North Carolina

Occupational Safety and Health Standards in Construction for Blasting & Use of Explosives

2002 Edition

N.C. Department of Labor
4 West Edenton Street
Raleigh, N.C. 27601-1092

Cherie K. Berry
Commissioner of Labor

North Carolina has promulgated amendments to the majority of the federal standards contained in Subpart U (29 CFR 1926.900 through 1926.914). This document combines those amendments and additions contained in 13 NCAC 7F.0201(5) with the original CFR standards which were not amended and remain in effect. Standards marked with an asterisk are amended standards, while standards in red and not marked with an asterisk are CFR standards.

Section 1926.900 General provisions:

*(a) The employer shall permit only persons qualified pursuant to §1926.901 to handle and use explosives. A blaster shall be in charge of each blasting operation; hereafter, referred to as the Blaster-in-Charge.

*(b) Smoking, firearms, sparks, open flame or heat producing devices shall be prohibited where explosives are being stored, handled, transported or used. Exception: This does not apply to devices specifically designed to initiate detonation.

*(c) See 1926.901(b). [MASK}

*(d) All explosives shall be accounted for at all times. Explosives not being used and not attended shall be kept in a magazine or container that meets the U.S. Bureau of Alcohol, Tobacco and Firearms (hereafter, ATF) storage and access requirements contained in 27 CFR Part 55, which is incorporated herein by reference, including any subsequent amendments and editions. Each employer shall maintain an inventory and use record of all explosives in that employer's possession. The employer, or employer authorized person, shall comply with all applicable local, State and federal laws and regulations requiring notification of any loss, theft, or unauthorized entry into a magazine or container.

(e) No explosives or blasting agents shall be abandoned.

(f) No fire shall be fought where the fire is in imminent danger of contact with explosives. All employees shall be removed to a safe area and the fire area guarded against intruders.

*(g) Original containers, ATF Type 2, Type 3, Type 4 or Type 5 magazines or Institute of Makers of Explosives (hereafter, IME) - 22 containers, shall be used for taking detonators and other explosives from storage magazines to the blast site.

*(h) In proximity to people, a structure, railway, highway or any other installation, the blaster shall take additional precautions to control the throw of fragments and to prevent bodily injury to employees and people not working directly on the blasting operation. Such additional precautions shall be taken in the loading, delaying, initiation and confinement of each blast and shall include confinement with mats or with mats and other methods.

*(i) All blast site employees shall follow the directions of the Blaster-in-Charge. All blast site employees shall use and adhere to every precaution to ensure employee safety including, but not limited to, visual and audible warning signals, flags, or barricades.

(j) Insofar as possible, blasting operations above ground shall be conducted between sunup and sundown.

*(k) Precautions shall be taken to prevent accidental discharge of electric detonators from current induced by radar, radio transmitters including 2-way radios and

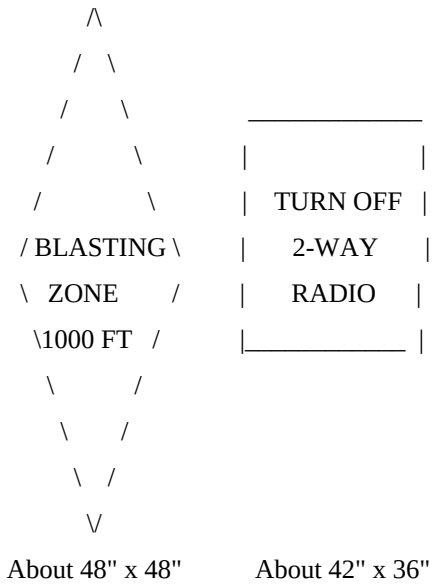
mobile telephones, lightning, adjacent powerlines, dust storms, or other sources of extraneous electricity. These precautions shall include:

*(1) See Section 1926.906(a) and (b). [MASK}

*(2) At the approach and progress of an electric storm, blasting operations shall be suspended and personnel removed to an area safe from concussion (shock wave), flying material, or gases from an explosion.

*(3) (i) The prominent display of adequate signs, warning against the use of mobile radio transmitters, (e.g., telephones and 2-way radios) on all roads within 1,000 feet of electric blasting operations. If adherence to the 1,000-foot distance would create an operational handicap, then a competent person (as defined in 29 CFR 1926 Subparts L and P) shall be consulted to evaluate the particular situation, and alternative provisions may be made which are designed to prevent any premature firing of electric detonators. A description of any such alternatives shall be reduced to writing and shall be certified by the competent person consulted as meeting the purposes of this subdivision. The description shall be maintained at the construction during the duration of the work, and shall be available for inspection by representatives of the Commissioner of Labor.

(ii) Examples of signs which would meet the requirements of paragraphs (i) and (k)(3) of this section are the following:



About 48" x 48" About 42" x 36"

*(4) Ensuring that mobile transmitters including telephones and 2-way radios which are less than 100 feet away from electric detonators, in other than original containers, shall be de-energized and effectively prevented from operating, (e.g., locked);

*(5) The Blaster-in-Charge shall comply with the recommendations of IME with regard to blasting in the vicinity of radio transmitters as stipulated in Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commerical Electric Detonators (Blasting Caps), IME Safety Library Publication No. 20, 2000, which is incorporated

herein by reference, including any subsequent amendments and editions.

*(l) Empty boxes and associated paper and fiber packing materials, which have previously contained explosives, shall not be used for any purpose, other than that associated with the blasting operation. Such boxes, paper and packing materials shall be disposed of in a manner that prevents reuse and does not constitute a hazard, i.e., burned. The method used for disposal shall comply with all applicable local, State or federal laws.

(m) Explosives, blasting agents, and blasting supplies that are obviously deteriorated or damaged shall not be used.

*(n) Delivery and issue of explosives shall only be made by and to authorized persons (as defined in 27 CFR Part 55) and into magazines or temporary storage or handling areas that meet the ATF storage requirements contained in 27 CFR Part 55.

*(o) Blasting operations in the proximity of overhead power lines, communication lines, utility services, or other services and structures shall not commence until the operators or owners have been notified and measures for safe control have been taken.

(p) The use of black powder shall be prohibited.

*(q) All loading and firing shall be directed and supervised by the Blaster-in-Charge.

*(r) All blasts shall be fired under the control of a blaster, with an initiation system in accordance with manufacturer's recommendations. All blasts shall be fired in accordance with the manufacturer's recommendations.

*(s) Buildings used for the mixing of blasting agents or water-based explosives shall conform to the requirements of this section.

(1) Buildings shall be of noncombustible construction or sheet metal on wood studs.

(2) Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.

*(3) All fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will be contained and will not drain toward the mixing plant building.

*(4) The building shall be adequately ventilated to prevent explosive or hazardous substance hazards.

*(5) Heating units may be used in the building if they do not depend on combustion processes, and are properly designed and located to prevent explosive or other hazards. All direct sources of heat shall be provided exclusively from units located outside the mixing building.

*(6) All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be isolated by a firewall and shall be properly ventilated to prevent explosive or exhaust gas hazards to employees. The exhaust systems on all such

engines shall be located so any heat or spark generated or emitted cannot be a hazard to any materials in or adjacent to the plant.

*(t) See .900(s). **[MASK]**

*(1) See .900(s)(1). [**MASK**]

*(2) See .900(s)(2). [**MASK**]

*(3) See .900(s)(3). [**MASK**.]

*(4) See .900(s)(4). [**MASK]**

*(5) See .900(s)(5). [**MASK]**

*(6) See .900(s)(6). [**MASK]**

*(u) To guard against unauthorized entry or initiation of a blast, a blast site shall be attended if loading is suspended or loaded holes are awaiting firing. Additionally, the blast site shall be barricaded, posted, and flagged as necessary to prevent unauthorized access.

*(v) No one shall carry explosives or explosives detonating materials (e.g., blasting caps, detonators, fuse, primers) of any kind on his or her person. This does not prohibit hand-carrying or passing such materials when a hole is being loaded."

"§ 1926.901 Blaster qualifications:

*(a) Blasters shall be able to understand and give written and oral orders.

*(b) Blasters and others authorized to handle or transport explosive materials or conduct blast site activities shall be in sufficiently good physical condition to perform the work safely and not be addicted to, or under the influence of, narcotics, intoxicants, or similar types of drugs.

*(c) Blasters shall be qualified, by reason of training, knowledge, or experience, in the field of transporting, storing, handling, and use of explosives, and have a working knowledge of State, federal and local laws and regulations which pertain to explosives.

*(d) Blasters shall be required by the employer to furnish evidence satisfactory to the employer of competency in handling explosives and performing in a safe manner the type of blasting that will be required.

*(e) Blasters shall be knowledgeable in the use of each type of blasting method used.

*(f) Pursuant to 29 CFR 1926.21(b), the employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to the employee's work and work environment."

"Section 1926.902 Surface transportation of explosives:

*(a) Surface transportation of explosives and blasting agents shall be in accordance with applicable U.S. Department of Transportation (hereafter, DOT) regulations. Where DOT regulations do not normally apply (e.g., off-road vehicles), compliance shall be in accordance with either the directly related DOT regulation or §1926.902(b) through §1926.902(1), as applicable. Where DOT regulations do not exist, §1926.902(b) through §1926.902(l) apply.

*(b) Motor vehicles or conveyances transporting explosives shall only be driven by, and be in the charge of, a licensed driver. The driver shall be familiar with the local, State, and Federal regulations governing the transportation of explosives.

(c) No person shall smoke, or carry matches or any other flame-producing device, nor shall firearms or loaded cartridges be carried while in or near a motor vehicle or conveyance transporting explosives.

*(d) Explosives, blasting agents, and blasting supplies shall not be transported with other materials or cargoes. Blasting caps and detonators shall not be transported in the same vehicle with other explosives unless the provisions of the IME Safety Publication No. 22, "Recommendations for the Safe Transportation of Detonators in a Vehicle with other Explosive Materials," which is incorporated herein by reference including subsequent amendments and editions, are followed.

(e) Vehicles used for transporting explosives shall be strong enough to carry the load without difficulty, and shall be in good mechanical condition.

*(f) When explosives are transported by a vehicle with an open body, an ATF Type 2, ATF Type 3, IME 22 or original manufacturer's container shall be securely attached to the vehicle to contain the cargo.

(g) All vehicles used for the transportation of explosives shall have tight floors and any exposed spark-producing metal on the inside of the body shall be covered with wood, or other nonsparking material, to prevent contact with containers of explosives.

*(h) Every motor vehicle or conveyance used for transporting explosives shall be marked or placarded on both sides, the front, and the rear with the word "Explosives" in red letters, not less than 4 inches in height, on white background. The motor vehicle or conveyance may also display, in such a manner that it will be readily visible from all directions, a red flag 18 inches by 30 inches, with the word "Explosives" painted, stamped, or sewed thereon, in white letters, at least 6 inches in height.

*(i) Each vehicle used for transportation of explosives shall be equipped with a fully charged fire extinguisher, in good condition (as described in 29 CFR 1926.150). An extinguisher, approved by a nationally recognized testing laboratory, of not less than 10-ABC rating will meet the minimum requirement. The driver shall be trained in the use of the extinguisher on the vehicle.

*(j) Motor vehicles or conveyances carrying explosives or blasting agents, shall not be taken inside a garage or shop for repairs or servicing.

(k) No motor vehicle transporting explosives shall be left unattended.

*(l) In order to prevent explosives hazards, explosive materials shall be transported to the storage or blast site without delay."

"Section 1926.903 Underground transportation of explosives:

*(a) In order to prevent explosives hazards, all explosives or blasting agents in transit underground shall be taken to the place of use or storage without delay.

*(b) The quantity of explosives or blasting agents taken to an underground loading area shall not exceed the amount estimated by the Blaster-in-Charge to be necessary for the blast.

(c) Explosives in transit shall not be left unattended.

(d) The hoist operator shall be notified before explosives or blasting agents are transported in a shaft conveyance.

(e) Trucks used for the transportation of explosives underground shall have the electrical system checked weekly to detect any failures which may constitute an electrical hazard. A certification record which includes the date of the inspection; the signature of the person who performed the inspection; and a serial number, or other identifier, of the truck inspected shall be prepared and the most recent certification record shall be maintained on file.

(f) The installation of auxiliary lights on truck beds, which are powered by the truck's electrical system, shall be prohibited.

(g) Explosives and blasting agents shall be hoisted, lowered, or conveyed in a powder car. No other materials, supplies, or equipment shall be transported in the same conveyance at the same time.

*(h) Vehicles containing explosive material shall be occupied only by persons necessary for handling the explosive material while in transit.

(i) No person shall ride in any shaft conveyance transporting explosives and blasting agents.

(j) No explosives or blasting agents shall be transported on any locomotive. At least two car lengths shall separate the locomotive from the powder car.

(k) No explosives or blasting agents shall be transported on a man haul trip.

(l) The car or conveyance containing explosives or blasting agents shall be pulled, not pushed, whenever possible.

*(m) Any powder car or conveyance used for transporting explosives or blasting agents shall bear a reflecting sign on each side with the word "Explosives". The sign’s letters shall be a minimum of 4 inches in height and shall be on a background of sharply contrasting color.

*(n) Compartments for transporting detonators and explosives in the same car or conveyance shall meet IME-22 container specifications or shall be physically separated by a distance of 24 inches or by a solid partition at least 6 inches thick.

(o) Detonators and other explosives shall not be transported at the same time in any shaft conveyance.

(p) Explosives, blasting agents, or blasting supplies shall not be transported with other materials.

*(q) Explosives or blasting agents, not in original containers, shall be placed in a nonconductive, closed container when transported manually."

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

"Section 1926.904 Storage of explosives and blasting agents:

*(a) Explosives and blasting agents shall be stored in magazines or containers that meet the applicable provisions of the regulations contained in 27 CFR Part 55, Commerce in Explosives.

*(b) Blasting caps and other detonators shall not be stored in the same magazine or container with other explosives or blasting agents. Surplus primers shall be disassembled and components stored separately.

*(c) Smoking and open flames shall not be permitted within 50 feet of explosives, detonators, or blasting agents storage.

*(d) No explosives or blasting agents shall be permanently stored in any underground operation until the operation has at least two modes of exit.

*(e) Permanent underground explosive materials storage shall be at least 300 feet from any shaft, adit, or active underground working area.

*(f) Permanent underground explosive materials storage containing detonators shall not be located closer than 50 feet to any storage containing other explosives or blasting agents."

"Section 1926.905 Loading of explosives or blasting agents:

*(a) Procedures that permit safe and efficient loading shall be established by the Blaster-in-Charge or the employer before loading is started.

*(b) Drill holes shall be sufficiently large to admit easy insertion of the cartridges of explosives.

*(c) Tamping shall be done only with non-metal, non-sparking tamping poles without exposed metal parts, except that nonsparking metal connectors may be used for jointed poles. Violent tamping shall be prohibited. The primer shall never be tamped.

*(d) No holes shall be loaded except those to be fired in the next round of blasting. After loading, remaining explosives and detonators shall be promptly moved to a safe location and attended or stored pursuant to ATF storage requirements contained in 27 CFR Part 55.

*(e) Drilling shall not be started until all visible butts of old holes are examined for unexploded charges, and if any are found, they shall be disposed of in accordance with §1926.911, before work proceeds.

(f) No person shall be allowed to deepen drill holes which have contained explosives or blasting agents.

(g) No explosives or blasting agents shall be left unattended at the blast site.

*(h) Machines, personnel and tools not required for the blasting operation shall be removed from the blast site before explosives are removed from storage or transportation vehicles. Blasting operation related vehicles or equipment shall not be driven over, or near enough to, explosive material or initiation systems to come into contact with the explosive material or initiation systems. Equipment not needed for the final blast shall not be operated within 50 feet of loaded holes.

*(i) During loading the only activity permitted within the blast site shall be that required to successfully and safely load the hole.

*(j) Powerlines and portable electric cables for equipment being used shall be kept a safe distance from explosives or blasting agents. The blaster shall assure that cables in the proximity of loaded holes are deenergized and locked out. Additionally, when using electric detonators, the provisions of §1926.906(b) apply.

*(k) Holes shall be checked prior to loading to determine depth and conditions. Only those holes determined by the Blaster-in-Charge to be satisfactory shall be loaded.

*(l) When loading a line of holes with more than one loading crew, the crews shall be separated by practical distance consistent with safe and efficient operation and supervision of crews.

*(m) No explosive shall be loaded or used underground in the presence of combustible gases or combustible dusts, unless the work is performed in accordance with the Mine Safety and Health Administration (MSHA) standards at 30 CFR 75 related to such environments, which are incorporated herein by reference, including subsequent amendments and editions, and unless the explosives have been approved as permissible explosives for use in gassy or dusty environments by MSHA.

*(n) No explosives other than those in IME Fume Class 1 shall be used. However, explosives complying with the requirements of IME Fume Class 2 and IME Fume Class 3 may be used if adequate ventilation has been provided to prevent explosive or hazardous substance hazards to employees.

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

(p) Warning signs, indicating a blast area, shall be maintained at all approaches to the blast area. The warning sign lettering shall not be less than 4 inches in height on a contrasting background.

*(q) A bore hole shall never be sprung when there is a risk of a premature detonation of a loaded hole.

(r) Drill holes which have been sprung or chambered, and which are not water-filled, shall be allowed to cool before explosives are loaded.

*(s) Areas in which loading is suspended or loaded holes are awaiting firing shall be attended, and barricaded, posted, or flagged as needed to guard against unauthorized entry or initiation.

*(t) The blaster shall keep an accurate, up-to-date record of explosives, blasting agents, and blasting supplies used in each blast and shall keep an accurate running inventory of all explosives and blasting agents in the blaster's custody.

*(u) When loading blasting agents pneumatically over electric detonators, semiconductive delivery hose shall be used and the equipment shall be bonded and grounded.

*(v) Primers shall be made up just before their time of use and at the point of use.

*(w) Holes shall not be drilled in a manner that disturbs or intersects a loaded hole."

"Section 1926.906 Initiation of explosive charges-electric blasting:

*(a) Electric detonators shall not be used where sources of extraneous electricity make the use of electric detonators dangerous. Except during testing, electronic detonator leg wires shall be kept short-circuited (shunted) until they are connected into the circuit for firing.

*(b) If the presence of extraneous electricity is possible, the blaster shall conduct a stray current survey. No holes shall be loaded using electric detonators until the danger of extraneous electricity is eliminated.

*(c) In any single blast using electric detonators, all detonators shall be of the same style or function, and of the same manufacture.

*(d) Electric initiation shall be carried out by using blasting machines or power circuits in accordance with the manufacturer's recommendations.

*(e) When firing a circuit of electric detonators, an adequate quantity of delivered current must be available, in accordance with the manufacturer's recommendations.

(f) Connecting wires and lead wires shall be insulated single solid wires of sufficient current-carrying capacity.

(g) Bus wires shall be solid single wires of sufficient current-carrying capacity.

*(h) When firing electrically, the insulation on all firing lines shall be in good condition and shall be adequate to prevent voltage leaks.

*(i) A power circuit used for firing electric detonators shall not be grounded.

(j) In underground operations when firing from a power circuit, a safety switch shall be placed in the permanent firing line at intervals. This switch shall be made so it can be locked only in the "Off" position and shall be provided with a short-circuiting arrangement of the firing lines to the cap circuit.

*(k) In underground operations there shall be a "lightning" gap of at least 15 feet in the firing system ahead of the main firing switch; that is, between this switch and the source of power. This gap shall be bridged by a flexible jumper cord just before firing the blast.

(l) When firing from a power circuit, the firing switch shall be locked in the open or "Off" position at all times, except when firing. It shall be so designed that the firing lines to the cap circuit are automatically short-circuited when the switch is in the "Off" position. Keys to this switch shall be entrusted only to the blaster.

(m) Blasting machines shall be in good condition and the efficiency of the machine shall be tested periodically to make certain that it can deliver power at its rated capacity.

*(n) When firing with blasting machines, the connections shall be made as recommended by the manufacturer of the electric detonators used.

*(o) The number of electric detonators connected to a blasting machine shall not be in excess of its rated capacity. A series circuit shall contain no more detonators than the limits recommended by the manufacturer of the electric detonators in use.

*(p) A blaster shall be in charge of the blasting machines.

*(q) A blaster shall test blasting circuits for:

*(1) Continuity of electric detonator in the blast hole prior to stemming and connection of the blasting line.

*(2) Resistance of individual series or the resistance of multiple balanced series to be connected in parallel prior to their connection to the blasting line.

*(3) Continuity of blasting lines prior to the connection of electric detonator series.

*(4) Total blasting circuit resistance prior to connecting to the power source. A blasting galvanometer, or other instrument specifically designed for testing blasting circuits, shall be used to conduct these tests.

*(r) Whenever the possibility exists that a leading line or blasting wire might be thrown over a live powerline by the force of an explosion, the total length of wires shall be kept too short to hit the lines, or the wires shall be securely anchored to the ground. If neither of these requirements can be satisfied, a nonelectric system shall be used.

*(s) The blaster shall assure that all connections are made from the bore hole back to the source of firing current, and that the leading wires remain shorted, except during testing, and not connected to the blasting machine or other source of current until the blast is to be fired. Only the blaster, or a qualified person (as described in §1926.900(a) and §1926.901) under the direct control of the blaster, shall make lead wire connections or fire the shot."

(t) After firing an electric blast from a blasting machine, the leading wires shall be immediately disconnected from the machine and short-circuited.

"Section 1926.907 Use of safety fuse:

*(a) A safety fuse that has been hammered or injured in any way shall not be used.

(b) The hanging of a fuse on nails or other projections which will cause a sharp bend to be formed in the fuse is prohibited.

(c) Before capping safety fuse, a short length shall be cut from the end of the supply reel so as to assure a fresh cut end in each blasting cap.

*(d) Only a cap crimper shall be used for attaching blasting caps to safety fuse. Crimpers shall be kept in good repair and accessible for use.

(e) No unused cap or short capped fuse shall be placed in any hole to be blasted; such unused detonators shall be removed from the working place and destroyed.

(f) No fuse shall be capped, or primers made up, in any magazine or near any possible source of ignition.

*(h) Safety fuses of at least the following minimum lengths shall be used:

*(1) At least a 36-inch length for 40-second-per-foot safety fuse and

*(2) At least a 48-inch length for 30-second-per-foot safety fuse.

*(i) At least two people shall be present when multiple cap and fuse blasting is done by hand lighting methods."

(j) Not more than 12 fuses shall be lighted by each blaster when hand lighting devices are used. However, when two or more safety fuses in a group are lighted as one by means of igniter cord, or other similar fuse-lighting devices, they may be considered as one fuse.

(k) The so-called "drop fuse" method of dropping or pushing a primer or any explosive with a lighted fuse attached is forbidden.

(l) Cap and fuse shall not be used for firing mudcap charges unless charges are separated sufficiently to prevent one charge from dislodging other shots in the blast.

(m) When blasting with safety fuses, consideration shall be given to the length and burning rate of the fuse. Sufficient time, with a margin of safety, shall always be provided for the blaster to reach a place of safety.

"Section 1926.908 Use of detonating cord and shock tube:

*(a) A detonating cord consistent with the type and physical condition of the bore hole and stemming and the type of explosives shall be used.

*(b) Detonating cord shall be handled and used in the same manner as other explosives.

(c) The line of detonating cord extending out of a bore hole or from a charge shall be cut from the supply spool before loading the remainder of the bore hole or placing additional charges.

*(d) Detonating cord shall be handled and used with care to avoid damaging or severing the cord during and after loading and hooking-up. Shock tube shall never be pulled, stretched, kinked, twisted, mashed or abused in any way which could cause the tube to break or otherwise malfunction.

*(e) Detonating cord connections, shock tube connections and splices shall be competent and positive in accordance with the manufacturer's recommendations. Knot-type or other cord-to-cord connections shall be made only with detonating cord in which the explosive core is dry. Down-the-hole shock tube splices are prohibited.

(f) All detonating cord trunklines and branchlines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation.

*(g) All detonating cord connections, shock tube connections and splices shall be inspected before firing the blast.

*(h) When detonating cord or shock tube millisecond-delay connectors or short-interval-delay electric detonators are used with detonating cord or shock tube, the practice shall conform strictly to the manufacturer's recommendations.

*(i) When connecting a detonator to detonating cord or shock tube, the detonator shall be taped or otherwise attached securely along the side or the end of the detonating cord, with the end of the detonator containing the explosive charge pointed in the direction in which the detonation is to proceed.

(j) Detonators for firing the trunkline shall not be brought to the loading area nor attached to the detonating cord until everything else is in readiness for the blast.

*(k) Shock tube shall not be connected to the initiation device until the blast is to be fired.

"Section 1926.909 Firing the blast:

*(a) The Blaster-in-Charge shall establish a code of blasting signals and all blast site employees shall familiarize themselves with and conform to the code. As a minimum, the code shall:

*(1) contain audible pre-blast and audible all clear signals, and

*(2) contain an emergency method for guards, flagmen, or other authorized employees to signal "do not fire", and

*(3) prohibit sounding of the all clear signal until the blaster has checked the blast site for misfires. Table U-1 is an example of a code of blasting signals that would meet these requirements. Further, the Blaster-in-Charge shall require the placement of Danger signs and posting of the blasting signals when personnel not associated with the blasting operation are within the blast area.

*(b) Before a blast is fired, the Blaster-in-Charge shall make certain that all surplus explosives are in an area meeting the ATF explosive storage requirements contained in 27 CFR 55 and that all persons are at a safe distance, or under sufficient cover.

*(c) Flagmen shall be safely stationed on highways which pass through the blast area so as to stop traffic during blasting.

*(d) The Blaster-in-Charge shall fix the time of blasting.

*(e) Before firing an underground blast, warning shall be given, and all possible entries into the blast area, and any entrances to any working place where a drift, raise, or other opening is about to hole through, shall be carefully guarded to prevent entry into the area. The Blaster-in-Charge shall make sure that all surplus employees have been removed from the blast area and that all personnel are out of the blast area."

TABLE U-1

WARNING SIGNAL - A 1-minute series of long blasts 5 minutes prior to blast signal.
BLAST SIGNAL - A series of short blasts 1 minute prior to the shot.
ALL CLEAR SIGNAL - A prolonged blast following the inspection of blast area.

"Section 1926.910 Inspection after blasting:

(a) Immediately after the blast has been fired, the firing line shall be disconnected from the blasting machine, or where power switches are used, they shall be locked open or in the off position.

*(b) Sufficient time shall be allowed, not less than 15 minutes in tunnels, for the smoke and fumes to dissipate before returning to the blast site. Subsequently, the blaster shall inspect the blast site and surrounding rubble for signs of misfires. If a misfire is found, employee access to the blast area shall be controlled pursuant to §1926.911. Where fumes, fire, or dust are a potential hazard (e.g., in tunnels), the muck pile shall be wetted down prior to general employees returning to the blast site."

"Section 1926.911 Misfires:

*(a) If a misfire is found, the Blaster-in-Charge shall invoke sufficient safeguards to exclude all employees from the potential blast area.

*(b) No work shall be done except that necessary to remove the hazard of the misfire. Only those employees necessary to do the work shall enter the potential blast area. Only the Blaster-in-Charge, and the absolute minimum number of competent, personnel (as defined in 29 CFR 1926 Subparts Land P), necessary to assess the situation shall approach the hole to inspect the misfire.

*(c) The Blaster-in-Charge shall determine the safest steps for removing the hazard of the misfire. During development and implementation of these steps, the Blaster-in-Charge shall comply with the manufacturer's recommendations. Further, the guidelines of the Safety in the Transportation, Storage, Handling and Use of Explosive Materials, IME Safety Library Publication No. 17, which is incorporated herein by reference, including any subsequent amendments and editions, shall be utilized.

*(d) If there are any misfires while using safety fuse and blasting cap, all employees shall remain out of the potential blast area for at least 30 minutes. If electric detonators, shock tube, gas tube or detonating cord systems or materials were used and a misfire occurred, the waiting period may be reduced to 15 minutes. In either case, the Blaster-in-Charge shall assess the circumstances and invoke a safe waiting period before allowing any personnel to enter the potential blast area. All lines shall be carefully traced and a search made for unexploded charges.

*(e) No drilling, digging, or picking shall be permitted until all misfires have been detonated or the Blaster-in-Charge approves the work."

"Section 1926.912 Underwater blasting:

*(a) In underwater blasting, no shot shall be fired without the approval of the Blaster-in-Charge.

(b) Loading tubes and casings of dissimilar metals shall not be used because of possible electric transient currents from galvanic action of the metals and water.

*(c) Only water-resistant detonators and detonating cords shall be used for all marine blasting. Loading shall be done through a nonsparking loading tube when tube is necessary.

*(d) No blast shall be fired while any vessel under way is closer than 1,500 feet to the blast site. Those on board vessels or craft moored or anchored within 1,500 feet shall be notified before a blast is fired. Note: The warning signals and personnel safety provisions of §1926.909 also apply.

(e) No blast shall be fired while any swimming or diving operations are in progress in the vicinity of the blasting area. If such operations are in progress, signals and arrangements shall be agreed upon to assure that no blast shall be fired while any person is in the water.

(f) Blasting flags shall be displayed.

*(g) The storage and handling of explosives aboard vessels used in underwater blasting operations shall be in accordance with the provisions of this Standard on handling and storing explosives.

*(h) Prior to firing the blast, the blaster shall determine the method(s) that will be used for detecting misfires and take preparatory steps (e.g., noting obvious indications of misfire, attaching float(s) that will be released by the firing, staging underwater cameras, or other appropriate means). Misfires shall be handled in accordance with the requirements of §1926.911."

"Section 1926.913 Blasting in excavation work under compressed air:

(a) Detonators and explosives shall not be stored or kept in tunnels, shafts, or caissons. Detonators and explosives for each round shall be taken directly from the magazines to the blasting zone and immediately loaded. Detonators and explosives left over after loading a round shall be removed from the working chamber before the connecting wires are connected up.

*(b) When detonators or explosives are brought into an air lock, the only employees who shall be permitted to enter the airlock are the powderman, blaster, lock tender and the employees necessary for carrying the detonators or explosives. No other material, supplies, or equipment shall be locked through with the explosives.

(c) Detonators and explosives shall be taken separately into pressure working chambers.

*(d) See §1926.900(a) and §1926.901. [***1926.900(a)** The employer shall permit only persons qualified pursuant to §1926.901 to handle and use explosives. A blaster shall be in charge of each blasting operation; hereafter, referred to as the Blaster-in-Charge.]

(e) All metal pipes, rails, air locks, and steel tunnel lining shall be electrically bonded together and grounded at or near the portal or shaft, and such pipes and rails shall be cross-bonded together at not less than 1,000-foot intervals

throughout the length of the tunnel. In addition, each low air supply pipe shall be grounded at its delivery end.

*(f) The explosives suitable for use in wet holes shall be water-resistant and shall be IME Fume Class 1."

(g) When tunnel excavation in rock face is approaching mixed face, and when tunnel excavation is in mixed face, blasting shall be performed with light charges and with light burden on each hole. Advance drilling shall be performed as tunnel excavation in rock face approaches mixed face, to determine the general nature and extent of rock cover and the remaining distance ahead to soft ground as excavation advances.

"Section 1926.914 Definitions applicable to this subpart:

*(a) "American Table of Distances" (also known as Quantity Distance Tables)-- the current edition of the American Table of Distances for Storage of Explosives approved by IME.

*(b) "Approved storage facility"-A facility for the storage of explosive materials conforming to the requirements of this part and covered by a license or permit issued under authority of the ATF. (See 27 CFR Part 55.)

*(c) "Blast area" - The area within the influence of flying debris, gases, and concussion from an explosion that may cause injury to property or persons.

(d) "Blaster" - The person or persons authorized to use explosives for blasting purposes and meeting the qualifications contained in 1926.901.

*(e) "Blasting agent" - A blasting agent is a mixture consisting of a fuel and oxidizer used for blasting where the finished (mixed) product cannot be detonated with a No. 8 test blasting cap when confined.

(f) "Blasting cap" - A metallic tube closed at one end, containing a charge of one or more detonating compounds, and designed for and capable of detonation from the sparks or flame from a safety fuse inserted and crimped into the open end.

(g) "Block holing" - The breaking of boulders by firing a charge of explosives that has been loaded in a drill hole.

(h) "Conveyance" - Any unit for transporting explosives or blasting agents, including but not limited to trucks, trailers, rail cars, barges, and vessels.

(i) "Detonating cord" - A flexible cord containing a center core of high explosives which when detonated, will have sufficient strength to detonate other cap-sensitive explosives with which it is in contact.

*(j) "Detonator"- Blasting caps, electric blasting caps, electric delay blasting caps, and non-electric delay blasting caps.

*(k) "Electric detonator" - A detonator designed for and capable of detonation by means of an electric current.

*(l) "Electric blasting circuitry"

*(1) Bus wire. An expendable wire, used in parallel or series, in parallel circuits, to which are connected the leg wires of electric detonators.

*(2) Connecting wire. An insulated expendable wire used between electric detonators and the leading wires or between the bus wire and the leading wires.

*(3) Lead wire. An insulated wire used between the electric power source and the electric detonator circuit.

*(4) Permanent firing line. A permanently mounted insulated wire used between the electric power source and the electric detonator circuit.

*(m) "Electric delay detonators" - Detonators designed to detonate at a predetermined period of time after energy is applied to the ignition system.

*(n) "Explosives"

*(1) Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion; that is, with substantially instantaneous release of gas and heat, unless such compound, mixture or device is otherwise specifically classified by the U.S. Department of Transportation (USDOT).

*(2) Any material designated as a Class 1 Explosive by the USDOT. Under the USDOT classification system, Class 1 materials are divided into the following six divisions:
Division 1.1 - Mass exploding (Formerly Class A)
Division 1.2 - Projection hazard (Formerly Class A or B)
Division 1.3 - Fire hazard, minor blast or projection hazard (Formerly Class B)
Division 1.4 - Minor explosion hazard, not mass detonating (Formerly Class C)
Division 1.5 - Insensitive explosives, very little probability of initiation or transition from burning to detonation during transport. (Formerly Blasting Agent). Division 1.6 - Insensitive articles which do not mass detonate. (No commercial explosives in this division)

(3) Classification of explosives by the U.S. Department of Transportation is as follows:

Class A Explosives. Possessing detonating hazard, such as dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.

Class B Explosives. Possessing flammable hazard, such as propellant explosives, including some smokeless propellants.

Class C Explosives. Include certain types of manufactured articles which contain Class A or Class B explosives, or both, as components, but in restricted quantities.

(o) "Fuse lighters" - Special devices for the purpose of igniting safety fuse.

*(p) "Magazine" - Any container, building or structure, other than an explosives manufacturing building, used for the storage of explosives.

(q) "Misfire" - An explosive charge which failed to detonate.

(r) "Mud-capping" (sometimes known as bulldozing, adobe blasting, or dobying). The blasting of boulders by placing a quantity of explosives against a rock, boulder, or other object without confining the explosives in a drill hole.

*(s) "Non-electric delay detonator" - A detonator with an integral delay element in conjunction with and capable of being detonated by a detonation impulse or signal from miniaturized detonating cord or shock tube.

(t) "Primary blasting" - The blasting operation by which the original rock formation is dislodged from its natural location.

(u) "Primer" - A cartridge or container of explosives into which a detonator or detonating cord is inserted or attached.

*(v) "Safety fuse" - A flexible cord containing an internal burning medium by which fire is conveyed at a continuous and uniform rate for the purpose of firing detonators.

(w) "Secondary blasting" - The reduction of oversize material by the use of explosives to the dimension required for handling, including mudcapping and blockholing.

*(x) "Stemming" - An inert incombustible material or device used to confine or separate explosives in a drill hole, or to cover explosives in mud-capping.

(y) "Springing" - The creation of a pocket in the bottom of a drill hole by the use of a moderate quantity of explosives in order that larger quantities or explosives may be inserted therein.

*(z) "Water-based explosives" - Explosive materials that contain substantial quantities of water in their formulation. They may be bulk or packaged products and may be cap sensitive or non cap sensitive (blasting agents). Examples of water-based explosives include emulsions, slurries and water gels.

(aa) "Semiconductive hose." Semiconductive hose - a hose with an electrical resistance high enough to limit flow of stray electric currents to safe levels, yet not so high as to prevent drainage of static electric charges to ground; hose of not more than 2 megohms resistance over its entire length and of not less than 5,000 ohms per foot meets the requirement.

*(bb) "Appropriate authorities" or "Authorities having jurisdiction" - local, State and federal law enforcement authorities required to be notified by law or permit or this Standard.

*(cc) "Blaster-in-Charge" - The person who meets the qualifications contained in §1926.901 and who is authorized to oversee the blasting operations and to use explosives for blasting purposes.

*(dd) "Blast site" - The area where explosive material is handled during loading, including the perimeter formed by loaded blast holes, and 50 feet (15.2 meters) in all directions from loaded holes. A minimum distance of 30 feet (9.1 meters) may replace the 50 feet (15.2 meters) if the perimeter of loaded holes is demarcated with a barrier. The 50 feet (15.2 meters) and alternative 30 feet (9.1 meters) requirements also apply in all directions along the full depth of the holes. In underground mines, 15 feet of solid rib or pillar may be substituted for the 50 feet distance.

*(ee) "Shock tube" - A small diameter plastic tube used for initiating detonators. Shock tube contains a limited amount of reactive material so that the energy

transmitted through the tube by means of detonation wave is guided through, and confined within, the walls of the tube.

*(ff) "Blasting operation" - Any work or activities associated with the use of explosives on a blast site.

*(gg) "Attended" - Presence of an individual or continuous monitoring to prevent unauthorized entry or access."