STATE OF NEW JERSEY
DEPARTMENT OF LABOR AND INDUSTRY
Percy A. Miller, Jr., Commissioner

RULES AND REGULATIONS

governing

QUARRY BLASTING AND RELATED OPERATIONS

Bureau of Engineering and Safety
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Division of Labor

Trenton, New Jersey
Revised Effective Date - August 21, 1953

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FOREWORD

Pursuant to the provisions of the State Explosives Act, the Commissioner of Labor and Industry is empowered to *"...make such rules and regulations, to have the force and effect of law, which may be required to facilitate the administration and enforcement of the provisions of this act."; with the direction, in part, that the Commissioner shall be therein guided..." by considerations of safety to life and limb of persons, and preservation of property...".*

It is deemed necessary, in the general public interest, to prescribe certain conditions regarding the use of explosives and related operations for the quarrying industry. One of the important factors that directed attention to such a need was the general proximity of quarries to masses of concentrated population and highly developed land areas.

In the preparation of these rules and regulations, free use has been made of the results of research undertaken by the U. S. Bureau of Mines, the recommendations of the National Safety Council and the Institute of Explosives Makers together with the collective experience of a group of New Jersey quarry operators.

The requirements concerning seismic effects and sound pressure were developed in collaboration with Dr. L. Don Leet, Seismologist in Charge, Seismograph Station, Harvard University, Harvard, Massachusetts.

The Bureau is committed to a program of continued research and study in the field encompassed by these rules and regulations and, as experience is gained through the application of these rules and regulations, will continue to maintain a conference program with the above mentioned groups.

SECTION 1 - Purpose and Scope

1.1 Purpose. It is the purpose of these rules and regulations to provide minimum standards for safety to life, limb and property, for the general public welfare and for safe practices in the use of explosives for quarry blasting purposes and related operations including drilling and preparation for blasting.

1.2 Scope. These rules and regulations shall apply to every quarry where explosives are used to extract minerals and compliance with the requirements herein contained shall be necessary in all such places.

1.3 Variations. In cases of practical difficulty or unnecessary hardship, the commissioner may grant exceptions from these rules provided that a request for such exception has been made in writing to the Deputy Director. Exceptions can only be granted when it is clearly evident that a satisfactory, safe and sanitary condition is attained.

SECTION 2 - Definitions

2.1 General Definitions

2.1.1 *Approved* - shall mean approved by the Commissioner of Labor and Industry or his authorized representative.

2.1.2 *Commissioner* - shall mean the Commissioner of Labor and Industry of the New Jersey Department of Labor and Industry or his authorized representative.

2.1.3 *Department* - shall mean the New Jersey Department of Labor and Industry.

2.1.4 *Division* - shall mean the Division of Labor of the Department.

2.1.5 *Bureau* - shall mean the Bureau of Engineering and Safety of the Division.

2.1.6 *Deputy Director* - shall mean the deputy director in charge of the Bureau.

2.1.7 *Effective date* - the date indicated on the cover on which these rules and regulations become effective.

2.1.8 *Existing* - prior to the effective date.

2.1.9 *Operator* - shall mean the owner of the quarry, or the lessee, as applicable.

2.1.10 *Shall* - where used, shall mean a mandatory requirement.

2.1.11 *Should* - shall mean an advisory or recommended practice recognized as satisfactory to the Department.

2.1.12 *Singular-Plural* - the singular shall mean the plural and the plural the singular.

2.1.13 *Superintendent (or equivalent)* - the person designated by the quarry operator to be in charge of quarry operations for the quarry operator at a given quarry location.

2.1.14 *Adequately, effective, securely* - shall mean satisfactory conditions subject to determination by the Commissioner.

2.2 Special Definitions

2.2.1 Blast Area shall have the following meaning:

2.2.1.1 *For Well Holes* - the area included within a distance equal to the greatest burden of any single hole contained in each blast, such distance to be measured in all directions.

2.2.1.2 *For Toe Holes and Block Holes* - the area included within a distance equal to the horizontal measurement of the combined area to be detonated, such distance to be measured in all directions, but not less than 35 feet.

2.2.2 *Blaster* - the person in possession of a valid state permit of appropriate grade to use explosives for blasting purposes.

2.2.3 *Delay Firing* - shall mean detonation by approved short period delay caps or equivalent in effectiveness, or switch.

2.2.4 *Primary blasting* - extraction of a mineral volume from the original natural body or bed by the use of explosives; primary blasting shall include toe and seam shooting.

2.2.4.1 *Toe shooting (snake-holing)* - removing, through the use of moderate quantities of explosives loaded in small diameter holes, ledge or high bottom that remains after a main primary shot.

2.2.4.2 *Seam shooting* - removing loosened or overhanging material from the quarry face by the use of explosives.

2.2.5 *Quarry* - open excavations for the extraction of minerals embracing any and all parts of quarry property that contribute directly or indirectly to the extraction of minerals; the term "quarry" shall include prospect openings, pits, banks and open cut workings.

2.2.6 *Secondary blasting* - the reduction of oversize material by the use of explosives to facilitate shovel operations or to be accommodated by the crusher; secondary blasting shall include mud capping and blockholing.

2.2.6.1 *Mud capping (adobe blasting, dobying)* - the firing of a quantity of explosives on or against a rock, boulder, or other object without confining the explosive in a bore hole.

2.2.6.2 *Block-holing* - the fragmentation of boulders through the firing of a small quantity of explosives that has been loaded therein in a small diameter bore hole.

2.2.7 *Sprung* - the enlargement of a bore hole with a moderate quantity of explosives in order that larger quantities of explosives may be inserted therein for the main primary blast.

2.2.8 *Stemming* - suitable material used in confining explosives in a bore hole.

SECTION 3 - General Provisions

3.1 Responsibility of operator. The operator of every quarry shall use every reasonable precaution to provide for the safety of all employees in the quarry and of such other persons who may be legally entitled to be on such quarry property and it shall be the duty of such operator to comply with the provisions of these rules and regulations.

3.2 Responsibility of employees. Every employee shall observe all of the provisions of these rules and regulations which directly concern or affect his conduct and no person shall willfully permit a violation of these rules and regulations.

3.3 State Explosives Law. Every quarry operator shall comply with all of the provisions governing storage, sale, transportation and use of explosives.

3.4 Responsibility of Blaster.

3.4.1 No person, hereinafter called the blaster, shall use and detonate explosives unless he is in possession of a valid state permit to use explosives for blasting purposes, provided, however, that a blaster, to whom a permit of any grade has been issued, may use and detonate explosives in all circumstances when the work is under the direct and immediate supervision of a blaster with a permit of the required grade.

3.4.2 The blaster shall not use and detonate explosives unless the requirements of these rules and regulations have been observed and every reasonable precaution, not specifically set forth in these rules and regulations, taken to prevent accidents, damage to property or unreasonable disturbance.

3.5 Reasonable compliance with the requirements of these rules and regulations shall constitute satisfactory and acceptable quarry blasting and related operations.

SECTION 4 - General Safety Provisions

4.1 Safety Organization. A safety organization shall be established and maintained in every quarry. Regular safety meetings shall be held and the attendance of employees encouraged to develop and maintain effective teamwork for accident prevention

in connection with the use of explosives for blasting purposes and all related operations.

4.2 Rules. Quarry management shall provide all employees with approved written rules or standards governing the procedure to be used by all employees in the safe use of explosives.

4.3 Safety Committee. Safety committees shall be appointed for the purpose of promoting safety in the use of explosives. Safety committees shall make inspections at least monthly. A written report shall be made to the management after each inspection

4.4 Safety Training and Education.

4.4.1 All employees should be trained and stimulated to follow safe methods of work and to take sincere interest in the safety of all concerned in using explosives.

4.4.2 Every employee shall be instructed in the hazards of his occupation with respect both to himself and to his fellow workers.

4.4.3 Special attention shall be given to all new employees and to those transferred to unaccustomed tasks.

4.4.4 Workmen shall be instructed in the use of and the necessity for using the personal protective equipment and any other protective equipment provided by the employer necessary to their safety in the use of explosives and related operations.

4.5 First Aid Training and Equipment.

4.5.1 The operator shall provide and maintain a supply of first-aid material and equipment. Such material and equipment shall be kept in a first-aid room or place where first aid is administered, in a dry, dust tight container. It shall be available at all times while there are employees at work and shall include the following items:

Tourniquet (inelastic)
Forceps or tweezers
Scissors
Wire or thin board splints
Eye dropper
Aromatic spirits of ammonia (in ampoules)
Sterile castor oil or mineral oil
Tannic acid jelly
Sterile borated petroleum jelly
Tincture of iodine (in ampoules)
Paper cups
Triangle bandage
4" bandage with compress
2" bandage with compress
Sterile gauze pads
Sterile gauze compress (1 sq. yd.)
Assorted sterile gauze bandages in rolls
1" compresses on adhesive tape
½" adhesive tape
Absorbent cotton
Safety pins
Basin, soap, towels
First-Aid handbook

4.5.2 The operator shall provide and maintain in the quarry at a place or places always readily accessible, a stretcher suitable for carrying injured persons, a woolen blanket and a waterproof blanket in good condition. Where 100 or more persons are employed, at least two such stretchers and blankets shall be provided and maintained.

4.5.3 There shall be at least two persons engaged in the operations in the vicinity of the quarry face who are instructed in and capable of administering first-aid.

4.5.4 In every quarry where fifty or more are employed a first-aid corps of at least five employees shall be organized.

4.5.5 The first-aid corps shall meet not less than once every six months for instruction by a physician, or a registered nurse, or a person holding a certificate from the American Red Cross or the United States Bureau of Mines authorizing such person to administer first aid.

SECTION 5 - Explosives

5.1 Permits. The quarry operator shall comply with all permit requirements relating to the storage, sale, transportation or use of explosives by his employees for blasting purposes as required by the State Explosives Law.

5.2 Handling Explosives--Personnel. Only persons duly authorized by the blaster shall in any way handle or use explosives.

5.3 Smoking and Open Lights. Smoking or open lights or other flames are prohibited in an area included within a radius of 25 feet of any explosives magazine or 100 feet where explosives are being handled, used or temporarily kept.

5.4 Explosives for Use. Any approved standard commercial explosive in good condition may be used for blasting except straight nitroglycerin dynamite.

5.5 Destroying Explosives. Explosives which have deteriorated, or have been damaged so that they have become unfit for use shall be destroyed by a qualified person experienced in this work and designated by the superintendent or management.

5.6 Operations During Electrical Storms. All use of explosives, and any handling thereof, shall be stopped immediately upon the approach of a thunderstorm and all personnel in the area shall immediately seek a place of safety in a proper location designated by the operator or his representative.

5.7 Transportation. Any vehicle transporting explosives either on the public highway or on quarry property shall comply with state rules and regulations governing transportation of explosives, provided that when explosives are transported on quarry property only, a permit to transport shall not be required.

5.8 Storage.

5.8.1 The location and construction of every magazine shall be approved by the Commissioner before any explosives are stored therein.

5.8.2 All explosives shall be stored in approved magazines.

5.8.3 Except while cleaning or inspecting, all magazines and all enclosures used for explosives shall be kept locked at all times except while placing explosives therein or removing explosives therefrom.

5.8.4 Only persons authorized by the superintendent shall have access to magazines.

5.8.5 Detonators shall be stored in a separate magazine and no other explosives, materials or tools except a wooden wedge and wooden mallet, shall be stored in such magazines.

5.8.6 All explosives, other than detonators, shall be stored in a separate magazine devoted exclusively to such explosives.

5.8.7 When not in use all blasting equipment and loading tools used in connection with blasting shall be stored in a separate place, compartment or enclosure devoted to such purpose and so constructed as to keep such equipment and tools in good working condition at all times.

5.8.8 All magazines shall be so located and so protected as to prevent accidental impact from vehicles or falling objects.

5.8.9 The floor and roof of every magazine and the area surrounding it shall at all times be kept clean and free from particles of explosives.

5.8.10 Artificial lighting of the area surrounding the magazines shall be by floodlights. No lights shall be permitted in a magazine except electric flash lights or electric lanterns, so constructed that it will not be possible to obtain a difference of potential between any two points on the outside of the lamp casing.

5.8.11 In using explosives, those of appropriate kind that have been longest in the magazine shall be used first.

5.8.12 Packages of explosives shall not be opened at any point less than 50 feet distant from any magazine. No tools except wooden wedges, and wooden, fibre or rubber mallets shall be used for opening packages of explosives except that non-ferrous slitters may be used for opening fibre board containers, provided such slitters cannot come within range of metallic case fasteners.

5.8.13 Doors

5.8.13.1 Doors of all Class A magazines shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of a mortise lock and a padlock; or with a mortise lock that requires two keys to open; or with a 3-point lock. Padlocks and mortise locks shall be the equivalent of a 5 tumbler jar-proof lock.

5.8.13.2 Doors shall be provided with strong hinged hasps, and staples attached by welds, rivets or by bolts fitted with lock washers and nuts on the inside of the magazine, and installed in such a manner that the fastening cannot be removed when the magazine door is closed and locked.

5.8.14 Signs

5.8.14.1 The premises on which a permanent magazine is located shall be conspicuously marked by signs containing the works "EXPLOSIVES -- KEEP OFF". Such signs shall adequately warn any person approaching the magazine of the presence of explosives, but the sign shall not be so placed as to direct general public attention to the location of the magazine.

5.8.14.2 No signs shall be placed on surface magazines or barricades, or be so located that a bullet passing directly through the face of the sign will strike the magazine.

5.8.15 The area surrounding a magazine for not less than 25 feet in all directions shall be kept free of rubbish, dry grass, or other combustible material.

5.9 Use

5.9.1 Blasting operations shall be carried on with the smallest possible number of persons present.

5.9.2 All drill holes shall be of proper size so that the cartridges of explosives can be easily inserted to the bottom of the hole without forcing or ramming.

5.9.3 Explosives should not be removed from the original wrapper before being loaded into bore holes except when irregularities of the hole make it impossible to load whole cartridges with safety, or in blockholing where small charges are desirable. This rule shall not apply to free running explosives.

5.9.4 Excessive ramming should be avoided in loading or tamping explosives in a bore hole and wooden tools only with no exposed metal parts shall be used for this purpose. In tamping only hardwood rods without metal parts other than non-ferrous metal ferrules for extending the length thereof shall be used.

5.9.5 No activity of a continuous nature, nor more than two men engaged in intermittent work, shall be permitted in front of a face being loaded with explosives and within the probable range of flying material in the case of a premature blast, (a) when steam equipment is being employed, or, (b) when primers containing electric blasting caps are employed. The probable range of flying material shall be considered to be not less than 100' or 1½ times the height of the quarry face whichever is greater provided that end clearance may be reduced by one-half.

5.9.6 When loading free running or bulk explosives, a bronze, wooden or heavy paper funnel shall be used unless the explosives can be poured directly from a container into the hole in such a manner as to prevent scattering of loose explosives around the collar of the hole. The use of mechanical or pneumatic methods of loading shall be prohibited.

5.9.7 When priming with electric caps, they shall be tested with a blasting galvanometer before using and during loading and the primers shall not be made up until just prior to loading into the hole. Great care shall be exercised to see that the cap is properly fastened in the cartridge and the primer seated in the charge without rough handling.

5.9.8 Blast may be fired electrically with either a power circuit or blasting machine. Such method of firing shall at all times be maintained in good operating condition. The power used shall be energized by not less than 200 volts nor more than 500 volts.

5.9.9 When firing with a power circuit ample capacity shall be provided to supply the theoretical current requirements of the blast. The detonators shall be connected in straight series, straight parallel or parallel series. When firing with a blasting machine, detonators shall be connected in straight series or parallel series, but never in straight parellel. In every instance of electrical diring, regardless of source of power, the explosives manufacturer's instructions shall be observed.

5.9.10 The power wires and leading wires shall be thoroughly insulated and kept from contact with any electrical conductor, air lines or pools of water or oil.

5.9.11 The leg wires of detonators shall be kept short-circuited until connected into the circuit or to the leading wires. All bare connections shall be either taped or blocked up in position so as to prevent current leakage or entrance of stray

currents. While making connections in the blast area the leading wires shall be kept short circuited at the power source end but not grounded and shall remain in the possession of the blaster. They shall then be strung from the blast area toward the source of power to make the final connections for firing the blast. Before connecting the leading wires to the power circuit, the blaster shall make certain by test that an unsafe difference in potential does not exist between the two wires of the blasting line.

5.9 12 A power circuit used for firing shall be controlled by a switch located at a safe distance to be determined by the blaster but not less than 150 feet from the blast area. Such switch when in actual use shall be firmly fastened in position, thoroughly insulated against grounds, and wholly enclosed in a tight box that shall be kept closed and locked at all times except while firing, and no person other than the blaster shall have access to the switch. The switch shall be provided with a short circuit in the "off" position and shall be so arranged that the box enclosure can be locked only when the switch is in the "off" position.

5.9.13 When firing by means of a power circuit the blasting circuit shall at all times be broken in at least one place by a gap of at least five feet on the incoming side of the switch, except during the firing operation.

5.9.14 When firing with a blasting machine, it shall be located at a safe distance to be determined by the blaster but not less than 150 feet from the blast area.

5.9.15 When firing by means of a blasting machine, the leading wires shall be kept short circuited until the shot is ready for firing and shall not be connected to the blasting machine until immediately before the time of firing and shall be disconnected from the blasting machine and short circuited immediately after firing.

5.9.16 Electric detonators and blasting circuits shall be tested only by means of a blasting galvanometer designed for this purpose.

5.9.17 Required Warnings

5.9.17.1 Before firing any blast all means of access to the danger zone, the extent of which shall be determined by the blaster, shall be effectively guarded to exclude all unauthorized personnel. The blaster shall then sound a warning distinctly audible to all persons within the danger zone and all such persons shall retire to a safe distance or to a safe shelter. The danger zone shall then be examined by the blaster to make certain that all persons have retired therefrom to a place of safety. No blast shall be fired while any person is in the danger zone.

5.9.17.2 When the blast area is within 300 feet of a highway, the blaster shall just prior to the blast designate a sufficient number of employees of the operator, each carrying a red warning flag, to stop all vehicular and pedestrian traffic on each possible route of travel in the vicinity of the blast area until the blast has been fired.

5.9.18 Proximity to highways

5.9.18.1 Primary blasting shall be prohibited if the blast area is within 50 feet of the traveled roadway or walkway of a highway, horizontally measured.

5.9.18.2 When the floor of a quarry is more than 5 feet below the average grade of a highway at any point within 100 feet of a highway, an effective and approved barrier shall be erected by the operator along the property line nearest the highway for an approved distance to provide protection against the drop or fall of vehicles or persons.

5.9.19 No person shall return from such safe distance or shelter until permitted to do so by the blaster as announced by audible or visual signal.

5.9.20 Immediately following the blast the area shallbe examined by the blaster for evidence of misfired charges. If such is found, he shall provide proper safeguards for excluding all personnel from the danger zone.

5.9.21 All misfires shall be reported at once to the superintendent or manager who shall then determine the safe and proper method of disposal. Each misfire presents an individual problem which shall be placed under the supervision of a person thoroughly competent to handle such matters. The unexploded charge shall be detonated if such can be accomplished without risk of injury to personnel. If repriming is necessary any stemming present in the hole may be removed by a jet of water or air. In cases where competent supervision is not available locally, the explosives manufacturer shall be consulted as to availability thereof.

5.9.22 Drilling in any hole that is known to contain or have contained explosives is prohibited until satisfactory neutralization is effected.

5.9.23 A complete record shall be kept at the operator's quarry plant office showing all misfires and method of disposal.

5.9.24 In case a charge fires but does not bring down the burden, it is permissible to reload the bore hole, if in suitable condition, but only after the temperature of the hole has been reduced by water or otherwise to not more than 150 degrees F.

5.9.25 Stemming

5.9.25.1 Each blast hole shall be stemmed to the collar or to a point high enough to provide efficient confinement of the charge and to minimize the chance of injury to personnel from flying material.

5.9.25.2 For toe holes the collar stemming shall in no case be less than one-third the depth of the hole.

5.9.26 Block holes shall contain at least 85% of stemming material.

5.9.27 There shall be compliance with the following requirements to eliminate the hazards of radio-frequency energy in connection with the use of electric blasting caps.

5.9.27.1 Irrespective of ownership, mobile transmitting stations with outputs up to 30 watts such as those of the portable type or installed in automobiles shall be kept at least 100 feet away from any electric blasting cap except when in original containers. Users of such stations shall be notified by the contractor and such users shall comply with the requirements of section 5.9.27.

5.9.27.2 When such radio transmitters are less than 100 feet away from electric blasting caps in other than original containers they shall be de-energized and should be effectively locked.

5.9.27.3 When electric blasting caps are transported in a motor vehicle equipped with a radio transmitter, they shall either be in their original package or stored in a closed metal box that is lined with a cushioning material such as wood or sponge rubber. When the electric caps are being placed into or removed from the box, the transmitter circuit shall be disconnected.

5.9.27.4 All blasting operations shall be conducted at no less distance from any fixed or mobile radio transmitter than indicated in the following table:

Transmitter Power Output in Watts	Minimum distance from blasting operations using electric blasting caps, in feet
5-25	100
25-50	150
50-100	220
100-250	350
250-500	450
500-1,000	650
1,000-2,500	1,000
2,500-5,000	1,500
5,000-10,000	2,200
10,000-25,000	3,500
25,000-50,000	5,000
50,000-100,000	7,000

5.9.27.5 When it can be demonstrated by means of approved tests that electric blasting may be carried out at lesser distances from the transmitter than required by the table shown in 5.9.27.4, the commissioner may allow a variation from the requirements of said table.

5.9.27.6 Blasts shall be detonated by other than electrical method if the location or power output of a radio transmitter is either doubtful or presumed to exist to a dangerous degree.

5.9.28 Delay firing shall be used when necessary to comply with the requirements of section 6.

5.10 Primary Blasting

5.10.1 While explosives are being loaded in bore holes or drill holes, the blaster shall keep all persons not necessary for the blasting operations away from the blast area.

5.10.2 When loading a blast primed with electric detonators, explosives shall not be transported into the blast area until all electric power circuits have first been disconnected to a point not less than 100 feet from the blast area.

5.10.3 When drilling and loading are being performed simultaneously in the same area, the two operations shall be separated as widely as practicable and in no case shall drilling be conducted closer to a loaded hole or a hole that is being loaded than a distance equal to the deepest blast hole in the area.

5.10.4 Holes shall be checked prior to loading to determine depth and condition. After any explosives have been loaded all measuring shall be done with a cloth tape or non-ferrous measuring device and lead plumb bob, or a wooden tamping pole or wooden dolly free of exposed metal parts.

5.10.5 Loading of Explosives - Amount in Blast Area

5.10.5.1 Under no circumstances shall the amount of explosives taken into a blast area exceed the amount estimated by the blaster as necessary for the blast. Such explosives shall be stacked in piles at least 25 feet from the nearest holes being loaded or as far as the width of the bench or floor permits, and at such distances apart that any premature explosion will not be likely to propagate from one pile to another, as provided in section 5.10.5.3.

5.10.5.2 The explosives containers, if any, shall be opened at the pile and carried up to the hole one case or unit at a time for immediate loading or placed at a loading station not less than six feet from the hole except that not more than 100 pounds of explosives shall be allowed at the loading station at any one time.

5.10.5.3 Explosives shall be distributed in such a manner that the distances from storage piles to the allowable maximum quantity of 100 pounds of explosives at the loading station or between such 100 pound loading station piles shall not be less than the quantities shown in the following quantity-distance table:

Pounds of Explosives	*Distance between piles of explosives in feet (See Sec. 5.10.5.3)*
up to 50	21
100	25
200	32
300	37
400	41
500	44
750	50
1000	55
1500	64
2000	70
2500	75
5000	96
10000	123

NOTE: Interpolation is permitted.

5.10.6 Blasting operations shall be carried on with the smallest practical number of persons present and no one but authorized personnel shall be allowed in or near the blast area.

5.10.7 Drill holes shall not be sprung when they are less than 100 feet from the nearest hole containing explosives.

a. Holes that have been sprung shall not be charged with explosives until the maximum temperature in any portion of such holes has been reduced to 150 degrees F. Where practical the use of water is recommended for cooling purposes.

5.10.8 When loading a blast primed with detonating fuse, the detonator or detonators required for firing the blast shall not be brought into the blast area nor attached to the detonating fuse until all persons, except the blaster and his assistants, have been cleared from the danger zone and retreated to a safe distance or to a place of safe shelter.

5.10.9 In all primary blasting and all other blasting where the firing of any one hole is likely to break into or damage another hole in the vicinity or where the firing of any hole may propagate the charge in a loaded hole in the vicinity, all holes which have been loaded shall be included and fired in the blast.

5.10.10 All holes for blasting shall be checked before attempting to load explosives. Blast holes may be checked with a dolly or tamping block or by visual inspection with the aid of a mirror.

5.10.11 Water standing in blast holes should be bailed out if possible and the holes shall be loaded with an explosive of adequate water resistance.

5.10.12 Blasting crews shall consist of the minimum number of experienced men to do the work in an efficient manner, and should be organized carefully and each man assigned to definite tasks tc avoid confusion.

5.10.13 Loading Chart for Primary Blasting

5.10.13.1 A blast shall be planned before loading is started. The planned charge for each hole shall be recorded.

5.10.13.2 The condition of each hole to be loaded and the amount, height, and position of the explosives charge or charges placed in the hole shall be recorded cn the loading chart.

5.10.14 Members of loading crews engaged in loading blast holes should be prohibited from wearing hobnail or steel-plated shoes to avoid striking sparks cn rocks.

5.10.15 Large dynamite cartridges may be dropped in blast holes only when the hole is free from obstructions to the depth at which the cartridge is to rest.

5.10.16 Large dynamite cartridges shall not be dropped in blast holes containing excessive water until the charge is above the water level.

5.10.17 Large dynamite cartridges that have been wedged in a blast hole shall not be tamped with a dolly. After pouring water into the hole, attempts to dislodge or pierce them shall be made with a spear-shaped wooden tamping block, a small-diameter wooden pole.

5.10.18 Rough or ragged holes, and holes partly closed by an obstruction that cannot be readily removed shall be loaded with cartridged dynamite lowered with a rope, with free running powder, or with dynamite cut in small pieces.

5.10.19 When loading a long line of holes with more than one loading crew, the crews shall be separated by the greatest practical distance which can be maintained as the loading operations progress, and which is consistent with efficient operation and supervision of the crews. Every effort shall be made to keep the loading crews a minimum of 25 feet apart and to prevent the simultaneous loading of adjacent holes.

5.10.20 Excessively large amounts of explosives shall not be delivered to the loading area at one time. If deliveries of explosives are made by truck, the quantity permitted at or near the loading operations shall be limited to one truck load. Other trucks loaded with explosives shall wait or be unloaded in separate safe places away from the loading operations.

5.10.21 Explosives should be delivered first to the holes farthest from the truck to avoid driving or walking among piles of explosives.

5.10.22 Explosives in excess of immediate requirements, when removed from the main storage magazine and delivered in the vicinity of a blasting operation, shall be stored in a Class A magazine.

5.10.23 Sufficient suitable stemming or tamping material shall be placed by each hole before the delivery of explosives to the holes is started. Stemming material shall be screened or free from excessively coarse pieces.

5.10.24 Stemming shall be placed in each hole with care to avoid damage to the detonating fuse or leg wires of electric detonators.

5.10.25 A single hole or any number of holes in a row should not be fired when adjacent to or near one or more other holes which are loaded and which are not intended to be fired.

5.10.26 Detonating Fuse

5.10.26.1 All detonating fuse shall be covered with maximum stemming where physically possible.

5.10.26.2 When priming blast holes with detonating fuse it shall be lowered to the bottom of the hole either by attaching it to the first cartridge or by other means. After allowance for settlement, it shall then be cut from the reel and the reel moved well away or to the next hole before any other explosives are loaded.

5.10.26.3 The detonating fuse shall extend from the hole a distance of one or two feet more than sufficient to compensate for any subsidence, should be drawn taut, and made secure on the top where it will not interfere with loading operations or come in contact with explosives on the ground.

5.10.26.4 It shall be checked each time before stemming material is used to see that it has not been broken.

5.10.26.5 When detonating fuse is used, main or trunk line splices shall be factory splices or tight square knots. No splices shall be used in the drill hole.

5.10.26.6 All branch line connections and all connections in the main line other than splices shall be tight and at right angles.

5.10.26.7 Main or trunk line shall be laid out free of kinks or coils, and all connections shall be inspected before firing the blast.

5.10.26.8 When connecting an electric blasting cap to detonating fuse, a connector for the purpose shall be used, in accordance with manufacturers instructions.

5.10.26.9 Caps shall not be brought to the loading area nor attached to the detonating fuse until all is in readiness to fire the blast.

5.10.26.10 Plain detonating fuse may be used for trunk lines or in shallow drill holes, but reinforced or wire protected types shall be used in deep or ragged holes.

5.10.27 Toe hole blasting

5.10.27.1 The charge of explosives shall be pushed to the end of the hole with a wooden pole, using care not to block the hole.

5.10.27.2 Care shall be used in placing stemming in the hole, especially if loose explosives are on the bottom of the flat hole.

5.10.27.3 Only wooden or non-ferrous poles shall be used in loading snake holes.

5.10.28 Wagon Drill Hole Blasting

5.10.28.1 The same precautions shall be followed in loading small-diameter drill holes, such as wagon drill and jack hammer holes, as in loading larger diameter holes.

5.10.28.2 When wagon drill holes or smaller diameter bore holes are to be loaded for blasting, the explosives containers shall be stacked in piles out of line with and at least 25 feet from the nearest drill hole to be loaded.

5.10.28.3 The container shall be opened at the piles as needed and the opened explosives cases carried one at a time to the loading crew. The amount of explosives at one hole shall be limited to 100 pounds. Empty cases and lining paper shall be removed immediately to a waste pile.

5.10.29 Quantities of explosives that may be used in primary blasting shall be governed by allowable limits as set forth in these rules and regulations.

5.11 Secondary blasting

5.11.1 Wherever practicable, oversize fragments shall be reduced to shovel or crusher size by use of the ball method, except as otherwise directed by the Commissioner.

5.11.2 Mud-capping shall be prohibited except where written approval for an exception has been received from the Deputy Director.

5.11.3 No tools or equipment or activity of any kind shall be permitted on a muck pile directly above a blaster while he is loading explosives into block holes.

5.11.4 Charges of explosives shall be confined in all cases, by suitable, inert stemming material.

5.11.5 No person, except the blaster and any others directly engaged in loading block holes, shall be permitted within the immediate area while loading is being performed. Loading of any block hole shall be completed in one continuous operation including insertion of the primer and the stemming.

5.11.6 Not more than ten (10) pounds of explosives shall be detonated at any one time in a secondary shot except where practice to the contrary is safe and for which resulting effects are within the limitations of Section 6, under which circumstances, the Commissioner may, in writing, allow continuance.

SECTION 6 - Seismic Effects and Air Blast

6.1 Allowable limits. Allowable limits of ground motion and sound pressure contained in this section shall be considered neither to produce structural damage in any structure that has been reasonably well constructed according to accepted engineering practice nor to constitute a nuisance to persons.

6.2 Restrictions on quantity of explosives. All primary shots shall be fired with quantities of explosives not in excess of those permitted by this section and except as further restricted by other requirements of those rules and regulations.

6.3 Frequency-amplitude relations. When ground frequency and displacement characteristics in relation to known quantities of detonated explosives in primary blasts have been determined by approved means of instrumentation to the satisfaction of the Commissioner the allowable limits of the maximum amplitude of ground vibrations related to frequencies of vibration shall be as indicated in the following table:

TABLE OF FREQUENCY-AMPLITUDE RELATIONS

Frequency of ground motion in cycles per second	*Maximum amplitude of ground motion, in inches*
up to 10	not more than 0.0305
20	0.0153
30	0.0102
40	0.0076
50	0.0061
60	0.0051

6.4 Allowable quantities of explosives. Without approved methods of instrumentation, the quantities of explosives used in any primary blasting shall not exceed the following:

QUANTITY-DISTANCE TABLE

Distance from blast area to nearest structure, neither quarry owned nor quarry leased, in feet	*Maximum quantity of explosives per shot for instantaneous firing or per delay for delay firing, in lbs.*	
	Normal overburden	*Abnormal overburden* **
100 *	340	70
200	420	78
300	525	100
400	635	125
500	800	160
600	950	200
700	1175	245
800	1500	300
900	1830	360
1000	2250	430
1200	3500	610
1400	----	820
1600	----	1250
1800	----	1900
2000	----	3000

* Minimum allowable distance when approved missile protection methods are used.
** More than 50 feet to bedrock.

6.5 Variations in quantity-distance relations. When ground motion characteristics for any given quarry operation have been determined by the Commissioner, based on instrumentation data submitted by the operator, the allowable quantity-distance relations between amount of explosives used in primary blasting and distance from blast area shall be determined from the accepted results of instrumentation at the given quarry operation for the various weights of explosives. The maximum amplitudes shall not exceed those given in the table of section 6.3.

6.6 Allowable sound pressure. The maximum allowable sound pressure beyond quarry property lines resulting from quarry blasting shall not exceed 100 decibels.

6.7 Effective date. The provisions of this section shall become effective ninety days after the effective date of these rules and regulations

SECTION 7 - Drilling

7.1 Blockholing

7.1.1 Drillers shall wear goggles when starting or blowing out block holes or at other times when there is danger from flying particles.

7.1.2 Drillers shall wear hard-toed shoes.

7.1.3 The bank shall be trimmed of loose boulders that might roll down on the driller before drilling is started.

7.1.4 Drillers shall, when possible, stand facing the bank in order to better observe any movement of rock above them.

7.1.5 Drillers working close to the bottom of the face or at the foot of a bank of broken rock shall wear hard hats.

7.1.6 Repairs or adjustments to air connections shall not be made until the air pressure has been removed from the line.

7.1.7 Drilling in the "boots" of old drill holes shall be prohibited, since unexploded dynamite may be concealed in the boot.

7.1.8 Safety belts and life lines shall be used when barring down dangerous banks.

7.1.9 Bars used in trimming banks should be blunt on one end.

7.1.10 Soft metal hammers shall be provided to loosen drill steel in a hole. Hard-faced hammers shall not be used.

7.2 Toe Hole Drilling

7.2.1 Toe hole drilling, especially under high banks, is unusually hazardous and care shall be taken to trim the bank before a hole is started.

7.2.2 Drillers and helpers shall wear goggles when blowing out a hole with a blow pipe.

7.2.3 Two men should work on each machine when drilling toe holes.

7.2.4 The machine shall be lowered to the lowest possible position on the mast of a wagon drill when not in operation.

7.2.5 The hoist cable supporting the machine on a wagon drill shall be inspected frequently.

7.2.6 Soft metal hammers shall be provided to loosen drill steel in the hole. Drillers shall be prohibited from using hard-faced hammers to hammer the steel.

7.3 Well Hole Drilling

7.3.1 Electric drills shall be grounded when in operation.

7.3.2 Employees shall never work under a suspended string of tools. The tools shall be lowered to the level of the platform.

7.3.3 Because of splashing mud, employees should be cautioned to keep their heads away from the collar of the hole after water has been added.

7.3.4 Men working at the top of the mast shall wear safety belts.

7.3.5 The well drill or churn drill shall be stopped before greasing the machinery and parts.

7.3.6 Electrical repairs should be made only by qualified personnel.

7.3.7 Electric cable shall be kept out of water as much as possible. Slack cable shall be coiled in a safe place.

7.3.8 Operators shall be warned of danger when working near power lines.

7.3.9 Oil and grease shall not be allowed to accumulate on the floor around the machinery.

7.3.10 Good housekeeping shall be required on all drilling machines.

SECTION 8 - Records

8.1 Scope. Records shall be kept of every primary well-drill blast in an approved manner and for such other primary blasting as the Commissioner may require.

8.2 Minimum recorded data. Minimum recorded data shall be as follows:

a. Plan of the involved portion of the quarry showing location of holes, spacing of holes.

b. A cross-section of each hole showing overburden; burden at top of face and toe; height of face; depth of hole; kind and quantity of explosives including distribution of explosives load as deck charges, or otherwise as appropriate; length and kind of stemming material.

c. Drilling record showing unusual joint or seam conditions in the rock.

d. Tonnage.

e. Kind of blasting caps, distribution of instantaneous or short-period delay blasting caps; or both; delay interval used; order of firing by switch.

f. Comments by blaster in charge regarding character of breakage; height of breakage; length of throw; effectiveness of shot; unusual results or effects.

g. Weather conditions including - direction and approximate velocity of wind; atmospheric temperature, relative humidity; cloud conditions.

h. Date and time of firing of blast.

i. Name of person in responsible charge of loading and firing; blaster permit number.

j. Name and location of quarry.

k. Signature and title of person making report.

8.3 Number of copies. At least one copy of records required by Section 8.2 shall be maintained at the quarry at all times and shall be available for examination by the Commissioner.

8.4 Seismograph records. If seismograph or air pressure readings, or both, are taken upon authorization of the operator of any quarry, a copy of the covering seismograph report shall be forwarded to the Commissioner without delay together with a copy of the records required to be maintained by Section 8.3, in order to provide basic data for research and study of seismic effects.

8.5 Recorded Seismograph Data. Seismograph reports shall include identification of instrument, name of observer, name of interpreter, distance and direction of recording station from the area of detonation, type of ground at recording station or location in structure, maximum amplitudes for all components as well as resultant for all recorded frequencies of vibrations, duration of motion in excess of one-one thousandths of an inch; a copy of the photographic record of seismograph readings.

8.6 Qualifications of seismologist. Seismograph reports shall be signed by a person whose qualifications are satisfactory to the Commissioner, in order to be given any consideration by the Commissioner for modification of quantity-distance relations permitted in Section 6. Such person shall be held responsible for the authenticity and correctness of such reports.