes, cigars, carbide lamps, or other unsafe means to ignite safety fuse.

USING EXPLOSIVE MATERIALS:
AFTER-BLAST PROCEDURES

DISPOSAL OF EXPLOSIVE MATERIALS

ALWAYS treat deteriorated or damaged explosive materials with special care. They may be more hazardous than explosive materials in good condition.

ALWAYS dispose of explosive materials using proper methods. Check with your supervisor or the manufacturer. If the manufacturer is not known, check with an IME member company listed in the front of this booklet.
NEVER reuse any explosive material packaging.
NEVER burn explosive materials packaging in a confined space.

**MISFIRES**

**ALWAYS** deal with misfires of electronic detonator systems in accordance with the manufacturer’s recommended procedures. *(Electronic detonator systems may vary widely in design and application).*

**ALWAYS** wait at least 30 minutes with fuse detonator misfires and at least 15 minutes with electric and other nonelectric detonator misfires, unless the manufacturer recommends otherwise, before returning to the blast area. Comply with Federal, State, and local laws and regulations.

**ALWAYS** wait a minimum of 30 minutes with electronic detonator misfires unless the manufacturer recommends additional time before returning to the blast area.

**ALWAYS** shunt the bare wires of a misfired electric detonator by twisting them together and taping them to the metal shell to protect against extraneous sources of electrical energy.

NEVER drill, bore, or pick out any explosive materials that have been misfired. Misfires should ONLY be handled by a competent experienced person knowledgeable of the blast design, including the location and type of all explosive materials.

**BLAST-GENERATED FUMES**

**ALWAYS** assume toxic fumes are present from all blasts or burning explosive materials and stay away until they have dissipated.

**ALWAYS** assume toxic concentrations of carbon monoxide gas from heavily confined shots such as those used in trenching can migrate through the earth and accumulate in nearby underground enclosed spaces such as basements or manholes.

**ALWAYS** comply with applicable Federal, State, and local laws and regulations for safe fume levels before returning to blast area.
REDUCING POST-BLAST FUME HAZARD

ALWAYS monitor nearby enclosed spaces for toxic gasses such as carbon monoxide after blasting.

ALWAYS ventilate nearby enclosed spaces and continue to monitor them if any carbon monoxide gas is detected in the enclosed space after blasting.

ALWAYS excavate blasted material from heavily confined shots as soon as possible. Blasted material may harbor dangerous concentrations of carbon monoxide gas for days if not excavated.

ALWAYS use the largest diameter cartridge that fits the job.

ALWAYS use water resistant explosive materials in wet conditions, and fire the blast as soon as practicable after loading.

ALWAYS spray the muckpile with water in accordance with Federal, State, and local laws and regulations.

ALWAYS avoid conditions that might cause explosive materials to burn rather than detonate.

NEVER enter a recently blasted trench or an enclosed space without checking for toxic gasses such as carbon monoxide.

NEVER use explosive materials that appear deteriorated or damaged.

NEVER use more explosive material than necessary.

NEVER add combustible materials to the explosive material load.

NEVER use combustible materials for stemming.

USING EXPLOSIVE MATERIALS:
SEISMIC PROSPECTING

ALWAYS secure explosive material at a safe depth in the borehole. Use shot anchors when needed.
ALWAYS secure any casing that might blow out of the borehole.

ALWAYS place the detonator and/or primer near the top of the explosive column, in the side or in the cap well of one of the top two cartridges.

NEVER approach explosive material thrown out of the borehole by an explosion until you are sure that it is not burning.

NEVER drop a seismic charge containing the primer cartridge.
IME SAFETY LIBRARY

IME’s Safety Library is comprised of 11 publications which address a variety of subjects pertaining to safety and its application to the manufacture, transportation, storage, handling, and use of commercial explosive materials. Many of the industry recommendations set forth in these Safety Library Publications (SLPs) have been adopted by Federal, State, and local regulatory agencies.

The following SLPs comprise the Safety Library:

SLP 1 Construction Guide for Storage Magazines
SLP 2 American Table of Distances
SLP 3 Suggested Code of Regulations
SLP 4 Warnings and Instructions
SLP 12 Glossary of Commercial Explosives Industry Terms
SLP 14 Transportations and Distribution Handbook
SLP 17 Safety in the Transportation, Storage, Handling and Use of Explosive Materials
SLP 22 Recommendations for the Safe Transportation of Detonators in the Same Vehicle with Certain Other Explosive Materials and Guide for the Use of IME 22 Container
SLP 23 Recommendations for the Transportation of Explosives, Division 1.5 and Ammonium Nitrate Emulsions, Division 5.1 in Bulk Packagings
SLP 25 Explosives Manufacturing & Processing Guideline to Safety Training

Cost data and purchasing instructions are available from the IME office:

Institute of Makers of Explosives
1120 19th Street, N.W., Suite 310
Washington, DC 20036-3605
Phone (202) 429-9280
www.ime.org
info@ime.org
NOTES:
DESTRUCTION OF COMMERCIAL EXPLOSIVE MATERIALS

At times it may be necessary to destroy commercial explosive materials. These may consist of explosives or blasting agents from containers that have been broken during transportation or may be materials that have exceeded their recommended shelf life or are believed to be overage or are no longer needed.

Due to the many developments in explosive technology over the past few years the appearance and characteristics of products have undergone marked changes. To be sure that you are familiar with the properties of the product that you plan to destroy, the manufacturer of that product should be consulted for the most current product information and the recommended method of disposal and/or destruction.

The member companies of the Institute of Makers of Explosives have agreed to supply advice and assistance in destroying explosives. If the manufacturer is known, seek his assistance. If the manufacturer is not known, a member company of the Institute of Makers of Explosives may provide advice or assistance.

The above policy of IME member companies relates only to commercial explosive materials. It does not include handling improvised explosive devices or bombs, military ordnance, military explosives or homemade explosive materials.

IME member companies also cannot become involved in destroying explosive materials, which have been used for illegal purposes, are reportedly stolen property or are considered as evidence in any potential civil litigation or criminal prosecution.
LOCK 'EM UP!
So children can’t get hurt

Explosives are not for child’s play –
Protect our children!

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